SYNERGY IN SCIENCES: FROM MOLECULES TO MACHINES

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PERFACE

In a world increasingly shaped by interdisciplinary inquiry, *Synergy in Sciences: From Molecules to Machines* aims to illuminate the profound interconnectedness that defines modern scientific progress. This book is a celebration of the collaborative spirit that spans across chemistry, biology, physics, engineering, and computational science—disciplines once siloed, now deeply intertwined in both theory and application. The title reflects a journey: from the tiniest building blocks of matter to the vast complexity of engineered systems. Molecules represent the foundation of life and materials; machines represent the culmination of human ingenuity, powered by the knowledge of those very building blocks. Along this spectrum, synergy is not just a metaphor—it is a methodology. Scientific breakthroughs increasingly occur at the intersections: bioengineers designing synthetic organs, chemists collaborating with physicists to understand quantum materials, or computer scientists modeling protein folding with machine learning. This volume was inspired by the need to document and explore how these interdisciplinary collaborations drive innovation. Each chapter is designed to highlight a critical area where synergy is not optional but essential. Whether it is the integration of nanotechnology in medicine, the role of artificial intelligence in drug discovery, or the engineering of biomimetic machines, the unifying theme is clear: progress in science today is defined less by specialization and more by collaboration. The contributors to this volume are researchers, practitioners, and thinkers who operate at the cutting edge of their fields, often blurring disciplinary boundaries. Their insights, presented through original research, review articles, and conceptual frameworks, offer readers a panoramic view of how different scientific domains converge to solve complex problems. Special care has been taken to ensure accessibility for a wide audience—from advanced undergraduates and graduate students to professionals across diverse scientific backgrounds. Our intent is not only to inform but also to inspire. We hope that this book serves as a springboard for new ideas, collaborations, and questions. What can a chemist learn from a roboticist? How might a physicist's model of energy transfer inform a biologist's understanding of neural networks? These are the kinds of questions that give rise to new fields and transform existing ones. We are grateful to the many contributors, reviewers, and institutions whose support made this work possible. Their commitment to the vision of scientific synergy is reflected in every page. We also thank our readers, whose curiosity and dedication to knowledge continue to push the boundaries of what science can achieve when disciplines converge. As you turn the pages, we invite you to see the science not as segmented silos but as a symphony—complex, dynamic, and deeply interconnected. From molecules to machines, the story of science is, and has always been, a story of synergy.

Editors

Message from the Secretary

It is with immense pride and enthusiasm that I extend my heartfelt greetings to all contributors of the forthcoming book "Synergy in Sciences: From Molecules to Machines." This initiative is not just a scholarly endeavor but a celebration of the innovative spirit that binds various scientific domains together in the pursuit of discovery.

Science has never operated in isolation. From molecular biology influencing artificial intelligence to quantum mechanics enabling breakthroughs in materials science, it is evident that true progress lies at the confluence of disciplines. This publication is a living testimony to such synergy—a bridge that connects the infinitesimal world of molecules with the macro realms of machines.

What makes this volume particularly special is its diversity—of topics, ideas, and contributors. Researchers have woven together threads of physics, chemistry, biology, and engineering with a creativity that echoes the innovative vision behind this compilation. I believe this book not only serves as a valuable academic resource but also ignites a new conversation—one that embraces change, nurtures collaboration, and drives innovation.

I commend the editorial team and contributors for their diligence and depth of inquiry. Your commitment to exploring interconnections in science paves the way for transformative thinking and real-world applications. Let this book inspire budding scholars to look beyond boundaries and seek out innovation in every connection.

Congratulations to all involved in this noble and necessary project. May this endeavor continue to grow and make its mark in the academic landscape.

Warm regards,
Mr. N. R. D. Premkumar
Secretary

Message from the Joint Secretary

It is with great pleasure that I convey my sincere appreciation to all the scholars, academicians, and contributors whose intellectual labor has shaped the upcoming publication "Synergy in Sciences: From Molecules to Machines." This endeavor is a glowing example of what can be accomplished when passionate minds collaborate with a shared vision.

This compilation stands as a collaborative testament to the power of contribution—not just in terms of knowledge, but in the willingness to connect diverse perspectives from multiple scientific realms. Every paper submitted is a piece of a greater puzzle that highlights how molecular sciences, applied technologies, and mechanical innovations complement each other in today's complex world.

I am especially proud of the way this project brought together participants from varied academic and research backgrounds. It is through your contributions that we are able to showcase a spectrum of research, insights, and future-forward thinking that will enrich readers and practitioners alike.

Moreover, this book stands not only as a collection of research but as an invitation—an invitation to think beyond silos, to challenge existing paradigms, and to offer fresh perspectives. The combined efforts of authors, reviewers, and editors deserve to be celebrated for creating such a comprehensive and dynamic volume.

I extend my heartfelt congratulations to every contributor for their valuable input. May your dedication continue to inspire a culture of sharing and scholarly excellence. Together, you have built more than a book—you have built a beacon of collaborative scientific growth.

With gratitude and respect,
Dr. P. E. R. Premchand
Joint Secretary

Message from the Principal

I am delighted to extend my hearty congratulations to the entire team behind the book "Synergy in Sciences: From Molecules to Machines." This timely and thought-provoking publication exemplifies academic rigor, collaborative spirit, and the unyielding pursuit of scientific excellence.

The title itself encapsulates the essence of modern scientific inquiry—where microscopic molecular interactions find their echo in sophisticated machines that shapes our world. This collection of papers illustrates how today's challenges demand an integrated scientific approach. It is heartening to see scholars from various disciplines come together to contribute to this noble initiative.

I take great pride in witnessing such academic ventures that not only uphold the integrity of research but also amplify its impact across domains. This publication is a tribute to the dedication of those who understand that science is not confined by boundaries, but rather flourishes through connection and cooperation.

Each contribution to this book signifies countless hours of study, experimentation, reflection, and refinement. The effort poured into crafting these papers is commendable and reflects a sincere devotion to knowledge creation and dissemination.

I congratulate every contributor, the editorial board, and the coordinators for their commitment to quality and scholarly depth. This book will undoubtedly serve as a reference and an inspiration for future researchers and students who wish to explore the convergence of scientific ideas.

May this initiative continue to grow, sparking future collaborations and innovations that shape the world we live in.

With best wishes,
Dr. C. Initha Lebanon Ebency
Principal

Message from the Vice Principal

It gives me immense joy to pen this message for the book "Synergy in Sciences: From Molecules to Machines." This publication reflects not only the brilliance of its content but also the extraordinary effort, planning, and teamwork that made it possible.

Often, behind every great scientific endeavor lies a foundation of dedication, discipline, and diligent work. From the call for papers to the final compilation, the journey of this book has been a collective commitment to excellence. I extend my appreciation to every contributor, editor, and coordinator who worked tirelessly to bring this vision to fruition.

As the academic coordinator, I have closely observed the seamless coordination and spirited discussions that marked this project. The working model adopted—focusing on cross-disciplinary engagement, regular feedback loops, and quality review—has set a benchmark for future academic compilations.

This book stands as evidence that science thrives when minds are aligned and efforts are unified. The transition from molecules to machines, explored across these pages, is symbolic of the meticulous processes that mirror the work behind this very book—systematic, interlinked, and profoundly impactful.

Let this book be a celebration of not just knowledge, but the work that transforms ideas into contributions, and contributions into legacies.

I extend my warmest congratulations to everyone involved and wish continued success in all future academic pursuits.

Sincerely,
Mrs. Japhia Solomon
Vice Principal

ABOUT THE EDITORS

As a member of the Department of Biochemistry at Annai Violet Arts & Science College, Dr. P. Kalaivani, M. Sc, Ph. D takes immense pride in contributing to the academic and research growth of our vibrant institution. With a deep-rooted passion for scientific discovery, she has dedicated herself to cultivating a dynamic and inquiry-driven learning environment that encourages students to explore the ever-evolving world of biochemistry.

It is with great enthusiasm that she shares her recent academic accomplishment as the author of the book *"**Synergy in Science: From Molecules to Machines**."* This work represents a multidisciplinary approach to science, bridging biochemical principles with modern scientific innovations, and aims to inspire both students and researchers alike.

Dr. P. Kalaivani earned her Master's degree in Biochemistry in 2011 and her Doctor of Philosophy in Biochemistry in 2022, both from Vels University. Her Ph.D. research was supported by the prestigious Vels Research Fellowship.

Dr. P. Kalaivani began her academic career in June 2013 as a Lecturer at Sri Devi Nursing College and continued her career at Jaya College of Arts and Science. She currently serves as an Assistant Professor in the Department of Biochemistry at Annai Violet Arts & Science College, Ambattur, Chennai, Tamil Nadu. With a distinguished career spanning a decade, she has contributed significantly to academic excellence. She also serves as the Assistant Head of Criteria 7. Moreover, she has served as a practical external examiner for Jaya College of Arts and Science and JNN Arts and Science College.

Dr. P. Kalaivani has published many articles in various journals, presented around 20 papers at national and international conferences, and published papers in Web of Science and Scopus-indexed journals. She has also been a Resource Person, motivating students in their careers.
I look forward to engaging in future scholarly pursuits and contributing to platforms that promote knowledge exchange and scientific collaboration.

Dr.P. Kalaivani
Assistant Professor, Department of Biochemistry
Annai Violet Arts & Science College

As the Head of the Department of Microbiology at Annai Violet Arts & Science College, Mrs. Angel Jenefa. B, M. Sc, M. Phil is honored to contribute to an institution that fosters innovation, excellence, and a passion for scientific discovery. Her academic journey has been driven by a commitment to instilling curiosity and critical thinking in the field of microbiology—a science that unlocks the unseen world and its profound impact on life.

With immense pride, she shares her role as the author of the book *"Synergy to Science: From Molecules to Machines."* This multidisciplinary work reflects her belief in the interconnectedness of scientific disciplines and the power of knowledge to bridge foundational theories with real-world applications.

Mrs. B. Angel Jenefa began her academic career in June 2011 as an Assistant Professor. She has contributed to the institution through committee work, advising students, mentoring graduate students, and engaging in outreach activities. She is dedicated to conducting original research, having published two scholarly articles, one book, and presented at conferences. She is also recognized for her contributions as a question paper setter for Selvam College of Arts and Science, Namakkal. Moreover, she has served as a practical external examiner for Jaya College of Arts and Science.

She served as the Coordinator of Rangers and Rovers from the academic year 2022–2023 and has been a member of the NAAC IQAC Core Committee.

Looking forward, she remains committed to advancing the academic mission of our college and fostering a learning environment where students are inspired to lead, explore, and innovate in the world of microbiology.

Mrs. Angel Jenefa
Head, Department of Microbiology
Annai Violet Arts & Science College

It is with great pride and academic fulfillment that Mrs. S. Jeba Sheeja, M. Sc, M. Phil serves as the Head of the Department of Chemistry at Annai Violet Arts & Science College. Throughout her journey in the field of education, she has remained committed to nurturing a deep appreciation for chemistry while fostering a spirit of scientific inquiry and critical thinking among students.

As a culmination of her passion for interdisciplinary learning and academic exploration, she authored the book *"Synergy to Science: From Molecules to Machines."* This work reflects her vision to bridge foundational chemical concepts with emerging scientific innovations, offering readers a comprehensive perspective that spans from the microscopic to the mechanical.

Mrs. S. Jeba Sheeja received her Master of Science degree in 2003 from the University of Madras and her Master of Philosophy in Science degree in 2005 from Bharathidasan University.

In June 2005, she began her academic career as an Assistant Professor and currently serves as the Head of the Department of Chemistry at Annai Violet Arts & Science College, located in Ambattur, Chennai, Tamil Nadu. With a distinguished career spanning 17 years, she continues to inspire both her students and colleagues.

Since 2014, she has also served as an ISO Auditor. Currently, she is serving as the NAAC-Criteria-I Co-Ordinator, as well as an Examination Evaluator and Practical Examiner for various colleges. She is also a member of the editorial board for a conference held in 2023-24, has published four research papers in renowned journals, attended numerous Faculty Development Programs (FDPs), and made significant contributions to the academic growth of the institution.

With continued enthusiasm, Mrs. S. Jeba Sheeja looks forward to further advancing the academic excellence of the college and inspiring future generations of scientific thinkers.

Mrs. S. Jeba Sheeja
Head, Department of Chemistry
Annai Violet Arts & Science College

On behalf of the Department of Computer Science, Mrs. Krishnaveni N. is delighted to express her sincere gratitude and enthusiasm for contributing to the academic enrichment of our institution.

It brings her great pride to have authored the book *"Synergy in Science: From Molecules to Machines"* — a multidisciplinary work that explores the fascinating intersections of scientific fields, from the tiniest molecular structures to the vast complexities of modern machinery. This book is a testament to the evolving landscape of science and its limitless potential to inspire innovation and deeper understanding.

Mrs. Krishnaveni N., serving as an Assistant Professor, is passionately guiding students in their academic and research pursuits in the field of Computer Science. She began her teaching career in 2009 and has continued to serve as an Assistant Professor at Annai Violet Arts & Science College. In 2014, she became an ISO Auditor, and in 2023, she served as the Fine Arts Coordinator and a member of Criteria 6. She has published three research papers, attended four conferences, and participated in many Faculty Development Programs (FDPs). She has also served as an external examiner for Naan Mudhalvan.

She is currently pursuing a Ph.D. in Computer Science, furthering her commitment to academic excellence and research. Her dedication to both academics and extracurricular activities has significantly impacted the institution's growth. Throughout her career, she has been committed to fostering an environment of learning and professional development. She remains actively involved in initiatives that promote academic excellence. Additionally, her contributions to the college extend beyond the classroom. With a passion for teaching and innovation, she continues to inspire and guide students in their academic journey.

She looks forward to further collaborative endeavors that celebrate knowledge and stimulate progress in science and technology.

Mrs. Krishnaveni. N
Assistant Professor, Department of Computer Science
Annai Violet Arts & Science College

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"A Natural Shield: Investigating the Antimicrobial and Anti - haemolytic Effects of *Moringa oleifera* Fruit Peel"

Dr. R. Harini[1*], Ms. K. Gopika[2], Ms. K. Pachaiyammal[3], Mr. A. Boominathan[4], Ms. K. Parameshwari[5], Mr. S. Akshay[6]

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Abstract

Moringa oleifera, commonly known as the drumstick tree, has long been valued in traditional medicine for its wide array of therapeutic properties. While extensive research has been conducted on various parts of the plant, including leaves, seeds, and roots, the fruit peel remains underexplored. This study investigates the antimicrobial and antihemolytic potential of aqueous and ethanolic extracts of *Moringa oleifera* fruit peel. The antimicrobial activity was assessed using the agar disc diffusion method against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans*, and *Enterococcus faecalis*. Results demonstrated concentration-dependent inhibition, with *Candida albicans* showing the highest sensitivity, while *Pseudomonas aeruginosa* remained resistant. In addition, the antihemolytic effect was evaluated using goat erythrocytes exposed to oxidative stress, with ethanolic extracts offering significantly higher protection than aqueous counterparts. The observed biological activities are attributed to the presence of polyphenols and flavonoids known for their antioxidant and membrane-stabilizing properties. These findings suggest that *Moringa oleifera* fruit peel may serve as a cost-effective, natural source of antimicrobial and antihemolytic agents, warranting further phytochemical and pharmacological investigations.

Keywords: *Moringa oleifera, Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans, Enterococcus faecalis*

INTRODUCTION

The World Health Organization (WHO) has stated that 80% of the developing world still benefits from the use of traditional medicines derived from medicinal plants. The total estimated number of plants is approximately 374,000 in comparison to 28,187 medicinal species used by humans. WHO has also recorded the names of over 20,000 species of medicinal plants and described medicinal plants as one of the potential sources of new drugs. More than 100 countries have developed regulations for medicinal plants. There are over 1340 plants with defined antimicrobial activity and over 30,000 antimicrobial compounds have been isolated from plants. Moreover, it has been estimated that 14–28% of higher plant species are medicinal and that 74% of bioactive plant-derived compounds were discovered based on ethnomedicinal uses (Natalia *et al.*, 2021).The extensive, inappropriate, irregular, and indiscriminate uses of antibiotics have resulted in the emergence of antimicrobial resistance, making many currently available medications ineffective. The use of and search for drugs and dietary supplements derived from plants have accelerated in recent years. Ethnopharmacologists, botanists, microbiologists, and natural-products chemists are combing

the Earth for phytochemicals and "leads" which could be developed for treatment of infectious diseases. While 25 to 50% of current pharmaceuticals are derived from plants, none are used as antimicrobials. Traditional healers have long used plants to prevent or cure infectious conditions; Western medicine is trying to duplicate their successes. Plants are rich in a wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which have been found in vitro to have antimicrobial properties. Natural antimicrobial agents can act alone or in combination with antibiotics to enhance antimicrobial activity against a wide range of microbes. As the antimicrobial action of many medicinal plants is still unexplored, researchers are increasingly targeting the search for fast-growing new and effective treatments (Marjorie, 1999).

The antimicrobial activity of an agent is mainly attributed to two mechanisms, which include interfering chemically with the synthesis or function of vital components of bacteria and/or circumventing the conventional mechanisms of antibacterial resistance. However, bacteria can create resistance to multiple antimicrobials inherently by selective pressures or acquire the resistance machinery from neighboring microb (Magiorakos *et al.*,2012; Velayati *et al.*,2009). The mechanism described below correspond to known antimicrobial drugs. Moringa (*Moringa oleifera Lam*). is a type of local medicinal Indian herb which has turn out to be familiar in the tropical and subtropical countries. The other terms used for Moringa are Horseradish tree, Mulangay, Mlonge, Benzolive, Drumstick tree, Sajna, Kelor, Saijihan and Marango (Fahey, 2005).

Moringa oleifera is one of the vegetables of the Brassica order and belongs to the family Moringaceae. The Moringaceae is a single genus family with 13 known species (Khawaja *et al*., 2010). *Moringa oleifera* is a small native tree of the sub-Himalayan regions of North West India, which is now indigenous to many regions in Africa, Arabia, south east asia, the Pacific and Caribbean Islands and South America. Traditionally, besides being a daily used vegetable among people of these regions, the Moringa is also widely known and used for its health benefits. Among commoners, it has earned its name as 'the miracle tree' due to its amazing healing abilities for various ailments and even some chronic diseases. Several investigations were carried out to isolate bioactive compounds from various parts of the plant due to its various applications (Guevara *et al*., 1999). Therefore, herbal plants in medicine or known as phytomedicine are still trustworthy and widely applied as one of the alternative approaches in medicinal field due to its affordable cost (Abalaka *et al*., 2009).Similar to the roots, the bark of the moringa tree has antibiotic properties. It is used to help treat almost all diseases.ost of the studies utilized moringa fruit, seeds, leaves, root, bark, flowers, buds for analyzing their antioxidant value. In the context of moringa fruit peel, though it is edible, it is not explored so far. Hence, in the present study, moringa fruit peel extract was given importance for revealing their antimicrobial efficacy and antihemolytic property.

MATERIALS & METHODS

SAMPLE COLLECTION & PROCESSING FOR EXTRACT PREPARATION

Moringa oleifera (drumstick) fruit was purchased from the local vegetable market near Ambattur, Chennai. Fruits were cleaned, skin was peeled. Then fruit peels were sun dried.

The dried fruit peels were prepared by powdering each individually and then sieved. Then the extraction process, infusion, a type of maceration was utilized for the extract preparation. After sieving, the fine powder was placed in a clean container. Then the ethanol (50%) is poured on top of the fine powder, soaked, and kept for a short period of time (2h) to extract the bioactive constituents that are readily soluble. Simultaneously, aqueous extract was prepared using water. Then, the samples were filtered with grade 1 Whatman paper. The extract prepared was 2% and; they were stored and utilized for further analysis.

ANTIMICROBIAL ACTIVITY

Preparation of Inoculum

The antimicrobial properties of plant extracts were tested against *S. aureus, P. aeruginosa, C. albicans* and *E. faecalis*. Bacteria were pre-cultured in Mueller Hinton broth (MHB) overnight in a rotary shaker at 37°C. Afterward, each strain was adjusted at a concentration of 10^8 cells/ml using 0.5 McFarland standard (Bhalodia and Shukla, 2011).

Antimicrobial Screening

Agar disc diffusion method was used to screen the antibacterial activities of extracts as displayed by (Daoud *et al*., 2015). One ml of fresh bacterial culture was pipetted in the center of sterile Petri dish. Then, 100 µl of each extract (20% w/v) was added to respective discs. The concentration of extracts (20% w/v) has been selected based on previous literature. The plates were placed in the refrigerator for 30 min to let the extracts diffusion well into the agar. Then, the plates were incubated at 37°C for 18 h. Antimicrobial activity was detected by measuring the zone of inhibition (including the discs diameter) appeared after the incubation period. DMSO at a concentration of 10% was employed as a negative control.

Antihemolytic Activity

Antihemolytic activity of the extracts was assessed as described by Nabavi *et al*., 2010. 10% Triton X-100 (1% V/V) was used as standard. Phosphate buffered saline (PBS) was used as negative control. Erythrocytes from goat blood were separated by centrifugation and washed with phosphate buffer (pH 7.4). Erythrocytes were then diluted with phosphate buffered saline to give 4% suspension.

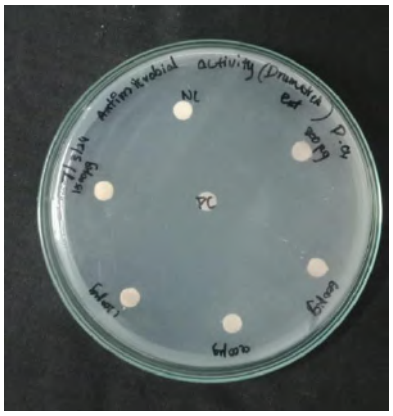
Then 0.5 mL of different concentrations of each extract was added to 2 mL of erythrocyte suspension and the volume was made up to 5 mL with saline buffer. The mixture was incubated for 60 min at room temperature. After incubation, the reaction mixture was centrifuged at 1700 Xg for 5 min and the extent of hemolysis was determined by measuring the absorbance at 540 nm corresponding to hemoglobin liberation.

Statistical Analysis

In this study, all the experiments were carried out in three independent biological replicates, and data were reported as mean ± standard deviation for each set of conditions. Statistical significance of the data was tested through one - way analysis of variance (ANOVA) using least significant difference with $p<0.05$, $p<0.01$, $p<0.001$.

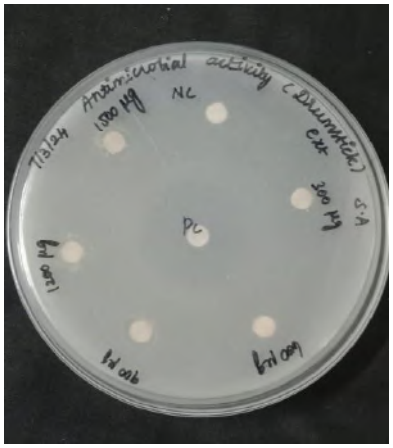
RESULTS

Enterobacter faecalis



Pseudomonas aeruginosa

Candida albicans



Staphylococcus aureus

FIGURE 1: ANTIMICROBIAL ACTIVITY OF AQUEOUS & ETHANOLIC EXTRACT OF DRUMSTICK FRUIT PEEL.

TABLE 1: ZONE OF INHIBITION IN mm

CONCENTRATION	*Candida albicans*	*Staphylococcus aureus*	*Enterobacter faecalis*	*Pseudomonas aeruginosa*
300µg	6mm	NI	NI	NI
600µg	10mm	NI	8mm	NI

900µg	10mm	2mm	8mm	NI
1200µg	10mm	9mm	7mm	NI
1500µg	13mm	9mm	9mm	NI
PC	27mm	25mm	23mm	20mm

Figure 1 and Table 1 depicts the antimicrobial activity of drumstick fruit peel extract against *Candida albicans, Staphylococcus aureus, Enterobacter faecalis, Pseudomonas aeruginosa.*It showed the increase in antimicrobial activity on increasing the concentration from 300µg to 1500µg portrayed from zone of inhibition in figure 1 and table 1 for Candida albicans. Towards *Staphylococcus aureus*, higher concentration only (900µg to 1500µg), and towards *Enterobacter faecalis*, higher concentration only (600µg to 1500µg) and towards *Pseudomonas aeruginosa*, no zone of inhibition was observed for all concentrations compared to positive control tetracycline.

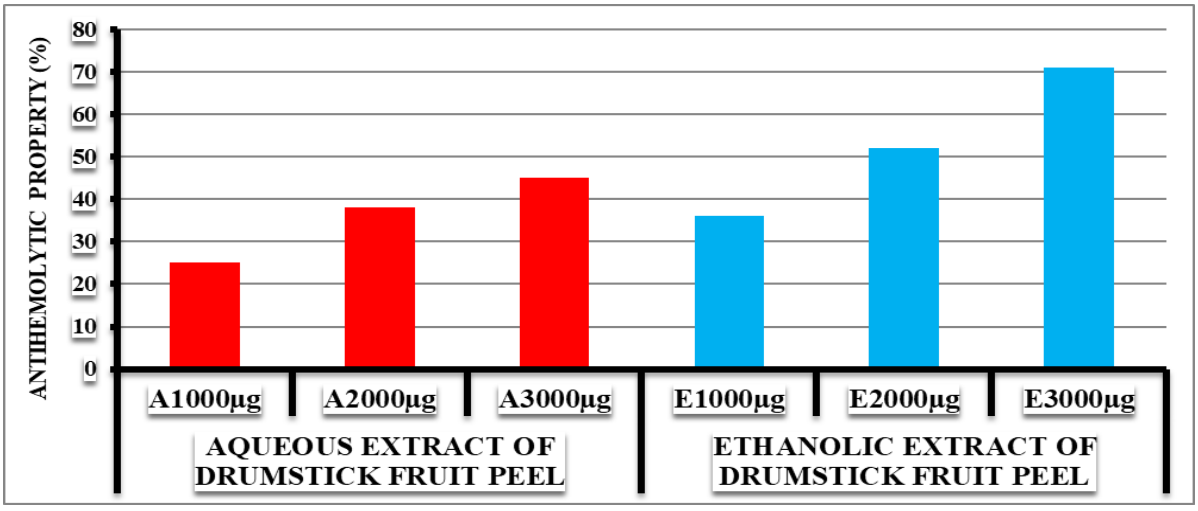


FIGURE 2. ANTIHEMOLYTIC PROPERTY OF AQUEOUS &ETHANOLIC EXTRACT OF DRUMSTICK FRUIT PEEL. N=5.

Table 2 depicts the antihemolytic property of aqueous and ethanolic extract of drumstick fruit peel which showed the significant increase in inhibition of hemolysisby ethanolic extract compared to aqueous extract of drumstick fruit peel.

DISCUSSION

Present study is the first study explored the antimicrobial activity and antihemolytic property of moringa fruit peel extracts. Antimicrobial activity is represented in Figure 1 and Table 1which depicts the antimicrobial activity of drumstick fruit peel extract against *Candida albicans, Staphylococcus aureus, Enterobacter faecalis, Pseudomonas aeruginosa.*It showed the increase in antimicrobial activity on increasing the concentration from 300µg to 1500µg portrayed from zone of inhibition in figure 1 and table 1 for *Candida albicans*. Towards *Staphylococcus aureus*, higher concentration only (900µg to 1500µg), and towards

Enterobacter faecalis, higher concentration only (600µg to 1500µg) and towards *Pseudomonas aeruginosa*, no zone of inhibition was observed for all concentrations compared to positive control tetracycline.

Similarly, *M. oleifera* ethanolic root extract was tested and found to contain a compound N-benzylethyl thioformate (an aglycone of deoxyniazimincin) responsible for the antimicrobial and antifungal effect toward an extensive array of microbes and fungi (Upadhyay *et al*., 2015). *M. oleifera* methanolic leaf extract were analyzed and found to exert inhibition of urinary tract infections caused by Gram-negative and Gram-positive bacteria such as *Klebsiella pneumoniae, Staphylococcus aureus, Escherichia coli* and *Staphylococcus saprophyticus*(Maurya and Singh, 2014).

The inhibitory effect of extracts from leaves, seeds, and stems of *M. oleifera* has been specified in various fungal strains such as *Aspergillus flavus, Aspergillus terreus, Aspergillus nidulans, Rhizoctonia solani, Aspergillus niger, Aspergillus oryzae, Fusarium solani, Penicillium sclerotigenum, Cladosporium cladosporioides, Trichophyton mentagrophytes, Penicillium species, Pullarium species*(Upadhyay *et al*., 2015). Coherently*M. oleifera seeds* have active components 4-(alpha-L-rhamanosyloxy) benzyl isothiocyanates, which are believed to be responsible for their antimicrobial activity (Padla *et al*., 2012). The juice of Moringa leaves also showed potential against human pathogenic bacteria (Mishra *et al*., 2011). The methanolic leaf extract has nearly 99% inhibition against *Botrytis cinerea* (a necrotrophic plant fungus) (Ahmadua *et al*., 2020).

The fruit of *M. oleifera* contains alkaloids, flavonoids, and steroids, which have an inhibitory effect against the culture of *Candida albicans* by either denaturing the protein or inhibiting the germination of spores through the steroid ring they contain. It is suggesting that this may be attributed to the antimicrobial property of moringa fruit peel extract.

In agreement to our study results, strong inhibitory effects of moringa seed kernel extract were observed by another study for *Bacillus cereus, Staphylococcus aureus, Mucor species,* and *Aspergillus* species. However, it was less effective against *P. aeruginosa* and *E. coli*. This indicated that, except for *E. coli* and *P. aeruginosa*, moringa seed kernel extract might be utilized to treat infections caused by these species (Dinesha *et al*., 2018). A recent study has been conducted, which states that only apolar extract obtained from seeds of *M. oleifera* showed anti-microbial activity against Gram-positive bacteria (Anzano *et al*., 2022).Hence, it is suggesting that various studies explored only the various parts of moringa plant which includes seeds, fruits, buds, leaves, roots, other than fruit peel. In this context, moringa fruit peel was analyzed and found a significant antimicrobial activity towards *Candida albicans, Staphylococcus aureus, Enterobacter faecalis.*

In addition, antihemolytic property of moringa fruit peel extracts were tested. Both aqueous and ethanolic extracts were ascertained for their antihemolytic efficacy. In the context of antianemic property, Table 2 depicts the antianemic efficacy through ascertaining antihemolytic property of aqueous and ethanolic extract of drumstick fruit peel which showed the significant increase in inhibition of hemolysisby ethanolic extract compared to aqueous extract of drumstick fruit peel. It is suggesting the significant solubility nature of

phytochemicals in organic solvent- ethanol and the associated efficient antihemolytic property compared to that of aqueous extracts. It is well known that anemia can result from physiological hemolysis, defined as the destruction of senescent RBCs after chemical and mechanical stresses that progressively damage them during their 120 days life span. This phenomenon increased hemoglobin catabolism, loss of membrane proteins, and altered ion transport (Badior and Casey, 2018). Moreover, anemia most commonly presents aspathological hemolysisdue to alterations in the quantityand/or quality of proteins involved in maintaining the RBC membrane's properties, resulting in their increased and premature destruction. It may have a corpuscular or extracorporeal origin due to chronic, hereditary, or acquired destructions (Phillips and Henderson, 2018; Rai *et al*., 2020). Similarly, a study performed an assessment to explore the ability of leaves and bark extracts of *R. alaternus*to protect red blood cells from damagecaused by AAPH-induced hemolysis. The anti-hemolytic activity demonstrated that treating erythrocytes with *R. alaternus*leaves and bark extracts enhanced their resistance to AAPH damage in a dose-dependent manner.

Hence, it is suggested that this antihemolytic activity is probably due to thevarious phenolic compounds in both extracts, known as phenolic hydrogen atom donors. They help stabilize free radicals through their antioxidant activity, increasing erythrocytes' oxidative stress resistance. Moreover, the phenolic components present in plant extracts could donate one or more electrons to neutralize the free radical while inhibiting hemolysis at the same time. In addition, polyphenols have also been shown to have the ability to interact with the hydrophilic section of the lipid membrane, causing changes in the packing arrangement of the polar heads of the lipids (Balderrama-Carmona *et al*., 2020).

Recent studies suggested that various flavonoids, as well as otherpolyphenolsfound in both extracts, may protect erythrocyte cell membranes by interacting with membrane phospholipids, which protect them from lipid deterioration (Derouich *et al*., 2020). Flavonoids also promote Van der Waals contacts within the lipid bilayer and may be a source of membrane stability, protecting erythrocytes from free radical damage (Ramchoun *et al*., 2015).Similarly,*B. gymnorrhiza* showed an effective hemolysis prevention activity. Furthermore, the results show a strong connection between total phenolic content and anti-hemolytic assay. Coherent to our study results, the addition of the aqueous extract of *T. satureioides* indicates an increase of the level of erythrocytes membranes stability. The actions of aqueous extract, total polyphenols or total flavonoids are not limited to inhibit the free radicals, but it also seems to have an influence on the structural stability of the erythrocyte membrane.Various authors mentioned that flavonoids and the widely distributed subgroup of polyphenols had beneficial effect on the erythrocyte membrane stability. Overall, our study demonstrates that a good part of the antimicrobial activity and consequently the resistance of the erythrocytes to hemolysis inducted by different extract of moringa fruit peel extract can be linked up to the content of polyphenols and flavonoids; however it remains to be elucidated.

CONCLUSIONS: Our current study concludes that it’s bioactive potential could be highly useful in preventing and treating microbial infections and hemolytic anemias and the accompanied disorders involving excessive oxidative stress generation.

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ANTIBACTERIAL ACTIVITY OF *SYZYGIUM AROMATICUM*

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Abstract

Syzygium aromaticum, commonly known as clove, is a traditional medicinal spice renowned for its antimicrobial properties, primarily attributed to its bioactive compound eugenol. This study investigates the antibacterial activity of methanolic extracts of *Syzygium aromaticum* against *Escherichia coli* using the agar disc diffusion method. Plant materials were collected, authenticated, dried, powdered, and subjected to cold maceration for extraction. The antibacterial assay revealed a measurable zone of inhibition of 6 mm at 5 µg/µl concentration of clove extract, compared to an 18 mm zone for the control. Although the inhibition was modest, the findings support the antibacterial potential of clove, even at lower concentrations. The results indicate that clove extract can inhibit *E. coli* growth, reinforcing its potential use as a natural antimicrobial agent. Further studies are warranted to explore higher extract concentrations, synergistic effects with antibiotics, and efficacy against antibiotic-resistant strains. These results provide a foundation for the development of alternative or complementary therapies in managing bacterial infections amid rising antibiotic resistance.

Keywords:*Syzygium aromaticum*, clove, antibacterial activity, *Escherichia coli*, eugenol, natural antimicrobial, antibiotic resistance.

INTRODUCTION

Syzygiumaromaticum, commonly known as clove, is a spice derived from the dried flower buds of the *Syzygiumaromaticum* tree, belonging to the Myrtaceae family. Native to the Maluku Islands in Indonesia, it is now widely cultivated in tropical regions around the world. Clove has been utilized for centuries, not only as a culinary spice but also for its medicinal properties, in both traditional and modern medicine. In particular, *Syzygiumaromaticum* has gained significant attention for its potent antibacterial activity, which is attributed to its bioactive compounds, primarily eugenol, a phenolic compound with well-established antimicrobial properties.The antibacterial properties of *Syzygiumaromaticum* have been documented in several studies, which demonstrate its ability to inhibit the growth of a wide range of pathogenic bacteria. These include both Gram-positive and Gram-negative bacteria, many of which are responsible for common infectious diseases. The most studied antibacterial component of clove is eugenol, which constitutes up to 70-90% of the essential oil extracted from clove buds. Eugenol has been found to disrupt bacterial cell membranes, inhibit enzyme activities, and interfere with various cellular functions, leading to the bacteriostatic or bactericidal effects observed in vitro. One of the main reasons for the growing interest in the antibacterial activity of *Syzygiumaromaticum* is the increasing prevalence of antibiotic resistance. In recent years, multidrug-resistant (MDR) bacteria have become a major public health concern, as they render conventional antibiotic treatments

ineffective. This has led to a renewed interest in the exploration of natural products as potential sources of novel antimicrobial agents. Clove, with its antimicrobial potential, is seen as a promising candidate to complement or replace synthetic antibiotics, especially in the treatment of infections caused by resistant strains of bacteria.Numerous scientific studies have evaluated the antibacterial properties of *Syzygiumaromaticum* against a variety of bacterial pathogens. In vitro studies involving the disk diffusion method, broth dilution, and agar well diffusion techniques have demonstrated that clove extracts, particularly its essential oil, exhibit broad-spectrum activity against both Gram-positive bacteria such as *Staphylococcus aureus*, *Bacillus subtilis*, and *Enterococcus faecalis*, and Gram-negative bacteria like *Escherichia coli*, *Salmonella typhi*, and *Pseudomonas aeruginosa*. The essential oil of clove has been shown to inhibit bacterial growth by interfering with the synthesis of cell wall components, disrupting bacterial cell membrane integrity, and inducing leakage of intracellular contents.

The mechanism of action of clove's antibacterial activity is believed to involve several factors. Eugenol, the main active compound, interacts with the bacterial cell membrane by disrupting the lipid bilayer, increasing membrane permeability, and leading to the leakage of cellular contents, including ions and macromolecules. Furthermore, eugenol is known to inhibit bacterial enzymes like ATPase, which plays a crucial role in maintaining cellular energy balance, ultimately leading to bacterial cell death. Other compounds present in clove essential oil, such as β-caryophyllene, have also been shown to contribute to the overall antimicrobial effect.The effectiveness of *Syzygiumaromaticum* against antibiotic-resistant bacteria has been a focal point in recent studies. The rise in resistance to antibiotics like penicillin, ampicillin, and tetracycline has underscored the need for alternative antimicrobial agents. *Syzygiumaromaticum* has shown significant activity against resistant strains of *S. aureus*, including methicillin-resistant *Staphylococcus aureus* (MRSA), a notorious pathogen responsible for hospital-acquired infections. The ability of clove extracts to combat such resistant bacteria has spurred further investigation into the potential of clove as a natural antibacterial agent for treating infections in clinical settings.

MATERIALS AND METHODS

Collection of Plant materials

The whole ***Syzygium aromaticum*** wascollectedinthemonthof February ,Chennai,Tamil Nadu, India. The plant was identified taxonomically and authenticated at the HeteroGene Biotech PvtLtd, Chennai, Tamil Nadu, India.

Drying: The disease-free ***Syzygium aromaticum*** were separated dried at temperature between 30^{o} C. The size reduction of the dried meliadubia was done with the help of mechanical blender and the powdered material was stored in the desiccator until further use

Extraction

The medicinally important secondary metabolites from selected ***Syzygium aromaticum*** materials were extracted using selective solvents using standardprocedures(Handaetal., 2008).

Cold Mercerization Extraction

5g of powder was soaked in 50ml of methanol in a conical flask and stirred vigorously with a

glass rod. This setup was placed without any disturbance at room temperature for 24h. After incubation, the extract was filtered using Whatman no.1 filter paper and allowed to freeze dried. The extracted sample was stored at 4^{o}C.

ANTIBACTERIAL ACTIVITY

Collection of bacterial strains:

The pure cultures of bacterial strains were used in the present study namely *E.coli*were collected.

Reagents Required:

All the reagents and chemicals were procured.

Muller Hinton agar medium (w/v):

Thirty-four grams of Muller Hinton agar was dissolved in 1000ml of distilled water and boiled till dissolved completely. The dissolved medium was autoclaved at 15lbs pressure at 121℃ for 15minutes. The medium was then poured to 100mm petridishes and allowed to solidify.

Standard antibacterial agent

McFarland standard preparation (Cockerill et al., 2012)

0.5 McFarland standard was prepared using 0.05ml 0f 1.175% barium chloride dehydrate (BaCl2.H2O) and 9.95ml of 1% sulphuric acid (H2SO4). The two chemicals are mixed well to form a barium sulphate precipitate which causes turbidity.

Inoculum preparation:

A few colonies from each selected bacterial strains were picked separately using a sterile inoculation needle. It was then transferred separately in sterile test tubes containing 4ml of nutrient broth and were marked the tubes accordingly. The inoculated tubes were then incubated for 2-6 h until turbid. If the turbidity was more, then the suspensions were adjusted by dilution with 0.9% saline solution until its density visually equivalent to that of a 0.5 McFarland standard.

Antibacterial assay:
Agar- Disk diffusion in vitro method:

The zone of inhibition assay using agar disk diffusion method was performed by the standard operating procedure (Bauer et al., 1966).

Principle:

The antibiotic impregnated discs were placed on the bacterial inoculated plates, moisture was picked up and the antibiotic diffuses outward radially in the medium which develops an antibiotic concentration gradient.

Procedure:

The prepared solidified Muller Hinton agar plates were streaked evenly on the surface of the medium using sterile glass L-rod. After 5 minutes, sterile Whatmann No.1 filter paper discs with 6mm in diameter were impregnated with different concentration (5µg/µl)of plant extracts were dried at room temperature. Then the discs were placed on the medium surface and gently press down for proper adherence using sterile forceps. The readily available standard antibiotics discs (30µg/ml) were placed on the surface of the medium. These plates were then incubated at 37℃ for 24h. After the incubation period, the diameter of the zone of inhibition was measured with the help of a ruler. The test was performed thrice and the results were substantially expressed as mean ± standard error (SE).

RESULT

Table 1: Antibacterial Activity of *Syzygium aromaticum* (Clove) against *Escherichia coli* (E. coli)

Organism	Control	5 µg/µl - A
E.coli	18mm	6 mm

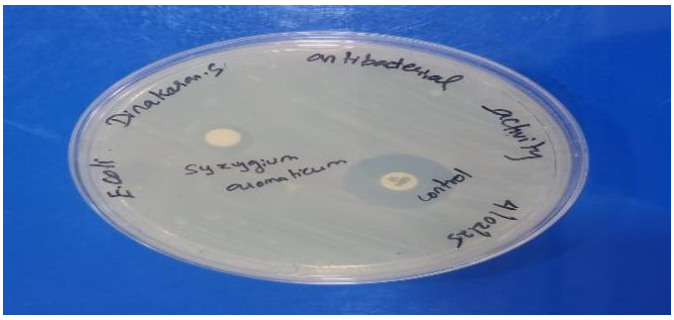

Figure 1:Antibacterial Activity of *Syzygium aromaticum* (Clove) against *Escherichia coli* (E. coli)

DISCUSSION

In this study, the antibacterial activity of *Syzygium aromaticum* (clove) against *Escherichia coli* (E. coli) was assessed using a disc diffusion method. The results showed a significant difference in the zone of inhibition between the control and the sample (5 µg/µl) for *E. coli*. The control exhibited an 18mm zone of inhibition, while the sample with clove extract at a concentration of 5 µg/µl showed a 6mm zone of inhibition.The results suggest that clove has antibacterial properties, but the observed antibacterial activity at the tested concentration is relatively modest when compared to the control. The 18mm zone in the control group likely represents the natural or baseline bacterial growth inhibition under normal conditions, indicating that the bacteria had no exposure to any antimicrobial substance. However, the 6mm zone of inhibition in the *E. coli* culture exposed to the 5 µg/µl concentration of clove extract demonstrates that *Syzygium aromaticum* (clove) contains

compounds that can inhibit the growth of *E. coli*, even at lower concentrations.It is well-documented that clove essential oil, particularly the active compound eugenol, possesses strong antibacterial properties. Studies have shown that eugenol can disrupt the bacterial cell membrane and inhibit essential metabolic processes. However, the smaller zone of inhibition in this experiment may indicate that either the concentration of clove extract used was insufficient to elicit a more significant antibacterial response, or that the strain of *E. coli* used in this study might have some degree of resistance to the antimicrobial components present in clove.

The results from this study align with previous research that suggests clove oil has variable antibacterial effects depending on factors such as the concentration of the extract, the method of application, and the type of bacteria being tested. It is possible that increasing the concentration of clove extract could result in a more pronounced inhibition of bacterial growth, as suggested by the findings in other studies where higher doses of clove extract were shown to increase the size of the inhibition zones. Additionally, the formulation of the clove extract, such as its purity and preparation method, could influence its antibacterial efficacy.It is also essential to consider the strain-specific resistance mechanisms of *E. coli* in this study. Certain strains of *E. coli* may have developed resistance to specific bioactive compounds like eugenol. Resistance could be attributed to factors such as the presence of efflux pumps, modifications in the cell membrane, or the production of enzymes that degrade the active compounds. Further studies are needed to better understand the precise mechanism of clove's antibacterial action against *E. coli* and to identify optimal concentrations for maximum efficacy. It would also be useful to investigate other strains of *E. coli*, including antibiotic-resistant strains, to evaluate whether clove can serve as a potential alternative or adjunct to conventional antibiotics in combating *E. coli* infections. Additionally, combination studies with clove extract and other antimicrobial agents should be explored to assess any synergistic effects that could enhance its antibacterial activity

CONCLUSION

In conclusion, *Syzygium aromaticum* (clove) shows promise as a natural antimicrobial agent, especially in the fight against bacterial infections like *E. coli*. However, future studies are required to determine its full potential, identify the most effective formulations, and assess its role in combating antibiotic-resistant strains of bacteria.

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Antidiabetic Activity of Cumin (*Cuminum cyminum*)

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Abstract

The rising prevalence of diabetes mellitus, particularly type 2 diabetes, has intensified the search for effective natural remedies to complement conventional therapies. Cumin (*Cuminum cyminum*), a widely used spice known for its culinary and medicinal properties, has demonstrated promising antidiabetic potential. This study investigates the antidiabetic activity of cumin through its effect on glucose uptake using a yeast cell model. Cumin seeds were collected, authenticated, dried, powdered, and subjected to methanol extraction. The extracted compounds were tested for their ability to enhance glucose uptake in yeast cells, with metformin serving as the standard reference drug. Results indicated that cumin extract significantly improved glucose uptake in a dose-dependent manner, although its efficacy was lower compared to metformin. The percentage increase in glucose uptake ranged from 49.52% to 11.99% across different glucose concentrations. These findings suggest that cumin exhibits moderate antidiabetic activity, potentially due to its bioactive compounds like flavonoids, terpenoids, and essential oils, which may enhance insulin sensitivity and reduce oxidative stress. While promising, further clinical studies are needed to confirm these effects in human subjects and to elucidate the underlying mechanisms. This research highlights cumin's potential as a natural adjunct in diabetes management, offering a complementary approach to conventional antidiabetic therapies.

INTRODUCTION

Cumin (*Cuminum cyminum*), a popular spice derived from the seeds of the plant belonging to the Apiaceae family, has been utilized for centuries not only for its distinctive flavor in culinary applications but also for its medicinal properties. Native to the Mediterranean region, cumin has spread worldwide and is widely used in traditional medicine systems, particularly in the Middle East, India, and North Africa. Over time, researchers have begun to explore the pharmacological potential of cumin, and its bioactive compounds have been shown to have various health-promoting effects, including antidiabetic activity. Diabetes mellitus, a chronic metabolic disorder characterized by high blood glucose levels, is a major global health challenge. The disease is primarily categorized into type 1 diabetes, which results from autoimmune destruction of insulin-producing beta cells in the pancreas, and type 2 diabetes, a condition where the body becomes resistant to insulin or fails to produce enough insulin. The increasing prevalence of diabetes, particularly type 2, has led to a growing interest in natural remedies that can manage blood glucose levels and complement conventional therapies. Given the increasing burden of diabetes and the limitations of synthetic drugs, there has been a resurgence in interest in plant-based therapies, which have fewer side effects and offer a more sustainable approach to managing the condition. *Cuminum cyminum* has long been recognized in traditional medicine for its ability to manage

various ailments, ranging from digestive issues to respiratory problems. More recently, scientific studies have provided substantial evidence supporting its antidiabetic effects. Various phytochemicals present in cumin, such as flavonoids, alkaloids, terpenoids, and essential oils, have been found to exert multiple pharmacological effects that can help control blood sugar levels. Cumin seeds contain a wide array of compounds that have antioxidant, anti-inflammatory, and insulin-sensitizing properties, all of which play a role in regulating glucose metabolism. The antidiabetic activity of cumin is attributed to its potential to enhance insulin sensitivity, promote glucose uptake, and reduce the risk of oxidative stress associated with diabetes. Oxidative stress plays a pivotal role in the development of insulin resistance and beta-cell dysfunction, both of which are key features of type 2 diabetes. By neutralizing free radicals and improving the antioxidant defense system, cumin may help alleviate the oxidative damage that contributes to the progression of diabetes. Furthermore, cumin's active compounds may stimulate the pancreas to produce more insulin or enhance the body's responsiveness to the hormone, thereby improving glucose utilization and lowering blood sugar levels.

One of the primary mechanisms through which cumin exerts its antidiabetic effects is by improving insulin resistance. Insulin resistance is a hallmark of type 2 diabetes, where the body's cells fail to respond adequately to insulin. This leads to elevated blood glucose levels, which in turn contribute to further complications such as cardiovascular disease, neuropathy, and retinopathy. Cumin's bioactive compounds, including flavonoids and essential oils, have been found to activate specific cellular signaling pathways that promote insulin sensitivity, thereby improving glucose uptake by the cells and reducing blood sugar levels. In addition to its insulin-sensitizing properties, cumin has been shown to have a beneficial impact on lipid metabolism. Dyslipidemia, characterized by abnormal levels of cholesterol and triglycerides, is another common complication of diabetes. Elevated cholesterol levels and the accumulation of triglycerides in the blood are associated with increased cardiovascular risk in diabetic individuals. Studies have suggested that cumin supplementation can help normalize lipid profiles by reducing total cholesterol, LDL cholesterol (the "bad" cholesterol), and triglyceride levels while simultaneously increasing HDL cholesterol (the "good" cholesterol). This dual effect on glucose and lipid metabolism makes cumin an attractive natural adjunct for managing diabetes and its associated complications.

Moreover, cumin's role in modulating inflammatory pathways has also been highlighted as a contributing factor to its antidiabetic effects. Chronic inflammation is another key feature of diabetes and contributes to insulin resistance and beta-cell dysfunction. By reducing the levels of pro-inflammatory cytokines and inhibiting the activation of inflammatory enzymes such as cyclooxygenase (COX-2), cumin can help alleviate inflammation and improve insulin action. Beyond its impact on insulin sensitivity and metabolic regulation, cumin also has a favorable effect on other markers of diabetes. Studies have indicated that cumin supplementation can improve glucose tolerance, reduce HbA1c levels (a marker of long-term blood glucose control), and lower fasting blood sugar levels. The results of these studies suggest that cumin can be used as a supportive treatment for individuals with type 2 diabetes, alongside lifestyle modifications and conventional antidiabetic medications.

Several studies conducted on animal models have demonstrated the positive effects of cumin in managing diabetes. Animal trials have shown that cumin extracts or cumin seed powder significantly reduced blood glucose levels, enhanced insulin secretion, and improved the overall metabolic profile. These findings were supported by clinical studies that have investigated the antidiabetic potential of cumin in humans. For instance, some clinical trials have reported significant reductions in fasting blood glucose and postprandial glucose levels in diabetic patients who consumed cumin supplements or cumin-based products. The results of these studies provide further evidence of cumin's effectiveness as an alternative or complementary therapy for diabetes management. In addition to its role in controlling blood sugar, cumin is also beneficial for individuals with diabetes due to its other health benefits. It has been shown to support liver function, improve digestive health, and possess antimicrobial and anti-inflammatory properties. These attributes make cumin a holistic remedy that can support overall health in individuals with diabetes, who are often prone to digestive issues, infections, and liver complications due to the effects of high blood sugar on various organs.

MATERIALS AND METHODS

Collection of Plant materials

The whole cumin was collected in the month of February, Chennai,Tamil Nadu, India. The plant was identified taxonomically and authenticated at the Hetero Gene Biotech Pvt Ltd, Chennai, Tamil Nadu, India.

Drying

The disease-free cumin was separated dried at temperature between 30^{o} C. The sizereduction of the dried cumin was done with the help of mechanical blender and the powdered material was stored in the desiccator until further use

Extraction

The medicinally important secondary metabolites from selected cumin materials were extracted using selective solvents using standard procedures (Handaetal., 2008).

Cold Mercerization Extraction

5g of powder was soaked in 50ml of methanolinaconical flask and stirred vigorously with a glass rod. This setup was placed without any disturbance at room temperature for 24h. After incubation, the extract was filtered using Whatman no.1 filter paper and allowed to freeze dried. The extracted sample was stored at 4oC.

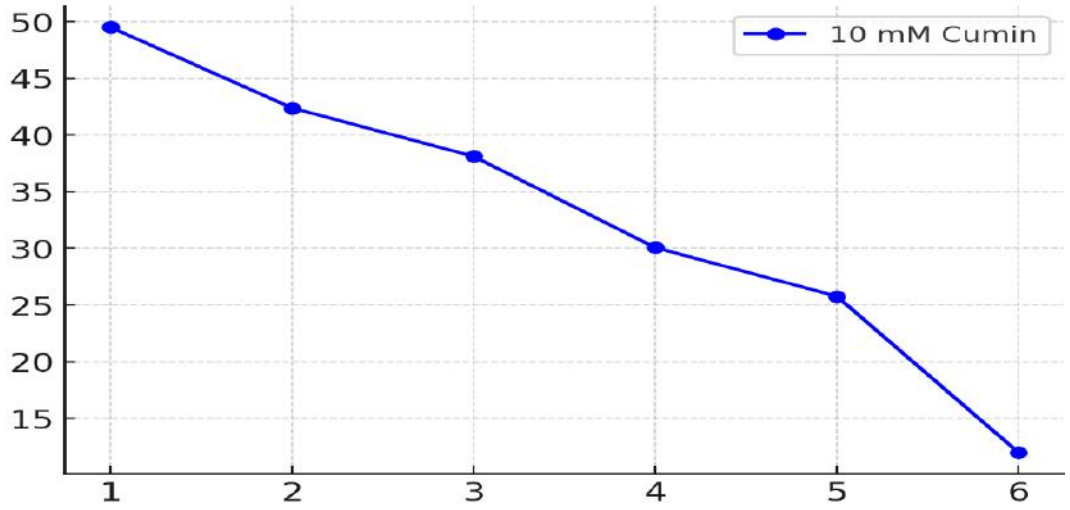
Anti diabeticactivity

This assay was performed according to the well-defined method of cirillo. Commercial baker’s yeast was dissolved in distilled water to prepare 1% suspension. The suspension waskept overnight at room temperature (25^{o}C).On the next days, yeast cells suspension was centrifuged at 4200 rpm for 5 minutes. The process was repeated by the addition of distilledwater to the pellet until a clear supernatant was obtained. Exactly 10 parts of the clear

supernatant fluids were mixed with 90 parts of distilled water to get a 10% v/v suspension of they east cells. About 1–5 mgw/v of plant extract of cumen was mixed with dimethyl sulfoxide (DMSO) till dissolution. The mixture was then supplemented with various concentrations (5,10, and 25 Mm) of 1 mL of glucose solution and incubated for 10 min at 37°C. To initiate there action,100 μLof yeast suspension was poured in the mixture of glucose and extract,vortexed, and incubated for another 60 minutes at 37°C. After incubation, the tubes were centrifuged for 5 minutes at 3800 rpm and glucose was estimated by using a ELISA at 520 nm. Absorbance for the respectivecontrol was alsorecorded. The percent increase in uptake was calculated by the formula where control is the solution having all reagent sexcept the test sample. Metronidazole was used as standard drug

RESULT

Graph 1: Graphical representation of **Antidiabetic Effects of Cumin (*Cuminum cyminum*)**



DISCUSSION

Antidiabetic Effects of Cumin (*Cuminum cyminum*)

Cumin (*Cuminum cyminum*) has long been valued for its culinary uses and medicinal properties. Recently, significant attention has been paid to its potential therapeutic effects, particularly its antidiabetic activity. This discussion synthesizes the findings from various studies that explored the pharmacological potential of cumin, focusing on its role in managing diabetes and the underlying mechanisms responsible for its antidiabetic effects.

Antidiabetic Activity of Cumin Based on Glucose Uptake Capacity by Yeast Cells

The data presented in the report investigates the glucose uptake capacity of yeast cells exposed to varying concentrations of glucose, including different treatments (control, cumin, metformin) in the presence of 10 mM glucose. The optical density (OD) values represent the extent of glucose uptake by yeast cells in the presence of these different treatments, and the

percentage increase in glucose uptake provides valuable insights into the antidiabetic potential of *Cuminum cyminum* (cumin) compared to a standard antidiabetic agent, metformin.

Effect of Glucose Concentration on Yeast Cell Glucose Uptake

From the data, we can observe that as the glucose concentration increases (from 1 mg to 5 mg), the OD values increase, suggesting a proportional increase in glucose uptake by yeast cells. This trend is expected, as higher glucose concentrations would naturally lead to greater availability of glucose molecules for uptake by the yeast cells.

Comparison of Cumin with Control and Metformin

The key objective of this study is to examine the antidiabetic potential of cumin by comparing its effect on glucose uptake with that of a standard antidiabetic agent (metformin). The data shows the following:

Control Group: The OD values for the control group (without any treatment) show a consistent increase in glucose uptake as glucose concentration increases, with the highest OD (0.842) observed at the 10 mM glucose concentration. This suggests that, under normal conditions (without treatment), yeast cells exhibit baseline glucose uptake in response to increasing glucose concentrations.

Cumin Treatment: For the 10 mM cumin group, there is a gradual increase in glucose uptake (from 0.425 OD at 1 mg to 0.625 OD at 5 mg glucose concentration). The observed OD values indicate that cumin is able to facilitate glucose uptake by yeast cells, albeit at a slightly lower rate compared to the control group. The cumulative percentage increase in glucose uptake, calculated as (Absorbance of control - Absorbance of sample) × 100 / Absorbance of control, reveals the following increases in glucose uptake:

49.52% increase at 1 mg glucose

42.39% increase at 2 mg glucose

38.12% increase at 3 mg glucose

30.07% increase at 4 mg glucose

25.77% increase at 5 mg glucose

These values suggest that cumin has a moderate effect on glucose uptake by yeast cells, and this effect appears to decrease with increasing glucose concentrations. Although the increase in glucose uptake is not as pronounced as the control group, the results indicate a potential for cumin to enhance glucose uptake in a dose-dependent manner, though to a lesser extent than the metformin treatment.

Metformin Treatment: Metformin, a well-known antidiabetic drug, serves as a standard for comparison in this study. The OD values for the metformin-treated group (5 mg) range from 0.741 OD at 1 mg glucose to 0.625 OD at 5 mg glucose, which reflects an increase in glucose

uptake in yeast cells. Metformin is known to enhance insulin sensitivity and glucose uptake by facilitating the action of insulin, thereby lowering blood glucose levels. The data shows that metformin treatment results in a substantial increase in glucose uptake, suggesting that it effectively facilitates glucose utilization by yeast cells.

Percentage Increase in Glucose Uptake

The percentage increase in glucose uptake for each treatment group (cumin and metformin) compared to the control group demonstrates how each treatment enhances glucose uptake.

Cumin: The highest percentage increase in glucose uptake occurs at the lowest glucose concentration (1 mg), with a 49.52% increase. As the glucose concentration rises, the percentage increase in glucose uptake decreases, indicating a diminishing effect at higher glucose concentrations. However, the cumulative results indicate that cumin does have some effect in promoting glucose uptake, albeit to a lesser extent than metformin.

Metformin: The metformin treatment shows a steady and more significant increase in glucose uptake across all concentrations, with a 41.99% increase at 1 mg glucose and a 25.77% increase at 5 mg glucose. Although metformin's effect diminishes at higher concentrations, it still shows a greater increase in glucose uptake compared to cumin. This finding aligns with the known mechanism of action of metformin, which sensitizes cells to insulin and enhances glucose uptake.

Implications for Antidiabetic Activity

The results of this study suggest that cumin has potential antidiabetic effects, as evidenced by its ability to enhance glucose uptake by yeast cells. However, cumin's effect appears to be less pronounced than that of metformin. This could be due to the specific bioactive compounds present in cumin, such as flavonoids, terpenoids, and phenolic compounds, which may work synergistically to promote glucose uptake, though their potency is lower compared to the established mechanism of action of metformin. The decrease in the percentage increase in glucose uptake with increasing glucose concentrations may indicate that cumin's effects are more beneficial in situations of mild to moderate insulin resistance or elevated blood glucose. In more severe forms of insulin resistance or diabetes, cumin may need to be used in conjunction with other treatments, such as metformin or insulin, to achieve optimal therapeutic benefits.

CONCLUSION

In conclusion, this study provides evidence that cumin may have potential as a natural agent for promoting glucose uptake, which can contribute to managing elevated blood glucose levels in diabetes. The moderate effect of cumin in enhancing glucose uptake by yeast cells suggests that it could be used as an adjunct to conventional antidiabetic treatments. However, more in-depth studies are needed to confirm its efficacy in human clinical trials and to elucidate the exact mechanisms by which cumin affects glucose metabolism. Future research should also focus on identifying the specific bioactive compounds responsible for cumin's antidiabetic effects and determining their optimal dosages for therapeutic use.

Additionally, investigating the long-term safety and effectiveness of cumin in diabetes management could provide further support for its clinical application in the prevention and treatment of diabetes mellitus.

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Phytochemical analysis of *Azadirachta indica* and *Melia azedarach*

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ABSTRACT

OBJECTIVE Current study was planned to study the phytochemicals present in leaf extract of *Azadirachta indica* and *Melia azedarach.*

METHOD Extract was extracted using soxhlet apparatus using solvent like ethanol and aqueous. The extracts were evaporated using rotary evaporator. The phytochemicals were measured qualitatively.

RESULT

A variety of phytochemicals, including carbohydrates, terpenoids, phenols, tannins, saponins, flavonoids, alkaloids, anthocyanins, betacyanins, quinones, glycosides, cardiac glycosides, steroids, and coumarins, are identified in both ethanol and aqueous extracts, as demonstrated in Table 1 and Figures 1, 2, 3, and 4. In contrast, it was observed that certain phytochemicals, such as triterpenoids, proteins, amino acids, anthraquinones, and phlobatannins, were absent.

INTRODUCTION

India is rich in a diverse array of medicinal and aromatic plants. There are approximately 15,000 species of higher plants, with 9,000 of them being commonly utilized. Among these, 7,500 are recognized for their medicinal properties, while 3,900 are edible. Additionally, 700 plants hold cultural significance, 525 are used for fiber, 400 serve as fodder, 300 are employed in the production of pesticides and insecticides, another 300 are sources of resins and dyes, and 100 are utilized for incense and perfumes. Notably, 25% of pharmaceutical drugs are derived from plants and their derivatives. These medicinal and aromatic plants are known to contain biologically active chemical compounds, including saponins, tannins, essential oils, flavonoids, alkaloids, and various other substances (Harborne, 1973; Sofowara, 1993). According to the World Health Organization, 80% of the global population relies on medicinal plants for disease treatment. Phytochemicals such as flavonoids, saponins, and alkaloids are recognized as biologically active molecules, and therapeutic products for anti-obesity have been developed from both plants and microbes.

Saponins are significant phytochemicals that contribute to various industries, including foams, beverages, agriculture, and the development of antibiotic, antiviral, and antifungal medications. The antitumor properties of saponins were demonstrated by **Agarwal and Rastogi in 1974**. Additionally, they have been shown to lower cholesterol levels **(Messina, 1999)** and exhibit anti-diabetic and anti-ulcer effects ***(Marhuenda et al., 1993)***. The application of natural herbal products for the treatment of diseases in both humans and animals is prevalent due to their cost-effectiveness. Azadirachta indica, commonly known as Neem, possesses numerous pharmacological properties, including anti-ulcer, anti-feedant,

acaricidal, and nematicidal activities. Therefore, the current study aims to qualitatively analyze the phytochemicals present.

Figure 1& 2: Leaves of *Azadirachta indica*&*Melia azedarach*

Collection of Leaves

The leaves of *Azadirachta indica*, known as veppiai in Tamil,*Melia azedarach* called as malai vempu were sourced from a medicinal plant vendor and verified for authenticity. Both the plants belongs to Meliaceae family.

Extraction of Leaves from *Azadirachta indica and Melia azedarach*

To prepare the extract, the leaves of *Azadirachta indica* were shade-dried and ground using a mechanical grinder. The resulting powder was extracted with ethanol, and water through a Soxhlet apparatus, concentrated, and then lyophilized until a dry powder was achieved. This extract was stored in a glass bottle for the duration of the experiment.

Preliminary Phytochemical Screening

Phytochemical analysis was conducted on the powdered samples following standard procedures to identify the various constituents, as outlined by Sofowara 1993, Trease1989, and Harborne 1973.

Sample Preparation

For the preparation, 100 mg of n-hexane, ethyl acetate, ethanol, and aqueous leaf extracts of ***Azadirachta indica and Melia azedarach*** were weighed, dissolved, and diluted to 100 ml in separate standard flasks (resulting in a concentration of 1 mg/ml). This extract was utilized for further studies.

Test for Carbohydrates

To test for carbohydrates, combine 2 mL of the leaf extract with 1 mL of Molisch's reagent and a few drops of strong sulfuric acid. The appearance of a purple colour indicates the presence of carbohydrates.

Test for Terpenoids

To detect terpenoids, take 0.5 ml of the leaf extract, add 2 ml of chloroform, and carefully introduce strong sulfuric acid; a red-brown color at the interface indicates terpenoids.

Test for Triterpenoids

To test for triterpenoids, combine 1.5 ml of the leaf extract with 1 ml of Liebermann-Burchard Reagent (acetic anhydride and concentrated sulfuric acid). A blue or green hue suggests the presence of triterpenoids.

Test for Phenols

For phenols, mix 1 ml of leaf extract with 2 ml of distilled water, then add a few drops of 10% ferric chloride. The appearance of a green color indicates the existence of phenols.

Tannin Test

To test for tannins, combine 1ml of the leaf extract with 2ml of 5% ferric chloride; if a greenish-black tint develops, tannins are present.

Saponin Test

For saponins, add 2ml of leaf extract to 2ml of purified water. Shake the ingredients in a graduated cylinder for 15 minutes. Saponins can be found when a 1cm layer of foam forms.

Flavonoid Test

To test for flavonoids, mix 5 ml of weak ammonia solution with a portion of the aqueous leaf extract. Then, cautiously add pure sulfuric acid. A yellow colour suggests the presence of flavonoids.

Alkaloid Test

To detect alkaloids, mix 2 ml of the leaf extract with 2 ml of strong hydrochloric acid, then add a few drops of Mayer's reagent. The presence of alkaloids is shown by the green hue.

Anthocyanin and Betacyanin Test

To test for anthocyanins and betacyanins, combine 2ml of the leaf extract with 1ml of 2N sodium hydroxide and heat at 100°C for 5 minutes. Betacyanins can be identified by their yellow tint.

Quinone Test

For quinones, combine 1ml of the leaf extract with 1ml of strong sulfuric acid. A red color suggests the presence of quinones.

Glycoside Test

To test for glycosides, mix 3ml of chloroform with 2ml of the leaf extract and add 10% ammonia solution. The formation of a pink color indicates the presence of glycosides.

Cardiac Glycoside Test

For cardiac glycosides, take 0.5ml of the leaf extract and add 2ml of glacial acetic acid along with a few drops of 5% ferric chloride. Layer this with 1ml of concentrated sulfuric acid. A brown ring at the interface indicates the presence of cardiac glycosides.

Steroid and Phytosteroid Test

To test for steroids and phytosteroids, mix 2ml of the leaf extract with 5ml of chloroform and filter it. Then, add 2ml of acetic anhydride and 2ml of sulfuric acid to the filtrate. A color change fromviolet to blue or green and this indicates the presence of steroids.

Test for Phlobatannins

Take 1.0 ml of the leaf extract and add a few drops of 10% ammonia solution. If a pink color appears, it indicates the presence of phlobatannins.

Anthraquinones,

Take 1.0 ml of the leaf extract and mix in a few drops of 2% HCl. The appearance of a red precipitate suggests the presence of anthraquinones.

Coumarins

To check for Coumarins, take 1 ml of the leaf extract and add 1 ml of 10% sodium hydroxide. A yellow color formation indicates the presence of coumarins.

Proteins and Amino acids,

Take 2.0 ml of the leaf extract, add a few drops of 0.2% Ninhydrin, and heat the mixture. The formation of a purple color indicates the presence of amino acids and proteins.

RESULT

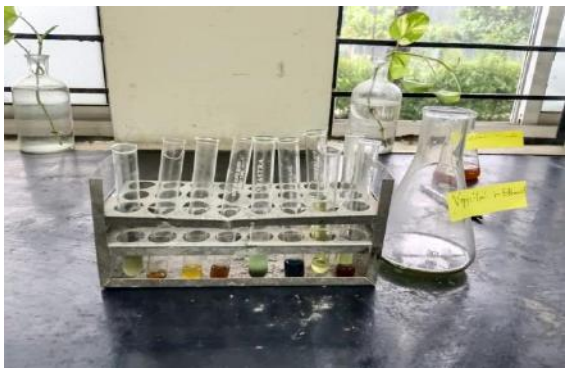

Figure 3 showed that phytochemical analysis of *Azadirachta indica and Melia azedarach*

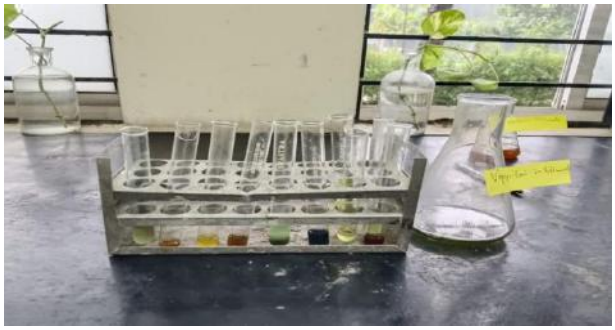

Figure 2 showed that phytochemical analysis of *Azadirachta indica in aqeous extract*

Figure 4: Showed that presence of phytochemicals in ethanolic extract of *Melia azedarach*

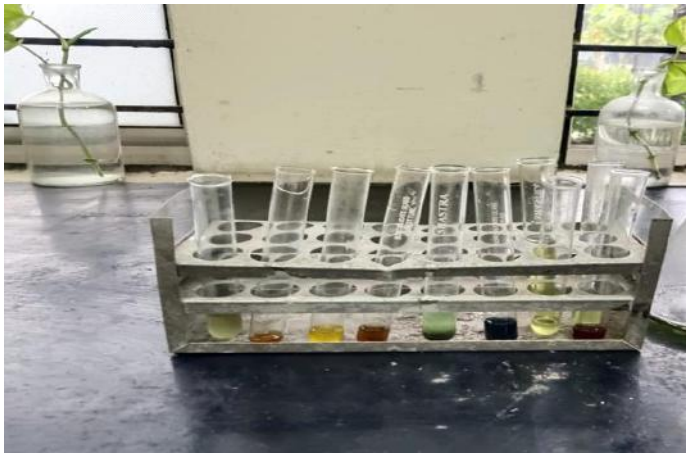

Figure 4: Showed that presence of phytochemicals in aqueous extract of *Melia azedarach*

Table 1: Preliminary qualitative phytochemical screening of *Azadirachta indica and Melia azedarach*

S. NO	Plant Constituents	*Azadirachta indica*		*Melia azedarach*	
		Ethanol	**Aqueous**	**Ethanol**	**Aqueous**
1	Carbohydrates	+	+	+	+
2	Terpenois	+	+	+	+
3	Triterpenoids	+	-	+	-
3	Phenolics Compounds	+	+	+	+

4	Tannins	+	+	+	+
5	Saponins	+	+	+	+
6	Flavonoids	+	+	+	+
7	Alkaloids	+	+	+	+
8	Anthocyanins&Betacyanin	-	-	-	-
9	Quinones	+	+	+	+
10	Glycosides &Cardiac glycoside	+	+	+	+
11	Sterols	+	+	+	+
12	Coumarins	+	+	+	+
13	Proteins &Aminoacids	-	-	-	-
14	Phlobatannins	-	-	-	-
15	Anthraquinones	-	-	-	-

Table 1 and Figures 3, 4, 5, and 6 illustrate the presence of various phytochemicals in both ethanol and aqueous extracts, including carbohydrates, terpenoids, phenols, tannins, saponins, flavonoids, alkaloids, anthocyanins, betacyanins, quinones, glycosides, cardiac glycosides, steroids, and coumarins. Conversely, certain phytochemicals such as phlobatannins, proteins, amino acids, anthraquinones, and triterpenoids were found to be absent.

Discussion

The presence of phytochemicals such as phenols, flavonoids, and tannins is significant for assessing their potential anti-cancer properties and their ability to inhibit bacterial growth ***(Antonisamy et al., 2015)***. Phenolic compounds are known for their antioxidant properties, which primarily arise from their capacity to donate hydrogen atoms to free radicals. This function is crucial for absorbing and neutralizing free radicals, as well as for quenching both singlet and triplet oxygen, and for the decomposition of peroxides *(Sulaiman et al., 2011)*. The phenolic content is also associated with a reduced risk of heart disease, as it helps slow the progression of atherosclerosis and exhibits antioxidant effects on LDL cholesterol ***(Kanner et al., 1994)***. Additionally, the polyphenolic compounds found in Clerodendron colebrookianum contribute to its hypolipidemic activity ***(Devi et al., 2011)***.

Phytochemicals such as saponins, terpenoids, flavonoids, tannins, steroids, and alkaloids exhibit anti-inflammatory properties **(Liu et al., 2005; Manach et al., 1996)**. Additionally, glycosides, flavonoids, tannins, and alkaloids demonstrate hypoglycemic effects **(Bever, 1980)**. Flavonoids, which are water-soluble antioxidants, effectively scavenge free radicals, thereby preventing oxidative damage to cells and exhibiting significant anticancer properties ***(Havsteen, 2002; Marimuthu et al., 2012)***. They also contribute to a

reduced risk of heart disease and possess anti-inflammatory effects due to their antioxidant capabilities, offering protection against conditions such as cancer and cardiovascular diseases. The rhizome of Maranta arundinacea contains elevated levels of phenolic compounds and flavonoids, which are responsible for its antioxidant properties that scavenge free radicals **(Ruba Angel & Mohan, 2013)**. Furthermore, research by ***Rupasinghe et al. (2003)*** indicates that saponins have hypocholesterolemic and antidiabetic effects. The seeds of Syzygium cumini contain these phytochemicals, contributing to these beneficial properties. Saponins consist of a carbohydrate moiety linked to a triterpenoid or steroidal glycone, which aids in reducing glucose and cholesterol absorption in the gut. Extracts from Azadirachta indica and Melia azedarach exhibit various activities, including antimalarial, antibacterial, and acaricidal effects, primarily due to the phytochemicals they contain.

Conclusion

Phytochemicals such as saponins, terpenoids, flavonoids, tannins, and steroids are highlighted in the current study, which demonstrates that both ethanol and aqueous extracts contain a range of phytochemicals. These include carbohydrates, terpenoids, phenols, tannins, saponins, flavonoids, alkaloids, anthocyanins, betacyanins, quinones, glycosides, cardiac glycosides, steroids, and coumarins. These compounds are responsible for the antimalarial, antibacterial, and acaricidal effects of *Azadirachta indica* and *Melia azedarach*. A comparative examination of the phytochemicals in both extracts shows that they share several identical compounds, indicating that both plants exhibit similar biological properties.

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Comparative Study on Phytochemical Screening of *Acalypha Indica* Using Aqueous and Ethanolic Extract

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ABSTRACT

Acalypha indica is an herb found in tropical regions. This plant has traditionally been used to treat a variety of ailments. In the current work, we conducted phytochemical analyses on *Acalypha indica* leaf extracts extracted using various solvents such as water and ethanol. Fresh, mature leaves were picked and shade dried. The leaves powder was successfully extracted using several solvents. This study focuses on screening phytochemicals found in *Acalypha indica* leaves.

Keywords: *Acalypha indica*, aqueous, ethanol, flavonoids, phenol, tannin

INTRODUCTION

Research on traditional medicine and medicinal plants has gained global attention. Many underdeveloped countries continue to rely on traditional healers and medicinal herbs. To meet their daily primary health-care requirements. Herbal medicines, often known as phytomedicines, have long been popular for historical, cultural, and economic reasons. India has one of the most diverse plant medical traditions in the world. Almost 70% of current medicines in India are made from natural ingredients. Medicinal plants have long been used to cure ailments such as diabetes Grover et al., 2002; Modak et al., 2007; Rizvi and Mishra, 2013; Wang et al., 2013). Future therapeutic techniques will involve a combination of different medicines. Polyherbal formulations incorporate plant medicines with various pharmacological properties, resulting in synergistic and potentially agonistic/antagonistic effects (Eisenberg et al., 1993; Maclennan et al., 1996). Over 200 compounds from plant sources have been found to lower blood glucose levels, potentially preventing complications and correcting metabolic abnormalities. Bnouham et al. (2006) discovered that some bioactive drugs isolated from hypoglycemic plants have antidiabetic properties. Medicinal plants contain a variety of compounds, including flavonoids, polyphenols, polysaccharides, alkaloids, coumarins, vitamins, tannins, lignin, steroids, carbohydrates, terpenoids, amino acids, and inorganic ions. These compounds have strong antioxidant activity and may protect cells from free radicals (Grover et al., 2002; Verma and Kumar, 2011).

They are commonly used as radical scavengers, metal chelators, reducing agents, hydrogen donors, and singlet oxygen quenchers. Plant-based antioxidants inhibit the action of free radicals, protecting the body from a variety of ailments (Narayanaswamy and Balakrishnan, 2011). Because manufactured antioxidants have been linked to cancer, scientists have focused on evaluating naturally occurring antioxidants (Valyova et al., 2009). Several studies have found antibacterial activity in crude plant extracts (Alzoreky et al., 2003;

Igoli et al., 2005). Euphorbia species have been used to treat a variety of ailments, including antimicrobial, antioxidant, anticancer, and anti-inflammatory properties (Rajeh et al., 2010; Majid et al., 2015). Acalypha species leaves have been shown to have antimicrobial properties (Akinyemi et al., 2005), hypolipidemic, hypoglycemic, diuretic, and anti-hypertensive properties.

Acalypha indica (L.): Study for model plant

Acalypha indica is a weed plant with valuable medicinal properties for human health. It is often found in India, Sri Lanka, Thailand, and Pakistan. Chekuri et al. (2020) found that extracts from plant parts, including leaves, roots, and stems, can treat eye infections, respiratory difficulties, rheumatism, and skin disorders, as well as lower blood sugar levels. Many worldwide articles on *Acalypha indica* have been published from the Indian region due to its close relationship with Ayurvedic, Sidda, and Unani medicinal procedures practiced by previous generations (Sivasankari et al., 2014).

Figure 1: The whole plant of *Acalypha indica*

MATERIALS & METHODS

SAMPLE COLLECTION & PROCESSING FOR EXTRACT PREPARATION

20 grams of powder sample were transferred separately in to three different conical flasks. The conical flask containing 1000ml of different solvents (aqueous, ethanol) were added and vigorously shaking for one hour using rotatory shaker. The mixture was kept in 24 hours. After 24 hours the different extracts were filtered with Whatman No.1 filter paper. The filtrate was stored at 4°C for phytochemical screening.

PRELIMINARY PHYTOCHEMICAL SCREENING

Phytochemical analysis was conducted on the powdered samples following standard procedures to identify the various constituents, as outlined by Sofowara 1993, Trease1989, and Harborne 1973.

Sample Preparation

For the preparation, 100 mg of n-hexane, ethyl acetate, ethanol, and aqueous leaf extracts of ***Azadirachta indica and Melia azedarach*** were weighed, dissolved, and diluted to 100 ml in

separate standard flasks (resulting in a concentration of 1 mg/ml). This extract was utilized for further studies.

Test for Carbohydrates

To test for carbohydrates, combine 2 mL of the leaf extract with 1 mL of Molisch's reagent and a few drops of strong sulfuric acid. The appearance of a purple colour indicates the presence of carbohydrates.

Test for Terpenoids

To detect terpenoids, take 0.5 ml of the leaf extract, add 2 ml of chloroform, and carefully introduce strong sulfuric acid; a red-brown color at the interface indicates terpenoids.

Test for Triterpenoids

To test for triterpenoids, combine 1.5 ml of the leaf extract with 1 ml of Liebermann-Burchard Reagent (acetic anhydride and concentrated sulfuric acid). A blue or green hue suggests the presence of triterpenoids.

Test for Phenols

For phenols, mix 1 ml of leaf extract with 2 ml of distilled water, then add a few drops of 10% ferric chloride. The appearance of a green color indicates the existence of phenols.

Tannin Test

To test for tannins, combine 1ml of the leaf extract with 2ml of 5% ferric chloride; if a greenish-black tint develops, tannins are present.

Saponin Test

For saponins, add 2ml of leaf extract to 2ml of purified water. Shake the ingredients in a graduated cylinder for 15 minutes. Saponins can be found when a 1cm layer of foam forms.

Flavonoid Test

To test for flavonoids, mix 5 ml of weak ammonia solution with a portion of the aqueous leaf extract. Then, cautiously add pure sulfuric acid. A yellow colour suggests the presence of flavonoids.

Alkaloid Test

To detect alkaloids, mix 2 ml of the leaf extract with 2 ml of strong hydrochloric acid, then add a few drops of Mayer's reagent. The presence of alkaloids is shown by the green hue.

Anthocyanin and Betacyanin Test

To test for anthocyanins and betacyanins, combine 2ml of the leaf extract with 1ml of 2N sodium hydroxide and heat at 100°C for 5 minutes. Betacyanins can be identified by their yellow tint.

Quinone Test

For quinones, combine 1ml of the leaf extract with 1ml of strong sulfuric acid. A red color suggests the presence of quinones.

Glycoside Test

To test for glycosides, mix 3ml of chloroform with 2ml of the leaf extract and add 10% ammonia solution. The formation of a pink color indicates the presence of glycosides.

Cardiac Glycoside Test

For cardiac glycosides, take 0.5ml of the leaf extract and add 2ml of glacial acetic acid along with a few drops of 5% ferric chloride. Layer this with 1ml of concentrated sulfuric acid. A brown ring at the interface indicates the presence of cardiac glycosides.

Steroid and Phytosteroid Test

To test for steroids and phytosteroids, mix 2ml of the leaf extract with 5ml of chloroform and filter it. Then, add 2ml of acetic anhydride and 2ml of sulfuric acid to the filtrate. A color change fromviolet to blue or green and this indicates the presence of steroids.

Test for Phlobatannins

Take 1.0 ml of the leaf extract and add a few drops of 10% ammonia solution. If a pink color appears, it indicates the presence of phlobatannins.

Anthraquinones,

Take 1.0 ml of the leaf extract and mix in a few drops of 2% HCl. The appearance of a red precipitate suggests the presence of anthraquinones.

Coumarins

To check for Coumarins, take 1 ml of the leaf extract and add 1 ml of 10% sodium hydroxide. A yellow color formation indicates the presence of coumarins.

Proteins and Amino acids,

Take 2.0 ml of the leaf extract, add a few drops of 0.2% Ninhydrin, and heat the mixture. The formation of a purple color indicates the presence of amino acids and proteins**.**

RESULTS

Table 1: Preliminary qualitative phytochemical screening of *Acalypha indica*

S.No	Test analysis	Aqueous	Ethanol
1	Alkaloids	-	+
2	Aminoacids	+	+
3	Carbohydrates	+	+

4	Protein	+	-
5	Phenol	+	+
6	Flavonoids	+	+
7	Steroids	+	+
8	Diterpenoids	-	+
10	Tannin	+	+
11	Quinones	+	-
12	Glycosides	-	+

+ indicates Present; - indicates Absent

Table 1 shows the phytocompounds present in *Acalypha indica* and Figure 2 & 3 shows the extract of aqueous and ethanolic extract of plant sample.

Figure 2: Aqueous Extract of *Acalypha indica*

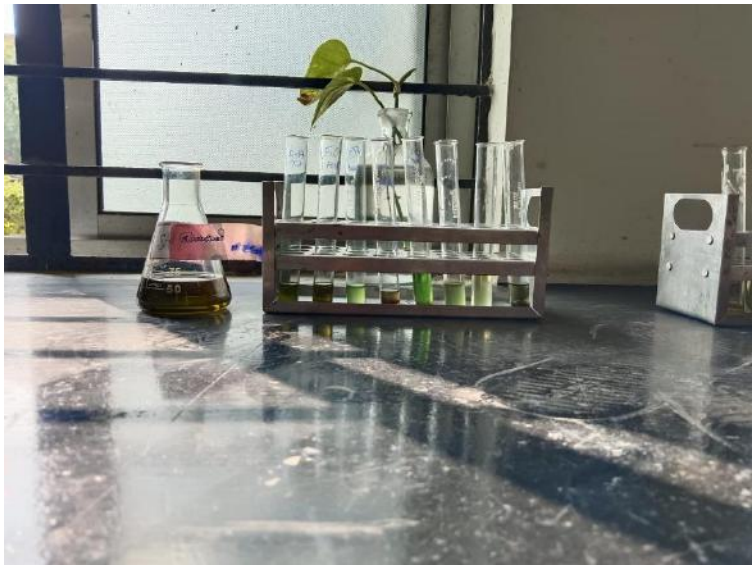

Figure 3: Ethanolic Extract of *Acalypha indica*

DISCUSSION

Medicinal plants' curative qualities may stem from secondary metabolites like aminoacid, sugars, proteins, flavonoids, phenols, and tannins. This study found that the leaves of *Acalypha indica* are high in carbs, starch, glycosides, alkaloids, and proteins. Sofawara (1993) suggests that they have therapeutic and physiological properties. Chandra Mohan and Dinakar (2010) conducted preliminary phytochemical investigation on *Achalypa indica*. The chloroform extracts of these plants include a variety of phytochemicals, including alkaloids, carbohydrates, starch, glycosides, proteins, phenols, and tannin. *Acalypha indica* contains phytochemicals with antibacterial, anti-inflammatory, acaricidal, diuretic, and anti-diabetic properties (Govindarajan and Samidurai 2008; Mohana Vamsi and Sunil Kumar 2008; Lingaiah 2013; Singh and Raman 2004; Das et al 2005; Manisha Masin et al 2011). Ruchi et al. (2007) found antioxidant properties, while Suresh Reddy et al. (2002) reported wound healing effects.

The leaves have laxative qualities and can be used as a substitute for senega in powdered or decoction form. When mixed with garlic, they act as an anti - helminthic for worms. Scabies can be treated with garlic, and rheumatic arthritis can be treated with a mixture of their juice and oil. The juice of the leaves is a safe and effective emetic for children with croup. It can also be used as an expectorant in smaller dosages for chronic bronchitis, asthma, and consumption. The decoction can be used to treat earaches as an instillation or fomentation. The crushed leaves can also be used to syphilitic ulcers, maggot-eaten wounds, and snakebites to ease discomfort (Kirtikar KR and Basu BD (1999)

Fresh leaf extract, combined with lime and onion, can treat scabies and other skin conditions. It is an effective stimulant for rheumatism. Powdered dry leaves are used to treat bed sores. To cure congestive headaches, inserting a piece of cotton soaked in plant or leaf juice into each nostril is said to cause hemorrhage from the nose. To treat stubborn constipation in youngsters, grind the leaves into a paste, form a ball, and insert it into the rectum to relax the sphincter and promote unrestricted movement. Infusing or bruising the root in water can have

a cathartic effect (Dr. K.M. Nadkarn, 2000). From the current study, comparatively ethanolic extract shows the presence of more phytocompounds than the aqueous extract.

CONCLUSION

Acalypha indica leaves contain secondary metabolites such as aminoacids, sugars, glycosides, flavonoids, proteins, phenols, and tannins. These compounds have therapeutic potential. The aqueous and ethanol extracts of Acalypha indica leaves contained at least four phytoconstituents apiece. The *Acalypha indica* leaf extract is now being investigated and might potentially lead to the creation of new life-saving medications. This study examines the phytochemistry of the plant and the purported bioactive compounds. Traditional medicine has employed whole plants for decades, and studies have supported this practice. Previously, the herb was employed in Ayurvedic, homeopathic, and Siddha treatment. Additional clinical and pathological research are necessary to fully explore the plant's potential.

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PHYTOCHEMISTRY INVESTIGATION AND ANTIULCER ACTIVITY OF MENTHA LEAVES

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ABSTRACT

This study investigates the phytochemical composition, proximate analysis, and antiulcer potential of mint (Mentha spp.) leaves using various extraction methods. Phytochemicals, including tannins, alkaloids, saponins, flavonoids, glycosides, and steroids, were identified through aqueous, ethanolic, and hydroalcoholic extractions. Among these, the ethanol extract exhibited the highest concentration of bioactive compounds, prompting further evaluation of its therapeutic properties. Proximate analysis revealed significant differences between fresh and dried samples, with dried leaves showing higher crude fat (6.12%), protein (8.59%), fiber (7.16%), and ash content (24.35%), whereas fresh leaves had notably higher moisture (87.5%) and carbohydrate content (93.2%). Mint's traditional use in dental care and medicine is supported by its antimicrobial and aromatic properties. The antiulcer activity of the ethanol extract was assessed in rat models, demonstrating significant gastroprotective effects against ulcers induced by pylorus ligation and chemical irritants. The extract showed a neutral pH (7.2), with measurable acid neutralizing (0.831) and buffering capacities (0.0166). The presence of flavonoids, known for their protective effects on gastric mucosa and cancer cells, likely contributes to the antiulcer effect. These findings validate the medicinal potential of mint, especially its ethanol extract, in managing gastrointestinal disorders and support its broader pharmacological applications.

Keywords: Mint leaves, Phytochemicals, Ethanol extract, Antiulcer activity, Proximate analysis, Flavonoids

INTRODUCTION

Ancient civilizations such as India, Greece, Egypt, China, Africa, and Arabia relied heavily on medicinal plant products to treat wounds, infections, and ailments. India is one. One of the top herbal practitioners and the world's second-largest supplier of medicinal herbs. Jain (1992) found that various climatic, geographical, and landscape conditions support over 15,000 higher plant and animal species. Medicinal plants provide valuable active ingredients for both the pharmaceutical industry and traditional therapy. According to Cunningham (1993) around 80% of people in underdeveloped nations still rely on traditional plant-based remedies for primary health care. Sustained availability of appropriate medications is crucial for successful healthcare. Plants have a significant role in the pharmaceutical sector, alongside synthetic medications and antibiotics (Flower, 1983; Sahoo et al., 1997).

Phytochemicals are categorized into primary and secondary metabolites. The first one exists in nature. These compounds are found in seeds and vegetative sections of higher plants. This

is necessary for cellular metabolism. Flowering plants produce primary metabolites, including carbohydrates, fatty acids, and vegetable oils. Primary metabolites are used to create pharmaceuticals, insecticides, and microbicides. Secondary plant products often originate from higher plants. Medicinal plants include secondary metabolites that can treat various ailments, either directly or indirectly. Plants' primary metabolism functions do not interact with secondary plant products, yet they nonetheless serve ecological purposes such as chemical defence against pathogens and insects. The main metabolites are difficult to separate from cells. Secondary metabolites play a crucial role in biological processes. In comparison to primary metabolites, this has a high value despite its low volume. Examples of such compounds include alkaloids, flavonoids, steroids, quinines, and terpenoids. Plant extracts using organic or aqueous solvents are commercially employed in the pharmaceutical business to manufacture medications. Plant metabolic chemicals contain biological action and can be used to synthesize or semi-synthesise medicines. According to Farnsworth and Morris' 1976 analysis of the pharmaceutical industry, about 25% of prescription drugs are plant-based.

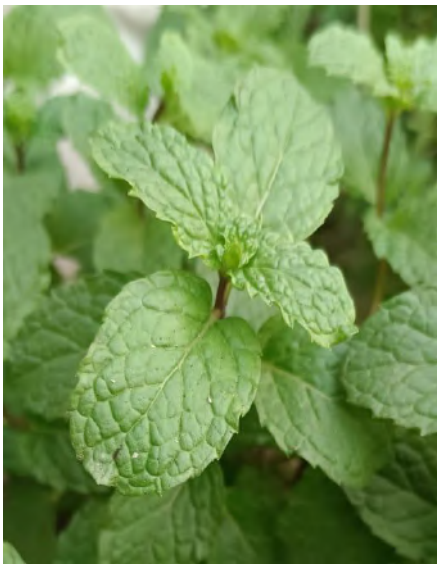

Figure 1.1: Mentha Leaves

MATERIALS AND METHOD

Proximate composition of dried mint leaves powder

Fresh mint leaves and its prepared powder were analyzed for proximate composition including moisture, fat, protein, total carbohydrate, crude fibre, ash and mineral composition was carried out as per the methods given by (AOAC, 2005).

Preparation of alcoholic extract

20 grams of powder samplewere transferred separately in to three different conical flasks. The conical flask containing 1000ml of different solvents (aqueous, ethanol and hydro-alcohol (70%)) were added and vigorously shaking for one hour using rotatory shaker. The mixture was kept in 24 hours. After 24 hours the different extracts were filtered with Whatman No.1 filter paper. The filtrate was stored at 4°C for phytochemical screening.

PRELIMINARY PHYTOCHEMICAL SCREENING

The following protocol was followed for the preliminary phytochemical screening of extracts.

Test for Carbohydrates

To test for carbohydrates, combine 2 mL of the leaf extract with 1 mL of Molisch's reagent and a few drops of strong sulfuric acid. The appearance of a purple colour indicates the presence of carbohydrates.

Test for Terpenoids

To detect terpenoids, take 0.5 ml of the leaf extract, add 2 ml of chloroform, and carefully introduce strong sulfuric acid; a red-brown color at the interface indicates terpenoids.

Test for Triterpenoids

To test for triterpenoids, combine 1.5 ml of the leaf extract with 1 ml of Liebermann-Burchard Reagent (acetic anhydride and concentrated sulfuric acid). A blue or green hue suggests the presence of triterpenoids.

Test for Phenols

For phenols, mix 1 ml of leaf extract with 2 ml of distilled water, then add a few drops of 10% ferric chloride. The appearance of a green color indicates the existence of phenols.

Tannin Test

To test for tannins, combine 1ml of the leaf extract with 2ml of 5% ferric chloride; if a greenish-black tint develops, tannins are present.

Saponin Test

For saponins, add 2ml of leaf extract to 2ml of purified water. Shake the ingredients in a graduated cylinder for 15 minutes. Saponins can be found when a 1cm layer of foam forms.

Flavonoid Test

To test for flavonoids, mix 5 ml of weak ammonia solution with a portion of the aqueous leaf extract. Then, cautiously add pure sulfuric acid. A yellow colour suggests the presence of flavonoids.

Alkaloid Test

To detect alkaloids, mix 2 ml of the leaf extract with 2 ml of strong hydrochloric acid, then add a few drops of Mayer's reagent. The presence of alkaloids is shown by the green hue.

Anthocyanin and Betacyanin Test

To test for anthocyanins and betacyanins, combine 2ml of the leaf extract with 1ml of 2N sodium hydroxide and heat at 100°C for 5 minutes. Betacyanins can be identified by their yellow tint.

Quinone Test

For quinones, combine 1ml of the leaf extract with 1ml of strong sulfuric acid. A red color suggests the presence of quinones.

Glycoside Test

To test for glycosides, mix 3ml of chloroform with 2ml of the leaf extract and add 10% ammonia solution. The formation of a pink color indicates the presence of glycosides.

Cardiac Glycoside Test

For cardiac glycosides, take 0.5ml of the leaf extract and add 2ml of glacial acetic acid along with a few drops of 5% ferric chloride. Layer this with 1ml of concentrated sulfuric acid. A brown ring at the interface indicates the presence of cardiac glycosides.

Steroid and Phytosteroid Test

To test for steroids and phytosteroids, mix 2ml of the leaf extract with 5ml of chloroform and filter it. Then, add 2ml of acetic anhydride and 2ml of sulfuric acid to the filtrate. A color change fromviolet to blue or green and this indicates the presence of steroids.

Test for Phlobatannins

Take 1.0 ml of the leaf extract and add a few drops of 10% ammonia solution. If a pink color appears, it indicates the presence of phlobatannins.

Anthraquinones,

Take 1.0 ml of the leaf extract and mix in a few drops of 2% HCl. The appearance of a red precipitate suggests the presence of anthraquinones.

Coumarins

To check for Coumarins, take 1 ml of the leaf extract and add 1 ml of 10% sodium hydroxide. A yellow color formation indicates the presence of coumarins.

Proteins and Amino acids,

Take 2.0 ml of the leaf extract, add a few drops of 0.2% Ninhydrin, and heat the mixture. The formation of a purple color indicates the presence of amino acids and proteins.

Antiulcer Property of mint leaves extracts

Preparation of mint leaves extracts: Mint leaves were procured from the local area near Redhills, Chennai. Leaves were separately dried at room temperature in uncovered recipients, grounded to a fine powder and dried again. Extraction process, infusion, a type of maceration was utilized for the extract preparation. After grinding into fine powder, they were placed in a clean container. Then the extraction solvent 50% ethanol is then poured on top of the sample material, soaked, and kept for a short period of time (24h) to extract the bioactive constituents that are readily soluble. Then, the samples were filtered with grade 1 Whatman paper. 2% extracts were prepared using 50% ethanol; stored and utilized for further analysis.

Preparation of artificial gastric acid: A 2g of NaCl and 3.2 mg of pepsin enzymes were dissolved in 500 ml distilled water. Hydrochloric acid (7.0 ml) and adequate water were

added to make a 1000 ml solution of artificial gastric acid. The pH of the artificial gastric acid solution was adjusted to 1.20.

Determination of pH of the extracts: The pH of ninety milliliters of each test solution was determined at temperatures ranging from 25ºC to 37ºC. The pH values of the sodium bicarbonate (SB) and water was also determined for comparison.

Preliminary Antacid Test

Preliminary antacid test was performed based on the method stated in the United States Pharmacopeia (U.S.P) national formulary[10]. Forty milliliters (40 mL) of each test solution was continuously stirred for 1 minute. Then, 10 mL of standardized 0.5 M HCl was added. The mixture was continuously stirred for 10 minutes and then the pH was measured.

Pepsin Induced Artificial Stomach Acid Assay (Acid Neutralizing Capacity): The anti-ulcer activity was determined by evaluating the neutralization of gastric juice through Pepsin induced artificial stomach acid assay. For the preparation of artificial gastric juice, 2 gm of NaCl and 3.2 gm of pepsin were dissolved in 500 ml distilled water. Hydrochloric acid (7.0 ml) and adequate water were added to make a 1000 ml solution. The pH of the prepared solution was adjusted to 1.2. Here the efficacy of the extract in regards to neutralizing the gastric juice was determined by measuring the pH with digital pH meter.

Determination of the Acid Neutralization Capacity (ANC) Using the Titration Method of Fordtran's Model.

Acid neutralization capacity was determined using the titration method of Fordtran's model[12,13]. Fifty milliliters (50 mL) of each test solution was continuously stirred and then titrated with artificial gastric juice to the endpoint of pH 3. The total consumed H+ (mmol) was measured as 0.063096 (mmol/ml) × V (ml)[10].

Acid-Buffering Capacity Assay

Buffering capacity was evaluated based on the Official Methods of Analysis of the Association of Official Analytical Chemists[14]. Forty milliliters (40 mL) of each test solution was continuously stirred at 60 rpm. Forward titration was performed by gradual addition of 0.5 mL of standard 0.099207 M HCl until the pH decreased to 1.5, *i.e. Normal stomach pH*. The samples were then back titrated by gradual addition of 0.5 mL of standard 0.100995 M NaOH until the pH increased to 10. Initial pH level and all further measurements taken during titration were recorded after an equilibration period of 1 min after addition of acid or base. The acid buffering capacity (BC) was computed based on the equation by Van Slyke: total volume of acid added to each sample multiplied by the acid molarity, divided by the total change in pH[15].

RESULTS

Preliminary Phytochemical Screening

Table 2: Proximate analysis of fresh and dried Mentha Leaves

S. No	Sample	Fresh %	Dried (%)
1	Ash	4.10	24.35

2	Moisture	87.50	17.00
3	Proteins	3.05	8.59
4	Carbohydrates	93.2	57.14
5	Fiber	1.56	7.16
6	Lipids	0.82	6.12

Table 3: Preliminary qualitative phytochemical screening

S.No	Test analysis	Aqueous	Ethanol	Hydroalcoholic
1	**Alkaloids**	**-**	**+**	**+**
2	**Aminoacids**	**+**	**+**	**+**
3	**Carbohydrates**	**+**	**+**	**+**
4	**Protein**	**+**	**-**	**+**
5	**Phenol**	**+**	**+**	**+**
6	**Flavonoids**	**+**	**+**	**+**
7	**Steroids**	**+**	**+**	**+**
8	**Diterpenoids**	**-**	**+**	**+**
9	**Tannin**	+	+	+
10	**Glycosides**	+	+	+

+ indicates Present; - indicates Absent

Figure 1.2: Three Extracts of Mentha Leaves (Aqueous, Ethanolic and 70% Hydroalcoholic)

A

B

B

Figure 1.3 : A –Phytochemical analysis of aqueous Extract of Mentha L.

B – Ethanolic Extract of Mentha L.

C – 70 % Hydroalcoholic extract of Mentha L.

Antiulcer activity of Mint Leaves extracts

Table 4: pH of the extract

S.No	Name of the extract	pH
1	Ethanolic extract of mint leaves	7.2±0.002

Table 5: Preliminary antacid test

S.No	Name of the extract	pH
1	Ethanolic extract of mint leaves	1.0±0.05
2	Sodium bicarbonate	8.5±0.07

Table 6: Pepsin Induced Artificial Stomach Acid Assay (Acid Neutralizing Capacity)

S.No	Name of the extract	Total consumed H+ (mmol)
1	Ethanolic extract of mint leaves	0.094±0.003
2	Sodium bicarbonate	0.831±0.013

Table 7: Acid Buffering Capacity:

S.No	Name of the extract	Total consumed H+ (mmol)
1	Ethanolic extract of mint leaves	0.0166±0.001

DISCUSSION

Phytochemical composition refers to the existence of physiologically active chemicals in plants. The phytochemicals impart color, flavor and smell to the plants. They also contribute towards imparting a defence. Mechanism to the plants against diseases (Okwu,2005). Table 1 shows the proximate component analysis of both fresh and dried samples. The results clearly showed that the moisture content was substantial (87.5%) as compared to 17% in the dried sample. The dried leaves had a larger crude fat content (6.12%) than the fresh leaves (0.82%). The amount of crude fat in both samples appears to be moderate and may be sufficient for eating without posing any health risks. This discovery was consistent with an earlier investigation by James and Emmanuel, who discovered that excessive fat consumption was linked to various cardiovascular illnesses such as atherosclerosis, cancer, and aging. The dried sample had a larger percentage of crude protein (8.59%) than fresh (3.05%), which is consistent with prior findings (Fasuyi,A.O., 2007). However, fresh leaves had a significantly lower percentage of ash content than dried leaves (4.10% vs. 24.35%). Alternanthera sessilisred (ASR) and green (ASG) were found to have increased ash content, as were twenty-seven vegetables that are typically included in a daily diet (Azizah, O et al., 2014). The percentage of crude fiber is higher in dried samples (7.16%) than fresh leaves (1.56%), while fresh leaves have 93.2% of carbohydrate, which is higher than the dried leaves (57.14%). When compared to some vegetables, the carbohydrate content are higher in fresh than dried leaves, such as Telfaria occidentalis and Talinum triangulare (Okon, I.E., James, U.S. (2015)).

Mint is also employed as a bucco dental bar because its leaves have the ability to stain teeth. Modern mint-leave area units used as mouth washes in manduction minimize animal tissue discomfort (Lamendine et al., 2004). Mint is used in dentifrices because it freshens the breath. Many research is being conducted on the benefits of mint leaves in preventing cavities and plaque, and it is known that mint leaf extract creates unfavorable conditions for microorganisms. The therapeutic effect of plants used in traditional medicine stems from the presence of phytochemical principles in certain portions of the plants. Therapeutic plants contain naturally dynamic manufactured chemicals, such as saponins, tannins, flavonoids, alkaloids, and other chemical compounds with medicinal qualities. In this study, phytochemical analysis was performed utilizing water, ethanol, and 70% hydroalcoholic extraction methods. Table 2 demonstrates the existence of several secondary metabolites, including tannins, alkaloids, saponins, glycosides, and steroids. Similar findings were shown in previous literature, Muhammad Murtala Mainasara et al., 2018. In this study comparatively, the following secondary metabolites such as amnio acid, carbohydrates, phenol, flavonoid, tannin and glycosides found to present in all the three extracts.

Mint species make significant contributions to the synthesis of bioactive medicinal compounds. Because of its aromaticity, the plant has high commercial value. It has long been used as a food flavoring and to treat colds and fevers. The plant's current therapeutic uses include the treatment of gastro-intestinal and cardiovascular problems. Furthermore, antibacterial, anti-ulcer, anticancer, insecticidal, anti-diabetic, and anti-inflammatory properties are among its numerous biological potentials and characteristics. The mint plant's pharmacological potential stems mostly from the presence of a diverse variety of bioactive compounds (Balakrishnan A., 2015). Apart from the above results maximum phytochemicals were found to present in the ethanol extract and hence the antiulcer study of mint leaves was carried out with the ethanol extract.

In a prior study, ethanol extract of peppermint shown antiulcer properties after pylorus ligation, indomethacin, and noxious chemicals produced stomach mucosal injury in rats. Peppermint suspension's antisecretory action may contribute to its antiulcer efficacy in animal models where elevated stomach acidity plays a role in the development of gastric and duodenal ulcers (Rafatullah et al., 1995). Additionally, ulcer disease has been linked to acidity or hyperacidity (Modlin, 1995). Acid hypersecretion is a key element in the development of peptic ulcers. Potential antisecretory drugs may aid in healing by inhibiting acid secretion (Arakawa etal, 1992). The study indicated that peppermint suspension can prevent ulceration, and the pH of the ethanolic extract of mint leaves was 7.2. The preliminary extract shows 1.0, while sodium carbonate exhibits 8.5. Mint leaves had an acid neutralizing capacity of 0.831 and an acid buffering capacity of 0.0166. The values of pH were shown in the Table 3,4,5,6. Ruiz et al. (1996) found flavonoids to be effective against gastric ulcers. Additionally, Matsukawa et al. (1990) found flavonoids to have a protective effect on stomach cancer cells. Akhtar et al. (1992) found that volatile oil and flavonoids from a peppermint plant had antiulcerogenic properties.

CONCLUSION

Mint species are widely used around the world as a crucial therapeutic plant. The investigation demonstrates that both samples contain essential phytochemicals and their

proximate analysis. However, the fresh sample of Mentha L has a higher nutritious content than the dried sample. This could be owing to the moisture content in the fresh sample, which caused the concentration of constituents to be higher. On the other hand, increased moisture content increases the concentration of nutritional and mineral components in the fresh sample. As a result, the fresh leaves of these peppermint plants contain more nutrients than the dried leaves. Mint L also possess the important secondary m,etabolites such as phenol, carbohydrates, flavonoid, alkaloid and tannin. The existence of phytochemical compounds in the plant may contribute to the antiulcer action, which cannot be discounted. Further research is needed to isolate and understand the mechanism of action of antiulcer compounds used as traditional medicine for various gastrointestinal illnesses.

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Bacteriological Analysis of Drinking Water by MPN Method from a Private Institution

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ABSTRACT

Bacteriological analysis of drinking water was analysed by multiple tube fermentation test to find the total or presumptive coliform count, whose results were expressed as most probable number (MPN) index. Of the 3 water samples from three different sources tested, 1 was satisfactory and 2 were unsatisfactory. Of the 2 samples, which were graded as unsatisfactory, one was RO purified water and one was can water filled from RO purified source. MPN index of water samples which tested satisfactory was 2 per 100 ml and MPN index of water samples which were graded as unsatisfactory ranged from 2 to 8 per 100 ml. Eschericia coli were isolated only in one sample indicating feacal contamination. Thus, the water tested (2/3) were unsatisfactory for drinking which highlight the poor quality of drinking water available and necessary measures has to be taken to improve the quality of drinking water as well as awareness among the people about the enteric diseases spread by contaminated waters and its preventive measures.

Keywords: Bacteriological analysis, Multiple tube fermentation test, Total coliform count, Escherichia coli (E. coli), Fecal contamination, Water quality

INTRODUCTION

The scenario of water pollution imparted by the existence of microorganisms in drinking water is not unusual and the resultant disease endemics or epidemics are common vastly in the developing countries where sanitation, water purification and the practice of hygiene are ignored [3]. Mainly water supply in any institution is generated from the underground water (aquifer under 50 and 120 meters) sources without any treatment because of the lack of chance to microbial contamination from the outside environment. Some water supplies may also serve water from surface water sources which are treated to remove contaminations before supplying in the distribution system. General people use water for drinking purposes either directly consuming or after some processing of the water by means of filtration or boiling [3].

The major health risk from drinking water is caused by the presence or introduction of fecal coliforms in the drinking water supply which may come from the non-treated sewage systems sited nearly the water source or distribution system as well as overflow from them [19,8,14,2,20] Coliform bacteria may account for public health associated diseases including diarrhea, dysentery, typhoid, salmonellosis, listeriosis, parasitic worm infestations, and viral infections are introduced from the diseased or carrier stage patients shedding such pathogens which by chance come into contact with the potable water systems [7,21,17,16,18].

The quality of drinking water can be tested by the processes determining the presence of different contaminating bacteria in the water sample which is usually time consuming as well as costly [13]. Moreover, often the pathogens present are very low in number so that they could be missed during the testing procedures [11]. A comparatively easy way to examine the water quality is to determine the presence of coli form bacteria serving as indicator, and hence the presence of such bacteria indicates the risk of pathogenic contamination from fecal origin [5, 23] The most common test for indicator organism is to determine the presence of Escherichia coli which only indicates the possibility of fecal contamination [13].

However, for rapid detection of indicator organisms in drinking water, the most probable number (MPN) method, which is not that common in usage, might be considered [1]. It is a qualitative test rather than quantitative indicating only the presence of coliforms, not their numerical presentation. This test is carried out in three continuous stages: presumptive test, confirmed test and completed test through which the presence of indicator organism E. coli is detected and confirmed [6]. The test is also called multiple tube test which involves the use of multiple tubes to determine the presence of indicator organism using some key characteristics of them including – lactose fermentation, producing gas, green metallic sheen on eosin methylene blue (EMB) agar. Overall, with a shortfall of microbial enumeration, the MPN method of water quality detection is cost effective and rapid as well to determine the water quality. Along these lines, the present study employed MPN method to determine the microbiological quality of drinking water.

MATERIALS AND METHODS:

1. Study area and sampling:

The drinking water samples used by the private institution were tested in the current study. Three water samples were collected from different points which were used to consume after pretreatments during the last week of January 2025. Samples were collected aseptically in sterile conical flasks and transported to the laboratory within minutes, and immediately subjected to microbiological analysis [3].

2. MPN test protocol

Presumptive test:

Presumptive test involves the primary presumption for the presence of Gram negative coli form bacteria in the samples demonstrated by the appearance of gas in the lactose fermentation broth. For the presumptive test procedure 15 sets of test tubes containing MacConkey broth required for each sample under analysis. Each test tube contained 10 ml of broth and inoculated with the water sample in a sequential order of 10 ml in five of each 2X fermentation broth, 1ml in five of each 1x fermentation broth and lastly 0.1 ml in five of each 10ml 1X lactose fermentation broth. All the test tubes were incorporated with Durham tubes for detection of gas formation by Gram negative coli form bacteria. Test tubes were incubated at 37°C for 24 hours. This procedure was followed for all the 3 samples individually.

Confirmed test:

Positive samples with the production of gas in the lactose fermentation broth were selected for the confirmed test procedures to detect the indicator bacteria of fecal origin Escherichia

coli. EMB media was used to differentiate other Gram negative coliform bacteria from the Escherichia coli by the production of green metallic sheen in the media. The presence of green metallic sheen in EMB confirms the presence the indicator bacteria E. coli. One loop full sample from the positive test tubes was inoculated on EMB by streaking and incubated at 37°C for 24 hours and then observed for the production of green metallic sheen.

RESULT AND DISCUSSION

Poor water quality, sanitation and hygiene account for about 2 million deaths a year world-wide (3.1% of all deaths and 3.7% of daily), mainly through infectious diarrhea [15,16]. Such diseases are more common in places where water is not treated carefully. Present experiment was conducted for the determination of the processed drinking water quality to be either potable or non-potable based on the presence of indicator bacteria which indicates the chance of fecal contamination as well as the health associated risks. This identification procedure was done by applying the MPN method which is rather cheap and less time consuming.

Bacteriological quality of the drinking water samples tested:

The potable waters samples used in the current study were contaminated with lactose fermentation positive bacteria which were determined by the formation of gas in the Durham tube after 48 hours of incubation at 37 C. Of the 2 water samples from three different sources tested, 1 was satisfactory and 2 were unsatisfactory. Of the 3 samples, which were graded as unsatisfactory, one was RO purified water and one was can water filled from RO purified source. MPN index of water samples which tested satisfactory was 2 per 100 ml and MPN index of water samples which were graded as unsatisfactory ranged from 2 to 8 per 100 ml. Eschericia coli were isolated only in one sample indicating feacal contamination. Processing drinking water by more sophisticated ways and by detecting the ways of contamination, the degree of such health problems might be lessened. Finally, our study reported the non-portability of 1 processed drinking water samples by observing the indicator bacteria E. coli. Which also indicated the possible presence of other pathogenic bacteria. Several factors such as environmental contamination, inadequate processing and improper handling etc. might be responsible for contamination of drinking water.

CONCLUSION

The present data referred the microbiological test of water in a private institution. Due to the poor water distribution system, the quality of supplied water samples was not satisfactory and were also indicative of the possibilities to impart various enteric diseases. The situation may aggravate in near future if the authority does not pay attention and take immediate actions to restore water quality in the distribution system.

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Water Quality Assessment of Temple Pond water in Tiruvallur District using Biological Oxygen Demand (BOD)

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Abstract

Water quality assessments are the ways for evaluating the water chemistry and the biological characteristics of the water body. The main aim of current study was to assess water quality such as Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) in temple lake located near the college surrounding areas. The physico-chemical and biological characteristics of all aquatic ecosystems are dynamic, because of the factors like temperature, rainfall, sedimentation, decayed organic materials, location of water body etc. The whole nature of water bodies is also getting worse due to the contamination of water. Some of the industrial waste water discharges are being released untreated into the environment and causes water pollution. At the end, the results obtained those low values of dissolved oxygen (DO) and high values of Biological Oxygen Demand (BOD) suggests that temple lake water is not suitable for direct drinking purpose as per criteria laid down by the IS 10500:2012 without filtration or necessary pretreatments. It can be uses for other purposes washing, bathing, holy dip etc. This is due to increased population and manmade activities and performing rituals, water is being highly polluted with different types of contaminates.

Key words: Temple Pond water, Dissolved oxygen, Physico-chemical analysis, organic pollution.

Introduction

Freshwater ecosystems provide countless ecosystem services such as provision for water, food, and nutrient recycling. Even though their importance is recognized, they are being severely damaged by anthropogenic activities.[1,3] India is a rapidly urbanising country, and the recent studies states that by 2030 nearly 40 % of the Indian population will be living in cities. 16 Pollution has severely damaged the water quality of most urban water bodies including lakes and ponds in India. Pollution not only hampers the ability of lake to provide ecosystem services but it is also hazardous to health of the citizens.[3] Quality of water in ponds and rivers may vary subject on geological morphology. Due to the growing population and increasing human activities, the sewage and municipal wastage are responsible for pollution of lentic and lotic water bodies. One of the religious purposes of water is its use in sacred rituals performed at temple premises. The neglected temple tanks are enriched with nutrients by surface runoff, temple effluents, holy dips, cleaning of cloths, limbs, and utensils, lighting of lamps and spreading of holy powders.[13] The maintenance of healthy temple pond water is dependent on the physicochemical features. There is proper monitoring of temple ponds with necessary parameters with reference to the water quality. It may prevent the further deterioration of pond water.[10]

The maintenance of healthy aquatic ecosystem is dependent on the physicochemical properties and biological diversity. A regular monitoring of water bodies with required number of parameters with reference to the quality of water not only prevents the outbreak of diseases and occurrence of hazards but checks the water from further deterioration.[10] One of the most effective ways to communicate water quality is by determining the Water Quality Index (WQI), where the water quality is assessed on the basis of calculated water quality indices. Quality of water is defined in terms of its physical, chemical, and biological parameters.[2] Horton (1965) proposed the first WQI, A water quality index provides a single number that expresses overall water quality at a certain location on several water quality parameters and turns complex water quality data into information that is understandable and usable by the general people.[8]

The present study is an attempt to determine the Water Quality Index of these temple tanks in order to understand the ecological health of water bodies. It is the first and essential step towards ecological restoration of temple lakes.[14]

Sampling Methodology

Sampling Point:

Sampling point was not uniform within the water body. It varied with area, size, and also the morphometric of water body. The sampling point was fixed in dead storage region of water body, because in order to maintain the reliability. In several places, the water samples from water body were collected in a place where water was present, even if the dead storage was not available.

Sample Collection:

Samples were collected in clean 1L plastic bottles. The samples were collected from 30cm below the water surface and brought to the laboratory for physico-chemical analysis. The D.O was fixed in the field by collecting water sample in 300 ml BOD bottle and brought to laboratory for analysis.[3]

Dissolved Oxygen (D.O)

All living organisms are dependent upon oxygen in one form or the other to maintain the metabolic processes that produce energy for growth and reproduction. Aerobic processes are of great interest, which need free oxygen for wastewater treatment. Dissolved Oxygen (DO) is also important in precipitation and dissolution of inorganic substances in water. DO levels in natural waters and wastewaters depend on physical, chemical and biological activities in water body. The solubility of atmospheric oxygen in fresh water ranges from 14.6mg/L at 0°C to about 7.0mg/L at 35°C under normal atmospheric pressure. Since it is poorly soluble gas, its solubility directly varies with the atmospheric pressure at any given temperature. Analysis of DO is a key test in water pollution control and wastewater treatment processes. Method used for analysis of D.O is Modified Winkler's method (Azide Modification) as described in CPCB guide manual for water and waste water analysis and IS 3025 part 38. The basic principle of Winkler's method is estimation of dissolved oxygen

uptake at 27ºC temperature. It has been modified to remove Nitrate interference by adding sodium azide along with Alkali-Iodide.[4]

This is a measure of the amount of oxygen dissolved in water. Typically, the concentration of dissolved oxygen in surface water is less than 10 mg/L. The DO concentration is subject to diurnal and seasonal fluctuations that are due, in part, to variations in temperature, photosynthetic activity and river discharge.

Biological Oxygen demand:

The Biological Oxygen Demand (BOD) is an empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of water and waste water. A number of factors may affect the accuracy and precision of BOD measurements. For instance, soluble and floatable solids, oxidation of reduced ions and sulphur compounds, lack of mixing etc. the BOD test is dependent of dissolved oxygen (DO) available in the incubated sample. Therefore, it is necessary to dilute the sample before incubation, to bring the oxygen demand and supply in to appropriate balance.

The Method used for analysis of BOD is Modified Winkler's method (Azide Modification) as described in CPCB guide manual for water and waste water analysis and IS 3025 part 44. The basic principle of Winkler's method is estimation of dissolved oxygen uptake at 27°C temperature under incubation for 3 days. It has been modified to remove Nitrate interference by adding sodium azide along with Alkali-Iodide.[4] Biochemical Oxygen Demand is an important water quality parameter because it provides an index to assess the effect discharged wastewater will have on the receiving environment. The higher the BOD value, the greater the amount of organic matter or "food" available for oxygen consuming bacteria. If the rate of DO consumption by bacteria exceeds the supply of DO from aquatic plants, algae photosynthesis or diffusing from air, unfavourable conditions occur. Depletion of DO causes stress on aquatic organisms, making the environment unsuitable for life. Further, dramatic depletion can lead to hypoxia or anoxic environments. BOD is also used extensively for wastewater treatment, as decomposition of organic waste by microorganisms is commonly used for treatment. Regulations for BOD will vary by country and region. In general, maximum allowable concentration for direct environmental wastewater discharge fall around 10 mg/L BOD and maximum allowable concentrations for discharge to sewer systems around 300 mg/L BOD.

Results and Discussion

In the present study the physio chemical examination of the temple lake water are carried out to normal atmospheric conditions. Samples are collected in the morning time before 10 a.m. and brought to laboratory for the analysis of various water quality parameters such as dissolved oxygen and biological oxygen demand.

Dissolved Oxygen

Occurrence of Dissolved Oxygen (DO) in natural and wastewater depends on the physical, chemical and biological activity in a water body. The analysis for DO is important

in water pollution control and waste treatment process. Oxygen content of a fresh water body is depleted in numerous ways. DO is an index of physical and biological process going on in the water. The presence of oxygen demanding pollutants like organic wastes causes rapid depletion of DO from water.[11]

The result of DO in the sample was 2.5mg/l and 1.23mg/l. DO level was much lower than the desirable limit. Its depletion is the most critical manifestation of pollution.[12] It is the basis for BOD, which is an important parameter to evaluate pollution potential of wastes, it is responsible for corrosively, photosynthetic activity and septicity and is necessary for all aerobic biological wastewater treatment processes.

BOD

Biological Oxygen Demand determination is a most useful technique to check the strength of organic waste (sewage, effluents and other pollutants) in water and provides data on the pollution load in all-natural water. In unpolluted waters BOD is lower while it is higher in the case of polluted ones.[9] Presence of decomposable organic wastes and the organic pollutants cause a BOD raise in proportion to volume of organic materials in waters. The permissible limit of BOD is 5mg/l.[15] In the present study, BOD level of the sample was 2.9mg/l and 10.26mg/l. The water sample have BOD values much higher than the permissible limit due to trough of rice ball and organic matters like flowers, plant leaves, wood materials etc. BOD tolerance limit of ISI-IS: 2296-1982 for inland surface water is 3mg/L.[15]

Conclusion

Temple pond is a stagnant source of fresh water, replenished by means of rainwater and groundwater. The draining of organic materials in the pond increases the nutrient level of the water and the phytoplankton present in water helps in maintaining or balancing the ecosystem. Pond ecosystem ensures the economic prosperity, social wellbeing and environment sustainability. Bioremediation of temple ponds not only keeps it clean but also helps to keep the aquatic life healthy. The preservation of temple ponds helps to maintaining both the quality and quantity of water. Regular maintenance, constant monitoring, sustainable cleaning methods and hygienic waste management methods are some of the best ways to keep temple ponds premises clean and hygienic. This can be achieved by encouragement of local people by creating a proper awareness about the importance of temple pond and water for their active participation by involving local administrative bodies. The water in temple ponds serves as a vital role in recharging the underground water and also reduce the runoff water which ensures sufficient water in domestic wells during the summer days. The present study illuminates the significance of temple pond in preservation of sources of rich and varied plant species in turn serves as source of potable water, aesthetics, recreation, preserving medicinal flora and also enhance the nutritional value of the water as it is a home for many beneficial microalgae, which having commercial significance too.

Future prospects

Water resources are declining day by day at the faster rate. The temple ponds can be seen everywhere but yet they are endangered so we need to protect and conserve before

getting extinct. It is very important and responsibility to preserve, conserve the temple ponds as they are the integral part of ecosystem as they maintain healthy balance of aquatic life. One of the challenges in the future is the need for more active participation of the community in conserving these temple ponds.

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Evaluation of Antimicrobial Activity of *Acalypha indica* (Kuppaimeni) and *Phylanthus niruri* (Keelanelli) on wound pathogens

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Abstract

Herbal medicine is gaining popularity as a safer alternative to synthetic antibiotics, especially in light of increasing antibiotic resistance among pathogenic bacteria. This study investigates the antimicrobial activity of ethanol extracts from two traditionally used medicinal plants, *Acalypha indica* (Kuppaimeni) and *Phyllanthus niruri* (Keelanelli), against common wound pathogens *Escherichia coli* and *Pseudomonas aeruginosa*. The plant leaves were collected, shade-dried, and extracted using 90% ethanol. Antibacterial activity was evaluated using both disc diffusion and agar well diffusion methods. Results indicated that both plant extracts exhibited dose-dependent antibacterial effects, with *Phyllanthus niruri* showing significantly larger zones of inhibition compared to *Acalypha indica*. Among the two bacterial strains tested, *E. coli* demonstrated higher susceptibility than *P. aeruginosa*. These findings support the traditional use of these plants in treating infections and showed their potential as natural antimicrobial agents in the development of alternative therapeutics.

Introduction

Herbal medicines are becoming popular in the current era, with people preferring them over conventional drugs to treat ailments with the notion that they cause lesser adverse effects. Also, certain pathogens have developed resistance to the conventional antiseptics and antibiotic, stipulating their cautious use [11]. Synthetic drugs may have side effects and antibiotic resistant microorganisms also increasing every year. Hence, researchers are paying more attention in herbal drug discovery for the treatments of various diseases [3]. The traditional medicinal plants-based treatment covers the basic health needs in the developing countries [14].

Acalypha indica, (Euphorbiaceae) commonly known as kuppaimeni in Tamil is an annual plant grown in India, in wastelands throughout the plains. Entire plant is used in indigenous system of medicine, it contain acalyphine, an alkaloid, the plant is used as cathartic, antihelminthic, expectorant, emetic, laxative, asthma and wound healing property. In siddha medicine the plant is used in treating respiratory disorders such as asthma and wheezing [1]

Antibiotics are powerful medicines that fight bacterial infections. Used properly, antibiotics can save lives. They either kill bacteria or keep them from reproducing. Antibiotics provide the main basis for the theraphy of microbial and bacterial infections. Since the discovery of these antibiotics and their uses as chemotherapeutic agents. [13] *Acalyphaindica* Linn is a member of Euphorbiaceae family. It is essentially a weed which grows in waste areas. It is anannual herb, about 80 cm high and commonly found in waste places or fields [2] . Previous studies on *A. indica* revealed that this plant has antibacterial activity against several gram

positivebacteria[4,7]. The petroleum ether and ethanol extract were found to have anti-implantation activity when they were given to female albino rats.

Phyllanthusniruri commonly termed ‘stone breaker’ in English is a common weed, found in both cultivated fields and wastelands. It is considered to be antihepatotoxic, antihepatitis-B and an antidiabetic [10-12].

Recently, there has been increasing interest in the use of various herbal materials as an alternative medicine to treat some of the enteric infections and many compounds of natural products have been specifically targeted against resistant pathogenic bacteria [5]. Therefore these of native medicinal plants as an alternative to antibiotics are being extensively evaluated and are considered to play a prominent role in the treatment [12].

The present study focuses on the antimicrobial activity of the Ayurvedic medicinal plant *Phyllanthusniruri* Linn and *Acalyphaindica* Linn Leaf extracts of this plant were tested against a panel of bacterial pathogens important to human health. The antimicrobial efficacy of these extracts was assessed against selected *Pseudomonas aeruginosa* and *E.coli*bacterial strains using the agar well diffusion method. The zone of inhibition was measured to evaluate the potency of each extract, and the results were compared with standard antibiotics as controls. This investigation aims not only to validate the traditional use of Kuppaimeni and Keelanelli as antimicrobial agents but also to provide a scientific basis for their potential inclusion in the development of alternative therapeutics, particularly in the face of increasing antibiotic resistance.

Materials and Methods

Collection of Plant Materials

Fresh leaves of *Acalyphaindica* and *Phyllanthusniruri* were collected, washed, and shade-dried for 3-5 days. The dried leaves were milled into a fine powder for further extraction.

Preparation of Plant Extracts

Approximately 30–50 grams of dried plant powder were soaked in 50 mL of 90% ethanol and left to stand overnight at room temperature to facilitate extraction of bioactive compounds. The resulting mixture was then filtered, and the filtrate was concentrated using a rotary evaporator set at 45°C to remove the ethanol. The concentrated plant extracts were stored at 4°C in sterile bottles until further use. For antibacterial testing, a stock solution was prepared at a concentration of 400 mg/mL, and serial dilutions were performed to obtain working concentrations of 100 mg/mL, 50 mg/mL, and 25 mg/mL.

Test Microorganisms

Two bacterial cultures*Escherichia coli*(*E. coli*) and *Pseudomonas aeruginosa.*were used toevaluate the antimicrobial activity

Antibacterial Assay

The antibacterial activity was evaluated using the disc diffusion and agar well diffusion methods.

Disc Diffusion Method

Muller-Hinton agar medium was prepared and poured into sterilized Petri dishes, allowed to solidify, and then inoculated with test bacterial cultures of *Escherichia coli* and *Pseudomonas*

aeruginosa. Sterile discs were soaked in plant extract solutions at concentrations of 100 mg/mL, 50 mg/mL, and 25 mg/mL, and subsequently placed on the surface of the inoculated agar plates. The plates were incubated at 37°C for 24 hours to allow for bacterial growth and interaction with the extract. Antibacterial activity was then evaluated by measuring the diameters of the zones of inhibition around each disc, indicating the effectiveness of the plant extract against the test organisms.

Results and Discussion

All ethanolic extracts of herbs and antibiotics showed the antimicrobial property. The extract of Tulsi showed the zone of inhibition (ZOI) against the *S.aureus* (22 mm) while found resistant (no zone) against the *E.coli* [14]. The present study evaluated the antimicrobial potential of ethanol extracts of *Acalyphaindica* and *Phyllanthusniruri* against two common bacterial pathogens, *Escherichia coli* and *Pseudomonas aeruginosa*, using the disc diffusion method. The antibacterial activity was assessed by measuring the zone of inhibition at different extract concentrations (100 mg/mL, 50 mg/mL, and 25 mg/mL).

Table – 1 *Antimicrobial effect of Acalypha indica (Kuppaimeni) leaf extract on different pathogens*

Test Organism	Zone of Inhibition (mm) in different Concentration		
	100 mg/ml	50 mg/ml	25 mg/ml
Escherichia coli	18	15	12
Pseudomonas aeruginosa	20	17	11

Table – 2 *Antimicrobial effect of Phyllanthusniruri (Keellanelli) leaf extract on different pathogens*

Test Organism	Zone of Inhibition (mm) in different Concentration		
	100 mg/ml	50 mg/ml	25 mg/ml
Escherichia coli	24	22	20
Pseudomonas aeruginosa	25	16	14

The results clearly indicate that both plant extracts possess notable antibacterial activity, with the ethanol extracts exhibiting greater inhibitory effects compared to aqueous extracts (data not shown). Among the tested plants, *Phyllanthus niruri* showed a relatively higher zone of inhibition against both bacterial strains, suggesting a stronger antibacterial efficacy (Tables 1 and 2).

The present study evaluated the antimicrobial potential of ethanol extracts of *Acalypha indica* and *Phyllanthus niruri* against two common bacterial pathogens, *Escherichia coli* and *Pseudomonas aeruginosa*, using the disc diffusion method. The antibacterial activity was assessed by measuring the zone of inhibition at different extract concentrations (100 mg/mL, 50 mg/mL, and 25 mg/mL).

The inhibition zones were concentration-dependent, with higher concentrations yielding greater zones of inhibition. *E. coli* was found to be more sensitive to both plant extracts than *P. aeruginosa*, which is consistent with its less robust resistance mechanisms compared to the latter. Notably, *P. aeruginosa*, a known multidrug-resistant organism, displayed reduced susceptibility, particularly at lower concentrations of the extracts.

CONCLUSION

The antimicrobial potential of ethanol extracts of *Acalypha indica* and *Phyllanthus niruri* against *Escherichia coli* and *Pseudomonas aeruginosa*. The results showed that both plant extracts inhibited bacterial growth in a concentration-dependent manner, with *Phyllanthus niruri* exhibiting higher antimicrobial efficacy. *E. coli* was found to be more sensitive than *P. aeruginosa*, a multidrug-resistant organism known for its resilience to conventional antibiotics. The result showed that these plants can serve as promising candidates for the development of herbal-based antimicrobial formulations. This study demonstrated the antimicrobial potential of *Acalypha indica* (Kuppaimeni) and *Phyllanthus niruri* (Keelanelli) against common wound pathogens, *Escherichia coli* and *Pseudomonas aeruginosa*. The findings support the traditional use of these medicinal plants in treating infections and suggest their potential as natural alternatives to synthetic antimicrobial agents.

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Analysis of Quality of various Milk Samples by Methylene blue reduction Test

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ABSTRACT

Milk is a nutritional and healthy product. Raw milk is a milk that has not undergone pasteurization for an effective pathogen elimination, thus having a reduced shelf life due to microbial activities. Microorganisms such as bacteria can affect the quality of dairy products, hence the need to assess the microbial quality of natural cow milk and pasteurized milk. The aim of this study is to detect the quality of various milk samples by Methylene Blue Reduction Test, determine the microbiological quality of raw or pasteurized milk by evaluating the bacterial load, measure the extent of bacterial contamination by observing the time taken for the methylene blue dye to lose its color, monitor the spoilage of milk and provide a simple and cost-effective way to distinguish fresh milk from milk with high bacterial contamination.In this study, raw (unpasteurized) and pasteurised milk samples (Srinivasa, Nandini, Cavins, Aavin, Jersey, Arokya, Akshaya kalpa-organic, Heritage, Amul) were purchased from a commercial provision store located at Ambattur, in and around Chennai were analyzed using Methylene Blue Reduction Test (MBRT). Methylene blue reduction test result revealed that there was high bacterial count with more metabolic activity in the raw cow milk. The pasteurized milk samples which were used for testing are of good and excellent quality. This study reveals the need for milk handlers to practice good personal hygiene at every stage during milk processing, beginning from cow milking to packaging before consumption.

INTRODUCTION

Milk is defined as fresh, clean, whole undigested normal mammary secretion obtained by draining the udder of healthy cow that are properly fed and kept. Milk contains appreciable colostrums and has high nutritional value and an important source of protein, minerals, vitamins and fats in human diet. It provides excellent medium for growth of microorganisms. Due to high level of milk consumption worldwide, the potential milk-borne illness is a major concern to researchers, producers, regulators and consumers of milk and milk products. Milk can be classified into two groups namely: raw, natural or unpasteurized milk and pasteurized milk. The former being a natural milk gotten directly from the udder of a healthy cow that still has its composition in complete proportion while the latter has undergone pasteurization process. With the exception of raw cow milk, every other type of milk is considered as pasteurized milk . It may be worthy to note that pasteurization is the process of heat processing a liquid or food to kill pathogenic microorganisms so as to make the liquid or food safe for consumption. Milk protein is the protein in milk, and cow milk is the major source of milk protein for man. There are two types of protein in milk namely: whey and casein proteins. The whey protein constitutes 18% of the total milk protein while

the remaining 82% is the casein protein. The casein protein is only found in milk and contains all the nine amino acids, with the chains of amino acid molecules of the milk protein being connected by peptide bonds. Although milk contains beneficial microorganisms such as *Lactobaccillus* species, *Bifidibacterium* species and *Enterococcus species* , there are also harmful microorganisms which can affect the quality, safety and consumers acceptability of dairy products. Such microorganisms include: *Bacillus cereus, Listeria monocytogenes, Yersinia enterocolitica, Salmonella species, Staphylococcus aureus, Campylobacter jejuni, Aspergillus species, Penicillium species* and viruses particularly starter bacteriophages.

Most dairy farmers that produce fresh cow milk do not observe most of the quality control measures, thereby emphasizing the need to ascertain the safety level of milk and milk-products before human consumption . Minimization and possible elimination of these harmful microorganisms which are the major cause of milk-borne disease outbreaks especially in raw cow milk can be achieved through thorough cleaning of the udder with sterile towel and adherence to effective hand washing hygiene during milking.

The microbiological quality of raw and pasteurized milk can quickly be assessed using the methylene blue dye reduction test, commonly known as MBRT test. This test is based on the fact that the blue colour of the dye solution added to the milk gets decolourized when the oxygen present in the milk gets exhausted due to microbial activity. The sooner the decolourization, the more inferior the bacteriological quality of the milk is assumed to be. This test is widely carried out at the dairy reception dock, processing units and milk chilling centres where it is followed with an acceptance or rejection criteria for the raw and processed milk. This study therefore was projected towards the evaluation of raw andpasteurised milk sold in markets which are commonly used for consumption

MATERIALS AND METHODS

Sample Source and Collection

The raw cow milk were collected from local area, and pasteurized milk samples (Srinivasa, Nandini, Cavins, Aavin, Jersey, Arokya, Akshaya kalpa-organic, Heritage, Amul) were purchased from a commercial provision store located at Ambattur, in Chennai. The raw cow milk and the pasteurized cow milk were preserved in ice cold water immediately after collection and then transported to the laboratory for the analysis.

Methylene Blue Reduction Test (MBRT)

The principle of the methylene blue reduction test depends on the fact that the color imparted to the milk by adding a dye such as methylene blue will disappear more or less quickly, which depends on the quality of the milk sample to be examined. Methylene blue is a redox indicator that loses its color under the absence of oxygen and is thought to be reduced. The depletion of oxygen in the milk is due to the production of reducing substances in the milk due to the enhanced rate of bacterial metabolism. The dye reduction time refers to the microbial load in the milk and the total metabolic reactions of the microorganism.

1. Transfer 10 ml of each milk sample into appropriately labelled test tube.
2. Add 1 ml of redox indicator, methylene blue to each test tube containing milk sample.

3. Tighten the test tube mouth with stoppers. Gently invert the tubes at about four or five times to ensure proper mixing of the methylene blue solution.
4. Keep the tubes in the water bath at 37 ^{o}C
5. Note the incubation time. That is, the time elapsed for the color to turn whitish appearance.
   POSITIVE CONTROL - 10ml of Pasteurised milk + 1ml of water
   NEGATIVE CONTROL- 10ml of Pasteurised milk + 1ml of methylene blue dye
   Colour change of the milk from blue to white is noted

RESULT AND DISCUSSION

Methylene blue reduction within 30 minutes indicates very poor milk quality.

Time taken for decolourization	Milk Condition
5 hours and above	Excellent
3 to 4 hours	Good
1 to 2 hours	Fair
Less than ½ hours	Poor

The time taken for the decolorisation of the raw milk and various pasteurised milk samples are tabulated below:

S.NO	MILK NAME	TIME TAKEN	QUALITY OF MILK
1	Raw Milk	30 minutes	poor
2	Srinivasa	4 hours	Good
3	Nandini	4 hours	Good
4	Cavins	> 6 hours	Excellent
5	Aavin	> 6 hours	Excellent
6	jersey	> 6 hours	Excellent
7	Arokya	> 6 hours	Excellent
8	Akshaya kalpa-organic	> 6 hours	Excellent
9	Heritage	> 6 hours	Excellent
10	Amul	> 6 hours	Excellent

Methylene blue reduction test result revealed that there was high bacterial count with more metabolic activity in the raw cow milk which resulted to loss of the blue colour in the methylene dye. The pasteurized milk (Nandini and Srinivasa), which in turn resulted to an increase in the methylene blue reduction time upto 4 hours. Other Samples (Cavins, Aavin, jersey, Arokya, Akshaya kalpa-organic, Heritage, Amul) were of excellent and acceptable quality for human consumption since the methylene blue was not completely reduced even after 6 hours of incubation

CONCLUSION

Raw cow milk is unsafe for human consumption and would be better when processed especially through bottle sterilization. This study reveals the need for milk handlers to practice good personal hygiene at every stage during milk processing, beginning from cow milking to packaging before consumption. Furthermore, the need for hygienic processing equipment cum environment and an effective pasteurization of milk cannot be overemphasized

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Comparative study on antimicrobial activity of tulsi *(Ocimum sanctum*) and neem (A*zadirachta indica)* ethanol extract

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Abstract

The increasing prevalence of antimicrobial resistance has intensified the search for alternative therapeutic agents, particularly those derived from medicinal plants. This study investigates the antimicrobial potential of *Azadirachta indica* (neem) and *Ocimum sanctum* (tulsi), both widely used in traditional medicine for their therapeutic properties. The antimicrobial activity was evaluated against selected bacterial strains *Pseudomonas aeruginosa* and *Bacillus subtilis* using the agar well diffusion method. The results revealed that both neem and tulsi extracts exhibited significant antimicrobial activity, with ethanolic extracts. Among the tested microorganisms *Bacillus subtilis* were most susceptible to the plant extracts. Neem demonstrated slightly higher antimicrobial activity overall compared to tulsi. These findings support the traditional use of neem and tulsi in the treatment of microbial infections and highlight their potential as natural sources of antimicrobial compounds.

Introduction

The rising incidence of antimicrobial resistance has necessitated the exploration of alternative and complementary therapeutic agents derived from natural sources. Medicinal plants have long served as a cornerstone of traditional healthcare systems and continue to garner attention for their pharmacologically active constituents. Among such plants, *Azadirachta indica* (commonly known as neem) and *Ocimum sanctum* (commonly known as tulsi or holy basil) have been extensively utilized in Ayurvedic medicine for their broad spectrum of therapeutic properties, including antimicrobial, anti-inflammatory, antioxidant, and immunomodulatory effects.

The Latinized name of neem, A. indica, is derived from the Persian word “Azad” means free, “dirakht” means tree, and “i-Hind” means of Indian origin. Hence, it literally means “the free tree of India” [1]. Neem is a member of the Meliaceae family. Neem is known for its rich phytochemical profile, which includes compounds such as nimbin, nimbidin, azadirachtin, and quercetin, all of which have demonstrated antimicrobial efficacy against a range of bacterial and fungal pathogens. Neem is widely used in the field of pharmaceuticals, agriculture, as fertilizer due to presence of biologically important phytochemicals.(2) Acetone extract and chloroform extract of neem leaf found to be a strong candidate for cancer therapy and as strong antibiotics against pathogenic bacteria [3). Flavonoids are used in food and beverages of plant origin, such as

Ocimum sanctum, commonly known as tulsi or holy basil, has been used since ages in Ayurveda due to its healing property. It is also known as “queen of herbs” and is one of the

holiest herbs in India with Kingdom - Plantae, Subkingdom - Tracheobionta, Superdivision - Spermatophyta, Division - Magnoliophyta, Class - Magnoliopsida, Subclass - Asteridae, Order - Lamiales, Family - Lamiaceae, Genus - Ocimum, and Species - O. sanctum. Due to its powerful savor, it is regarded as the elixir in Ayurveda and believed to promote lifespan. The extract of tulsi is commonly known for the treatment of cold, headache, stomach disorders, etc. [5]. O. sanctum extract shows anticancer activity by decreasing cell proliferation, increasing reactive oxygen species, and by altering mitochondrial membrane potential [6]. Since ages dried leaves of tulsi have been used for repelling insects in grains. Tulsi has been effective in improving the lipid profile and basal metabolic rate [4]. The study of immune diffusion and inflammation shows that intake of a leaf extract before food can increase immune response by increasing the level of helper T cells.

The global rise in antimicrobial resistance poses a significant challenge to public health, prompting an urgent need for novel antimicrobial agents. Natural products, especially those derived from medicinal plants, offer a promising avenue for the development of effective alternatives to synthetic antibiotics. Among these, *Azadirachta indica* (neem) and *Ocimum sanctum* (tulsi or holy basil) hold a prominent place in traditional Indian medicine, particularly Ayurveda, due to their diverse pharmacological properties. Hence, there is always a need of developing potent antimicrobial drugs against them, and due to huge plant diversity and phytochemicals possessing secondary metabolites having antimicrobial activity, it can be a great alternative for synthetic drugs due to its cheaper cost and fewer side effects [7]

In this study, aqueous and ethanol extracts of neem leaves and tulsi leaves were prepared using standard cold maceration techniques. The antimicrobial efficacy of these extracts was assessed against selected *Pseudomonas aeruginosa* and *Bacillus subtilis* bacterial strains using the agar well diffusion method. The zone of inhibition was measured to evaluate the potency of each extract, and the results were compared with standard antibiotics as controls. This investigation aims not only to validate the traditional use of neem and tulsi as antimicrobial agents but also to provide a scientific basis for their potential inclusion in the development of alternative therapeutics, particularly in the face of increasing antibiotic resistance.

Methodology

Collection and Preparation of Plant Material

Neem and Tulsi leaves are collected, washed with distilled water to remove debris. Shade-dry the leaves for 7–10 days to prevent degradation of active compounds.Grind the dried leaves into fine powder using a clean grinder.

Preparation of Plant Extracts

Solvent Extraction Method

Take 10 g of powdered plant material. Add it to 100 ml of **ethanol** in a conical flask.Seal the flask and keep it on a shaker for 24–48 hours at room temperature Filter the extract using

Whatman No.1 filter paper. Evaporate the solvent using a water bath or rotary evaporator to get a concentrated extract.Store the extract in a refrigerator (4°C) until use.

Test organisms

Two bacterial culture were used to evaluate the antimicrobial activity *Pseudomonas aeruginosa* and*Bacillus subtilis*

Antimicrobial activity test

Nutrient agar plates were inoculated with the above-mentioned microorganisms by spreading the bacterial inoculum on the surface of the media (spread plate technique). Wells (6 mm in diameter) were punched in the agar. 50 µl extract of neem, tulsi, and their mixture of each concentration is allowed to diffuse out into the agar medium in separate Petri dishes, after incubation of 24 hr at 37°C, the zones of inhibition were observed uniformly circular as there was a confluent lawn of growth. Moreover, finally, the diameter of the zone of inhibition (ZOI) was measured in millimeters by Vernier scale. (8)

RESULTS AND DISCUSSION

The quantitative assessment for antimicrobial activity of the extracts was performed by measuring the diameter of ZOI at six different concentrations such as 0.2 g/ml, 0.3 g/ml, 0.4 g/ml, 0.5 g/ml and 0.6 g/ml, methanol extract of both the neem and tulsi. ZOI has been taken as absolute values neglecting±0.2 mm of standard error.

ZOI for *Pseudomonas aureus*

With neem for the above-discussed concentrations, 2.4, 4.7, 6.3, 7.5 and 9.2 mm, ZOI has been observed, respectively (Table 1). In tulsi 1.6, 3.5, 5.4, 6.7 and 8.1 mm ZOI was observed, respectively (Table 3).

ZOI for *Bacillis subtilis*

For the discussed concentration of neem 3, 5.2, 6.4, 8.7 and 11.2 mm diameter ZOI has been observed, respectively (Table 2). In tulsi for different concentration,2.3, 3.8. 5.1, 6.8 and 9.3 mmdiameter ZOI has been observed, respectively (Table 4)

Table 1: Neem leaf extract at various concentrations and their particular zone of inhibition for *pseudomonas aeruginosa*

S.No	Concentrations (g/ml)	ZOI (*Pseudomonas aeruginosa*) mm
1	0.2	2.4
2	0.3	4.7
3	0.4	6.3

4	0.5	7.5
5	0.6	9.2

Table 2: Neem leaf extract at various concentrations and their particular zone of inhibition for *Bacillus subtilis*

S.No	Concentrations (g/ml)	ZOI (*Bacillus subtilis)* mm
1	0.2	3
2	0.3	5.2
3	0.4	6.4
4	0.5	8.7
5	0.6	11.2

Table 3: Tulsi leaf extract at various concentrations and their particular zone of inhibition for *Pseudomonas aeruginosa*

S.No	Concentrations (g/ml)	ZOI (*Pseudomonas aeruginosa*) mm
1	0.2	1.6
2	0.3	3.5
3	0.4	5.4
4	0.5	6.7
5	0.6	8.1

Table 4: Tulsi leaf extract at various concentrations and their particular zone of inhibition for *Bacillus subtilis*

S.No	Concentrations (g/ml)	ZOI (*Pseudomonas aeruginosa*) mm
1	0.2	2.3
2	0.3	3.8
3	0.4	5.1
4	0.5	6.8
5	0.6	9.3

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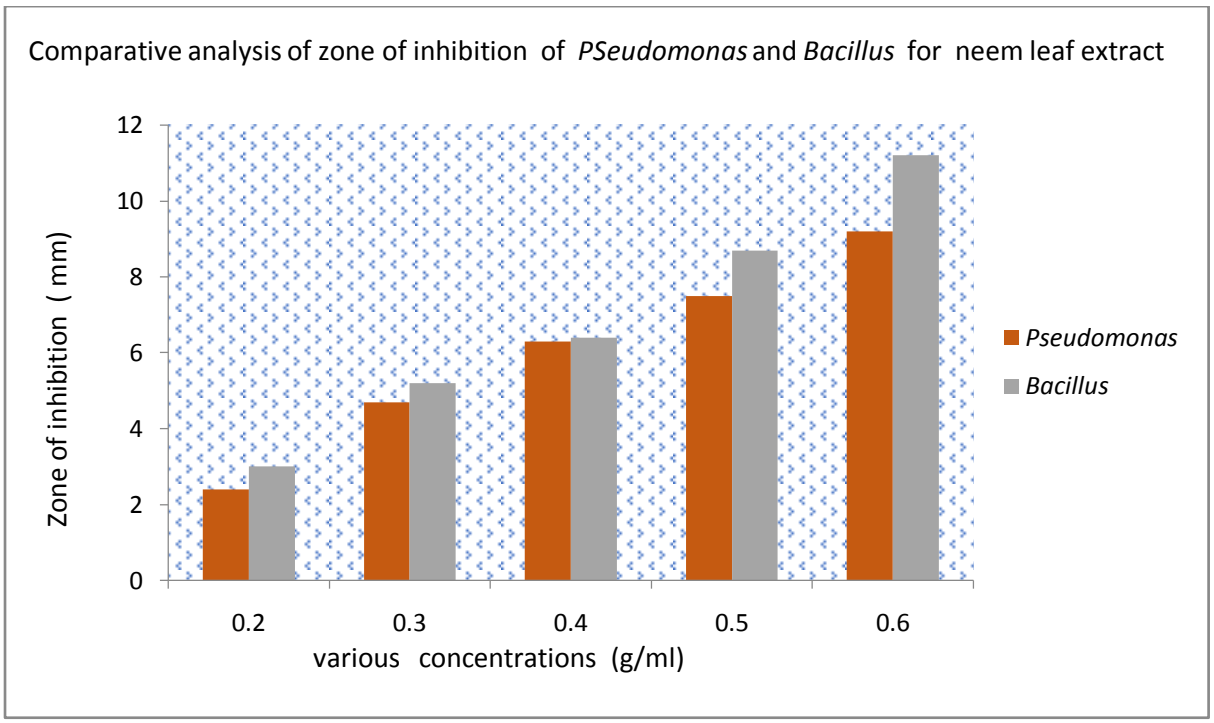
Graph analysis

Neem extract

Minimum inhibitory concentration (MIC) for both the microorganisms was found to be 0.2 g/ml. It has been observed that neem extract was more powerful against *Bacillus subtilis* in comparison to *pseudomonas aeruginosa* at higher concentrations. Neem was more powerful against *Bacillus subtilis* than tulsi.

Tulsi extract

Minimum inhibitory concentration (MIC) for both the microorganisms was found to be 0.2 g/ml. It has been observed that tulsi extract was more powerful against *Bacillus subtilis* in comparison to *pseudomonas aeruginosa* at higher concentrations.



Conclusion

From the above study it was inferred that both neem and tulsi has antimicrobial properties. It was observed that the neem has more antimicrobial properties compared to tulsi. Also the neem extract was more powerful against *Bacillus subtilis* in comparison to *pseudomonas aeruginosa* at higher concentrations. It has been observed that tulsi extract was more powerful against *Bacillus subtilis* in comparison to *pseudomonas aeruginosa* at higher concentrations.

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ANTI CANCER ACTIVITY OF METHANOL EXTRACT OF M*ELIA DUBIA*

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Abstract:

Melia dubia, a fast-growing tree native to the Indian subcontinent, is known for its broad pharmacological spectrum, particularly its antimicrobial, antioxidant, and anti-inflammatory effects. Recently, its anticancer potential has garnered scientific interest. This study evaluates the in vitro anticancer activity of the methanol extract of *Melia dubia* leaves against MCF-7 human breast cancer cell lines using the MTT assay. The plant material was collected, shade-dried, powdered, and subjected to cold methanol extraction. The extract's cytotoxic effect was assessed at various concentrations (15–250 µg/ml). A dose-dependent reduction in cell viability was observed, with the highest cytotoxicity at 250 µg/ml, indicating significant growth inhibition of MCF-7 cells. The findings suggest that bioactive compounds in *Melia dubia* may induce apoptosis and disrupt cancer cell proliferation, possibly by modulating key molecular pathways. These results highlight the potential of *Melia dubia* methanol extract as a promising natural therapeutic candidate in breast cancer treatment. Further in vivo studies and isolation of active constituents are recommended to better understand the mechanisms underlying its anticancer effects.

Keywords: *Melia dubia*, anticancer activity, MCF-7, methanol extract, cytotoxicity, apoptosis, natural compounds

INTRODUCTION:

Melia dubia, commonly known as the Indian cedar or white cedar, is a tropical tree speciesnative to parts of Asia, particularly India. This species belongs to the family Meliaceae, which also includes other important plants with medicinal properties, such as *Azadirachta indica* (neem). *Melia dubia* is widely known for its diverse pharmacological properties, including antimicrobial, anti-inflammatory, and antioxidant activities. Recently, the plant has gained attention in the field of cancer research due to its potential anticancer effects, which have been observed in various in vitro and in vivo studies. The plant's rich phytochemical profile, which includes alkaloids, flavonoids, saponins, and terpenoids, is believed to be responsible for its therapeutic effects.

Cancer, a leading cause ofdeathglobally, is characterized byuncontrolled cellgrowth, invasion, and metastas is of malignant cells. Traditional cancer treatments, such as chemotherapy, radiation therapy, and surgery, are often associated with severe side effects and limited efficacy. As a result, there is growing interest in natural compounds derived from plants, as they offer promising alternatives with fewer side effects. Phytochemicals fromplantslike *Meliadubia*have beenstudied fortheir potentialto inhibit cancer

cellproliferation, induce apoptosis (programmed cell death), and suppress angiogenesis (the formationof new blood vessels that supplytumors).

One of the key aspects of *Melia dubia* that has drawn the attention of researchers is its ability to modulate various molecular pathways involved in cancer development and progression. Studies have suggested that compounds present in *Melia dubia* can target important signaling molecules and enzymes, thereby hindering the growth of tumor cells. Additionally, the antioxidant properties ofthe plant may help protect cells fromoxidative damage, a contributing factor in the initiation and progression of cancer. By scavenging free radicals and reducing oxidative stress, *Melia dubia* may help mitigate the damage that promotes cancerous changes in cells.

Preliminary research on *Melia dubia* has shown promising results, particularly in the context of breast, colon, and lung cancer. The plant's extracts have demonstrated cytotoxicity against cancer cell lines, indicating that it can inhibit the growth and survival of these cells. Studies have also highlighted itspotentialto reducetumor size in animal models, further supporting its potentialas a therapeutic agent. The anticancer activity of *Melia dubia* is believed to be mediated through various mechanisms, including cell cycle arrest, induction of apoptosis, inhibition of metastasis, and modulation of molecular pathways such as the PI3K/Akt and NF-κB pathways, which are often dysregulated in cancer cells.

Further more,the bioactive compounds in *Melia dubia* have shown synergistic effects when used in combination with conventional chemotherapy drugs, suggesting that it may be an effective adjunct therapy. This combination therapy could reduce the dosage of chemo therapeutic agent minimizing their toxic effects on normal cells and improving the overall quality of life for cancer patients.

Despite the promising evidence, the anticancer potential of *Melia dubia* is still under investigation, and much remains to be explored. While in vitro and animal studies have yielded positive results, clinical trials in humans are necessary to confirm the safety, efficacy, and optimal dosages of *Melia dubia* extracts. In addition, the identification and isolation of specific active compounds responsible for the anticancer activity of *Melia dubia* remain critical areas of research. By understanding the molecular mechanisms through which these compounds exert their effects, it may be possible to develop more targeted and effective cancer therapies in the future.

MATERIALSANDMETHODS:

Collection ofPlantmaterials

The whole *Melia dubia*was collected in the month of January, Chennai, Tamilnadu, India. The plant was identified taxonomically and authenticated at the HeteroGene Biotech Pvt Ltd, Chennai, Tamil Nadu, India.

Drying

The disease-free Melia dubia were separated dried at temperature between 30^0C. The sizereduction of the dried Melia dubia was done with the help of mechanical blender and the powdered material was stored in the desiccator until further use.

Extraction

Themedicinally importantsecondary metabolitesfrom selectedMeliadubiamaterialswere extracted using selective solvents using standard procedures (Handa etal., 2008).

ColdMercerizationExtraction

5g ofpowder was soaked in 50 ml of methanol in a conical flask and stirred vigorouslywith a glass rod. This setup was placed without any disturbance at room temperature for 24h. After incubation, the extract was filtered using Whatman no.1 filter paper and allowed to freeze dried. The extracted sample was stored at 4^{o}C.

Anticanceractivityofmethanolextractof*Meliadubia*

The MTT (3-(4,5-dimethyl thiazol-2-yl) -2,5-diphenyltetrazolium bromide) tetrazolium reduction assay was the first homogeneous cell viability assay developed for a 96-well format that was suitable for high throughput screening (HTS). The MTT tetrazoliumas say technology has been widely adopted and remains popular in academic labs as evidenced by thousands of published articles. The MTT substrate is prepared in a physiologically balanced solution,added to cells inculture, usually at a final concentration of 62–1000µg/ml, and incubated for 1 to 4 hours. The quantity of formazan (presumably directly proportional to the number of viable cells) is measured by recording changes in absorbance at 570 nm using a plate reading spectrophotometer. A reference wavelength of 630 nm is sometimes used, but not necessary for most assay conditions.

Viable cells with active metabolism convert MTT into a purple colored formazan product withan absorbance maximum near 570 nm. When cells die, they lose the abilityto convert MTT into formazan, thus color formation serves as a useful and convenient marker ofonlythe viable cells. The exact cellular mechanismofMTT reduction into formazan is not well understood, but likely involves reaction with NADH or similar reducing molecules that transfer electrons to MTT. Speculation in the early literature involving specific mitochondrial enzymes has led to the assumption mentioned in numerous publications meena that MTT is measuring mitochondrial activity.

The formazan product of the MTT tetrazolium accumulates as an insoluble precipitate insidecells as well as being deposited near the cell surface and in the culture medium. The formazan must be solubilized priorto recording absorbance readings. Avarietyofmethodshave beenused to solubilizethe formazan product, stabilize the color,avoid evaporation,andreduce interference by phenol red and other culture medium components. Various solubilization methods include using: acidified isopropanol, DMSO, dimethylformamide, SDS, and combinations of detergent and organic solvent. Acidification of the solubilizing solution has the benefit of changing the color of phenol red to yellow color that may have less interference with absorbance readings.The pH of the solubilization solution can be adjusted to provide maximum absorbance if sensitivity is an issue; however, other assay technologies offer much greater sensitivity than MTT. The amount of signal generated is dependent on several parameters including: the concentration of MTT, the length of the incubation period, the number of viable cells and their and metabolic activity. All of these parameters should be

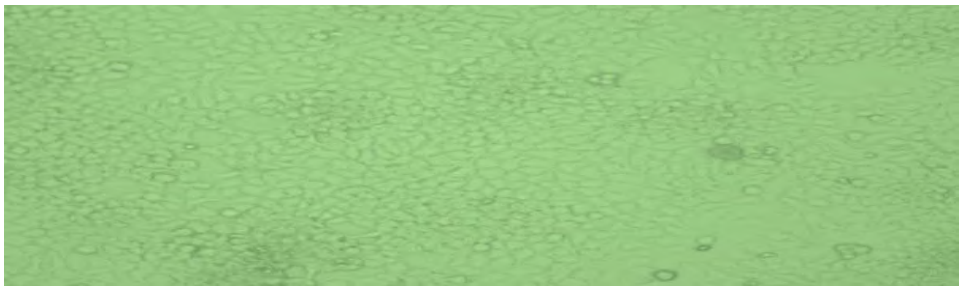
considered when optimizing the assay conditions to generate a sufficient amount of product that can be detected above background.

RESULT

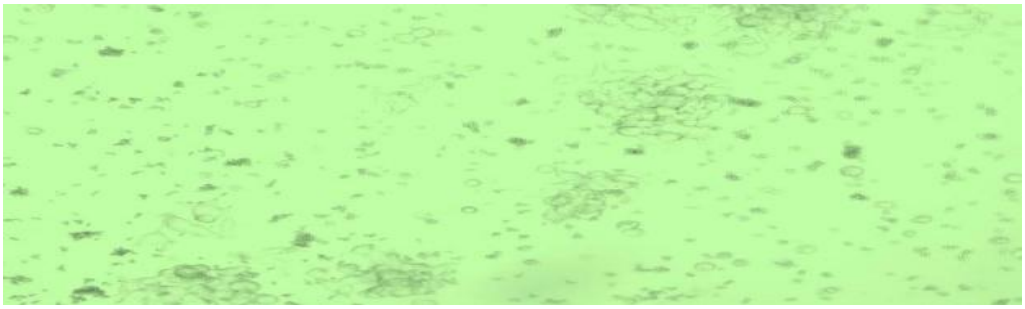
TABLENO.1: O.D.OF METHANOL EXTRACT OF MELIADUBIA AGAINST MCF-7CELL LINE

Concentration of (µg/ml)	%ofCellViability(Triplicate Values)			
	Trial1	Trial2	Trial2	Average
250	0.586	0.584	0.581	0.584
125	0.642	0.642	0.645	0.644
62	0.705	0.709	0.701	0.705
31	0.742	0.740	0.742	0.741
15	0.785	0.784	0.782	0.783
Control	0.845	0.840	0.841	0.840
Blank	0.851	0.852	0.849	0.850

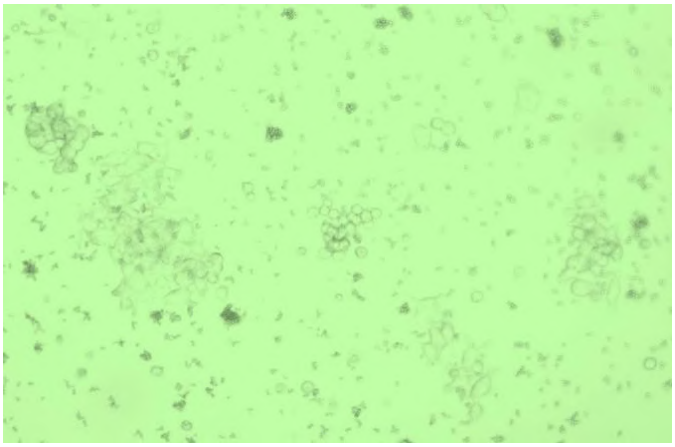
Control



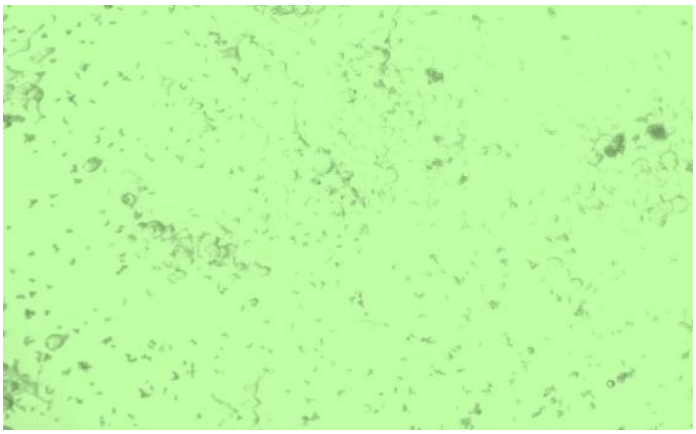
250 µg



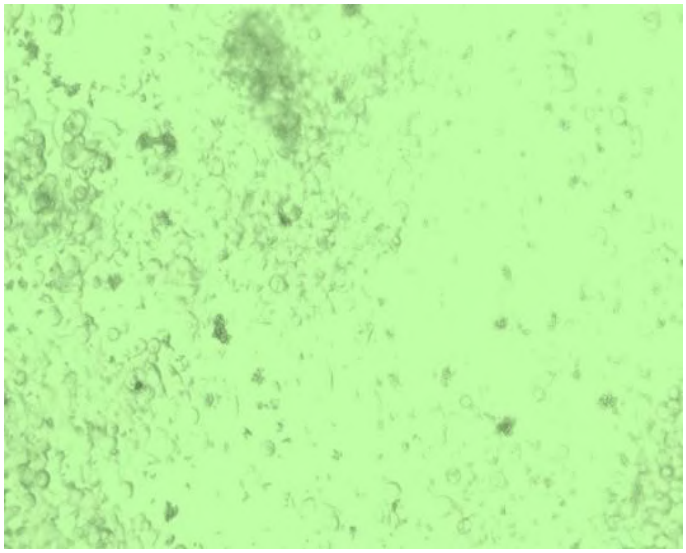
125 µg



62 µg



31 µg



Discussion:

The data presented in Table 1 provides a detailed examination of the effect of the methanol extract of *Melia dubia* onthe viabilityof MCF-7 breast cancer cells. The table includes readings of optical density (O.D.) for various concentrations of the extract, which were used to assess the percentage of cell viability. The results show a clear trend: as the concentration of the methanol extract increases, there is a corresponding decrease in cell viability, which is an indicator of the extract's potential anticancer properties.

Concentration- Dependent Decreasein Cell Viability

The optical density values in Table 1 show that at the highest concentration tested (250 µg/ml), the percentage ofcell viability is lowest (0.584), compared to the controland blank values. This suggests that the methanol extract of *Melia dubia* has a dose-dependent effect on MCF-7 cells, with higher concentrations leading to greater inhibition of cell viability. The average viability at 250 µg/ml is approximately 69%, which indicates that the extract exhibits significant cytotoxic activity at this concentration, killing a considerable proportion of the cancer cells. As the concentration of the extract decreases, the optical density values indicate a rise in cell viability, with the percentage of viability increasing at concentrations of 125 µg/ml (0.644), 62 µg/ml (0.705), and 31 µg/ml (0.741). This gradual increase in cell viability at lower concentrations suggests that the methanol extract is less effective at inhibiting cell growth as the dosage is reduced. This is expected for most cytotoxic agents, where higher concentrations tend to be more effective at inducing cell death. The control group, which received no extract, shows the highest optical density (0.840), indicating that the cells remained viable and healthy in the absence of treatment. Similarly, the blank sample, which contained only the solvent (methanol), shows a slightly higher O.D. value (0.850), suggesting that the solvent did not significantly affect the cell viability.

SignificanceoftheResults

The results demonstratethat the methanolextract of*Melia dubia* has anticancer potential against MCF-7 cells, as evidenced bythe reduction incell viabilitywith increasing concentrations ofthe extract. At higher concentrations (250 µg/ml), the extract appears to be most effective in in hibiting MCF-7cell proliferation, supporting the hypothesis that bioactive compoundsin *Melia dubia* may interfere with cancer cell metabolism, growth, and survival mechanisms.

This observation is consistent with previous studies that have shown that natural plant extracts, particularly those containing flavonoids, limonoids, and other bioactive compounds, can exert cytotoxic effectson cancer cellline sby inducing gapoptosis, in hibiting cellcycleprogression, andreducing cell proliferation. The reduction in cell viability in this study further confirms that *Melia dubia*'smethanolextract contains such active compounds that are capable of targeting and killing cancer cells.

Interpretation of Cell Viability and Potential Mechanisms

The decreasing cell viability in response to higher concentrations of the *Melia dubia* extract

suggests that it may trigger mechanisms of cell death, possibly through apoptosis or other forms of programmed cell death. It is well documented that natural extracts from plants like *Melia dubia* can induce apoptosis by activating caspases, disrupting mitochondrial function, or modulating the expressionofapoptotic proteinssuchasBaxand Bcl-2. These mechanismscould explain the decrease in cell viability observed in this study.

Furthermore, the methanol extract may exert its effects by interacting with key signaling path ways that regulate cell growth and survival, suchasthePI3K/Akt and MAPKpathways. The inhibition ofthese pathways can lead to reduced cancer cell proliferation and could contribute to the observed decrease in viability at higher concentrations.

ControlandBlankSamples

The control sample (0.840) and blank sample (0.850) show no significant differences, as expected, since the control represents the untreated MCF-7 cells, and the blank serves to account for any potential effects fromthe solvent (methanol) used to dissolve the extract. The very slight difference between these two groups further confirms that the solvent did not have any significant impact on the cell viability, ensuring that the observed effects were solely due to the *Melia dubia* methanol extract.

Conclusion:

In conclusion, the methanol extract of *Melia dubia* demonstrates significant anticancer activity against MCF-7 cells in a dose-dependent manner. The data indicate that higher concentrationsof the extract are more effective at reducing cell viability, which supports the hypothesis that bioactive compounds in *Melia dubia* may be responsible for inhibiting cancer cell growth and inducing cell death. These results suggest that *Melia dubia* has potential as a natural anticancer agent, though further studies are necessaryto explorethe specific bioactive compounds involved and to confirm these findings in vivo and in clinical trials. The current data provides a solid foundation for the continued exploration of *Melia dubia* as a promising therapeutic option for breast cancer.

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Production of biodiesel from castor oil

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Abstract

Biodiesel has become a key source as a substitution fuel and is making its place as a key future renewable energy source. As an alternative fuel for diesel engines, it is becoming increasingly important due todiminishing petroleum reserves and the environmental consequences of exhaust gases from petroleum-fuelled engines Rapid growth in industrialization of developing countries is resulting in increasing demand for new & ecofriendly energy sources. Depletion of petroleum resources has led to the search for alternative fuel which is renewable,biodegradable andeasily available.Vegetableoilscan be used directly orblendedwithdiesel tofuel diesel (CI) engines. Conversion of vegetable oils into fatty acid methyl ester by trans-esterification is the most convenient method of transforming vegetable oil to biodiesel. The proportional blends of Caster can be used in existing Compression ignition engines without any modifications.

Keywords –Biodiesel,Castoroil.

INTRODUCTION

During the last century, energy consumption has risensharply due to a change in life style and substantial population growth. Fossil fuels are limited in life and the rising cost of thesefuels has led to alternative renewable energy sources that led to energy security and environmental protection. It is important to find alternative fuels to meet the energy requirements. India has great potential for the production of biodiesel from inedible vegetable oil seeds. Biodiesel from vegetable oil have a promising alternative fuel for diesel fuel because of its renewability, better quality lighting, the comparable energy content and a higher safety without modification of the engine.

Mixtures based on the availability and relevance of consideration as an alternative fuel in dependence. Biodiesel is the formation of an alkyl ester of vegetable oil by the transesterification process. This process is in fact used saturated to remove plant oils and unsaturated fats. This form of oil alkyl ester is mixed with diesel fuel in compression ignition (diesel) for use with improved properties. Performance and emission parameters were the result of changes in fuel different proportions mixed with diesel and assessed for their feasibility.

Biodiesel is a diesel fuel replacement cleaner made from renewable natural resources burning, such as new and used vegetable oils and animal fat sources. As petroleum diesel, biodiesel can be used in engines with compression ignition or diesel engines. Biodiesel is mainly characterized by the viscosity, high calorific value, the value of the cetanenumber, cloud and pour points, distillation characteristic points, flash and combustion. Viscosity is the

most important property of biodiesel because it affects the operation of the fuel injection, especially at low temperatures where the increase in viscosity affects the fluidity of the fuel. The heat efficiency of the fuel mixed with some significantally biodiesel is increased compared to pure diesel fuel. With the use of biodiesel fuel combined with the specific fuel consumption mixed due to the reductionofbiodieselcalorific value compared to diesel fuel. Biodiesel has a higher value than that of diesel oil, cetane number and non-aromatic to 10% oxygen weight. Biodiesel Characteristics Emissions of particulate matter (PM), hydrocarbons (HC) and carbon monoxide (CO) in the exhaust gasarereduced withrespectto the clean diesel.

II. LITERATURESURVEY

For Jatropha biodiesel mixed with diesel has been experimentally observed that a mixture of 50% diesel conventional combustible with50% Jatropha Biodiesel (B50) provides performance pure diesel not as (D100) comparable. A mixture of 80% diesel conventional & 20% Jatropha Bio diesel (B20 gives ago odmechanical performance at full load.

Most of the studies are based on the results of the studyof the biodiesel process. Supports the use of biodiesel to reduce emissions of carbon monoxide. The dominant view is that HC emissions are reduced when biodiesel blends areused instead of diesel. This reduction is due to the more oxygen content.

Diesel and castor oil methylester (diesel, B5, B15, B25,B50, B75, B100) combustible mixtures are used for the drive power and with respect to the load. Biodiesel can COME25% blend with diesel from petroleum used in existing engines without modification. We can see with 75% pure diesel fuel that 25% pure mixed pure castor oil is the most suitable engine without heat melting and without rebuilding the engine. Castor oil can be used as an alternative to combustible diesel, cheap, abundant and relatively low emissions. Castor oil biodiesel requirements attended the ANP; therefore, it will allow combustible Combat. Castor oil biodiesel has a higher viscosity inflammation and the extent that the diesel oil. A higher flash point ensures handling and storage safety. After comparing with neat diesel CO emissions were slightly higher for B20 and B40 blends. Hydrocarbon emissions decreased by upto 12.8 % for B20 and 2.85% B40 compared to diesel at full load. Both blends tested result in a slightly reduced thermal efficiency and increased smoke, HC and CO levels.

MATERIALS AND METHODS

Certain edible oils such as, sunflower, cottonseed, rapeseed and palm can be used in dieselengines. For long life of the diesel engines these oils cannot be used directly. These oils are not cost effective to be used as an alternate fuel in diesel engines at present. Some of the non-edible oils such as mahua, castor, neem (Azadiracta indica), rice bran, linseed, Karanja (Pongamia pinnata), jatropha (Jatropha curcas) etc. can be used in diesel engines after some chemical treatment.

Materials

Castor (Ricinuscommunis):

The castor, ricinus communis, is a species of flowering plant in the wolf's milk, Euphorbiaceous family. Castor is native to the Mediterranean Basin, East Africa and India.Castorseed is the source of castor oil, which has a wide variety of uses. Castor's

reasonable advantage is that the growth period is much shorter than that of Jatropha and Karanja and are not far mid mayors of experience and awareness of the farmers on their plows. Growing, shrubs permanence cheating the size of a trivial tree can measure (about 12 subways / 39) cakes.

The seeds contain between 40% and 60% of oil, which is rich in triglycerides, main ricinoleína. Son seminal ricin toxin, which is also present in small concentrations along the plant. Premiums castor toxicity due to the occurrence of ricin, a toxic substance. The toxin has the castor with a degree of natural protection against harmful insects. Castor grows well in hot and humid tropical conditions and over a period of 4 to 5 months of growth. Castor oil is a light yellow, colorless liquid with no light or no odour or taste. Castor oil has a very low fog and Fourth points which will make the drying oil no Duro this good alternative biofuel conditions. It will do in the winter neither cured or thin excessive heat cold, so even common used lubricant for cars and jet engines race.

Catalyst:

Catalyst plays an important role in the production of biodiesel, which improves the reaction rate and high performance tranesterifications process producing high yield biodiesel. Alkali Catalysts such as Potassium Hydroxide (KOH), Sodium Hydroxide (NaOH), Sodium Methoxide, Potassium Methoxide, and Homogeneous acid catalysts come from strong mineral acids, p-toluene sulfonic acids most commonly used in the manufacturing process, industrial biodiesel. The transesterification of homogeneous catalyst generate saponification, however, and therefore requires post-process procedures to remove homogeneous catalysts that reflect the high production costs. However, heterogeneous catalysts are zeolites and ion exchange resins come have many advantages that non-corrosive, easy separation and require no washing of the ester. The disadvantage of biodiesel produced by heterogeneous catalyst gives low yiled of product and disposal problems.

IV. TRANSESTERIFICATION PROCESS

The transesterification procedure was conceded out in two steps: 1. Acid esterification and 2. Base esterification process. The acid esterification process was used to reduce the FFA of the particular oils up to 1-2% as they have additional acid than the 4 mg KOH/gm. The first step was carried out at a temperature range of 50-60oC with 200 ml methanol and 0.5% v/v H2SO4. A 4 ml sample of methanol was taken from the flask at 15 min intervals and the process carried out until the FFA level reduced. Sulphuric acid and excess alcohol with impurities was removed after pouring the product into a separating funnel.

The lower layer was collected from the separating funnel for the base trances terification process. During the transesterification process, 1% KOH (catalyst) dissolved in 25% v/v methanol was poured into the flask. The mixture was heated at a constant temperature of 70^{o}C and stirred at 700 rpm for 3 hours. The mixture was then poured into a separating funnel where two layers formed. The upper layer had methyl esters of vegetable oils and the bottom layer contained glycerol and impurities. The upper layer formed was washed by hot distilled water two to three times so that the catalyst and ethanol could be removed. Moisture from the biodiesel was removed by drying at 90- 100^{o}C under vacuum and passing the layer over an

hydrous sodium sulphate.

Property	Ranges	Experimental Results
Acid Value	0.4-4.0	2.2
Saponification Value	175-187	181
Iodine Value	82-88	87
Specific Gravity 20/25°C	0.957-0.968	0.95
Viscosity at 25°C	6.3-8.8 St	6.9

Comparison of FAME of Castor oil and Petro diesel

Property	FAME of Castor oil (Biodiesel)	Petro diesel
Density (15^0C, g cm^{-3})	0.921	0.834
Viscosity (40^oC, mm^2 s^{-1})	15.9	1.9 - 4.1
Cloud point (^{o}C)	-14.0	-15-5
Pour point (^{o}C)	-19.1	-35-15
Flash point (^{o}C)	186	60-80
Acid number (mg KOH)	0.85	0.5
Oxygen content (W%)	10	0

FUTUREWORK

The biodiesel is blended with petroleum diesel in different proportions to prepare testing blends which are tested on 4 stroke CI engine. The study of performance and emission characteristics of CI engine will be carried out.

CONCLUSION

From the study of literature, it is concluded that biodiesel blends in different concentrations can easily be used to provide alternative fuels to diesel. A held experimental research to sightsee the use of biofuels performance by using Castor oil in diesel engine and reports on the results.

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Determination of total hardness of water sample by titration using double burette method an economical approach

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Abstract

Titration is one of the most prevalent methods practice in almost all laboratories. Worldwide every curriculum for science and engineering undergraduate students has titrations included in their laboratory sessions. However, there are few drawbacks associated with it when it comes to chemical discharge and cost due to excess consumption of titrants, titrand and related chemicals during titration. Further, the method is an exhaustive time consuming process. In present study, conventional titration method using single burette used for determination of total hardness of water has been explored in different perspective by adopting a double burette method approach. Based on a comparative laboratory study it was found that a double burette method is not only safer and faster but also relatively more economical.

Keywords: titration; hardness; two burette method; safer; economical

Introduction

Analysis of water quality for its properties, pollution monitoring and developing standard guidelines for its specific use is an important aspect of water technology.Various analytical techniques are used for studying water quality. Among the different techniques available, the most classical method for analysis of water properties like acidity, hardness, alkalinity, other constituents and contaminants by using titration is a usual practice in almost all laboratories Titration method involves determination of the volume of a titrant of known concentration that is used to react quantitatively with the measured volume of titrant till the end point of the reaction. The volume of titrant determined is used to calculate the concentration of titrant.

As a part of curriculum water technology is also included in chemistry syllabus for high school and undergraduate students in most of the academic institutes worldwide. The course content includes theory detailing the properties of water, types of hardness, alkalinity, ill effect of untreated water, softening methods and its standard requirement for consumption and use in various industries. The curriculum also included laboratory session for experiential learning on determination of various properties of water. One such laboratory experiment includes determination of hardness of water using Ethylenediaminetetraacetic acid (EDTA) by complexometric titration method .EDTA and its use in analytical chemistry as metal complex forming ligand is well studied in literature. Traditionally, determination of hardness of water is carried out using single burette method. The single burette method is well-established and documented in literature which involves pipetting out a known volume of an

analyte solution or titrand in a conical flask, adjusting the pH of 10 using a standard buffer solution and addition of few drops of Eriochrome Black T indicator (EBT). Addition of EBT turns the color of water solution (containing e.g. Ca^{+2} and Mg^{+2}) to wine red. The content is then titrated with the titrant i.e. EDTA solution till the end point of the complexometric reaction i.e. wine red to blue .The procedure is repeated at least three times to get readings that are in close agreement.

Although, determination of hardness using single burette method is very popular there are some drawbacks associated with this method. One of the primary drawbacks with single burette titration method was that the analyte solution (acid, base or other reagent) were pipetted out by mouth. Therefore, there was a high chance of accidental swallowing of the chemicals by untrained high school and graduate students that can pose serious threat to the life of students. Fortunately, practice of pipetting of analyte solution is prohibited long back. Nowadays, wheel style pipette fillers and Peleus balls are used with volumetric pipettes.

However, another drawback that is to be taken into consideration is related to time and energy consumption i.e. laborious as a result of an exhaustive step involved while repeating the titration for obtaining at least three consecutive readings. The additional step includes transferring the titrant in a beaker and refilling the burette, pipetting out the fresh test analyte solution into the flask and addition of buffer followed by indicator. This is further associated with drawbacks like utilization of excess of chemicals and discharge of effluent after titration. Use of excess of chemicals pose burden on the budget grant of chemistry laboratories. Moreover, excessive use and discharge of chemical cause pollution to water bodies and add extra cost on water treatment.

To overcome the drawbacks associated with the traditional titration method, various methods are being explored to determine the hardness of water and are reported in literature. In one of the study, spectrophotometric titration of water sample was performed with the aim to avoid the problems like excess addition of titrant and surpassing the end point that introduce error in measurement associated with traditional method. Another study reported hardness determination using acoustic wave sensors that comprise of coated piezoelectric quartz crystals with the aim to overcome the laborious and time consuming methodology associated with traditional titration method .Similar approach in determination of hardness of natural water using potentiometric sensor array which make use of ion-selective electrodes has also been reported. Further, an ion-chromatography in conjunction with spectrophotometer has also been used and reported as rapid and advantageous method to estimate the hardness of water compared to EDTA titration method.

Although the methods reported are efficient and innovative, the instruments used are not only expensive but there is a recurring cost associated with their maintenance and calibration. Further, their use is primarily restricted for research purpose and not for laboratory sessions involving large number of students. Therefore, to address the drawbacks associated with single burette method a new approach with different prospective in determination of hardness of water was explored by adopting double burette method from the laboratory manual of University of Wisconsin-La Crosse .Unfortunately, information about the use of double burette method in water hardness determination is not available in literature. Thus,

exploration of double burette method to reduce the step involved in the procedure, time of performance and the cost associated with consumption/discharge of chemicals is the rationale behind the present study. This is a laboratory procedure developed to determine the total hardness of water sample without deviating from the basic principle of titration involved in determination of water hardness together with acquisition of data to estimate the probable reduction in the cost of chemicals used.

2. Principle involved in hardness determination

EDTA method involves titration of water sample against disodium salt solution of EDTA. This titration is carried out using Eriochrome black-T (EBT) indicator and at pH = 10. To maintain pH = 10 alkaline buffer solution (mixture of $NH_4Cl + NH_4OH$) is added. When Eriochrome black-T indicator is added to water sample containing Ca^{2+}, Mg^{2+} ions at pH = 10, it gives wine red colour to the water sample due to formation of a weak, soluble complex of metal cations with indicator as represented in equation 1.

$$\underset{\substack{\text{Typical Hardness Causing}\\ \text{Ions Present in Hard}\\ \text{Water Sample}}}{Ca^{2+}\text{ or }Mg^{2+}} + \underset{\substack{\text{Blue}\\ \text{Color}}}{EBT} \xrightarrow{\text{Buffer pH = 10}} \underset{\substack{\text{Wine Red Complex}\\ \text{(Weakly Stable)}}}{\text{[Ca-EBT] or [Mg-EBT]}} \quad (1)$$

When wine-red coloured solution is titrated with EDTA solution, unstable complexes of Eriochrome black-T are quickly converted into more stable complexes of EDTA. At this stage Eriochrome black-T is released from the metal - complexes, which gives or discharges blue color to the solution as represented in equation 2.

$$\text{[Ca-EBT] or [Mg-EBT]} + EDTA \xrightarrow{\text{Buffer pH = 10}} \underset{\text{Stable Colorless Complex}}{\text{[Ca-EDTA] or [Mg-EDTA]}} + \underset{\text{Blue Color}}{EBT} \quad (2)$$

Thus, in EDTA titration using Eriochrome black T indicator, the end point is indicated by change in color from wine red to blue.

3. Experimental overview

The experiment is performed using two titration methods. Method 1 makes use of classical single burette method (SBM) in which titrant is taken in burette and titrand is taken in a conical flask. Method 2 adopts double burette method (DBM) in performing the same titration. Double burette method as the name suggests comprise of two burettes in which both titrand and titrant are taken separately. The noticeable key feature of DBM is that after completion of titration, the solution is not discarded instead to the same solution, titrand is added using burette and titration is carried out as a consecutive step.

Both the titration methods comprises of two steps (1 and 2). Step 1 consists of titration between standard $ZnSO_4$ solution with EDTA solution i.e. standardization of EDTA solution. Step 2 consists of titration between standardized EDTA with sample hard water i.e. hardness determination. Each step (1 and 2) also includes addition of buffer solution and few drops of EBT indicator just before the titration. Both method 1 and method 2 is conducted during two 2-h laboratory practical session respectively.

In single burette method, three trials are performed such that each trial consists of step 1 followed by step 2 to obtain three consistence reading. While in double burette method, only one trial is performed such that step 1 and Step 2 are performed consecutively to obtain three readings in each step respectively. Burette readings are noted at the end point which is observed when the water sample turns from wine red to blue in color. A schematic of experimental overview showing steps involved in SBM and DBM is given in Figure 1 and the procedure followed in DBM is shown in Figure 2.

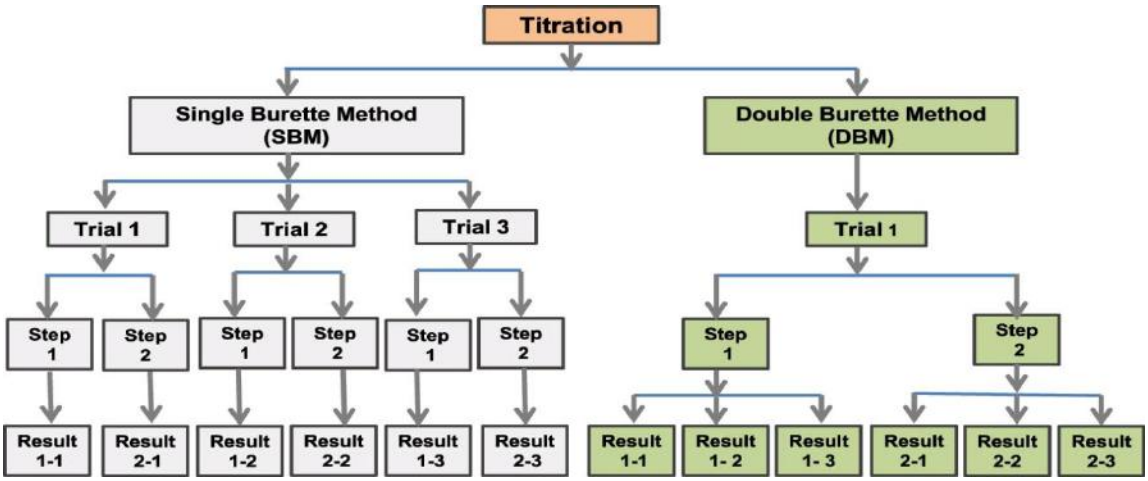

Figure 1:

Experimental overview showing steps involved in single burette method and double burette method.

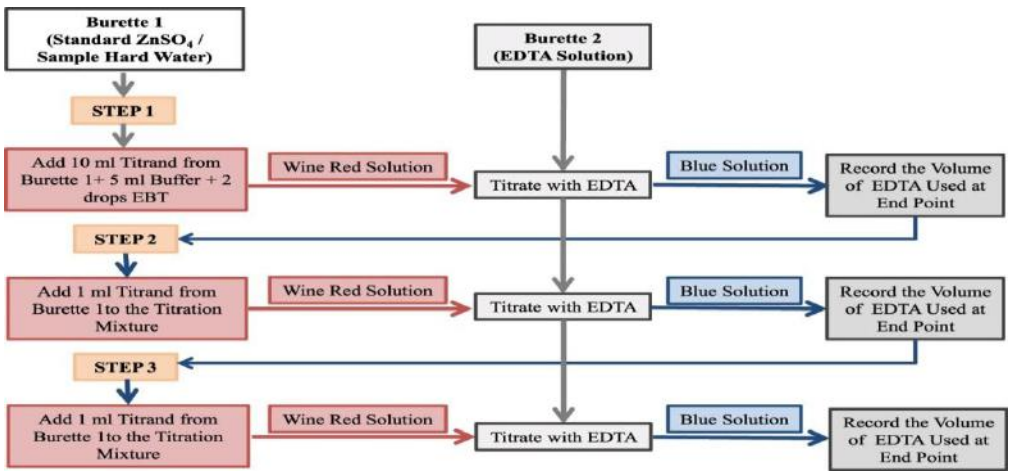

Figure 2:Schematic showing procedure followed in double burette method.

For this study a class of 6 undergraduate chemistry students was divided in two batches of 3 students. Each batch of 3 students was assigned to perform the titration in pairs by using single burette method and double burette method, respectively. Students were made familiar with the concept of hardness, types of hardness, degree of hardness, various units of hardness and their inter-relationship, EDTA titration method for hardness determination, ill effect of hard water with reference to boiler corrosion and preventive measures, various methods of water softening, their advantages and disadvantages in the regular chemistry class. For performing the experiment all required solution was prepared by laboratory assistant before the laboratory session and student handout was provided at the time of performance.

Students learning goals

Students learning goals focuses on understanding the principle of complexometric titration, estimating quantitatively the hardness of given sample of water and to compare the benefits of double burette method with classical single burette method in terms of ease of performing experiment, chemicals cost reduction, time of performance and reduction in effluent discharge i.e. environmental hazards. The benefit of using such experiential learning methods for students helps them apply their theoretical knowledge effectively in practice. Some of the pedagogical benefits that the learner can achieve with this laboratory activity include:

1. Understanding the importance of estimating hardness of water by titration method.
2. Distinguishing the benefits of innovative methods over classical method.
3. Developing thought process on innovating alternative methods in reducing cost and environment damage associated with the existing process.
4. Appreciating co-operative learning by working in groups and sharing experience.
5. Developing motor skills in handling and operating apparatus while performing titration.

Learning outcomes

Learning outcomes of the present study were categories into student's prospective i.e. student cognitive learning and economic prospective i.e. cost reduction analysis. The impact of experiential learning on the conceptual understanding and learning ability of the students was improved.

Student cognitive learning

Determination of hardness of water sample was carried out independently by SBM and DBM, without deviating from the principle of EDTA-complexometic titration, therefore both the methods have same impact on understanding the concept of hardness and corresponding learning outcome. It can be noted that the student learning ability is not compromised when a new procedure i.e. DBM is followed. Students were able to correlate the theoretical aspect of water technology with practical approach. Students were also able to develop confidence in quantitative estimation of amount of hardness present in water sample. They were also able to visualize the concept of complex formation between EDTA and metal ion causing hardness

as a result of observed color change at the end point of the titration. They understood the importance of buffer solution in maintaining pH = 10 of the water sample during titration. Further, they were able to appreciate EDTA as an important complexing agent in estimation of hardness. It is to be noted that during experiential learning the greatest challenge experience by students who followed single burette method keeping time management to performing experiment in given time slot. Whereas, students who followed double burette method were able to perform the experiment with ease and in sufficiently less time. The time taken by students using single burette method was around 40–50 min, that was reduced to 15–20 min using double burette method. The time saved during titration can have benefit of utilizing it in doing calculations, writing assignments related to the experiments and analyzing different water samples.

Cost and waste reduction analysis

In order to estimate the probable cost reduction, a comparative study was carried out by primarily considering the consumption of chemicals like zinc sulphate, EDTA, buffer (NH_4Cl + liquid NH_3), EBT indicator during titration. Additionally, total utilization of deionized water for making solutions, ethanol for indicator preparation, total volume of effluent discharge and time consumed in performing the titration was also estimated. The total volume of chemicals consumed during titration by each batch in either of the methods is given in Table 1. Based on the data obtained, a comparative consumption of chemical during titration by both the methods was estimated and is shown in Figure 3.

Table 1: Total volume of chemicals consumed in performing the titration per batch.

Chemicals Consumed per Batch	**Single Burette Method**	**Double Burette Method**
Volume of 0.01 M zinc sulphate	90 mL	36 mL
Volume of 0.01 M Na_2EDTA (both for standardization and hardness determination)	105 mL	49mL
Volume of buffer solution (NH_4Cl + liquid NH_3)	90 mL	30 mL
Volume of EBT indicator (approximate)	6 mL	3 mL
Total volume consumed and effluent discharge	291 mL	118 mL
Total utilization of distilled water for making solutions	300 mL	130 mL
Time consumed in performing the experiment	40–50 min	15–20 min
Deviation in results i.e. total hardness of water sample in present study	622.95 ± 19.77 ppm	644.65 ± 22.83 ppm

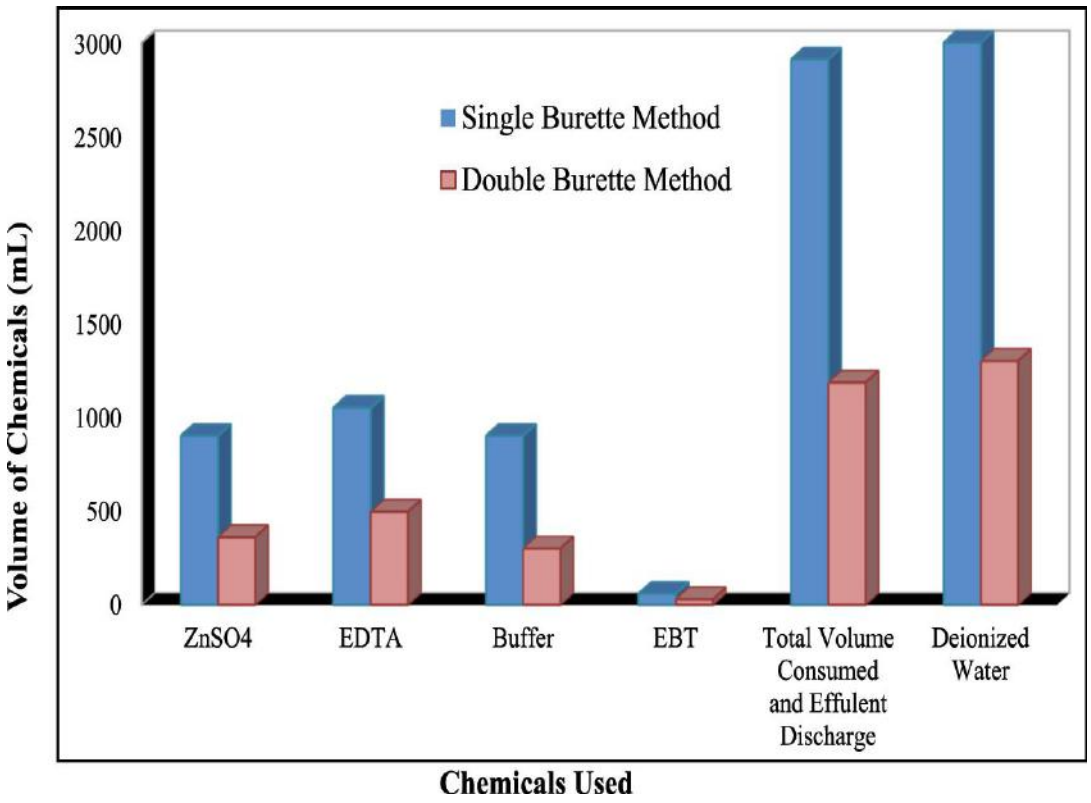

Figure 3: Relative consumption of chemicals per batch during titration.

From the data approximated in Figure 3, it can be clearly seen that in case of double burette method there is a significant reduction in the use of chemicals. The estimated reduction in consumption of each constituent chemical by two burette method was 0.01 M $ZnSO_4$ (40–45 %), 0.01 M EDTA (47–50 %), buffer solution (30–33 %) and EBT Indicator (50 %). The total volume of chemicals utilized in double burette method was 40 % less compared to single burette method. Based on the consumption of chemicals it can be estimated that the cost of chemicals can be reduced to 40–50 % by employing double burette method, considering the concentrations of solution used in present study and the current cost of chemicals. Moreover, the amount of chemical consumed in single burette method can be utilized for 2–3 more batches of student by adopting double burette method. If this data is extrapolated for large number of students or batches per academic year one can conclude that the double burette method consumes relatively less chemicals suggesting reduction in corresponding cost of the chemicals.

Further, since all solutions are made in deionized water it can also be inferred that the reduction in chemical consumption in double burette method adds on to the total cost reduction as a result of reduction in the use of electricity for production of deionized water in laboratory. This is clear from the 40 % reduction of total volume of deionized water utilized in making solution on adopting double burette method. A 50 % reduction in the use of EBT indicator also indicates a reduction in 50 % use of ethanol for the preparation of EBT indicator, which also contributes towards the total cost reduction. It is to be noted that reduction in utilization of 0.01 M $ZnSO_4$ and 0.01 M EDTA using DBM is due to the reduction in number of trials involved compared to SBM, where for each trial a fresh solution is used for titration. Similarly, reduction in the consumption of buffer solution and

EBT indicator using DBM can be attributed to the fact that the reagents are added only once during the start of titration, whereas in SBM these reagents are added during each and every trials. The double burette method also showed a reduction in effluent discharge per batch by 40 % compared to single burette method, estimated on the basis of total volume of titrant and titrand used in both the methods. Also, no accountable difference in result outcome was observed by both the titration methods for a given water sample, indicating the effective use of double burette method for determination of hardness of water.

Conclusion

In determination of total hardness of water by EDTA titration, a classical single burette method and a new double burette method was compared without deviating from the principle of titration. The double burette method was found comparatively easy, rapid and economical. The method has as found to be advantageous in reducing discharge of chemicals making it safer for the environment. The method can prove useful for educational institutes of underdeveloped countries in reduction of chemical cost. Further, the method can be applicable to other titration methods involving bulk consumption of chemicals.

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Growth and characterization of optical, electronic Vibrational spectra and structural studies of N-Acetyl l-Glycine and computational: a density functional theoretical approach

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INTRODUCTION

NLOresearchers have promised unique applications related to technology and recent innovations. It is a highly purified form of NLO crystal which enhance quality control. It has broad transmission ranges which have unique phase matching ranges [1]. NLO crystal improves their performance in optical ranges their designed characters completely vanish the scientist from various disciples towards their research in NLO crystal. These NLO crystals are eco-friendly with various features in the technology mode of operations. This crystal can withstand high-power laser and posse's good mechanical and thermal stability. Potential applications in data storage, optical switching, laser printing, fluorescence, remote sensing, medical diagnosis, and chemical and biological sensing [2,3].

To develop the formation of a crystal, we have to understand the growth and characterisation technology which is required for the scientist to develop these studies into various aspects to develop new material. Their structural advantages depend on the orientation of the crystal their uniformity and anisotropy nature are quite interesting to the researchers. This crystal growth knowledge in different aspects of view leads this work very unique. The significance of crystal growth to electrical engineering, chemistry and physics is illustrated in Figure 1.1 [4]. Crystal growth is encompassed a broad area of research including chemistry, physics and crystal engineering.

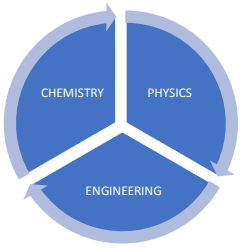


Figure 1.1 Combination of future science

THERMODYNAMICAL ASPECTS OF CRYSTAL GROWTH

Change in Gibb's free energy between the crystalline phase and the mother solution can act as a driving force to change the crystal structure. This phenomenon is used to understand the transformation from liquid to solid phase. At given temperature T, the Gibbs free energy (G) of a system of enthalpy (H) and entropy (S) of a system is given as,

G=H-TS
(1.1)

Gibb's energy change is a state function it doesn't depend on the path of the reaction. This act as a driving force between the supersaturated liquid and solid. This equation can be represented as,

$\Delta G=\Delta H-T\Delta S$
(1.2

ΔG determines the direction and extent of chemical change given reaction is thermodynamically feasible.

$\Delta G=RT\ln S$
(1.3)

The free energy change is zero in this equation represents

$\Delta H=T_e\Delta S$
(1.4)

Where T_e is the equilibrium temperature

By combining the equations 1.2 and 1.4 the equation becomes

$\Delta G=\Delta T.\Delta S$ (1.5
)

The supercooling temperature $\Delta T = Te - T$. when Te> T. The free energy change is positive and it depends on the latent heat of transition equation 1.5 holds the melt growth method of crystallization. The crystal growth, the free energy change is mainly dependent on supersaturation.

$\Delta G=RT\ln[C/C_0]$
(1.6)

Where, C is the actual concentration of the solution and C_0 is the equilibrium concentration at a given temperature. The ratio (C / C_0) is known as supersaturation ratio (S),

$\Delta G=RT\ln S$
(1.7)

This equation helps to know the free energy changes depend on supersaturation which is acting as a driving force for crystallization. It is preferred that the growth rate of the crystal considers an increasing function of ΔG when other parameters remain the same.

THEORY FOR NUCLEATION KINETICS OF CRYSTAL GROWTH

Nucleation is an important phenomenon in the crystal growth process. Crystal growth kinetics assist by particle growth with a rate of fluctuations of intermediate stage analyzed theoretically. This is the first step in the spontaneous formation of a thermodynamic phase or new structural phase. The nucleation fragments of a crystal is the new and more stable phase. This nucleation study was used to learn the initial stages of the kinetics of phase transformations [5].

Homogenous nucleation occurs away from the surface of the system. Heterogeneous nucleation occurs at the surface of the system makes faster the nucleation process. This nucleation occurs at an interface between liquid and vapour since the free energy barrier is low.

ΔG_v is the energy change per unit volume which is always a negative quantity. At the critical state, the free energy of formation obeys the condition that $d(\Delta G|dr) = 0$.

The interface is an important parameter for the theory of nucleation kinetics, Interface surface tension has been calculated based on the classical theory of homogeneous nucleation [6]. Critical nucleation parameters estimated through the interfacial tension with the help of induction period

$$\ln\tau=-\ln B+[\{16\pi\gamma^3V^2N_A\}/\{3R^3T^3(\ln S)^2\}] \quad (1.8)$$

τ is the interfacial tension, V is the molar volume of the crystal, *N* is the Avogadro number and R is the gas constant. B is a constant. S is the relative supersaturation ratio (S = C / C*), is the driving force for crystallization, where C is the actual concentration and solubility and C* is the current value of concentration adjusted with parameters like P^H, temperature etc.

A plot of $1/ (\ln S)^2$ against $\ln \tau$ is a straight line. The intercept of a straight line on the y-axis gives the value of ln B. Since ln B weakly depends on the temperature. The equation suggests a straight line fit for $\ln \tau$ against $1 / (\ln S)^2$ with a slope given by,

$$m=\{16\pi\gamma^3 V^2 N_A\} / \{3 R^3 T^3\} \quad (1.9)$$

The interfacial energy is calculated using the formula,

$$\gamma3=\{3R^3T^3(\ln S)^2 \ln \tau\} / \{16 \pi V^2 N_A\} \quad (1.10)$$

Interfacial surface energy between the solid crystal and the surrounding saturated solution is determined by the equation,

$$\gamma=\{3R^3T^3M/ 16 \Pi V^2 N_A\} \quad (1.11)$$

The lowering of γ value is due to the weaker interactions such as weak Vander walls forces and hydrogen bonds. Interfacial surface energy variation with temperature is important for nucleation and the growth of large-size crystals.

THEORY OF NUCLEATION PARAMETERS

The change in the Gibbs free energy (ΔG) between the crystalline phase and the surrounding mother solution results in a driving force, which stimulates crystallization. For crystallization process is enhanced by Gibbs free energy. As per the homogeneous nucleation, theory energy is required to form a spherical nucleation, this free energy change is depicted as [7],

$$\Delta G=4\pi r^2\sigma+(4/3)\pi r^3\Delta Gv \quad (1.12)$$

Where ΔGv is the energy change per unit volume, γ the interfacial tension, and r is the radius of the nucleus. The first term expresses the formation of the new surface and the second term

expresses the difference in the chemical potential between the crystalline phase and the surrounding mother liquor. At the critical state, the free energy formation obeys the condition d (ΔG) /dr = 0. The Critical free energy barrier (ΔG*) is given as,

$$\Delta = \frac{16\pi\gamma^3 V^3}{3k^2T^2(lnS)^2} \quad (1.13)$$

Supersaturation tense to decrease the ΔG* value Bulk energy change per unit volume is given by

$$\Delta G_v = -(KTlnS / V) \quad (1.14)$$

V is the specific volume of the solute, k is the Boltzmann constant (1.38 x 10^{-23} J/K)

The supersaturation increases the value of the critical nucleus (r*). the radius of the critical nucleus is given by,

$$R\frac{-2\gamma}{\Delta G_v} \quad (1.15)$$

Where $\Delta G_v = -\Delta\mu / v$, $\Delta\mu = -kT \ln S$, here $S = C / C^{\square}$, v is the molar volume of the crystal, T is the temperature of the solution in K, k the Boltzmann's constant, S the supersaturation ratio, C the actual concentration of the solution, and $C^{\square}$ the equilibrium concentration. The number of molecules in the critical nucleus (critical number, i*) is

$$de\frac{4\pi(r*)^3}{3v} \quad (1.16)$$

The number of critical nuclei formed per unit time per unit volume is depicted as,

$$J = A\exp(-\Delta G^*/kT) \quad (1.17)$$

A is the preexponential factor value is 10^{30}. This homogenous nucleation theory provides a clear view of the permanence of the aqueous solvent. The interfacial energy of the solution is inversely proportional to the crystal growth [8]. The nucleation parameters estimated the optimal growth of the crystal. The supersaturation ratio and the induction period enhance the nucleation rate of the crystal growth

SOLUTION GROWTH METHODS

- Simple Solution Growth Method
- Hydrothermal Synthesis Method
- Solute Solution Diffusion Method
- Solvent Evaporation Method
- Traveling Heater Method
- Temperature Difference Method under Controlled Vapor Pressure

Simple solution growth method

Crystal growth from solution is the process of mass of substances and heat transport from the environment to the crystal surface, followed by the integration process of these molecules at the crystal surface. Among varieties of crystal growth mechanisms from liquids, simple solution growth differs from the crystal growth from melts, hence heat transport is the major rate-determining process. In the solution growth, the mass transport of molecules in the

solution and the integration of molecules at the crystal surface are the rate-determining processes [9].

Hydrothermal synthesis method

Hydrothermal synthesis can be defined as a method that depends on the solubility of minerals in hot water under high pressure. The crystal growth is performed in an autoclave made out of thick-walled glass, which can be used up to 300 ℃ and 10 bar. This apparatus consists of a steel pressure vessel, nutrient is supplied along with water. A temperature gradient is maintained between the opposite ends of the growth chamber. At the hotter end of the dissolved nutrient solute, the cooler end seed crystal is deposited on a seed crystal in this method [10].

Advantages of the hydrothermal method over other types of crystal growth methods include the ability to create crystalline phases it is not stable at the melting point and materials which have a high vapour pressure can be grown by the hydrothermal method. The method is suitable for the growth of large good-quality crystals and for maintaining control over their composition. Disadvantages of the method include the need for expensive autoclaves and the impossible to observe the crystal as it grows in a steel tube.

Solute solution diffusion method

The solute solution diffusion method follows the process of substance tends to move from a region of high concentration in diffusion to a region of lower concentration until equilibrium is reached. The movement of molecules in an outer region of the more concentrated one and into the lesser concentrated one till the concentration is equal. This process does not require any kind of energy [11]. A concentration is in the form of stored energy, which is utilized as concentrations tend to equalize. The directional movement as a result of diffusion along a gradient is passive and continues this way till the molecules are dispersed evenly. Non-polar and small molecules can diffuse freely across the cell membranes. The rate of diffusion could be affected by many factors such as

- Temperature
- The rate of diffusion is higher if the concentration is higher
- Size of molecules – small particles have low resistance in a fluid medium

Solvent evaporation method

The solvent evaporation method is used to grow good-quality of single crystals that are stable over a steep temperature range. As in the slow cooling method, the apparatus is simple and a temperature programmer is not needed. Since growth occurs at a constant temperature, the concentration of equilibrium defects and the incorporation of solvent ions as impurities remain constant in a crystal [12]. The difficulty of controlling the evaporation rate is the main disadvantage, and the poisonous and corrosive nature of the solvent vapour is released when an open system is operated.

Travelling heater method

The travelling heater method (THM) is a powerful and multifaceted technique for the growth of a variety of materials, particularly those having a high melting point, exhibiting a first-

order phase transition below their melting point [13]. The disadvantage of this method is implementation needs technology support. Variants of THM will be described from examples related to different materials. The effects of segregation, purification, and formation of precipitates before outlining simulations and modelling of heat and mass transport. Considerable efforts and constant support to the THM single crystals method.

Temperature difference method under controlled vapour pressure

The fluctuation of growing temperature is ascertained to produce a defect due to the effect of controlled vapour pressure. It has been ascertained that an optimum vapour pressure, which is the function of growing temperature, suppresses the roots of this process to a minimum density [14]. There is a close relationship between the optimum vapour pressure in the heat treatment of crystals to reduce the generation density of lattice defects and the optimum vapour pressure used to obtain defect-free crystals in the crystal growth process. The epitaxial layers produced under optimum vapour pressure have the highest mobility and the lowest concentration. The lattice constant of the crystal under controlled vapour pressure shows a minimum value at optimum pressure.

CRYSTAL GROWTH TECHNIQUES

The growth of single crystals and the theory of crystal growth continue to be an area of central importance and increasing activity in materials science. The rate-limiting step is the evaluation of solid-state technology which enhance the attainment of a single crystal in the required composition and perfection. Single crystals are one of the most important groups of materials due to their continuous, uniform, and highly-ordered structure which enables them to possess unique properties [15]. In many aspects, single-crystal materials can be found to be advantageous over polycrystalline materials, and many properties which are found in single crystals cannot be replicated in polycrystals [16]. Currently, even with the technological developments of advanced polycrystalline materials which are designed for specific applications, the electrical, optical, thermal, mechanical, and other properties of single crystals remain superior. For these reasons, it is not surprising that single crystals, and the methods for their fabrication, are a topic of interest among many researchers [17-19]. The growth of the crystals is achieved by the solution which reaches the maximum point of salt-dissolved state called supersaturation. The saturation state is important to the crystallization process consist of three steps

- Achievement of supersaturation
- Formation of the nucleus in the micro size range
- Successive growth enhances the size perfection

Solution growth

In the simple growth technique in this method, the crystal is grown from the aqueous solution which is eco-friendly. This method is quietly related to green chemistry. The major types of solution growth facilitated such as,

A. Hydro Thermal growth.
B. Gel Growth.
C. Low-temperature solution growth.
D. High-temperature solution growth.

Types of low-temperature solution growth technique

(i) Slow cooling method
(ii) Slow evaporation method
(iii) Temperature gradient method

Slow evaporation method

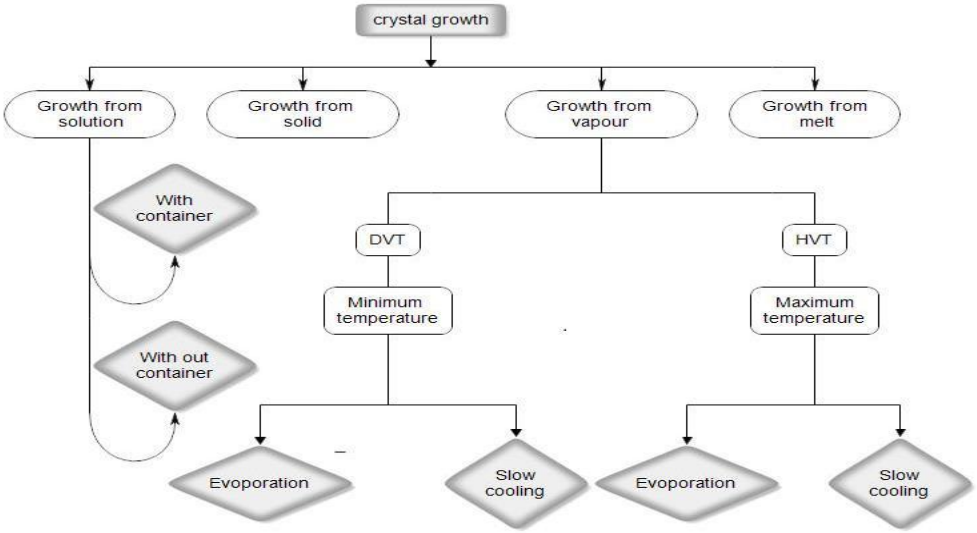
This is the easiest method to grow bulk crystals from the solution. This method is used to prepare dislocation-free crystals. To face this effect large amount of solvent is needed.

Advantages

1. Growth of dislocation-free crystals
2. Permits a variety of growth conditions
3. This is a simple method and convenient procedure to grow single crystal

Disadvantages

1. This is applicable in fair solvent
2. The change in evaporation rate



1. Classification of crystal growth methods

SALIENT FEATURES OF LOW-TEMPERATURE SOLUTION GROWTH

Low-temperature solution growth of crystals from aqueous solution is one of the ancient methods of crystal growth. The method of crystal growth from low-temperature aqueous solutions is extremely popular in the production of many technologically important crystals [20]. The growth of crystals by low-temperature solution growth involves weeks, months and sometimes years. Much attention has been paid to understanding the growth mechanism of the process. Materials having moderate to high solubility in the temperature range, ambient to 100 ^{o}C at atmospheric pressure can be grown by low-temperature solution growth method. This method is the most widely used method for the growth of single crystals when the starting materials are unstable at high temperatures [21]. This method is widely used to grow bulk crystals, which have high solubility and have variation in solubility with temperature [22] Growth of crystals from solution at room temperature has many advantages over other growth methods though the rate of crystallization is slow. Since growth is carried

out at room temperature, the structural imperfections in solution-grown crystals are relatively low [23]. The low-temperature solution growth technique also allows a variety of different morphologies and polymorphic forms of the same substance, which can be grown by variations of growth conditions or solvent. The proximity to ambient temperature reduces the possibility of major thermal shock to the crystal both during growth and removal from the apparatus. The main disadvantages of the low-temperature solution growth are the slow growth rate in many cases and the ease of solvent inclusion into the growing crystal [24]. Under the controlled conditions of growth, the solvent inclusion can be minimized and the high quality of the grown crystal can compensate for the disadvantage of much longer growth periods. After undergoing so many modifications and refinements, the process of solution growth now yields good quality International Journal of Engineering and Techniques [25].

NONLINEAR OPTICAL PHENOMENON

The principle behind the nonlinear effect is the incident beam of light propagates through a solid. Electric dipoles are created by the solid specimen of nuclei and associated electrons of the atoms. Oscillation is caused when electromagnetic radiation interacts with the dipoles. The dipole acts as the source of electromagnetic radiation thus the incident intensity increased with the frequency doubling occur. Nonlinear optical crystal growth towards optical signal processing, optical computers, ultrafast switches, ultra pulse lasers and laser amplifiers focus recent research [26]. The present work is to develop a crystal based on nonlinear optical characteristics. In this SHG process, the photons with the same frequency interact with crystals. The incident light beam strikes the solid surface the electrons present in the nuclei create the dipole and the dipole creates oscillation and it can act as electromagnetic radiation [27]. The incident radiation and amplitude of the rays have the same frequency. The incident ratio frequency increases the frequency doubling which causes the second harmonic generation [28]. This is the branch of optics which describes the behaviour nature of light polarization density. The polarization density responds nonlinearity to the electric field of the light it is observed only in very high light intensity the first nonlinear effect predicted.

TYPES OF NLO CRYSTAL

Excellent nonlinear optical (NLO) crystal with high growth rate and optical homogeneity owing to which it has wide demand for applications in UV-tunable laser systems, frequency conversion and optical data storage devices, laser-based imaging and remote sensing techniques, industrial photonics and optoelectronics devices NLO assisted photonics and high sensitive laser pulse applications the information of molecular arrangement and nonlinear processes involving SHG coefficient, laser-induced self-focusing tendency, nonlinear absorption coefficient and the magnitude of nonlinear susceptibility.

Inorganic NLO crystal

The laser has opened huge opportunities for the researcher to study the nonlinear optical study, The optical second harmonic generation obtained from quartz by Franken 1961 followed by laser-induced optics second harmonic generation in organic crystals Rentzepis and Pao 1964 [29]. The effect of doping in the KDP varies in the NLO nature and has been studied by various researchers [30-33]. The inorganic crystal of Yttrium ortho aluminate

(YAlO3) focus wave doubly resonant all-intracavity sum-frequency mixer [34]. In the recent past effective NLO properties of some inorganic NLO crystals bis(1H-benzotriazole) hexaaqua-zinc bis(sulfate) tetrahydrate (BZS) [35], monometallic NLO single crystals of Cd $(IO_3)_2$ [36] have been reported. The major advantages of inorganic crystal's chemical inertness, high conversion efficiency abandon mechanical strength [37]. Inorganic crystals possess certain drawbacks low levels of optical nature turned the researchers to focus on organic crystals for the best optics work. Combining the high optical nonlinearity and chemical flexibility of inorganics with thermal stability and excellent transmittance of organics focused.

Organic crystal

The Wohler 1828 first organic molecule synthesized urea from the inorganic salt ammonium cyanate it played a pivotal role in the definition of organic chemistry and now it is one of the most important and thorough studies of nonlinear optical organic materials [38]. The development of new NLO crystals with a wide range of fascinating properties focused the organic crystals [39,40]. Organic nonlinear material favours the high laser damage threshold and excellent second-order NLO characteristics [41,42]. The organic NLO crystal shows undesirable properties like minimum frequency ranges, low transparency, low-level mechanical hardness, environment instability and the inability of organic material to grow large-size single crystals diverting the researchers towards semi-organic crystals.

Semi-organic crystal

Semi-organic crystals combine the positive aspects of organic and inorganic materials resulting in useful nonlinear optical properties and this new design of semi-organics achieve this research field in various aspects [43-45]. The recent innovative importance of single crystals like sapphire [46], yttrium aluminium garnet (YAG) [47], for laser materials has also been demonstrated through numerous applications such as the electronics industry both as a passive substrate material. This semiorganic crystal approach metals with various oxidation state [48-50] active device, optical data storage, radiation detection, LED devices, optical windows, and other applications. Semiorganic materials are classified into three types namely, organic-inorganic salts, organometallic materials and metal-organic complex materials. In organic-inorganic salts, the organic part and inorganic part combine together to form the salt. examples of this are glycine phosphate and triglycine sulphate [51]. Semiorganic crystal in the field of nonlinear optical crystal diverted towards the preparation of novel materials functions of various photonic devices [52,53].

LITERATURE SURVEY ON AMINO ACID-BASED SEMI-ORGANIC NLO CRYSTALS

Abkari et al (2016)described the organic-inorganic salt, which was synthesized and characterized by FT-IR and Raman in the solid phase. The structure of the compound was optimized by density functional theory (DFT) using the B3LY method which proves the calculated values obtained by B3LYP with Lan2DZ and 6-31G (d, p) basis sets in better agreement with the experimental data. The computed vibrational frequencies were scaled by

different scale factors to yield good agreement with the experimental and vibrational frequencies [54].

Balakrishnan et al single crystal of γ-glycine grown from temperature reduction method using constant temperature bath at ± 0.01^{o}C [55]. Srinivasan et al The variation of crystal length along 'a' and 'c' directions of the grown crystal based on NaCl concentration [56].

Glycine is the only amino acid with no centre of chirality and is an optically inactive compound. Glycine possesses three polymeric forms α, β, γ in a friendly environment. The γ-form of glycine is always thermodynamically stable [57,58]. The readily available α- glycine converted the γ-glycine by various additives [59-61]. α and β glycine crystallize in centrosymmetric space group $P2_1/c$ and the γ-glycine crystallizes in noncentrosymmetric space group $P3_1$ to prove evident to NLO studies and applications [62-64]. Glycine is zwitter ionic amino acid as it contains donor carboxylic group COO^- and acceptor NH_3^+ group. This zwitter ionic nature is favouring the crystal hardness and it is capable of forming compounds with three polymeric crystalline chemical compounds [65,66].

Various forms of γ-glycine are like ε structures in monoclinic and Pn space groups [67]. The β-β' transformation of crystal procedure is followed under various conditions [68]. Though it is a centrosymmetric molecule due to metal coordination with glycine proves its NLO nature provides the suitable support and strength which demands the different physico-chemical nature provides innovation in industrial research [69-72].

The growth of bis-glycine manganese chloride (BGMC) single crystal by slow evaporation technique and optical properties have been reported in the literature [73]. The ORTEP diagram for DFT studies proved. Solubility with different temperatures namely 34,40,45,50,55 ^{o}C proves that the solubility increases with increasing temperature. Etching studies were carried out to study the shape and distribution of etch pits in the crystal.

The paramagnetic isotropic nature established in BGMC is reported in the literature [74]. The XRD indexing with various concentrations such as GMC1, GMC2, GMC3, GMC4 and the miller indices are calculated. A report on diglycine barium chloride (DGBCM) [75] focuses on the computational approach to DGBCM crystal through Density functional theory, Hirshfeld analysis and the percentage of PED distribution analysis calculated and presented. Frontier molecular energies are calculated. Transparent red rod-like glassy crystals of Glycine potassium dichromate (GPDC) have been grown by slow evaporation solution growth technique [76]. The potassium dichromate dopant proved the 1.3 times higher SHG efficiency than the KDP crystal. The maximum hardness obtained in this material is 64 kg / mm^2. The band gap value of the crystal is 5.27 eV. The yellow glassy glycine picrate crystal shows a band gap energy of 3.7 eV. Etching studies and the low values of dielectric constant with high frequency for the sample suggest that the sample possesses enhanced optical quality with lesser defects.

Glycine copper nitrate (GPN) [77] the PXRD showed a structural change from Triclinic (glycine) to Monoclinic (glycine) as the concentration of copper nitrate increased. The optical band gap was calculated and is found to be in the range of 5.77 eV to 5.62 eV

depending on the concentration of copper nitrate. The calculated refractive index is about in the high wavelength region (800-1000) nm while it is equal to the visible region. ferroelectric phase transition may be observed near 30^oC and a glass transition at 90^oC. The endothermic peaks for all concentrations were observed indicating the thermal decomposition of the sample has been proved.

Yogambal et al (2015) employed a solution growth technique to grow γ-glycine crystal which showed good absorption at 238 nm. The UV-Visible region and band gap energy 5.50 eV [78]. Dilip et al (2012) estimated the real (ε_r) and imaginary (ε_i) dielectric constant at λ = 1000 nm are 1.62 and 1.05 x 10^{-4} and the electric susceptibility $\chi c = 0.1292$ [79].

Glycine zinc sulphate (GZS) theoretical calculations were performed using the Density functional theory (DFT) method with B3LYP as the polarizability has been calculated. Frontier orbital molecular diagrams are represented [80]. A comparative characterisation carried out on pure and glycine-doped potassium thiourea chloride was carried out by Azhar et al [81]. It has the observed transmittance range of 67% for pure crystal and 77% for glycine-doped KTC crystal.

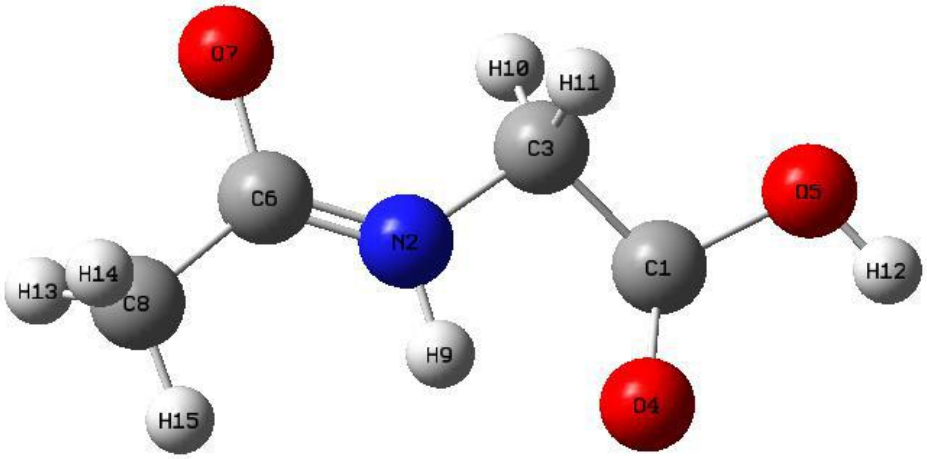
Sudha et al have reported [82] the Ni^{2+} doped glycine crystal decomposes at 266.8°C. The crystal was subjected to a Vicker microhardness test for various loads (25 to 100 gm) at room temperature. All the crystals show an increasing Vickers Hardness number (Hv), with increasing load P.Nickel chloride doped glycine has a higher dielectric constant.

Guruprasad et al (2012) employed a solution growth technique to grow a semi-organic single crystal of N-acetyl-L-cysteine (NAC) which showed effective absorbance in the UV-Visible region and higher band gap energy proved its optical efficiency [83]. NLO characterisation of NAC has been carried out to prove its efficiency is two times greater than SHG. In computational studies, first-order hyperpolarizability (0.85703) values are calculated. Moovendran et al (2015) have been grown N-acetyl DL-methionine by slow evaporation solution growth technique [84], which showed about transparency cut-off range of 235 nm and a band gap of 5.2 eV have been calculated. Phase transitions and thermodynamic stability has been proved.

Parra beruman et al (2011) synthesize the crystals of Gly-[$ErNO_3$]$5H_2O$ obtained from an aqueous solution at different concentrations (0.1, 0.2, 0.3, 0.4 and 0.5%) This work reports the crystal growth glycine doped with erbium nitrate pentahydrate, followed by characterisation of Ultraviolet-visible (UV-Vis), Fourier transform infrared (FTIR), Raman, analysis of X-ray diffraction (XRD) and second harmonic generation (SHG) efficiency. α and ϒ phase glycine occurred in most of the crystals except glycine 0.2% erbium. 0.1 and 0.5% of erbium, second harmonic efficiency was obtained, but the efficiency is higher in pure glycine than in erbium-doped. Thermodynamically phase change has been studied [85].

Silva Molina et al (2011) have reported the role of pH in second harmonic response in glycine sodium nitrate (GSN). The P^H of the solution at 1.0,2.0,4.0,7.0,9.0,10.0,11.0 X-ray pattern showed that the samples of GSN to basic P^H contained the GSN phase and the more acid P^H is observed that is obtained by glycine and sodium nitrate salt [86]

Growth and characterization of optical, electronic Vibrational spectra and structural studies of N-Acetyl l-Glycine and computational: a density functional theoretical approach



1.12 Dipole moment, Polarizability and hyperpolarizability calculations

The optimized geometrical structure of NALG crystal was obtained using computational studies. The geometrical parameters are presented using computational studies and tabulated. The experimental values of a similar compound are compared with the theoretically computed ones. The computational studies used to examine the hyperpolarizability of electric dipole moment and mean polarizability of NALG were analyzed using DFT/6-31G (d, p). The calculated structure of NALG was visualized using the Gauss view 6.0 program [87]. The ground state structure is optimized to minimize the potential energy surface and intensities of the normal modes calculated. The optimized structure is used to find the hyperpolarizability and linear polarizability of the NALG is calculated using the DFT approach [88]. The calculated dipole moments (μ) and the dipole moments. The highest value of dipole moment notation is in the x direction. The isotropic polarizability, anisotropy of polarizability, The first hyperpolarizability from Gaussian output are evaluated by using the formula (2.41) to (2.44). Using the cartesian coordinate system of (x, y, z) = (0,0,0) the first hyperpolarizability and the dipole moment values are calculated and represented in Table 1.1. The polarizability and hyperpolarizability expressed in atomic units the calculated atomic units converted into electrostatic unit (esu) for α one a.u = 0.148 x 10^{-24} esu and β one a.u = 8.639 x 10^{-33} esu the negative polarizability values proved the NLO activity of the crystal.

Table 1.1 Electric dipole moment (μ) polarizability (α) and hyperpolarizability (β) of NALG crystal

Parameter	Values for NALG
Electric dipole moment (μ) (Debye)	
μ_x	-3.8412

My	-3.1736
μ_z	-0.7920
μ_{total}	5.0452
Polarizability (α)	
Axx	-44.1233
Ayy	-57.2797
Azz	-45.6905
Axy	12.5092
Axz	2.9277
Ayz	-0.2813
Atotal	
$\alpha_{total} x10^{-24}$ (esu)	
Hyperpolrizability (β)	
Bxxx	-63.0508
Byyy	2.8176
Bzzz	0.9487
Bxyy	-4.8994
βxxy	37.7699
βxxz	-5.3561
βxzz	-3.4067
βyzz	-1.3581
βyyz	0.4567
βxyz	-0.0358
βtotal	
$\beta_{total} x10^{-33}$ (esu)	

1.13 Natural bond orbital (NBO) analysis

The computational studies were used to examine the hyperpolarizability, electric dipole moment and mean polarizability of NALG using B3LYP level with a 6-31G (d, p) basis set which is helpful to study NLO behaviour [89]. The NBO method gives the measured value of hyperconjugation or intermolecular delocalization of the value [90]. The particular crystal system stabilized due to electron density exchange due to donor to acceptor molecules. It gives information related to both filled and virtual orbital. NBO study was used to understand the hybridization and the electron density delocalization value of NALG tabulated in Table 5.8. To exhibit the intermolecular delocalization Fock matrix second-order perturbation theory [91] was carried out and full NBO calculations were performed.

The second-order perturbation energy is calculated using the formula

$$(\sigma \text{ F } \sigma)F\text{E}^{(2)} = -n_{\sigma} \frac{22ij^{-}\Delta^{*}}{} = -\varepsilon\sigma \qquad \varepsilon\sigma n_{\text{E}} \quad (5.5)$$

F(i,j) is the off-diagonal NBO Fock matrix, The E (2) is proportional to the charge transfer and conjugation of the system. The larger E (2) values (47.6 kcal/mol) are more intense and proves the interactions between the electron donor and acceptor.

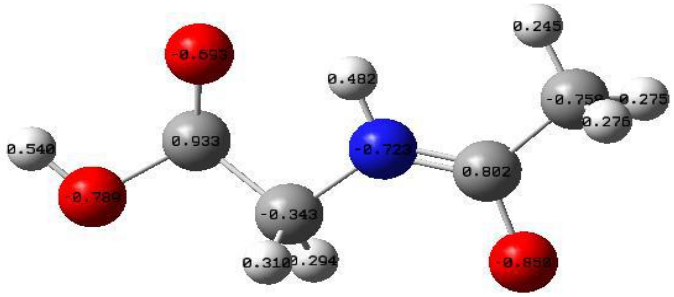


Table 1.2 Second-order perturbation theory analysis of Fock matrix in NBO

DONAR(i)	ED/e	Acceptor (j)	ED/e	E (2) (kcal/mol)	E(j)-E(i) (a.u)	F(i,j) (a.u)
BD (C2-H10)	1.969	BD*(C1-O5)	0.102	4.34	0.87	0.056
BD (O5-H14)	1.986	BD*(C1-C2)	0.084	4.77	1.10	0.066
BD (N6-H5)	1.983	BD*(C7-C9)	0.057	4.08	1.03	0.058
BD (C9-H16)	1.978	BD*(C7-O8)	0.248	5.00	0.55	0.050
LP (2)-O4	1.847	BD*(C1-C2)	0.084	19.6	0.62	0.100
LP (1)-O5	1.975	BD*(C1-O4)	0.022	7.45	1.21	0.085
LP (2)-05	1.817	BD*(C1-O4)	0.207	47.6	0.34	0.115
LP (1)-N6	1.732	BD*(C7-O8)	0.248	9.19	0.60	0.070
LP (2)-O8	1.866	BD*(N6-C7)	0.077	26.3	0.69	0.112

1.14 Mulliken atomic charges

Mulliken charges based on the electron density which is strongly depend on the basic set it is highly focused on the density probability [92] evaluated by the expression (3.13). It is used for the prediction of electrophilic and nucleophilic sites. It plays a major role in quantum mechanical calculation it is helpful to predict the range of charge distribution it is observed that the negatively distributed compounds are electron donors and the electron acceptors result in the positive charges these are calculated through non-bond orbital analysis results provided in

Figure 1.1

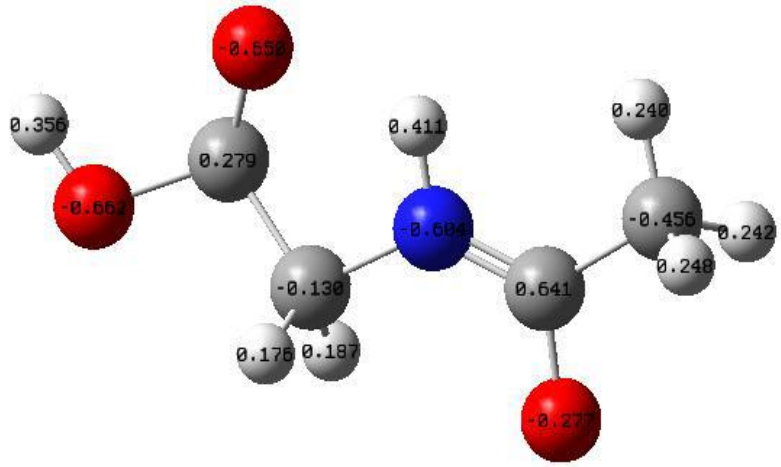


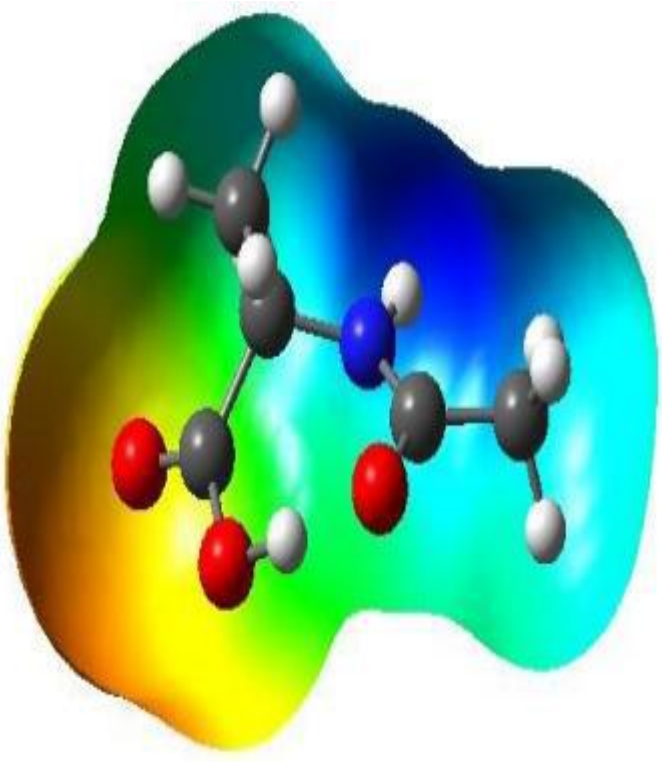
Table 1.3 Mulliken atomic charges of NALG

Atoms	Mulliken atomic charges
1C	0.2793
2N	-0.6043
3C	-0.1297
4O	-0.6505
5O	-0.6622
6C	0.6411
7O	-0.2770
8C	-0.4556
9H	0.4107
10H	0.1866

11H	0.1761	
12H	0.3564	
13H	0.2416	
14H	0.2476	
15H		0.2395

Electrostatic potential analysis

The molecular electrostatic potential (MEP) is a useful tool to study molecular structure [93,94]. The electrostatic potential is produced by the electrons and the nuclei of the molecule. The electrostatic potential mapping was used to analyse the electrophilic and nucleophilic regions. This electrostatic potential ranges in the colour code blue, green and red. The dark blue range denotes the electropositive region and the red region denotes the electronegative region the green range denotes the neutrality and the yellow region denotes the partial electronegativity of the NALG [95]. This MEP diagram in Figure 5.19 (a & b) is used to represent the hydrogen bonding and the molecule's reactivity. This diagram represents the inter-molecule and intramolecular hydrogen bonding interactions such as H - C…H, C - N….H, C - O…H. The carbonyl group possess oxygen atom having lone pairs that represent the large electronegativity potential.



(a)

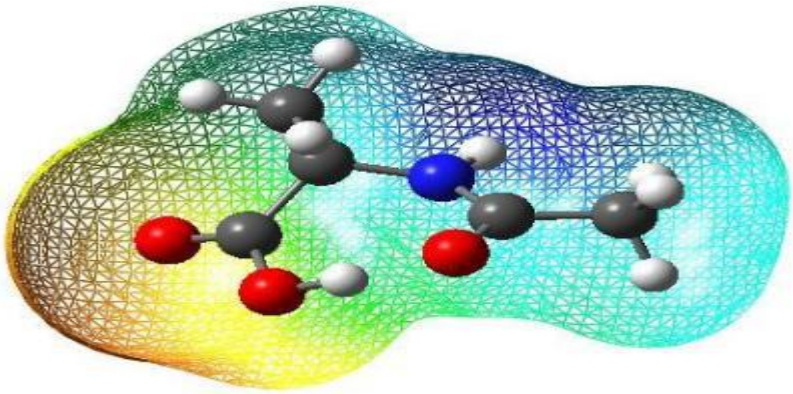


Figure 1.2 (a & b) MEP plot for NALG representation of hydrogen bonding and reactivity of molecules

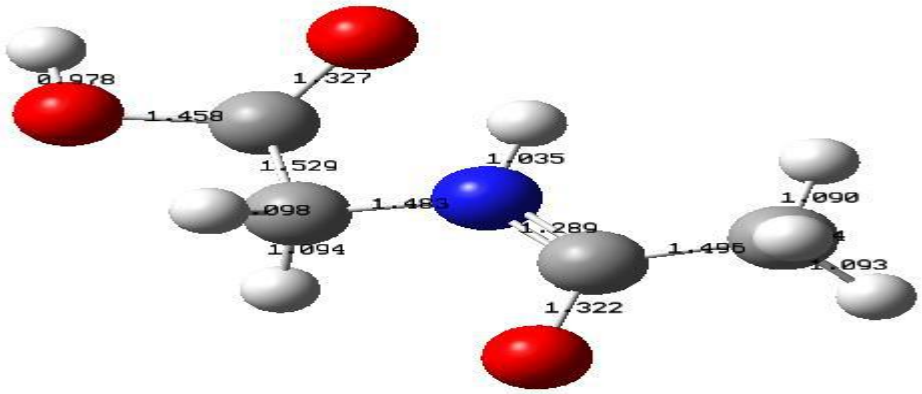


Table 1.4Optimized geometrical parameters of NALG

Bond angle (Å) (^{o}C)		Bond length (Pm)	
Parameter	Calculated	Parameter	Calculated
C4-C1-O5	122.5	C1-C4	1.509
C4-C1-O6	107.1	C1-O5	1.208
O5-C1-O6	122	C1-O6	1.338
C4-N2-C8	118.4	N2-C4	1.46
H3-N2-C4	118	N2-C8	1.369
H3-N2-C8	117.4	N2-H3	1.012
C1-C4-N2	109.8	C4-H14	1.113

C1-C4-H14	108.8	C4-H15	1.113
C1-C4-H15	108.8	O6-H7	0.972
N2-C4-H14	109.3	C8-O9	1.208
N2-C4-H15	109.3	C8-O10	1.509
H14-C4-H15	109.4	C10-H11	1.113
C1-O6-H7	106.1	C10-H12	1.113
N2-C8-O9	122.6	C10-H13	1.113
N2-C8-C10	114	C4-C1-O5	122.5
O9-C8-C10	122.5	C4-C1-O6	107.1
C8-C10-H11	109.47	O5-C1-O6	122.
C8-C10-H12	109.47	C4-N2-C8	118.4

Intramolecular hydrogen bond and the bond angle represented in Table 5.10 from oxygen to nitrogen atom two type hydrogen bonding N…H-O and O-H…N and the single and double bond length difference proves the bond strength. Intramolecular hydrogen bonding H_5-O_4 this hydrogen bond in the trans conformer leads to the formation of a five-membered ring and the intramolecular hydrogen bond H…O distance about 0.972Å. The N atom is sp^2 hybridized C_2-N_7-C_9, C_2-N_7-H_8, H_8-N_7-C_9 are around 120^o bond angle. The bond between the N_7-C_9-O_{10} atoms exhibits the highest bond angle 122.90^o due to repulsion between the atoms.

Vibrational assignments

Complete vibration analysis of the 48 fundamental vibrations of NALG has been carried over by experimental studies through FTIR and Raman spectral methods and DFT/B3LYP/631G (d, p) [96,97] for quantum mechanical calculations. The calculated vibrational wavenumbers measured FT-IR and Raman band positions and the calculated PED for each normal mode of vibration significant results are provided in Table 5.11. The close agreement between the scaled and experimental frequencies and intensities of IR observed and presented in Raman frequency matches is represented in

Figures.1.3

Frequency	**IR ranges**
70.75	8.0959
108.71	17.41
125.04	14.76
132.47	1.49

220.23	39.81
244.89	170.53
276.97	62.97
326.09	20.77
437.13	76.58
529.5	17.05
546.45	19.94
593.58	0.63
606.44	9.70
858.26	86.61
948.6	135.72
965.89	133.16
1007.37	191.14
1018.66	172.82
1043.79	47.83
1077.77	6.60
1122.14	70.76
1228.09	82.04
1244.86	72.25
1278.73	20.15
1373.53	197.8
1410.66	87
1440.44	27.88
1465.21	35.47
1477.98	15.11
1531.58	78.98
1541.21	9.04
1709.52	152.32
3041.28	78.20
3092.85	5.54
3118.55	31.38
3176.41	2.44
3210.36	9.78
3273.49	780.26
3652.81	34.51

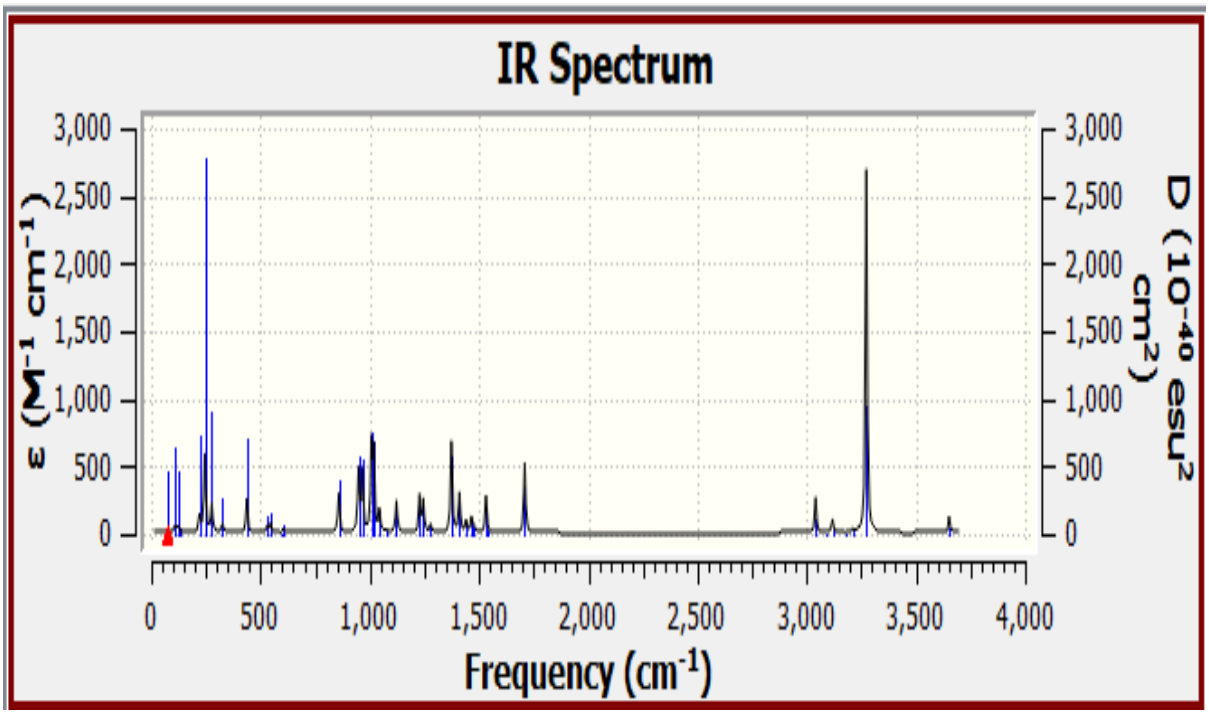


Figure 1.4 Theoretical IR spectrum of NALG

N-H vibration

The N-H stretching vibrations give rise to a band at 3500-3300 cm^{-1}. The stretching mode was calculated at the higher wave number 3452 cm^{-1} and the Raman vibrations at 3455 cm^{-1} with PED 99% 520,614 cm^{-1} NH rocking and the 519,615 cm^{-1} with PED 214,19%. The 474cm^{-1} NH torsion with PED 23%. The peak due to NH deformation was observed at 1454 cm^{-1} and 1455 cm^{-1} respectively with PED 64%. The experimental IR spectrum of NALG showed a broad peak in the weak fundamental band in the N-H stretching vibration region.

C-C vibrations

The carbon-carbon stretching vibrations occur in the region 1052 cm^{-1} and our IR & Raman spectra were observed in the same region. 240 cm^{-1} of Raman spectral value represents C-C torsion. 786 cm^{-1} represents C-CH out plane bending.1370 cm^{-1} of IR spectrum and 1369 cm^{1} in Raman represent C-C stretching with PED 79%. The calculated bands at the B3LYP level in the same region.

C-H vibrations

The C-H stretching vibrations in the region 2900-3100 cm^{-1}.The symmetrical stretching of CH_3 at 2933,2938 cm^{-1} with PED 93,97% and the IR spectra at 2996,3019 cm^{-1} with PED 96,98% for C-H stretching this vibration was absent in the Raman spectrum. 2999,3011,3051 cm^{-1} for asymmetrical stretching for CH_3 in IR frequency this mode is absent in the Raman spectrum. The 2996 cm^{-1} mode was absent in the Raman spectrum. The range of 1443,1446 cm^{-1} frequency CH_3 in-plane bending with PED 57,59%.1010,1149 cm^{-1} in-plane bending with PED 33,69%. The range of vibrations at 930,982 cm^{-1} represents the torsion vibration with PED 37,38%.

C=O vibrations

C=O stretching vibrations in the region 1600-1700cm^{-1}. The IR frequencies of 1630,1668 cm^{1} exhibit the C=O stretching vibration and 1628, 1669 cm^{-1} in Raman vibration with PED

91,87%. The IR absorption at 1283cm^{-1} is assigned as the C_2N_4 stretching and deformation of NH amide vibration with PED 47% this mode of vibration is absent in Raman spectra. The C-O vibration is identified at 1421 cm^{-1} and the spectra exhibited the same IR and Raman frequency with PED 79%

O=H vibrations

The O=H vibrations at 3751 cm^{-1} the scaled and calculated spectrum frequency value of 3602 cm^{-1} denotes the intramolecular OH stretching which shows the small variation between the theoretical and experimental values. The IR and Raman both exhibit in the range of 3602cm^{1} with PED 99%. 592,602cm^{-1} with PED 27,25% represent OH torsion.

1.17 Global Chemical Molecular Reactivity Descriptors

The highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) are called frontier molecular orbital this proves their important role in determining the NLO properties of the crystal [98,99]. NALG HOMO-LUMO obtained from the DFT approach is represented in Table 2.12 The HOMO energies of ionization energy, Electron affinity, Electron negativity and the LUMO are used to find the negative energies in the ground state geometry. Red and Green colour indicates the positive and negative phase. The lower HOMO-LUMO gaps show the highest stability. The difference between HOMO and LUMO of NALG is the lower value (6.454) means the material possess high polarizability and reactivity. The global molecular descriptors are shown in Table 2.13. Ionization potential (I), Electron affinity (A), Electrophilicity index (ω), Chemical hardness (η) and chemical softness (S) are expressed by the following equation (2.32) to (2.38)

Table 1.5 Electron density maps of the HOMO and LUMO of NALG & NALC

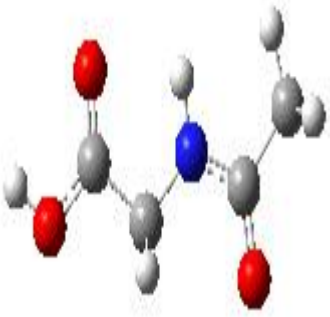
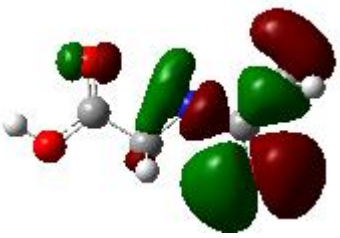
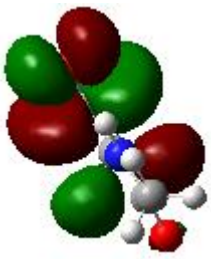
Compound	DFT optimized structure	HOMO	LUMO
N-Acetyl L-Glycine			

Table 1.5 Global chemical molecular descriptors of NALG crystal

Parameters	**NALG crystal**
EHOMO (eV)	-0.21929
ELUMO (eV)	-0.09779

EHOMO - ELUMO (eV)	-0.1215
Ionisation potential (I) (eV)	0.21929
Electron affinity (A) (eV)	0.09779
Chemical hardness (η) (eV)	0.06075
Chemical softness (σ)	8
Electronegativity (χ)	0.15854
Electrophilicity index (ω) (eV)	0.2068
Molecular dipolemoment (debye)	
Total energy (E γ) (eV)	

1.18 UV analysis

To recognize the electronic transition of NALG performed by using TD-DFT/6-31G (d, p). The calculated oscillator strengths (f) and excitation energy (E). The calculated values are present in Table 5.14. The experimental and theoretical value of UV spectra of NALG shown in Figures 5.22 & 5.23 proves its optical nature. The calculated value of 232 nm shows the HOMO to LUMO transition. The DOS density is calculated for this compound using Gauss-sum 2.2 program and the spectrum is shown in Figure 5.23.

Table 1.6 Electronic transition of NALG

E_{exc} (eV)	Experimental λ (nm)	Oscillator strength (f)
5.3203	233.04	0.0189
5.4301	228.33	0.0028
5.8826	210.77	0.0026

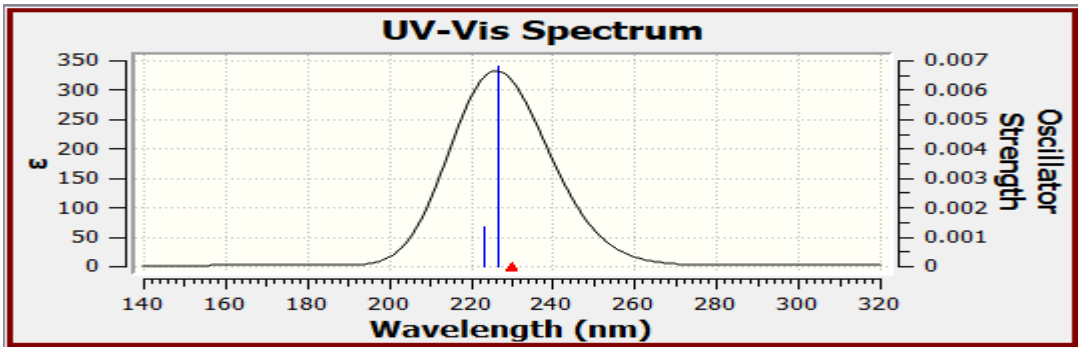


Figure 1.6 Theoretical UV spectrum of NALG molecule

Figure 1.7 Experimental UV spectrum of NALG molecule

The total density of states electrons is allowed to occupy the partial density state posse's particular energy. This represents the relative contribution represented by the atom. The Xaxis represents the energy level Y axis represents the number of states per eV. DOS increases the voltage if the potential energy barrier decreases. DOS plots prove the population analysis [100,101] of the orbital proves the energy range.

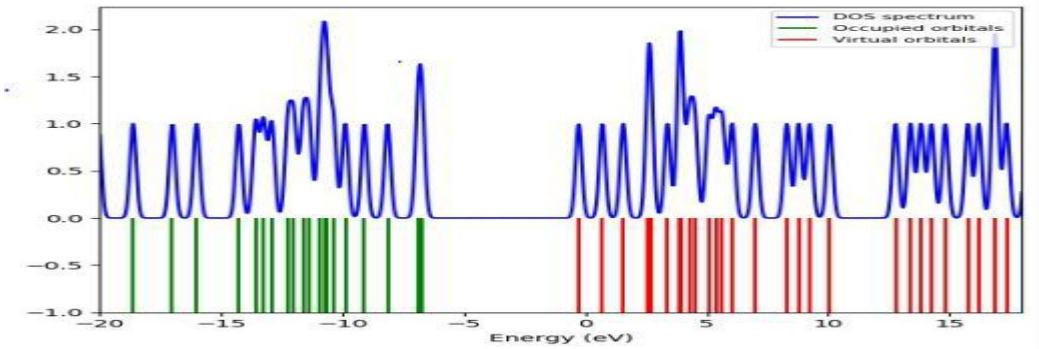


Figure 1.8 Density of state diagram for NALG

1.19 Second harmonic generation (SHG) studies

The second harmonic generation efficiency of the grown crystal has been estimated by Kurtz and Perry technique [102]. The grown crystal is ground into a very fine powder and packed in a microcapillary tube. A laser beam of wavelength 1064 nm, a pulse width of 10ns with a repetition rate of 10 Hz was made to fall on the sample. The sample cell is mounted in the path of laser beam energy and I_{SHG} output was generated by the grained powder samples by a laser beam pulse energy (per pulse) of 1.2 mJ. The emission of light radiation (λ = 532 nm) of the crystal confirmed the NLO behaviour of crystal samples and the intensities of the second harmonic signal have been measured for the standard KDP sample also. The SHG efficiency value of L-alanine formate [103] L-alanine DL-malic acid [104] is 0.75 & 0.92 compared with NALG having the SHG efficiency is 1.4 times greater than the NLO value of

KDP. The NALG crystal with high SHG efficiency might serve as a potential candidate for frequency conservation and optical devices [105]. The NLO active materials with higher SHG efficiency are capable of exhibiting higher hyper-polarizability and second-order electrical susceptibility per unit volume to enhance the device fabrication capacity [106].

1.20 Hirshfeld surface analysis

Hirshfeld analysis [107] is used to prove the intermolecular hydrogen bonding and the packing alignment of the crystal. Hirshfeld fingerprint analysis is done through the crystal explorer 3.0 version [108]. The interactions within the molecular crystal strength mapped onto the Hirshfeld surface using d_{norm} this is an essential one to prove the contact distance between the nearest atoms present inside (d_i) and outside (d_e). Curvedness is used to identify packing modes. The curvature of the surface regions of green separated by blue edges denotes the positive curvature. The shape index on the Hirshfeld surface is used to denote the hollows and bumps that can locate the place where two molecules touch one another. The plot drawn

shows the distance between the external and internal molecules. This graph denotes the O-H interactions are 25.8% which signals the bonding between the internal surface and the external molecule. The blue region represents the darker and lighter interactions which are plotted with the fingerprint region shown in Figure 1.9 (a-d). The de and di are the distance to the nearest atom in the centre to the exterior and interior.

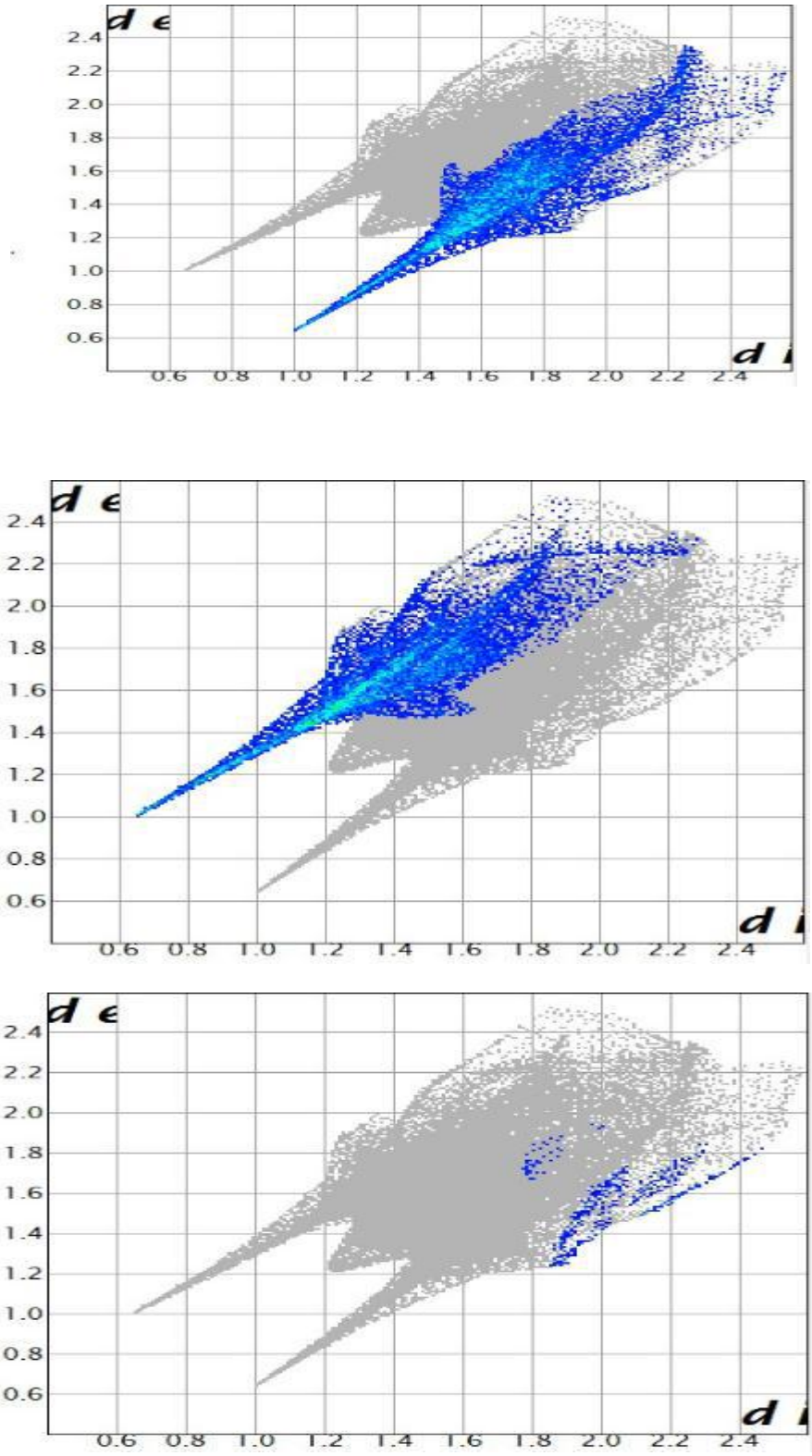
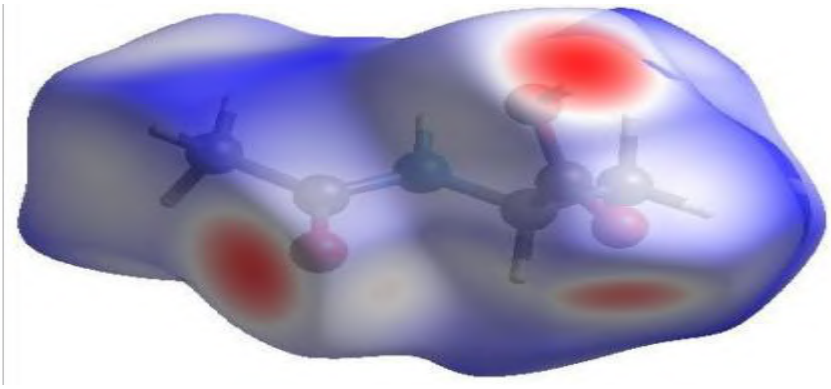
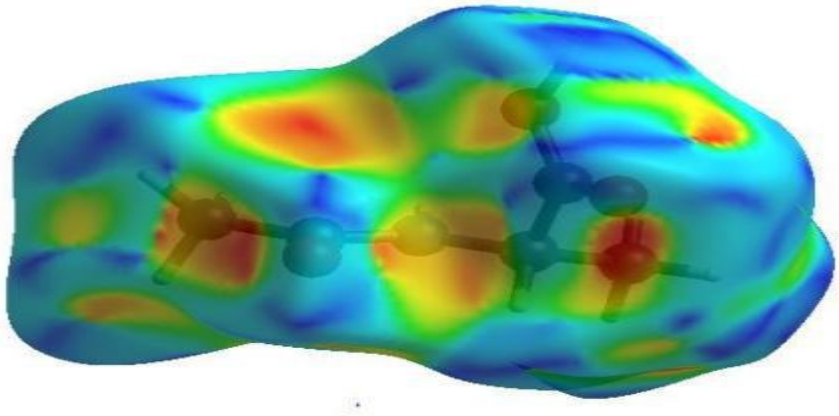


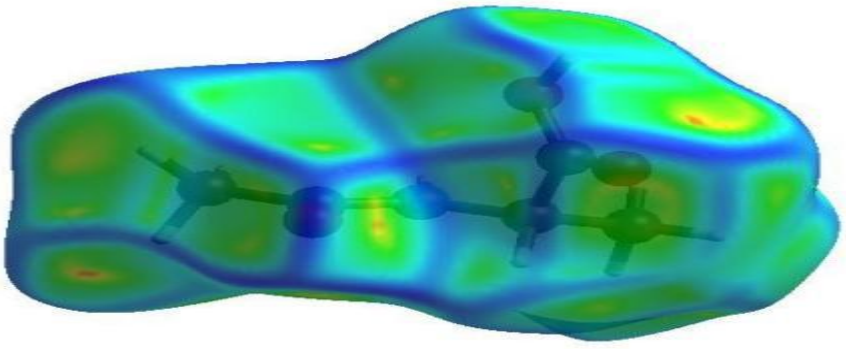
Figure 1.10 Graphical representation for the two-dimensional Hirshfeld surface analysis fingerprint plots for NALG. The external and internal distances in Å for (a) O-H (25.8%) (b) H-H (47.7%) (c) H-O (22%) (d) N-H (8%)



(a)



(b)

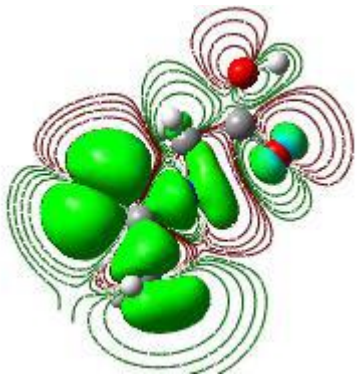


(c)

Figure 1.11 The Hirshfeld surface graphical representation (a) d_{norm} (b) curvedness (c) shape index for NALG

The blue region represents the darker and lighter interactions these regions are plotted with the fingerprint region. The red spot on the surface indicates the contact with the hydrogen bond shown in Figure 5.26. This contribution mainly represents the O...H bond (25.8%),

H…H bond (47.7%), H…O bond (22%) and N…H bond (8%). The de and di are the distance to the nearest atom in the centre to the exterior and interior. Topological properties of through curvature, curvedness and shape index this varies from a concave range of -1 to the convex range of +1. The red spot indicates the C-H…л contact.



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Automatic Fire Alarmusing IC555

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Abstract

Firesafetyis one ofthe most critical aspects of modern buildings, and timelydetection offire hazards is essential to saving lives and property. In this research, an automatic fire alarm system utilizing the IC 555 timer is proposed. The system is designed to detect heat using appropriate sensors and activate an alarm when the fire is detected. The use of IC 555 timerin this design offers advantages such as ease of implementation, low cost, and versatility.This paper presents the working mechanism, design, and implementation of the fire alarm system along with a discussion on the advantages, limitations, and potential improvements.

Keywords: Automatic Fire Alarm, IC 555 Timer, Fire Detection, Heat Sensors, Alarm System

Introduction

Fire accidents are among the leading causes of fatalities and property damage worldwide. Effective early detection systems are essential in preventing catastrophic outcomes. Automatic fire alarmsystems playa crucial role in detectingthe presence offire and alerting individuals in the affected area. Traditional fire alarm systems often rely on complex electronics that are expensive and require periodic maintenance. However, there is a growing need for cost-effective, reliable, and efficient fire detection systems, especially in residential and small-scale commercial buildings [1].

The IC 555 timer is a widely used integrated circuit in various electronic applications due to its versatility and ease of use. By leveraging the IC 555, an automatic fire alarm system canbe created that detects changes in environmental conditions such as temperature levels, triggering an alarm when fire is imminent. This paper explores the design, components, working principles, and implementation of an automatic fire alarm system using the IC 555 timer.

MaterialsandMethods

ComponentsUsed

The main components used [2,3] in the development of the automatic fire alarms ystem include:

IC 555 Timer: A key component used for timing and generating the pulse necessary to activate the alarm.

HeatSensor: A thermistororathermo couple is used to detect temperature changesin the environment caused by fire.

Buzzer:Emitsaloud sound to alertindividuals to thepresence of fire.

PowerSupply: Provides the necessaryvoltage tothe system components.

Resistors and Capacitors: Used for configuring the IC 555 timer's timing and triggering functionality.

Transistor: Used as electronic switches to control the alarm circuit. When a sensor detects fire (via smoke or heat), it triggers the transistor to turn on or off, activatingthe alarm.

Diodes: Used to direct current flow in one direction, preventing reverse current that may damage the circuit. In the context of a fire alarm, diodes can also be used for voltage regulation or surge protection.

Working Principle

The IC 555 is used in this fire alarm circuit (Figure 1), which is developed on the basis of an astable multivibrator [4]. A circuit that continuously produces pulses at the output terminal at the intended frequency is known as an a stable multivibrat or. Whenthe generated frequency is linked to a loudspeaker, sound is produced. The sensor utilized in the circuit above is a reverse-biased germanium diode (DR25). At normal temperature, electricity cannot flow through the diode due to its extremely high reverse resistance. The reset pin in our circuit's astable multivibrator is grounded. The astable multivibrator is unable to generate frequency under these circumstances. Transistor T1 is turned on at normal temperature because its base receives sufficient voltage due to the diode's high resistance and non-conducting state. In the event of a fire, the diode's junction breaks down and begins to conduct when its temperature rises. Its resistance drops to less than1KΩ a troughly 70°C. Since the ground connection to pin4of the IC 555 has been removed and is instead linked to the Vcc through R2, the base of Tl is now directly connected to ground through diode Dl,stopping T1 from conducting. Now that the astable multivibrator is turned on, it begins to generate the frequency that causes the alarm to ring.

Circuit Design

The circuitcons is ts of the following stages:

Sensor Stage: The heat sensors are connected to the input of the IC 555 timer. When heat exceeds a threshold, the sensor sends a voltage signal to the timer.

IC 555 Timer: In the monostable mode, the timer is triggered by the sensor input. A resistor and capacitor are used to define the duration of the alarm pulse.

AlarmS tage:The output from the IC555 timer is used to activate the buzzer. An optional relay can be used to trigger additional alarms or control other devices.

Results and Discussion

Performance Evaluation

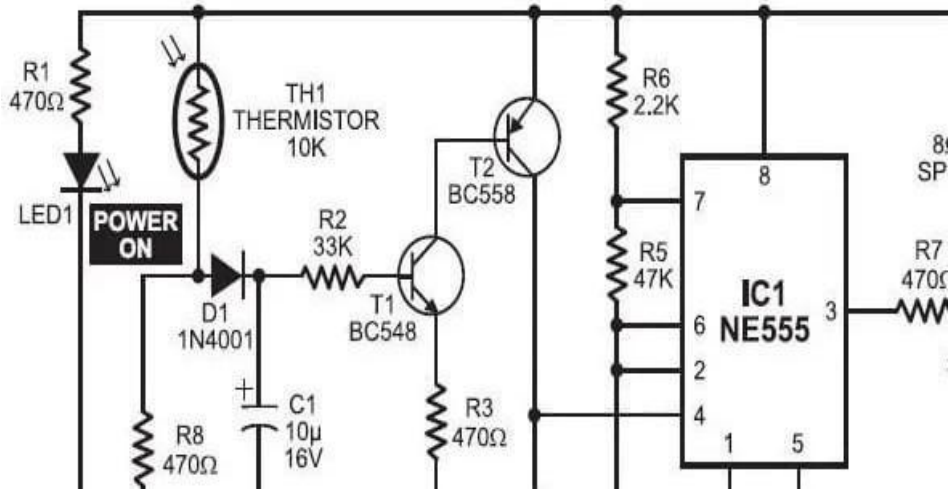
The fire alarm system [5] was evaluated based on the following criteria:

Response Time: The system successfully detected heat within a few seconds of theinitial changes, which is crucial for early fire detection.

Reliability:The system was as tested under different environmental conditions (including temperature variations) and exhibited consistent performance.

1. **\Cost-effectiveness**:The useof IC555,which is low-cost and widely available, makes this fire alarm system an affordable option for residential and small commercial buildings.

Figure1 illustrates the schematic diagram of the automatic fire alarm system.



Limitations

Whilethe systemprovesto be efficientin detectingfire, thereare afew limitations:

False Positives: The sensors may sometimes trigger the alarm in the presence of dust or high humidity.

Limited Detection Range: The system may not detect fires that are far away from the sensors.

Future Improvements

Future work can involve integrating the system with wireless communication modules (e.g., GSM, Wi-Fi) to send alerts to mobile phones or remote monitoring stations. Additionally, improving the sensitivity of the sensors and introducing multi-sensor configurations can enhance the reliability of the system.

Conclusion

The automatic fire alarm system using the IC 555 timer offers a simple, low-cost solution to fire detection. The system performs effectively in detecting both heat , triggering an alarm to alert people about potential fire hazards. Though it has some limitations, such as false positives and limited range, it provides a practical and affordable option for fire safety in various settings. Future improvements can address these issues and extend the system's capabilities.

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Design and implementation of a simple Automatic Water level Controller without Microcontrollers

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Abstract

Water level control is crucial in managing water resources effectively across various applications such as residential tanks, agricultural irrigation systems, and industrial water reservoirs. Traditional methods of water level control often require manual intervention, leading to inefficiency, waste, and potential damage from overflows. This paper proposes a simple, low-cost, and reliable automatic water level controller (AWLC) that does not rely on microcontroller-based systems like Arduino. The proposed solution uses basic electronic components such as float switches, relays, and transistors to monitor and control water levels, providing an effective alternative to automated systems without complex hardware and programming.

Keywords: Automatic Water Level Controller, Float Switch, Water Pump Control, Relay, Transistor, Water Level Detection, Low-Cost Solution.

1. Introduction

The control of water levels in storage tanks, reservoirs, and water-based systems is essential in both residential and industrial settings. Improper water level management can result in wastage, overflow, and equipment damage, while under filling can cause inadequate supply or damage to pumps. Historically, manual intervention has been employed to monitor and manage these systems, but this method is prone to human error, inefficiency, and energy wastage. The introduction of automatic water level controllers (AWLC) has significantly reduced the need for manual labor, allowing systems to operate autonomously. While many modern AWLC systems employ microcontrollers such as Arduino, there is still a demand for simpler, low-cost alternatives that do not require advanced computing platforms. This paper explores the design and implementation of a water level controller using basic electronic components like float switches, relays, and transistors, with no microcontroller involved.

2. Design and Working Principle

The automatic water level controller presented in this paper is based on the use of a float switch, transistor, relay, and water pump [1,2] to regulate water levels in a tank. This system does not involve microcontrollers and offers a simple yet effective solution for controlling water levels in various applications.

2.1. Float Switch for Water Level Detection

The **float switch** is the primary sensing element in the system. It consists of a float that moves with the water level. When the water drops below a predefined level, the float switch

closes, activating the circuit. The float switch is typically placed at the low-water level point of the tank, ensuring that water is only added when the level falls below the set threshold.

2.2. Transistor as a Signal Amplifier

The float switch provides a very low current signal, which is insufficient to directly control the relay or the water pump. Therefore, a **transistor (NPN)** is used to amplify this signal. When the float switch activates, it triggers the transistor's base, allowing current to flow from the collector to the emitter, which then energizes the relay coil.

2.3. Relay for Pump Control

The **relay** is used to control the on/off state of the water pump. It is wired in such a way that the relay is activated when the transistor is turned on, closing the circuit and supplying power to the pump. The relay also ensures that the water pump operates only when necessary, turning off when the water reaches a predefined high level.

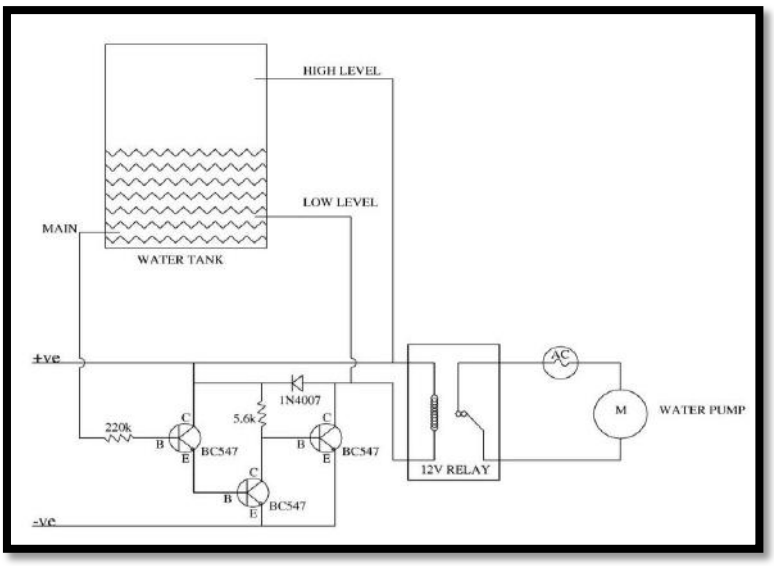
2.4. Water Pump

The **water pump** is connected to the relay's normally open (NO) contacts. Once the relay is activated, it completes the circuit to the pump, allowing it to operate and fill the tank. When the water reaches the desired level, the float switch opens, deactivating the circuit and turning off the pump.

3. Circuit Design

The automatic water level controller circuit [3] comprises the following components:

- **Float switch**: For detecting low water levels.
- **NPN Transistor:** For signal amplification.
- **Relay**: For controlling the water pump.
- **Diode (e.g., 1N4007)**: To protect the transistor from voltage spikes generated by the relay coil.
- **Water pump**: For filling the tank.
- **Resistor**: For limiting current to the transistor's base.



4. Advantages of the Proposed System

The proposed automatic water level controller offers several benefits [4, 5] over more complex systems that rely on microcontrollers:

4.1. Simplicity and Cost-Effectiveness

This system relies on simple electronic components like float switches, relays, and transistors, making it inexpensive and easy to build. Unlike microcontroller-based systems, there is no need for programming or advanced hardware, which simplifies construction and reduces costs.

4.2. Reliability

The use of basic components such as float switches and relays ensures high reliability. The system operates based on mechanical switches, reducing the likelihood of failure compared to systems that rely on sensors or microcontroller components.

4.3. Low Maintenance

The components used in this design are durable and require minimal maintenance. Regular checks for the float switch and relay operation are typically sufficient for keeping the system running smoothly.

4.4. Easy Integration with Existing Systems

The controller can be easily integrated into existing water systems such as domestic water tanks, irrigation setups, or industrial water reservoirs. It can be retrofitted with minimal modifications to existing setups, providing a practical solution for automatic water level control.

5. Applications

This system has several practical applications, particularly in environments where water level control is essential but advanced microcontroller-based systems are unnecessary:

5.1. Residential Water Tanks

In households, the system can be used to manage the water level in overhead or underground water tanks, ensuring that the tank fills automatically without the risk of overflow.

5.2. Agricultural Irrigation

In agriculture, the system can be employed to regulate water levels in irrigation ponds or water reservoirs. By automatically controlling the water pump, it helps prevent water wastage while maintaining the required water levels for irrigation.

5.3. Industrial Water Systems

Industries that rely on water for cooling or manufacturing can benefit from this water level control system. It ensures that water levels remain constant, preventing equipment damage from either overflow or inadequate water supply.

5.4. Aquaculture

In fish farms or aquariums, maintaining an optimal water level is critical to the health of the aquatic life. This system automates water level management, reducing labor and ensuring a stable environment for the fish.

6. Limitations and Future Work

While this system is effective and reliable, there are certain limitations:

6.1. Limited Features

This design provides basic water level control but does not include advanced features such as remote monitoring, alerts, or data logging. Future systems could integrate these features by incorporating IoT-based solutions.

6.2. Sensitivity to Mechanical Wear

The float switch is a mechanical device that can wear out over time, especially in harsh environmental conditions. Alternative sensor technologies could be explored for increased durability.

6.3. Power Consumption of Pump

The pump may consume significant energy, particularly in large-scale systems. Incorporating energy-efficient pumps or renewable energy sources like solar power could mitigate this limitation.

Conclusion

The design and implementation of an automatic water level controller using simple electronic components such as float switches, transistors, and relays provides an efficient and cost-effective solution for maintaining optimal water levels. This system is reliable, easy to implement, and offers practical applications in various domains, from residential tanks to industrial systems. By avoiding the need for complex microcontroller setups, this solution is an accessible and straightforward way to automate water level control. Future improvements could involve integrating additional sensors or IoT features for more advanced monitoring and control.

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Automatic Light Control Systems

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Abstract

Automatic lighting control systems are innovative lighting technology innovations that make it easier for consumers to control their lighting systems, maximizing efficiency and cost. These systems can be controlled remotely via the internet or remote control, reducing energy consumption and human errors. Thispaper focuses on designing a circuit for automatic light control, ensuring energy efficiency and extending the lifespan of electrical appliances. The use of Op-amp741, reeds witch and relay module implements the advantage of ease versatility and also under low cost. The content of this paper is all about the automatic light control system , its components description, working procedure, advantages in all basic fields and its potential implementation.

Keywords: Automatic light control system, Op-amp741, reed switch,relay module.

1. Introduction

The light controllers are smarter versions of the mechanical or electronic device previously used for light controlON-OFF operation. They come with energy conservation options like twi light saving, staggering or dimming. Automatic Light Control System is a simple and powerful concept, which uses transistor as a switch to switch ON and OFF the light automatically. By using this system manual works are removed. It automatically switches ON lights when the user enters. It automatically switches OFF lights under absence. This is done by a reed switch which senses the light actually and send signal to the relay module to switch on the control system in active mode. By using this system energy consumption is also reduced because now-a-days the manually operated lights are not switched off. This paper exploits the working of a transistor in saturation region and cut-off region to switch ON and switch OFF the lights at appropriate time with the help of an electro magnetically operated switch.In [1], reports on thetwo installation case studied in Scotland and Wales and explains the details and benefits of the technology. The system was called as MINOS that had a track record of over 100,000 units installed and working successfully. In [2] explains a system to reduce the power consumption oflights by avoiding inefficient lighting which wastes significant financial resources eachyear.This paper explores the design, components, working principles, and implementation of an automatic light system using the basic component such as reed switch and relay module. The technology applied are the Operational Amplifies (op-Amp) used as comparator to detect voltage changes ,Reed switch which senses the position of adoor or object ,Decade counter IC (CD4017) which controlsthe sequential output and Relay

module which enables the switching of high power devices.

2. Methodology

2.1 Details of the Components

The basic components required for the automatic light control system are:

1. **Op-Amp741:** The operational amplifier ICLM741 is a DC-coupled electronic voltage amplifier with a high gain. It compares two signals—an inverting signal and a non-inverting signal—using its single operational amplifier. Operational amplifiers can be utilized as voltage amplifiers and to perform mathematical operations in a variety of circuits since they oftenhave larger DC gains.

2, **Decade counter IC (CD4017):** A CMOS Decade counter IC is the CD4017. Applications requiring low range counting employ CD4017. From zero to 10 (the decadecount), this IC can count. This integrated circuit has a supply voltage range of 3 to 15 volts and is compatible with transist or logic(TTL).The CD4017's clock speed is 5 MHz.

3 **PNP Transistor (ICBC558):** BC558 is a PNP transist or in which the collector and emitter will be in the forward biased. When the base pin is held at ground and will be opened (Reverse biased) when a signal is provided to base pin. This is how a NPN transist or is different from a PNP transistor. It is used in switching and amplifier applications.

4 **Reed switch with magnet** : Reed switchis an electromagnetic switchwhich is used to control the flow of current in a circuit. In this project reed switch is used to detect the opening and closing of the gate. It contains a small magnetic sensitives witch subjected to small magnetic force which will either turnonor turn off the switch. The Reed switch is made up of two or more ferrous reeds. The switch is encased with a small glass tube-like envelope. The reeds becomes magnetized and move together or separate whenever a magnetic field is moved towards the switch.

5. (**5v relay module):** Relay is one kind of electro mechanical components that function as a switch. The relay coilis energized by DC so that contact switches can be opened or closed. A single channel 5 v relay module generally includes a coil, and two contacts like normally open NO and normally closed NC.6 Resistors (10kΩ,100Ω,820Ω) & connecting wires.

6. **Resisters (10kΩ,100Ω,820Ω):** Used for configuring the IC741 and Decade counter IC (CD4017) for functioning.

Outline of the circuit:

Operational Amplifier IC LM741 and Decade Counter IC CD4017 are thetwo primary parts of this device's circuit diagram. [3] The BC558 PNP transistor's base is linked to one end of the reed switch, and the other endisconnected to a +5V power source. The emitter is connected to the operational amplifier's non- inverting input, while the collector is connecte do +5 volts. The LM741's output pin was linked to the CD4017's clock pin. Pin 2 is the CD4017' s output pin, and it is linked to the relay's input pin. A connection is made between pin 4 and the CD4017's RESET pin.

Process of Working:

As indicated by the circuit schematic, correctly connect the circuit. To alter the reed switch's state, a magnet is affixed to the wall and the reed switch remains fixed.[4] This implies that when the door is closed, the reed switch will always be in the closed position, and when the

door is opened, it will always be in the open position. When the door is opened, the operational amplifier is in the HIGH state; when the door is closed, the operational amplifier is in the LOW state. Lights will turn on as a result of this changing the counter's status to pin2, which is also connected to the relay's output. The circuit diagrams hows a reed switch with a magnet on the wall that changes state when the door is opened and closed. Opening and closing the door causes the operational amplifier to be high and low, causing the counter state to change to pin 2. When the door is closed, the operational amplifier flow changes to low,causing the counter state to change to pin 4, which is connected to the reset button (Fig 1).In this way the device like automatic on/off light switch which can automatically turn on and turn off the light without the human intervention.

Result and Discussion:

3.1 Effectiveness of Automated light system:

Costs, Reduce Waster: Installing this device is a great step toward energy efficiency and lowering your bills. These systems automatically adjust your lights based on your needs, preventing energy waste. This can reduce your monthly bills by up to 60%.[5]

Safety with Automated Lighting: Automated lighting systems can make your workplace safer. For example, motion-sensing lights in industrial areas can turn on when someone enters a potentially dangerous area. Brighter lights in office areas can help prevent eye strain. There are many other ways that automated lighting can improve safety.

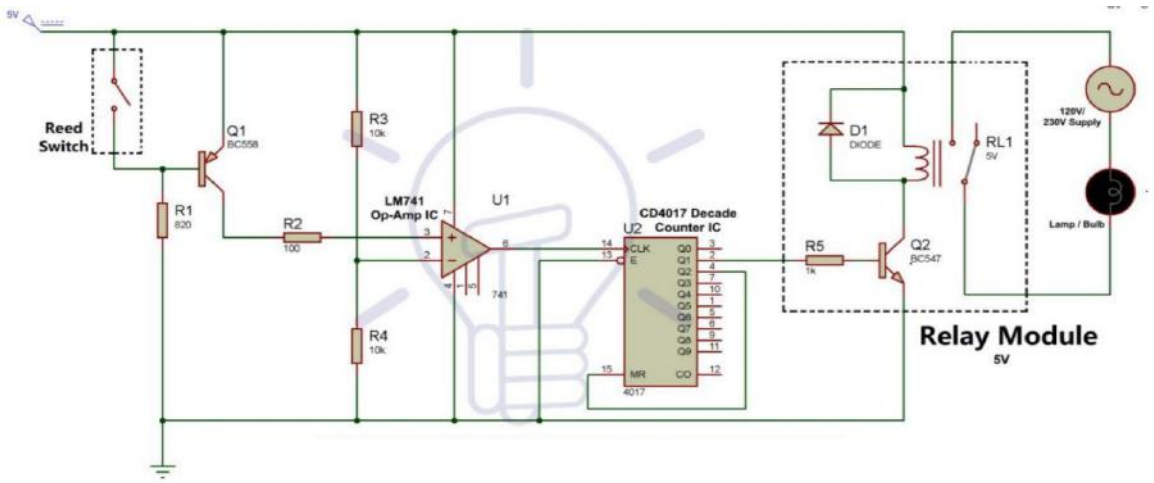

Figure1 Schematic Diagram of Automatic Light Control system

FutureScope:

The advanced stages of Automatic lighting that use infrared sensors and Arduino mini projects have a bright future. Here are some possible developments an duses:

1. **Energy Efficiency:** By utilizing cutting-edge algorithms and sensing technology, future advancements may concentrate on optimizing energy use. This might entail adaptive lighting control, which lowers energy consumption and costs by modifying light intensity in response to current traffic circumstances, pedestrianpresence,or ambient illumination levels.

2. **Integration with Smart Cities:** As smart city efforts gain traction, automatedstreet

lighting can be included into a wider network of sensors and linked devices. Centralized data analysis, control, and monitoring are made possible by this connection. For instance, in order to maximize overall efficiency and improve safety, street lights can interface with other city systems and equipment, such astraffic management systems.

3. **Environmental Monitoring:** In addition to detecting human presence, infrared sensors can be used to track environmental variables. Future advancements might incorporate more sensors to gauge temperature, humidity, noise levels, and airquality.Inordertomakewell-informed judgments about environmental management and urban development, these data can be gathered and examined.

4. **Wireless Connectivity:** Future autonomous street light systems might include wireless connectivity features like Blue tooth, Wi-Fi, as wire less technologies develop further. This makes the up keep and administration of the street light net work more effective by enabling remote monitoring, control, and even over- the-air firmware changes.

5. **MachineLearningandArtificialIntelligence:**Automatic street light systems can become more intelligent and adaptable by utilizing machine learning algorithms and artificial intelligence approaches. By analyzing patterns and learning from past data, these systems are able to adjust lighting schedules and intensities. Additional energy savings and enhanced performance may result from this.

6. **Integration with Renewable Energy Sources:** Automatic street light systems can be connected to renewable energy sources like wind turbines or solar panels as the globe shifts to sustainable energy alternatives. This connection makes the street lighting infrastructure more sustainable by enabling the use of clean energy and lowering reliance on the grid. It's crucial to remember that any technology's potential is dynamic and subject to constant improvement. Al though precise implementations will depend on a number of factors, such as technology break throughs, regulatory frameworks, and market demands, these prospective developments show the direction in which automatic light systems using IR sensors and Arduinomini projects may progress.

Conclusion:

In conclusion,the automatic light control system usingop-amp, decadecounter, Reed switch and relay module is an efficient and practical in uses. The systemutilizes Reed switch to detect the presence of human spresence, triggering there lay module to control the light system accordingly. Here are the key points to consider:

- Reduces energy was tage caused by forgetting to turn of flights
- Ensures convenience and efficiency with automatic light operation
- Increases the life span of electrical devices by lowering energy consumption
- Simple, cost effective, and reliable solution for automation
- Promotes eco-friendly practices by lowering energy consumption

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"UNVEILING SHADOWS: A COMPARATIVE STUDY OF CHILD SEXUAL ABUSE COVERAGE IN PRINT AND DIGITAL MEDIA"

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ABSTRACT

Newspaper and digital media are key drivers in the dissemination of social knowledge. Since a significant portion of the population relies on media for information and current events, media reports can shape public opinion and impact criminal case outcomes. Specifically, how child sexual abuse is portrayed in the media can affect legal responses to these cases on multiple levels. This study examines various portrayals of child sexual abuse in the media and their potential influence on whether victims report assaults to the police or legal authorities. The study emphasizes the importance of media not only providing objective reports on individual child sexual abuse cases but also accurately conveying research findings on such cases.

Keywords:Child, Sexual abuse, News report, Digital media, Newspaper

1.Introduction

News stories play an important role in our daily lives. Stories about crime and deviant behavior, in particular, make up a large part of these news stories. The topics of crime and criminal justice attract so much attention because such reports are full of drama, affect lives and property, and have the terrifying power to take away a person's freedom. In other words, crime news will always be "mainstream news," even though some writers argue that media coverage of crime has declined. Although many journalists take the position that they merely reflect the views of society, they do exercise a certain amount of power.

Child sexual abuse happens every day, but few incidents are recorded. We wanted to know: When child sexual abuse is reported in the news, why? Why this story, and why on this day? Many factors can influence news selection, from the details of the incident itself to what else is being considered for coverage that day. Reporters typically refer to the trigger for a story as the "hook." So for each article, we have identified the hook that answers the question "Why was this article published today?" Prominent events like the abuse revelations put the issue in the spotlight. But how do journalists report on child sexual abuse when there is no celebrity case? Do they routinely report on it? Do sensationalist stories that focus on the "stranger danger" fallacy (that child sexual abuse victims do not know their abuser) dominate coverage? Or does the news reflect prevailing patterns of child sexual abuse? Is there any

discussion of child sexual abuse prevention? In this framework document, we examine how child sexual abuse is portrayed in the news. (Akrami L, Davudi M., 2014)

1. 2NEWS ON CHILD SEXUAL ABUSE CASES

The sexual abuse of children has been around as long as mankind has existed. It seems to be a purely destructive aberration that serves no evolutionary or biological purpose. Child sexual abuse still exists because the perpetrators want to control their victims and exercise their power. child sexual abuse is always wrong and is about power, not sex. Victims are hurt by the process. Newspapers and tabloids have been able to report child sexual abuse cases before. Since then, the number of child sexual abuse cases in society has increased. But newspapers have not been able to report on everything. The main problem is that people are not able to come out of their shell and report the injustice that has happened to them. This is because they find it embarrassing or want to keep the respect of the family. They silently endure the painful thoughts that will haunt them for a lifetime. Some people also threaten the victim and his family not to reveal anything to anyone. In such cases, neither the media can report on the cases nor will justice be done to these people. (Karen J. T, 2015)

1.3 CHILD SEXUAL ABUSE IN SOCIETY

Most often, perpetrators who sexually abuse children know the child they are abusing, but they are not family. For example, the abuser may be a family friend, a babysitter, or a neighbor. About 6 in 10 abusers fall into this group. About 3 in 10 of those who sexually abuse children are family members of the child. These include fathers, uncles, or cousins. In only about 1 in 10 cases of child sexual abuse is the perpetrator a stranger. In most cases, the perpetrators are men, regardless of whether the victim is a boy or a girl.

Women are the perpetrators in about 14% of reported cases of abuse against boys and about 6% of reported cases of abuse against girls. Child pornographers and other abusers who are strangers can contact children via the Internet. (Goli S et al.,2022)

It is not always easy to tell if a child has been sexually abused. Child sexual abuse often occurs in secret, and there is not always physical evidence of the abuse. For these reasons, child sexual abuse is often difficult to detect. Some survivors of child sexual abuse may exhibit symptoms of post-traumatic stress disorder (PTSD). They may act nervous and agitated. Survivors may have bad dreams. They may reenact aspects of the abuse. They may show other fears and worries. Young children may lose skills they once learned and act younger than they are. For example, an abused child may start wetting the bed or sucking their thumb. Some survivors of child sexual abuse exhibit atypical behaviors not expected in a child. They may behave seductively or fail to maintain safe boundaries with others. Children, especially boys, may "act out" with behavioral problems. This may include being cruel to others and running away. Other children "butt in" by becoming depressed. They may withdraw from friends or family. Older children or teens may try to hurt or even kill themselves. (Goli S, et.al. 2021). Almost every victim of child sexual abuse describes the abuse as negative. Most children know it is wrong. They usually feel fear, shock, anger, and disgust. Child sexual abuse can be very confusing for children. For a child, it often means

being used or hurt by a trusted adult. The child may learn that he or she will only get attention or love if he or she gives something or gives up self-respect. Some children believe that the abuse is somehow their fault. Paris (Goodyear-Brown, 2011),They may think that the abuser chose them because they must have wanted it or because there is something wrong with them. If the abuser was same-sex, children (and parents) may wonder if that means they are "gay."

SIGNIFICANCE OF THE STUDY

In 2021, the Ministry of Women and Child Development surveyed children and young adults. 53.22% of children reported being affected by child sexual abuse. 5.69% had been affected by child sexual assault (oral sex or penetration of the vagina or anus). 21.90% of child respondents had experienced severe forms of child sexual abuse, including assault, exposure, or nude photos. 50.76% of respondents reported other forms of child sexual abuse, including sexual advances while travelling or married, exhibitionism, and being forced to view pornographic material fifty percent of the perpetrators were known to the children or were in a position of trust and responsibility. Most children had not reported the matter. (Debarati H, 2018),

The issue of child sexual abuse is still a taboo in India. There is a conspiracy of silence on the subject, and a very large percentage of people believe that it is largely a Western problem and that child sexual abuse does not occur in India. Part of the reason, of course, is because of a traditional, conservative family and community structure where children's sexuality is not talked about at all. Parents do not talk to their children about childhood sexuality and the physical and emotional changes that take place as they grow up. As a result, all forms of child sexual abuse to which they are exposed are not reported to anyone. The girl, whose mother did not even talk to her about such a basic topic as menstruation, is unable to tell her mother about the uncle or neighbor who made sexual comments to her. This silence encourages the perpetrator to continue the abuse and subject the child to more severe forms of sexual abuse. Very often, children do not even realize they are being abused. (Tener D et.al. 2021)

In the vast majority (70%) of child sexual abuse news stories from 2019 - 2021 describing a specific abuse case, the victim knew the accused. In 29% of the cases, the accused was an authority figure, such as a coach, teacher, or religious official. In 23% of the articles, the accused was an acquaintance of the victim or the victim's family. In 18% of these reports, the accused was a family member. In only 4% of the news stories was the accused described as a stranger. In 26% of the reports, the relationship between the child and the perpetrator was not stated at all. The nature of child sexual abuse described in the messages is not clear. Vague terms such as "degrading acts of child sexual abuse" or "inappropriate behavior of child sexual abuse" are used. The person abusing can abuse a child in many ways. This is done to uphold the ethics of journalism, but does it give the right picture to the audience? No! Sometimes even big cases are presented in such a way that they do not seem exaggerated. For this reason, a study was conducted on child sexual abuse cases in newspapers and digital media.

RESEARCH METHODOLOGY

In this study, qualitative research methods were used to achieve the objective of the study. The qualitative analysis focused on how issues related to past child sexual abuse allegations

have been portrayed by the newspaper media. Group discussion and Comparative analysis of Newspaper and Digital media news were adopted to find the effective results.

ANALYSIS OF GROUP DISCUSSION

The present study was conducted randomly selected individuals. Respondents were not asked to decipher words such as "abuse" or "harassment." Rather, they were asked to indicate whether they had experienced any specific child sexual abuse while under the age of sixteen that made them feel uncomfortable. Before being given the questionnaire, respondents were given approximately fifteen minutes to discuss the survey, address pertinent ethical issues, and answer all questions. The discussion is about child sexual abuse. Every person in this world has thousands of dreams, and their dreams start from early childhood, and it is said that their dreams are not for women. Every woman dreams of becoming a doctor, engineer, teacher, astronaut, pilot, etc., but these women are abused by someone in their early childhood. They are abused by people who are close to them. They destroy the dream of a child or a woman by abusing them and moving freely without feeling ashamed. But the affected person is ashamed and hides. Not only that the affected person is always questioned in society. For these reasons, they hide in their house or some leave their life until the end. Is there no solution to this problem? As long as child abuse is not completely stopped in society. We, the people, have no right to speak about the culture, behaviour, etc. All of us together in society have failed to stop the abuse of children or women. Although it is known that there are many problems with child abuse, 90% of children or women are abused in various ways from childhood, but the world does not know about it.

- Do we speak openly about the abuse that has happened?
- Do we have a place for them say
- Children as young as 15 to 16 years old are taking steps toward suicide! how much she might suffer as a result of child abuse
- Only one voice did not like to be told to her that it is not her fault, but only the fault of an abuser, and comforted her
- Why not give her hope

If we did these things, children could be alive without committing suicide.

Child abuse leads to suicide, it does not happen in a single day, however much the child struggles with it day after day, and what kind of mentality do children have who take these steps against suicide?

Dr Vandana argued that, the suicide is a kind of symptom of the dependent mind and the affected body in the recent case the affected girl was forced to abuse many times and she tried to justify the situation to the affected person when there was a hopeless situation she decided to make such a decision.

We cannot say there is no solution, but they could try to help in some way. We as a society miss them trying to help. Sometimes they feel guilty because there is a mistake when this feeling of guilt occurs in children who do not know who to tell. If we say they will only ask us? Have to these reasons for suicide decision. A child is abused only by people he knows,

such as relatives, neighbour, etc. The child is afraid to speak out because others will not believe him or say that it is their fault, so they decide to commit suicide

If the child commits suicide? or if the child has suffered from child abuse? that is not only the fault of the abuser? it is also society and the factors many things or there.

- The 1st error is the abuser.
- 2nd reason is that the child may not get to the point where she told the wrong person, so the wrong person could conclude the problem is addressed.

  For example, if the school, the school might try to close the problem without knowing others. Even asking the child, why did not talk to this person or why did they talk to this person, is rejected That's why this happened and so on. What kind of reasons make children go to the extreme?

Sandhiyan discusses that, there is a reason why the abuser chooses the child. For example, who is the weak child, who is the easy target, which parent does not respond to the child's language, which child does not spend more time with the parents, and which family uses to discuss or facilitate their part of the day? In this way, it is not only the fault of the perpetrator but also the fault of the parents who do not give space to the child. When we do not like a situation or we do not feel it, our body reacts to it.

But do we expose it to our parents? (No) If we are afraid, do we create an environment where we dare to talk about it with parents, school administrators, etc., and do they give the problem space to be heard? (No) We are all responsible for the problem, so we need to instruct everyone to give space for the children to talk and hear what they are saying to solve resolve their problems. Everyone used to start rumour, but what we have done to stop child abuse, is everyone has to think for themselves.

There is no connection with each problem. How does the perpetrator figure out that the child in question is just weak, and how do they target it? Do they plan more days to implement it?

Sandhiyan's opines that, in the past and still today we say that a child should not talk to an unknown person, so the child will not have contact with the unknown person anyway, he will be known to the child through relatives, friends, neighbour, the normal child will not have contact with the unknown person. So the perpetrator systematically plans for months or years how to bring the child into his contact and creates an appropriate atmosphere. If the child is open about the problem to the parents, they do not believe the incident, the abuser seems to raise good hope in their minds. With many factors, only the abuser gets to the child, for example, before approaching the child's control, he controls the parents and makes them believe everything they say. If they raise a very strong hope, then they approach the child. So the child will not be able to say anything to the parents about the person, even if he says something, the parents will believe it Or the parents blame the child for the mistake the abusers committed and manipulate the child to their control.

Do children openly tell their parents everything, do they have room for it? Parents grow up with their children from a young age, when the child is 16 or 17 years old, why do not

children talk openly with their parents about child abuse, what space have we created for the children?

Susila said that, when a child is abused somewhere, it shows the difference between power and powerlessness, when the child is 16 or 17 years old, to whom he will turn, only the mother is more powerful in the house because the children see that the father beats the mother and she is hopeless when she is powerless to fight against the father, as she will fight for us in society or towards the abuser, every mother openly goes and asks the child for the right answer to the teachers, no, every woman is dominated by men in society either way. If my child is abused, where do I go and ask? what will my neighbour say, what will society think? These are the problems that parents face. Usually, we analyse many things and justify them. We have found many cases of child abuse, but until now there is no solution. They just say it's the parents' fault, they did not raise the child well.

We must teach the children that even though we can overcome this problem, we have also become accustomed to it. We have to tell the affected child that there are no problems that they can overcome. The first contact with the child is the parent then only they seek the mentor, teacher etc. Now how is the relationship between the teacher and the students. Why there is a difference? 20 years back in a class if there are 20 to 30 students the teacher knows about all the students. regarding the studies, family background etc. If the student is weak they speak to a child and try to solve the problems. In this period and situation do teachers understand the children as before?

Personal opinion of Miss Suja (student) - When I was in 10th grade, my mother and brother were in the family, my brother slept in the hallway, I and my mother slept in the room, and the window was very close to the bed. Someone who knows about my family, until now we do not know who it is. He held a hand on me through the window because I was in a night of deep sleep, it took me some time to realize it. When I realized that someone is there, I screamed and my brother went out to look. But he ran away. At that time, my mother said to me, do not tell anyone that this happened, if a neighbour comes and hears my voice. Because my mother is worried that someone will say something wrong about my child.

My brother came and asked me, I told him what had happened. The next second my brother told me that it is not my fault. It is the fault of the person who put his hand on you. Now I am here and I have overcome my problems, and it's all thanks to my brother. He used to say, "If you know it's not your fault, why do you worry so much about it? I have overcome my whole life until now with the hope of what my brother said. From my mother's point of view, I perspective am a fatherless child, and no one should say anything wrong about me, but if my brother did not support me and if we behaved like normal people, maybe I would not be in this place.

Personal opinion of **Indhu** - I have a girl who is 10 years old. We need to create a space for the child all sudden fifteen years child, if we tell the child what happens, they will not because we do not practice space work from childhood. From childhood we need to respect their opinion, we need to listen to what the child says. We need to give time as a parent we

need to do these things. Everything we need to follow as a schedule I follow a schedule, before bedtime I have to tell my child what happened in the whole day.

So I dedicate my time to her telling me everything. This is not only a mother's response, but also the father's duty. Like all parents, we say we are pregnant, but only the two of us, father and mother, should have the responsibility to sit with the child and spend the day. We make the child a victim, so when the mistake happened, what do we have to do? We need to take the right perspective. The child will try to tell us what happened. It will have confidence if we say that we will find the solution. We have grown from the beginning, we make mistakes. A mistake will happen, it is an ongoing process. Only when we make mistakes will we learn more.

It is not a mistake to blame the child as a victim. At the age of the child, we have to explore the mistake that happened and we have to correct it and find a solution for the children.

As parents, we need to assure that we're there when something happens to help them with their problems, and we need to give them confidence. Don't be a spectator when something happens on the street, for example, ask a question about it and don't just watch and leave as a spectator. If only one person asks a question, others will ask the question, even your child will see what you're doing. Don't be a spectator in the house and in society. What happens to others today will happen to us on other days.

Ambika, Sociologist opines that, as everyone said, open communication is very important. in the child, they have the shyness of how to tell the parents. If we tell them, how will they react? If we tell a teacher in a class that there are 40 students, will the teacher ask questions in front of all the students? This one-way communication wants to get a child to speak openly. The child needs a counselling centre in school, in college, and even in the workplace. Nowadays, counselling centre only focus on special education and not focus on things like social-emotional learning values. We should create more awareness. We also need to create awareness of how a child can legally proceed. Not only does the child need to speak openly with the parents and the teacher but he or she also needs to speak openly with the counsellor.

Susila Anand said that, the total population, when a person goes to court legally it does not see the parents, or family, or mother, etc. The laws for the individual are the same for everyone. Those who have committed a mistake will be punished, and those who are innocent will be compensated. Will not the law say that he gave ten rupees less to his friend or husband? No. The court will not see these things. The law is the same for everyone. We give the law and the assurance to the people that we are there to live our lives boldly, it all depends on the welfare department and the institutions that should give the assurance and have to bear the responsibility. Education is more important in schools and colleges.

We have a law that everywhere in school, college, workplace, etc., we must maintain an internal grievance community. In the case of sexual abuse and sexual harassment in the workplace, it says that an internal grievance committee must be established. This is especially important in schools, colleges, workplaces, even teachers, etc. We were wondering why you did not complain to the teacher. Do you think the teacher has no child sexual abuse

problems? How many teachers are affected by child sexual harassment even if the teacher is facing the problem? There is child sexual abuse harassment against women everywhere. The Supreme Court law says that the internal community must be compliant. Are schools and colleges complying with this law? No.

When we take the child to school, they say we give 100% results! Does any school say a word about us taking care of your child? No. The government requires that rainwater harvesting be noted on a board in order to teach it. Is there a sign in the schools that says we have an internal complaint department in the school so you can keep your child safe? Is there a sign that says 1098 is the child protective services number to contact if you need help? Those are the most important things. If those things are in place, hopefully, I can get my child out. Are the people who are there taking those steps? No. That's everybody's social responsibility.

From another perspective, more girls are affected, and we need to stop contact with men to avoid the problem. So far, we are not creating awareness about child abuse among children. We just need to talk about child abuse and how it happens to the child to understand the problem and avoid the circumstances. So that is the inclusiveness that is more important than equal responsibility for all. We must not blame the individual, but be united to overcome the problem instead of blaming others.

Jaya Priya argued that, in schools, social studies and science are taught, but personality development and sex education are also important. But in schools, science and math teachers dig into PT classes for their subject and say that PT is not that important.

My request to all school teachers is not to do this. Personality development is the most important thing for children nowadays, even sex education is more important for children to overcome child abuse. Science and mathematics education does not help children to overcome child abuse, only personality development and sex education are compulsory for children.

Dr Vandana discusses - How to hold a point or take it to the beginning. The most important thing is awareness. Everyone is equally responsible to create awareness. Susila Anand's said that, We need to start this awareness at home. Some people do not have food or a roof over their heads, they sleep on the cot and do not notice if their dress moves or not. But in the morning they get up, use the public toilets and go about their daily work. If this child decides to die, there will be thousands of deaths. Without having hope, they just believe that we have to learn and make it in life, that is the only goal for the children who live there. The people who have all the opportunities to live their lives, if they decide to die, are not worthless. Parents must take their children to such places and explore the children to understand the situation. When a child goes to work and gets his paycheck, he knows how to use his ATM cards. A life skill is more important, my friend says if you come here, my country will take care of you.

But in the U.S., they deliberately say not to go to India, there is no security there. So it is not the responsibility of the individual. It is the responsibility of society and everybody.

Everyone has to know the laws, and each department has to do its duty, where everyone has a responsibility. The most important thing is to be aware that everyone has the same responsibility to create awareness. We must include character development and sex education in schools so that children overcome child abuse. Live your life courageously and face your problems courageously.

COMPARATIVE ANALYSIS

Table 4.1.1 Incidence of child sexual abuse reported in Tamilnadu (2021) survey – Sample by age and gender

AGE GROUP	MALE	FEMALE	TOTAL
18 –20	21	24	45
21 –25	2	7	9
26 –30	3	9	12
31 –35	1	2	3
36 –40	1	-	1

From the above Table 4.1.1 and Figure 4.1.1, it can be seen that a total of 70 people were interviewed. Approximately 45% were in the 18 to 20 age group, 21% males and 24% females. 9% were in the 21 to 25 age group, 2% of males and 7% of females. 12% were in the age group 26 to 30 years, 3% of men and 9% of women. 3% were in the age group 31 to 35 years, 1% of men and 2% of women. 1% were in the age group 36 to 40 years, 1% of which were male.

Table 4.1.2 Response to child sexual abuse issues a problem in the newspapers

	MALE	FEMALE	TOTAL
Think so	21	28	49
Think so to some degree	14	22	36
Don’t think so	5	4	9
Don’t know	3	2	6

Table 4.1.2 above and Figure 4.1.2 explain the number of people who agree or disagree with the question about whether child sexual abuse is a problem in newspapers. 49% think it's a big problem. 36% think it's to some extent. 9% don't think so. 6% of respondents aren't concerned about it.

Table 4.1.3 The Nature of Human Aggression

WITNESS FROM	PERCENTAGE
Did witness outside their home	86%
Did not witness outside their home	14%

From Table 4.1.3 and Figure 4.1.3 above, it appears that those who recalled abuse in the family were more likely to be arrested. This could be an indication of the importance of the environment.

Table 4.1.4 Percentage breakdown of primary substantial harm types in 2019 – 2021

HARM TYPE	PERCENTAGE
Physical abuse	34.8%
Lack of supervision	17.8%
Emotional abuse	15.5%
Sexual abuse	12.0%
Abandonment	0.6%
Physical neglect	15.0%

Table 4.1.4 and Figure 4.1.4 above explain the figures for the percentage breakdown of primary types of significant harm in 2019-2021: 34.8% psychophysiology of physical abuse, 17.8% lack of supervision, 15.5% emotional abuse, 12.0% sexual abuse, 0.6% neglect, 15.0% physical neglect.

Table 4.1.5 Child abuse and Neglect fatality victims by age

YEAR	PERCENTAGE
Younger than 1 year	41%
1 to 3 yrs	35%
4 to 7 yrs	12%
8 to 11 yrs	6%
12 to 17 yrs	6%

Table 4.1.5 and Figure 4.1.5 above explain People often speculate about why child abuse happens. Some wonder if the perpetrator has mental health problems, others believe it happens in low-income families. And still, others think it might be due to overzealous religious beliefs. Some wonder what the victim could have done to trigger such a harsh reaction. And often, it's not their fault. After all, some think, there must be a reason why perpetrators hurt their loved ones the way they do. It's as if it would be easier if we could find and acknowledge a reason why children are treated so cruelly. In reality, there are no boundaries when it comes to child abuse. It does not just affect a certain group of people. Yes, some abuse children because of their mental condition. These abusers may not know that what they are doing is wrong, or they may not be able to comprehend it. In their mental state, they may think that what they are doing is justified.

Table 4.1.6 Perpetrators of unwanted child sexual abuse experiences

Variables	Male No. Abused by	Female No. Abused	Percentage of all reported perpetrator
Parent	12	36	78.5
Other Relative	0	14	6.5
Foster Parent	1	1	0.4
Residential Facility Staff	0	1	0.2
Child daycare provider	1	3	0.7
An Unmarried partner of the Parent	3	8	4.1
Legal guardian	0	1	0.2
Other professionals	0	1	0.2
Friends or Neighbors	1	2	0.3
Other	0	9	5.1
Unknown or Missing	0	7	3.9

Table 4.1.6 and Figure 4.1.6 above explain the perpetrators of unwanted sexual experiences. The variables are: Parent 78.5%. Other relatives 6.5%. Foster parent 0.4%. Residential facility staff 0.2%. Day care centre staff 0.7%. An unmarried partner of parent 4.1%. Legal guardian 0.2%. Other professionals 0.2%. Friends or neighbors 0.3%. Other 5.1%. Unknown or absent 3.9%. The most important statistic, so often overlooked and rarely discussed, is that 95% of child sexual abuse is committed by family members.

Table 4.1.7 Newspapers that cover child sexual issues per month

NEWSPAPER	% OF STORIES COVERED PER MONTH
Times of India	20%
Deccan Chronicle	20%
Indian Express	11%
The Hindu	37%
Dinakaran	20%
Daily Thanthi	32%
Maalaimalar	11%

Table 4.1.7 and Figure 4.1.7 above illustrate the percentage of child sexual abuse reported monthly in the Times of India newspaper media as 20%. Deccan Chronicle 20%. Indian Express 11%. The Hindu 37%. Dinakaran 20%. Daily Thanthi 32%. Maalaimalar 11%. The number of stories published by these newspapers each month. The statistics show that most stories are published by The Hindu.

Table 4.1.8 Digital Media that cover child sexual issues per month

DIGITAL MEDIA	% OF STORIES COVERED PER MONTH
Twitter	10%
Facebook	10%
Instagram	30%
Whatsapp	50%

Table 4.1.8 above and Figure 4.1.8 provide information on the percentage of child sexual abuse reported per month in digital media: Twitter 10%. Facebook 10%. Instagram 30%. Whatsapp 50%. The number of stories reported in these digital media each month. The statistics show that most of the reports are published on Whatsapp'.

FINDINGS AND CONCLUSION

Both newspapers and digital media have their advantages and disadvantages and have a solid user base. However, looking at current trends, the number of digital media users is rapidly increasing and the share of newspaper media is decreasing. But the newspaper is not

threatened with extinction. Rather, the newspaper is gaining more and more users as the literacy rate increases. The ability to influence the character, development, or behaviour of someone or something, or the effect itself. This study focused on news, feature, and investigative journalism that reported child sexual abuse cases. We believe that as more and more cases of child sexual abuse are brought to light in the media, it will give victims who are hiding for various reasons the opportunity to break the chains of insecurity and threat they live in and come out and be an inspiration to others. This is exactly the problem that needs to be eliminated in the country. Society sometimes fails to recognize that children are the most vulnerable group in our community and therefore need the greatest protection. The social and economic costs to societies that do not prioritize the needs of children, particularly the prevention of child abuse and neglect, are well documented. In addition to news stories, articles, and investigative journalism, mass media education and prevention campaigns are sporadic. (Waalkes et al. 2022), These campaigns typically aim to increase the public's knowledge of child abuse and neglect, influence people's attitudes toward children and youth, and change behaviors that contribute to or accelerate the problem of child abuse and neglect in our communities.

The reality of newspaper media coverage of crimes against children is that journalists will attempt to interview child victims. Although victim service providers may try to protect the privacy of young victims, they ultimately cannot prevent them from being interviewed. The newspaper media play an important role in forming and influencing people's attitudes and behaviour. The essential role of the media in raising society's awareness of and response to child abuse and neglect is noted. Particular emphasis is placed on the role of news and features that report on specific child abuse cases, research, and intervention strategies. Such media attention to child abuse has at times positively influenced public, professional, and policy responses to the circumstances in which children and youth find themselves. Understanding the influences of the newspaper media and how to use them constructively can therefore be an important tool for those who advocate for children, youth, and their families.

Both newspapers and digital media have their advantages and disadvantages and have a solid user base. However, looking at current trends, the number of digital media users is rapidly increasing and the share of newspaper media is decreasing. But the newspaper is not threatened with extinction. Rather, the newspaper is gaining more and more users as the literacy rate increases. So we can say that newspapers and digital media coexist quite well.

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NALAM THODU

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Abstract

NalamThodu is an innovative healthcare digitization initiative aimed at modernizing government hospital services in Tamil Nadu by leveraging Aadhaar-linked patient health records. The project addresses critical inefficiencies in the existing healthcare system by introducing a centralized, secure, and accessible digital platform. It enables seamless patient registration, appointment scheduling, medical consultations, and lab report management, all integrated with real-time SMS and email notifications. The system ensures role-based access for hospital staff, doctors, and lab technicians, thereby streamlining hospital workflows and enhancing service delivery. Built using robust technologies including Python (Flask) for backend, HTML/CSS for frontend, and SQLite3 for database management, NalamThodu also incorporates AES encryption for data security. By enabling data-driven decisions and improving accessibility to patient records, the project contributes to a more efficient, transparent, and patient-centric public healthcare ecosystem

Keywords: Healthcare, Aadhaar, EHR, Patient Registration, Appointments, Medical Reports, Notifications, Flask, SQLite3, Data Security.

Introduction

The healthcare sector in India, particularly in government hospitals, often faces challenges like mismanagement of medical records, inefficiencies in patient registration, long wait times, and security concerns related to patient data. The NalamThodu project aims to address these challenges by digitizing patient records, enabling quick access to medical history, reducing administrative burden, and ensuring better coordination between healthcare providers.

Methodology

The Smart Healthcare System is designed by integrating wearable IoT devices, cloud infrastructure, and AI-powered analytics to deliver efficient and personalized healthcare. The system consists of wearable devices such as smartwatches, fitness trackers, and medical sensors that monitor vital signs like ECG, blood pressure, oxygen levels, and temperature in real time. These devices communicate with the cloud through Wi-Fi or Bluetooth, where the data is securely stored and processed. AI algorithms analyze both historical and real-time

health data to predict potential medical conditions, enabling early detection and timely intervention. Medical professionals can access patient data through a secure, web-based healthcare portal, which allows for remote monitoring and management. The system also supports telemedicine, enabling video consultations that are particularly valuable in remote and underserved regions.

Results and Discussion

The implementation of the Smart Healthcare System demonstrated multiple benefits. It significantly improved health monitoring by allowing patients to continuously track their vital signs, reducing the need for frequent in-person visits. The use of AI-powered analytics enabled early detection of potential health issues, allowing for quicker medical responses. Additionally, the system contributed to cost reduction by shifting the focus from reactive to proactive care, leading to fewer hospital admissions and emergency visits. The inclusion of telemedicine made healthcare more accessible, especially in rural areas, while the availability of real-time health data empowered patients to take a more active role in managing their well-being.

Challenges and Solutions

Despite its benefits, the Smart Healthcare System faced several challenges. One major concern was data privacy and security, which was addressed by implementing end-to-end encryption and using secure cloud platforms. Another challenge was user adoption, as some patients were hesitant to use wearable devices. This was mitigated through educational initiatives and the development of user-friendly interfaces. Connectivity issues in regions with limited internet access also posed a problem; however, the system incorporated offline data storage with synchronization capabilities once connectivity was restored, ensuring continuous data collection and analysis.

Conclusion

The Smart Healthcare System highlights the transformative potential of integrating IoT, AI, and cloud computing in the healthcare sector. By enabling real-time monitoring, predictive diagnostics, and remote consultations, the system enhances the quality of patient care, reduces overall healthcare costs, and supports a more personalized approach to treatment. As technology and infrastructure continue to advance, this system can be scaled to serve a broader population, particularly in areas where traditional healthcare services are limited.

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Bank Locker Management System

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Abstract

This project is mainly developed to manage the record of users and lockers digitally so that the record will remain available for a long time without error. The record is saved in the database so we can retrieve specific data anytime whenever we want. Manage the check in and checkout process of users easily without error. Manual system requires the manager to monitor each activity that is available in the bank Locker. This Bank Locker Management System is designed to improve accuracy and to enhance safety and efficiency in the bank locker. This cloud based system will help manager to improve check in check out management, bookings, lockers.

Introduction

1. Admin Module

This module allows bank staff (admin) to manage the entire system. Admins can add, update, or delete lockers, assign them to customers, track locker status, and manage rent payments. In a bank locker management system, the admin module provides comprehensive control and management capabilities. This module allows administrators to manage users (bankers and sub-bankers), configure locker types, assign lockers to customers, and generate reports.

2. Customer Module

Customers can view their locker details, check rent status, receive alerts for due payments, and apply for lockers (if enabled). It's usually a limited-access module. Bank Locker management system is a web-based application that deals with the bank lockers that store the valuables of bank customers. The system has three modules: Banker, Sub-banker, and User. The Banker module has several features such as Dashboard, Sub-banker, Locker-type, Assign locker, Reports, Account settings. The Sub-banker module has the same features as the Banker module except for Sub-banker creation. The User module is for customers who have a locker in the bank. With the help of a locker number, users can view the details of their locker.

3. Locker Management Module

This module handles the creation and maintenance of lockers, including locker types, rent amounts, and availability status. The Banker module has several features such as Dashboard, Sub-banker, Locker-type, Assign locker, Reports, Account settings. The Sub-banker module has the same features as the Banker module except for Sub-banker creation. The User module is for customers who have a locker in the bank. With the help of a locker number, users can view the details of their locker.

4. Locker Allocation Module

This handles assigning lockers to customers, setting allocation dates, tracking expiry, and updating locker status once assigned or vacated. The modern locker management system

eliminates the bottlenecks of the traditional locker management process and provides an easy, secure, and efficient way of managing lockers in the banks.

5. Rent Payment Module

Tracks and manages rent payments for lockers. It calculates due amounts, records payments, updates rent status, and sends alerts for due or late payments. It offers an effective way of managing lockers with minimal efforts and utmost precision. This automated locker management solution provides complete visibility over your locker management system and allows for a hassle-free locker maintenance. Dynamic dashboard, biometric integration, report generation and instant reminders are the standout features that sets **SAFE** a class apart.

6. Notification Module

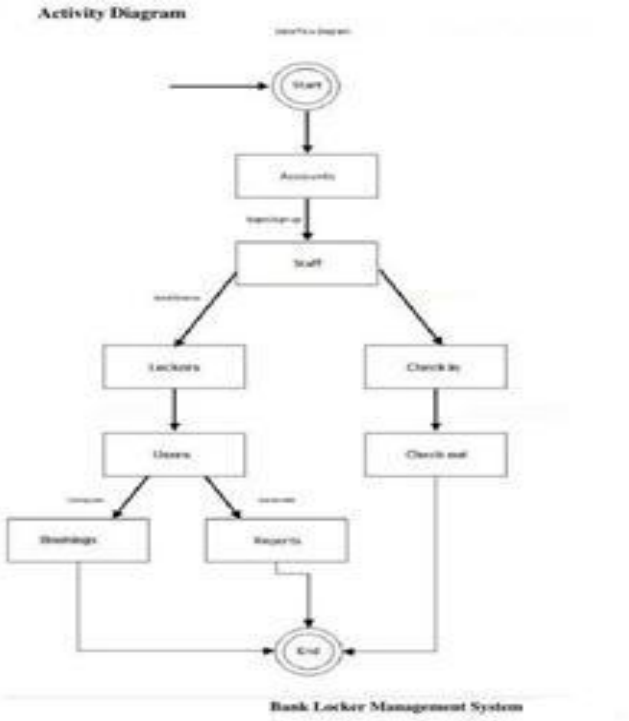
It Sends alerts and reminders to customers and admins like rent due notifications, locker expiry alerts, and payment confirmations.

7. Report Generation Module

A Report Generation Module in a Bank Locker Management System is a feature that allows users to generate various reports related to locker operations, including locker usage, availability, and performance metrics. These reports provide valuable insights for bank management and operations. These can be exported for record-keeping or audits.

8. Authentication & Security Module

Manages login, passwords, and role-based access (admin vs customer). Ensures only authorized users can access sensitive locker or payment information. It typically incorporates multi-factor authentication methods, biometric verification, and real-time monitoring to ensure only authorized users can access lockers.



Bank Locker Management System

Conclusion

The Bank Locker Management System is a vital technological solution designed to enhance the security, efficiency, and operational reliability of managing bank lockers. Traditional

locker management often involves manual record-keeping, security vulnerabilities, and inefficient customer service. This system addresses these challenges by integrating automated processes, advanced authentication mechanisms, and real-time monitoring to ensure seamless locker access and management. One of the key benefits of this system is its ability to provide enhanced security through multi-factor authentication, biometric verification (fingerprint, retina scan, or facial recognition), and RFID-based access. These security measures significantly reduce the risks of unauthorized access and fraud, ensuring that only authorized individuals can operate the lockers. Additionally, real-time monitoring and surveillance integration further strengthen the security framework. From an operational perspective, the system streamlines the entire locker management process, reducing the dependency on manual efforts. It automates locker allocation, maintains digital records of locker usage, and allows for efficient tracking of locker availability, thus improving banking staff productivity and reducing customer wait times. Integration with banking databases and centralized storage ensures that all transactions and locker usage logs are securely stored and easily retrievable.

The system also improves customer experience by providing a user-friendly interface and hassle-free access to lockers. Customers can request, book, and manage lockers through a secure web or mobile application, reducing the need for physical visits to the bank. SMS and email notifications keep customers informed about locker access and security alerts, adding an extra layer of transparency.

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Tomato Full Stack Application

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Abstract

The TomatoFullStackApplication is a cutting-edge food ordering platform developed using the MERNstack (MongoDB, Express.js, React.js, and Node.js) with integrated Stripe for secure payment processing. It features a responsiveReact.js frontend with a user-friendly interface that allows customers to easily browse menus, customize orders, and make purchases. On the backend, Node.js and Express.js manage real-time operations, while MongoDBAtlas provides scalable and reliable cloud-based data storage. Users can track their orders live, receiving real-time notifications on status updates and estimated delivery times. The platform implements JWT-based authentication and role-based access control, ensuring secure access for customers, restaurant owners, and administrators.

Introduction

The TomatoFullStackApplication is developed to meet the growing demands of the food delivery industry in the digital age, providing a seamless bridge between customers and food vendors. As online ordering becomes increasingly vital, Tomato offers an efficient, secure, and user-friendly solution that simplifies the entire process—from browsing menus to placing orders and completing payments—delivering a smooth experience for all users.

Powered by a modern technology stack, the application features a real-time, responsive interface that enhances order placement and tracking. Restaurant owners benefit from a unified dashboard where they can manage menus, monitor orders, adjust availability, and interact with customers. The platform supports secure, multi-option payment methods backed by robust encryption and fraud prevention protocols. It also ensures strong user authentication and data privacy through advanced verification mechanisms. To boost user engagement, AI-powered recommendations suggest relevant dishes, while accessibility features like voice search, dark mode, and keyboard navigation make the platform inclusive. Additionally, multilingual support and SEO optimization help broaden the application's reach.

Scalability and performance are at the core of Tomato's design. Its optimized architecture, including load balancing, ensures reliable operation even during peak hours. The modular, maintainable codebase allows for easy scaling and integration of new features without disrupting services. Real-time analytics empower restaurant owners to make data-driven decisions based on customer behavior and emerging trends.

Tomato also focuses on operational efficiency, offering real-time order tracking and route optimization to streamline deliveries. AI chatbots and live chat support handle customer queries, modifications, and issues promptly, enhancing service quality. Delivery personnel benefit from integration with mapping services for faster and more accurate deliveries. With a

suite of tools designed to support business growth, Tomato positions itself as a powerful and adaptable platform for thriving in the evolving digital food service landscape.

Methodology

The development of the TomatoFullStackApplication is driven by the need to overcome key limitations in the current food ordering ecosystem. Existing platforms often struggle with scalability, lack of flexibility, and minimal customization options, affecting both restaurants and customers. To address these challenges, the Tomato application follows a structured, problem-focused development methodology that ensures a high-performance, secure, and user-centric solution.

1. Identifying Gaps in Traditional Ordering Systems

The first step involves a comprehensive analysis of conventional food ordering practices, where many restaurants still rely on manual order-taking via phone or in-person, leading to communication errors and inefficiencies. The dominance of cash-based transactions further limits convenience and excludes users who prefer digital payment methods. These limitations highlight the need for a digital solution that simplifies and modernizes the ordering process.

2. Evaluating Third-Party Platform Dependencies

Tomato addresses the drawbacks associated with reliance on third-party delivery platforms such as high commission fees, delivery inefficiencies, and limited brand interaction. By creating an independent platform, Tomato empowers restaurants to retain greater control over their business and build direct relationships with customers, thereby fostering brand loyalty.

3. Enhancing Restaurant Control and Customization

Many food delivery systems lack options for restaurants to fully manage menus, pricing, and promotional strategies. Tomato's architecture includes dedicated dashboards for restaurant owners, providing complete control over business operations. The platform also enables direct communication with customers, allowing for service personalization and effective issue resolution. Integrated analytics tools offer detailed insights without the need for premium subscriptions.

4. Securing Transactions and Expanding Payment Options

A robust payment and security model is implemented, addressing issues like failed transactions, security vulnerabilities, and limited payment methods. Tomato integrates reliable payment gateways with encryption, fraud prevention protocols, and support for multi-currency and diverse payment options to ensure smooth, secure transactions for all users.

5. Designing for Optimal User Experience

User-centric design principles guide the frontend development of Tomato. The application features an intuitive, accessible interface that includes real-time order tracking, personalized recommendations, and multiple accessibility options. These enhancements are designed to improve customer satisfaction and streamline the ordering process.

6. Building for Scalability and Performance

To ensure long-term reliability and growth, the application employs a modern, scalable architecture. Techniques like load balancing, efficient database querying, and modular code structures are used to handle high-traffic scenarios without performance

degradation. Docker containerization and microservices architecture further enhance scalability and maintainability. Through this methodology, the Tomato Full Stack Application is strategically designed to fill the existing gaps in the market, delivering a secure, customizable, and scalable food ordering platform that caters to the needs of both restaurants and customers.

Proposed Work

The Tomato Full Stack Application represents a next-generation solution in the food ordering industry, designed to address the limitations of traditional and third-party platforms. It delivers a secure, scalable, and feature-rich environment that enhances the experience for customers, restaurant owners, and delivery personnel alike. By leveraging modern technologies, the platform ensures efficient order management, seamless transaction processing, and real-time communication throughout the ordering lifecycle. One of the core improvements Tomato offers is **a** fully digital and automated ordering system**,** eliminating the need for manual order-taking and significantly reducing errors. Customers can easily browse menus, customize their selections, and place orders instantly, while restaurants gain full control over dynamic menu updates without third-party constraints. The system facilitates direct restaurant-to-customer communication**,** enabling personalized service**,** feedback collection**,** loyalty programs**,** and promotional campaigns that help build strong customer relationships and reduce reliance on high-commission delivery platforms.

The application features a secure and flexible payment system powered by Stripe, supporting various methods including credit/debit cards, UPI, and digital wallets. Fraud detection and encryption protocols ensure transaction safety and user confidence. Real-time order tracking enhances transparency and convenience, with GPS-based updates on order preparation, dispatch, and estimated delivery, along with optimized routing for delivery personnel to ensure timely service. Tomato's advanced UI/UX design**,** built with React.js and Tailwind CSS, delivers a modern, responsive interface that works seamlessly across devices. AI-powered recommendation engines suggest meals based on user preferences and history, making the experience more engaging and personalized. The backend infrastructure, developed using Node.js, Express.js, and MongoDB Atlas, supports high-performance operations, efficient data management, and seamless scalability. Load balancing and caching mechanisms ensure the platform remains stable even under high traffic conditions.

Additionally, the application includes a comprehensive restaurant management dashboard that allows owners to oversee orders, menus, inventory, and analytics from a centralized interface. Automated reporting tools provide actionable insights into sales performance, customer behavior, and demand forecasting. The system also supports multi-branch and franchise operations with centralized controls, enabling businesses to expand effortlessly.

Conclusion

The Tomato Full Stack Application represents a major leap forward in the realm of digital food ordering. Built on the MERNstack (MongoDB, Express.js, React.js, and Node.js), it offers exceptional performance and scalability. Its innovative architecture effectively resolves the challenges posed by conventional and third-party platforms. The system provides users with a smooth, user-friendly experience across all devices. With

Stripeintegration, it enables fast, secure, and dependable payment processing. Tomato gives restaurants complete control over their operations and customer interactions. By combining reliability, security, and efficiency, it redefines standards in the food delivery industry.

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CLEAR VISION – TO FIND YOUR PATH

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Abstract

With the increasing reliance on digital learning, students often face difficulties in accessing quality study materials efficiently. The existing online resources are fragmented, leading to a waste of time and effort in locating appropriate content. **Clear Vision** is a proposed solution to this problem. The website offers a comprehensive collection of study links and materials for all subjects in a structured manner. Leveraging HTML for content, CSS for design, and JavaScript for interactivity, the platform ensures a seamless user experience. The primary objective is to provide a centralized, easy-to-navigate resource hub that saves students' time and enhances their productivity. Additionally, the website's responsive design makes it accessible across various devices, further supporting the goal of democratizing education.

Keywords: Online Education,Responsive Web Design,Student Productivity,E-Learning Tools,HTML CSS Java Script,Centralized Study Materials, Adaptive Learning.

Introduction

Clear Vision is an educational website designed to simplify the learning process for students by providing organized and accessible study materials for various subjects. In today's digital era, finding reliable resources quickly is a challenge due to the overwhelming amount of information available online. Clear Vision addresses this issue by centralizing essential study links and resources on a single platform. Built using HTML, CSS, and JavaScript, the website aims to enhance the learning experience through a clean and user-friendly interface. By offering well-categorized content and an intuitive navigation system, Clear Vision ensures that students can focus more on learning and less on searching for resources. There are also a few steps students can take to reduce the challenges of navigating scattered online resources.

Future Enhancements

While the current version of Clear Vision offers a solid foundation for an organized and user-friendly study resource platform, there is significant scope for future improvements and feature expansions. These enhancements aim to make the platform more interactive, personalized, and scalable for a larger audience.

User Account System

- Introduction of user registration and login functionalities.
- Personalized dashboards where students can bookmark resources, track their learning progress, and receive recommendations.

Admin Panel for Content Management

- A secure admin interface to easily add, update, or remove study materials.
- Moderation tools to ensure content accuracy and relevance.

AI-Powered Recommendations

- Integration of AI to analyze user preferences and study patterns.
- Smart suggestions for resources based on learning behavior and subject interest.

Gamification Elements

- Incorporation of points, badges, and leaderboards to encourage consistent learning.
- Challenges and quizzes to make studying more engaging and rewarding.

Multi-language Support

- Content translation and localization features to support students from different linguistic backgrounds.
- Promoting inclusivity and wider accessibility.

Community Forums

- A built-in discussion forum or Q&A section where students can interact, ask doubts, and help each other.
- Encouraging peer-to-peer learning and collaboration.

Mobile Application

- Development of a dedicated mobile app version for offline access and push notifications.
- Enhanced usability and convenience for students on the go.

By implementing these future enhancements, Clear Vision can evolve into a robust and intelligent learning ecosystem that continuously adapts to the needs of students and educators alike.

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By implementing these future enhancements, Clear Vision can evolve into a robust and intelligent learning ecosystem that continuously adapts to the needs of students and educators alike.

The Vision Behind Clear Vision

The inception of *Clear Vision* was driven by a simple but powerful question: *"What if students could access all essential learning resources from one platform without the noise?"* In an age dominated by digital transformation, students often find themselves lost in a sea of unorganized and inconsistent content. This challenge gave rise to a vision—a vision to build a centralized, structured, and intelligent learning hub that does more than just list resources. Clear Vision is not just a website; it's a mission to reduce educational disparity and digital fatigue. It aims to empower every student, regardless of their background or geographic location, with access to quality resources. The design philosophy revolves around **clarity, accessibility, and purpose**, ensuring that learning becomes not just easy, but enjoyable. By bridging the gap between scattered digital content and focused academic preparation, *Clear Vision* strives to help students not just find their path—but to walk it with confidence.

Real-World Impact and Relevance

Promoting Educational Equality

Clear Vision levels the playing field by offering a free and accessible platform for all students, especially those from underserved regions where quality resources are scarce or unaffordable.

Supporting Remote and Hybrid Learning

With the shift toward online education, especially post-pandemic, this platform acts as a reliable companion to online learners by streamlining resources and reducing time spent searching.

Mental Wellness through Simplified Learning

An organized platform reduces stress, anxiety, and decision fatigue. Students can focus more on learning and less on navigating chaotic information environments.

Encouraging Self-Learning and Curiosity

The categorized structure and interactive features invite students to explore new topics, fostering independent learning and deeper engagement.

Collaboration and Community Building

With upcoming features like feedback, forums, and resource contribution, Clear Vision is set to become a community-driven project where knowledge is both consumed and co-created.

Bridging the Gap Between Technology and Learning

While many educational tools exist today, few manage to strike the right balance between functionality and pedagogy. *Clear Vision* is purpose-built to sit at the intersection of **technology and learner needs**, offering a space that's technically robust yet academically driven. Whether a student is preparing for a competitive exam, brushing up on school subjects, or exploring new fields of interest, the platform serves as a bridge—making learning not just accessible, but purposeful and personal. This balance ensures that Clear Vision is not just a website, but a **learning companion** tailored to the digital age.

Scalability and Future Readiness

As the platform grows, *Clear Vision* is designed to scale—both in content and in impact. With modular development in mind, the architecture allows for easy expansion: new subjects, language options, user accounts, and even region-specific content. The use of standard web technologies like HTML, CSS, and JavaScript ensures it remains lightweight and adaptable for future upgrades. Moreover, with future integration of analytics and machine learning, Clear Vision has the potential to evolve into an **adaptive learning ecosystem**—customizing content paths for each user based on their strengths, weaknesses, and goals.

PROPOSED WORK

The proposed system aims to overcome the limitations of existing study platforms by offering a well-organized and efficient resource management system. Key features of the proposed system include:

User-Friendly Interface

- A clean and minimalistic design using CSS to enhance readability.
- Easy navigation with a structured menu for different subjects.

Categorized Study Resources

- Separate pages for each subject with categorized links such as notes, video lectures, and practice problems.
- A tagging system to help users quickly identify relevant resources.

Search Functionality

- A JavaScript-powered search bar for quick access to specific topics or resources.
- Filtering options to refine search results based on categories like notes, videos, or practice questions.

Interactive Elements

- JavaScript-enabled dynamic content such as accordions for FAQs and modals for additional information.
- A feedback system to collect user suggestions for continuous improvement.

Responsive Design

- Use of CSS media queries to ensure the website is accessible on desktops, tablets, and smartphones.

- Optimized loading speed for better user experience on different devices.

CONCLUSION

Clear Vision successfully addresses the challenges faced by students in accessing study resources efficiently. By consolidating all subjects and providing categorized links, the website simplifies the process of finding relevant study materials. The use of HTML, CSS, and JavaScript ensures a smooth and responsive user experience across all devices. With its user-friendly interface and well-organized structure, Clear Vision stands out as a reliable and accessible educational platform. The website not only saves time but also helps students focus better on learning by reducing the distractions caused by scattered resources.

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The Wellness Zone -Workout Warriors

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Abstract

The wellness Zone -Workout Warriors aims to provide an all-encompassing fitness and wellness program that integrates personalized training, nutritional guidance, and mental wellness strategies. This report details the methodology, implementation, and outcomes of the project. Through data analysis and case studies, we evaluate the effectiveness of different fitness regimens and dietary plans tailored to individual needs. The goal is to enhance overalldiabeteswell-being, reduce health risks, and optimize fitness performance.

Keywords: Fitness, Data Analysis, Wellness Programs, Training Methods, Health Optimization.

Introduction

Fitness and well-being have become essential aspects of modern life, with people seeking effective ways to improve their health. The wellness Zone -Workout Warriors is a comprehensive fitness project designed to provide personalized training and wellness solutions. The project integrates structured workout routines, dietary planning, and mental wellness strategies. By leveraging data-driven methodologies, it ensures that fitness plans are tailored to individual needs. Key parameters such as BMI, metabolic rate, and endurance levels are assessed to optimize fitness programs. The project also emphasizes the importance of mental well-being by incorporating stress management techniques. A combination of machine learning models and statistical analysis helps track progress effectively. Regular assessments and adaptive training plans enhance user engagement and performance. The ultimate goal is to promote a healthier lifestyle and prevent chronic diseases. This study evaluates the effectiveness of personalized fitness strategies in achieving long-term health benefits. The wellness Zone -Workout Warriors aims to revolutionize health management through scientific and customized approaches.

Fitness and Metabolism

Metabolism refers to the biochemical processes that convert food into energy, essential for sustaining life and physical activity. Fitness plays a crucial role in regulating metabolism by enhancing energy expenditure and optimizing fat utilization. Regular exercise, especially strength training and cardiovascular workouts, increases the body's metabolic rate, allowing for more efficient calorie burning. High-intensity workouts like HIIT stimulate excess post-exercise oxygen consumption (EPOC), which keeps metabolism elevated even after exercise. Muscle mass is a key factor in metabolic rate—more muscle leads to higher calorie expenditure, even at rest. Aerobic exercises improve cardiovascular health and enhance oxygen delivery, further boosting metabolic efficiency. Proper nutrition, including protein intake, supports muscle repair and metabolic function. Hydration is also critical, as water is necessary for metabolic reactions and energy production. Metabolism slows with age, but regular exercise can counteract this decline by preserving lean muscle mass. Hormonal balance, particularly insulin and thyroid hormones, also influences metabolism. A well-rounded fitness routine that includes resistance training, cardio, and flexibility exercises ensures optimal metabolic health. Ultimately, maintaining an active lifestyle leads to improved energy levels, fat loss, and long-term health benefits.

Fitness Assessment Tests

To evaluate physical health, professionals use various fitness assessment tests that measure endurance, strength, flexibility, and body composition. Body Mass Index (BMI) provides a basic weight-to-weight ratio, while body fat percentage gives a more accurate measure of fat levels. VO2 max testing assesses cardiovascular endurance by measuring oxygen consumption during exercise. Resting heart rate (RHR) and heart rate recovery indicate heart health and efficiency. For strength, the one-repetition maximum (1RM) test determines the heaviest weight a person can lift in one attempt. Muscular endurance tests, such as push-ups and sit-ups, evaluate stamina. Flexibility tests, like the Sit and Reach Test, measure joint mobility. Trainers use these assessments to design personalized fitness programs and track progress. Regular testing helps ensure a balanced and effective workout plan.

Physical and Mental Benefits of Exercise

Exercise improves cardiovascular health by strengthening the heart and enhancing blood circulation. It helps in weight management by boosting metabolism and promoting fat loss. Strength training increases muscle mass, bone density, and joint flexibility, reducing the risk of osteoporosis. Regular physical activity also lowers the chances of chronic diseases like diabetes and high blood pressure. Mentally, exercise stimulates endorphin release, reducing stress, anxiety, and depression. It enhances cognitive function by improving memory, focus, and problem-solving skills.

Activities like yoga and meditation promote relaxation and emotional stability. Regular workouts also build self-confidence and improve self-image. Exercise plays a crucial role in improving sleep quality by regulating sleep patterns. It reduces insomnia and helps individuals achieve deeper, more restful sleep. Better sleep enhances overall energy levels and daily productivity. Staying active leads to improved mood and emotional well-being. Socially, group exercises and team sports encourage social interaction and motivation. Exercising with others fosters a sense of community and accountability. Whether done solo

or in groups, fitness routines contribute to a healthier, happier life. A consistent exercise habit ensures long-term physical and mental wellness.

Nutritional Strategies for Fitness

A balanced diet with the right mix of macronutrients (proteins, carbohydrates, and fats) fuels workouts and aids recovery. Proper hydration and micronutrient intake support muscle function, endurance, and overall health. Meal timing and portion control optimize energy levels, muscle growth, and fat loss.

Impact of Hydration and Recovery on Fitness

Proper hydration is essential for muscle function, endurance, and temperature regulation during exercise. Dehydration can lead to fatigue, muscle cramps, and decreased performance. Drinking water before, during, and after workouts helps maintain energy levels and prevent overheating. Electrolytes like sodium, potassium, and magnesium are crucial for fluid balance and muscle recovery. Recovery is just as important as exercise for muscle growth and injury prevention. Rest days allow muscles to repair and strengthen, reducing the risk of overtraining. Quality sleep enhances muscle recovery, hormone regulation, and overall performance. Post-workout nutrition, including protein and carbohydrates, replenishes energy stores and supports muscle repair. Stretching and foam rolling improve flexibility and reduce soreness. A well-balanced hydration and recovery strategy ensures sustained fitness progress and long-term health.

Dataset Description

Dataset for The Wellness Zone -Workout Warriorsdataset is sourced from individuals participating in the program, covering attributes related to fitness, diet, and wellness. It includes various metrics to analyze health and performance

Table 1: Attribute can be Boolean (true /false), continuous or categorical valued

S.no	Attribute Name	Value Type
1	Age	continuous
2	Gender	M , F
3	Height	continuous
4	Weight	continuous
5	BMI	continuous
6	Body Fat Percentage	continuous
7	Activity Level	categorical
8	Calories Intake	continuous
9	Sleep Duration	continuous
10	Heart Rate	continuous
11	Blood Pressure	continuous

‘

Proposed Work

The Wellness Zone -Workout Warriors project focuses on analyzing the impact of physical activity, dietary habits, hydration, and metabolism on overall fitness. The study begins with data collection, where information such as BMI, metabolic rate, workout

frequency, and nutrition intake is gathered from individuals participating in the program. The collected data undergoes pre-processing and cleaning, ensuring accuracy by handling missing values and normalizing data.

Following this, feature selection identifies key fitness indicators, allowing for effective analysis. Exploratory data analysis (EDA) is performed to uncover patterns and correlations among variables, helping in understanding fitness trends. Machine learning models are developed to predict fitness levels and generate personalized recommendations based on individual attributes. The models undergo rigorous performance evaluation using metrics like accuracy and RMSE to ensure reliability. Visualization techniques are applied to represent key insights on fitness and metabolism effectively. The system is then implemented and validated, where real-world testing and user feedback improve its efficiency. Further refinements are made to enhance prediction accuracy and usability. Additionally, AI-driven fitness plans and real-time health monitoring features are integrated for better outcomes. Stress levels, sleep quality, and hydration effects are also studied for a more holistic approach to fitness. The developed system enables data-driven fitness planning, allowing individuals to optimize their workout routines and diet. Future enhancements may include wearable device integration to track fitness metrics in real-time. This research ultimately aims to create a scientifically backed, personalized fitness recommendation system, ensuring improved health outcomes through data-driven insights.

Conclusion

The Wellness Zone -Workout Warriors project provides a data-driven approach to understanding the impact of physical activity, nutrition, and lifestyle on overall health. By analyzing key attributes such as BMI, metabolic rate, workout frequency, and hydration levels, the system generates personalized fitness recommendations. Machine learning models enhance the accuracy of fitness assessments, enabling users to optimize their health strategies effectively. The study highlights the importance of balanced exercise, proper hydration, and dietary habits in maintaining well-being. With real-world validation and performance evaluation, the proposed system proves to be a reliable tool for fitness analysis. Future enhancements, including AI-driven plans and wearable device integration, will further improve the system's accuracy. This research contributes to the growing field of health informatics, empowering individuals with scientific insights for a healthier lifestyle. Ultimately, the project aims to make fitness management more efficient, personalized, and accessible.

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Kids Earning Game

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Abstract

This research presents a gesture-based learning game designed specifically for deaf and speech- impaired individuals, enabling an inclusive and interactive educational experience. The game utilizes hand gesture recognition technology, where an open camera sensor detects and interprets real-time hand movements as input commands. Since most deaf and speech-impaired individuals rely on hand gestures for communication, this approach ensures a natural and intuitive interaction method. The game provides a fun and engaging platform for learning, allowing players to answer questions and complete tasks using predefined gestures. By integrating hand gesture recognition, the system beyond entertainment, the game fosters development, skills enhancement, and improved hand-eye coordination.

Keywords: Hand Gesture Recognition, Deaf and speech-Impaired Accessibility, Inclusive Gaming, Open Camera Sensor Technology, Interactive Learning.

Introduction

A gaming experience designed specifically for deaf and speech-impaired individuals. Our game harnesses the power of hand gesture recognition technology to create an immersive and interactive environment that is both entertaining and accessible. By utilizing an open camera sensor to detect and analyze hand movements in real-time, our game enables players to communicate and engage with the game world in a natural and intuitive way. With a focus on enhancing cognitive and motor skills, our game offers a unique opportunity for deaf and speech-impaired individuals to enjoy an inclusive and interactive gaming experience that is tailored to their needs. Hand Gesture Recognition Technology: Enables players to communicate and engage with theme world using hand movements.

Open Camera Sensor: Detects and analyses hand movements in real-time.

Immersive and Interactive Environment: Creates an engaging and accessible gaming experience. These are the different types of gaming, to improve our skills and knowledge.

Home Page

Welcome to Hand Gesture Game, a revolutionary gaming experience designed specifically for deaf and speech-impaired individuals. Our game harnesses the power of hand gesture recognition technology to create an immersive and interactive environment that is both entertaining and accessible. Using an open camera sensor, our game detects and analyses hand movements in real-time, allowing players to provide answers or complete tasks with specific hand gestures. This innovative approach not only offers entertainment but also enhances cognitive and motor skills, creating an inclusive and interactive experience for users. Join our community today and discover a new world of gaming possibilities that are tailored to your needs. Start playing now and experience the thrill of inclusive gaming. In this game is designed especially deaf and speech-impaired individuals, and hand gesture movements for a interaction. Creating exclusive and inclusive experience for users. Using an open camera sensor while takea hand sensor movements, gestures and recognition.

Register and Login Page

Register Page: Username, Email, Password, Confirm Password, Name, Age
Login Page: Username, Password
Forgot Password: (Click to reset password)

Math Game

Game Description: Practice your math skills and hand gestures with this interactive game.
Players are presented with a math problem on the screen (e.g.2+2).
To answer, players use a specific hand gesture (e.g. holding up two fingers on each hand).
The game's camera sensor detects and analyses the hand gesture in real-time.

Math Operations: Addition, Subtraction, Multiplication, Division

Hand Gestures: Holding up a specific number of finger store present a number

Counting Game

Players are presented with a series of numbered cards on the screen, and their task is to count the cards using specific hand gestures. For example, to count the number 5, players would hold up five fingers on one hand. The game's camera sensor detects and analyses the hand gesture in real-time, providing instant feedback and rewards for correct answers.

Game Selection

Players are presented with a category (e.g. animals) and multiple objects (e.g. cat, dog, bird).
Players use a specific hand gesture to select the answer (e.g. holding up a finger to point to the correct object)

Categories: Animals, Food

Hand Gestures: Pointing to an object with a finger, Holding up a specific number of fingers to represent a choice

Dataset Description

Data Set Name: Hand Gesture Recognition for Deaf and Speech-Impaired Individuals
Description: This data set contains a collection of hand gestures performed by deaf and speech-impaired individuals, captured using an open camera sensor. The dataset is designed

to support the development of hand gesture recognition systems for inclusive gaming applications.

Data Set Features:
Hand Gesture Videos: A collection of videos capturing hand gestures performed by deaf and speech-impaired individuals.

Data Set Structure:
Training Set: A set of 1,000 hand gesture videos, each with corresponding labels and participant information.

Testing Set: A set of 500 hand gesture videos, each with corresponding labels and participant information.

S No	Attribute Name	Value Type
1	User Name	Admin123456
2	User id	12345678
3	E-mail id	Adm@gmail.com
4	Password	1234567
5	Confirm Password	1234567
6	Name	Admin Name
7	Age	0-15

Proposed Work

HGRGS is a gaming system designed for deaf and speech-impaired individuals, utilizing hand gesture recognition technology to enable interactive and inclusive gaming experiences. The Hand Gesture Recognition Gaming System (HGRGS) is a specially designed gaming platform for deaf and speech-impaired individuals. Utilizing an open camera sensor, HGRGS detects and analyses hand gestures in real-time, allowing players to interact with the game using specific hand movements. The system consists of a hand gesture recognition software, a game engine, and a user-friendly interface, providing an inclusive and accessible gaming experience. With a range of interactive games and activities, HGRGS enhances cognitive and motor skills, while offering entertainment and social interaction opportunities, ultimately creating a unique and engaging experience for deaf and speech-impaired individuals.

Conclusion

In conclusion, the hand gesture recognition game offers a ground breaking gaming experience tailored specifically for deaf and speech-impaired individuals. By leveraging innovative hand gesture recognition technology, this game provides an inclusive and interactive platform that not only entertains but also enhances cognitive and motor skills. With its unique approach to accessibility, this game has the potential to revolutionize the gaming industry and provide a sense of belonging and connection for deaf and speech-impaired individuals, ultimately promoting social inclusion and equality. In, this innovative approach not only offers an entertainment.

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Expense Tracker: A Data-Driven Personal Expense Tracker For Financial Wellness

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Abstract

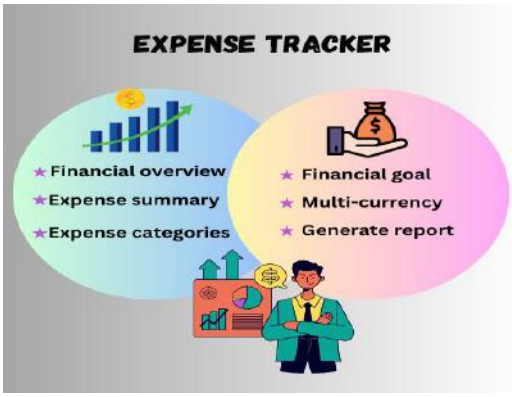
Expense tracking is a crucial component of personal financial management in today's data-driven environment. This article defines the scope and significance of expense tracking in daily life and elucidates, through system design and case-based usage, the recording, analysis, and management of personal financial data. Expense tracking is increasingly essential in modern lifestyles and is associated with improved budgeting behavior, particularly among young adults and working professionals. This article defines the core functionalities of an expense tracking system, discusses the user-centric design principles, and outlines the database and backend integration required for efficient data processing. It also elucidates, through modular components, the structure, implementation, and usage of the application, along with its impact on encouraging financial discipline and informed spending.

Keywords: Expense Tracking, Budgeting System, Personal Finance, Data Visualization, Full Stack Web Development.

Introduction

Financial management has become an essential aspect of modern life, with individuals actively seeking efficient ways to monitor and optimize their spending habits. Expense Tracker is a comprehensive financial tracking project designed to provide personalized budget planning and expense monitoring solutions. The project integrates structured spending analysis, savings goal-setting, and category-wise expense breakdowns to foster financial awareness. By leveraging data-driven approaches, the system ensures that budgeting recommendations are tailored to individual financial behavior. Key parameters such as monthly income, fixed and variable expenses, and savings trends are assessed to optimize financial planning.

The project also emphasizes the importance of financial discipline by incorporating alert mechanisms for overspending and providing real-time feedback on user progress. A combination of user-friendly interface design, backend data processing, and visual analytics helps individuals track and control their finances effectively. Regular tracking, insightful summaries, and adaptive budgeting tools enhance user engagement and long-term financial wellness. The ultimate goalis to promote responsible financial habits and prevent economic distress. This study evaluates the effectiveness of digital expense tracking strategies in improving individual financial outcomes. Expense Tracker aims to transform personal finance management through structured and intelligent approaches.



Income and Expense Analysis

Managing personal finances begins with understanding the flow of income and the pattern of expenses. This section of the Expense Tracker system focuses on accurately recording, classifying, and analyzing both income and expenditures. The system enables users to input multiple income sources, such as salaries, freelance payments, or passive earnings, and categorize them accordingly. Similarly, expenses are divided into well-defined categories like food, transportation, rent, entertainment, and utilities. This classification helps users monitor where their money is going.

Detailed monthly and yearly summaries offer insights into spending patterns. Visual tools such as pie charts and bar graphs highlight areas of excess spending and compare them against income. This helps users identify opportunities to reduce expenses and increase savings. The module also provides the option to tag transactions as fixed or variable, which further aids in forecasting and budgeting.

Benefits of Financial Tracking

Financial tracking plays a vital role in helping individuals gain control over their economic activities and achieve long-term financial well-being. By consistently recording income and expenses, users develop a heightened awareness of their spending behaviour, which promotes responsible financial decision-making. The Expense Tracker system allows users to clearly visualize where their money is being spent, making it easier to identify unnecessary expenditures and adjust budgets accordingly. This process encourages disciplined spending, which in turn supports the development of effective savings habits and investment planning. Regular financial tracking also aids in managing debt, as it enables users to prioritize repayments and reduce financial liabilities over time. Furthermore, it prepares individuals for unforeseen expenses by promoting the creation and maintenance of emergency funds.

Data-Driven Insights and Reporting

The Expense Tracker system applies a structured, data-centric approach to help users monitor and manage their financial activities effectively. Every recorded transaction—whether income or expense—is categorized and stored in the database for organized tracking. These categorized records are used to generate meaningful summaries that allow users to evaluate their spending patterns and overall financial behavior. To further enhance understanding, the system incorporates pie charts that visually represent the proportion of spending across different categories such as food, transportation, rent, and entertainment. These visuals help users quickly identify which areas consume most of their income and where adjustments might be necessary. Regular access to such insights enables users to better

plan their monthly budgets and work toward their financial goals with greater clarity. The straightforward presentation of data ensures ease of use while supporting informed decision-making. Ultimately, the use of data-driven summaries and pie chart-based visualizations promotes greater financial awareness, discipline, and control.

Integration and Automation

The Expense Tracker system integrates essential automation features that enhance usability, reduce manual workload, and provide a more interactive experience for users. While the project does not involve direct integration with banks or digital payment services, it leverages internal automation to streamline data analysis and representation. One of the key automated elements is the generation of pie charts based on user-inputted data. As users record income and expenses, the system automatically categorizes the transactions and calculates totals, which are then visually represented through pie charts. This graphical representation simplifies financial analysis, allowing users to quickly understand their spending distribution and identify areas that require attention

Budget Planning and Goal Setting

In the Expense Tracker system, budget planning and goal setting are simplified through intelligent guidance provided by an integrated assistant bot. Rather than requiring users to manually set budget limits or manage payment-based funds, the system focuses on offering practical financial advice based on recorded income and expenses. As users input their financial data, the assistant bot analyzes the transaction patterns and provides helpful tips on managing expenses more effectively. These suggestions may include identifying high-spending categories, encouraging savings in specific areas, or recommending adjustments in daily habits to improve financial health. The bot also supports users in setting achievable financial goals by offering personalized suggestions based on their past behavior and spending trends. For example, it may prompt users to reduce spending in non-essential categories or aim for a certain balance each month. While the system does not enforce strict budgeting rules, it encourages users to be more mindful of their financial actions and promotes a habit of goal-oriented thinking. By delivering smart insights and motivational guidance, the assistant bot enhances the user's financial decision-making without overwhelming them with complex settings. This approach ensures that users remain engaged and focused on improving their financial well-being in a way that feels natural and manageable.

Dataset Description

The dataset used in this project consists of structured financial records manually entered by users through the web-based application interface. It captures essential income and expense data along with user interactions with the built-in assistant bot. This dataset is used to monitor spending behavior, analyze financial patterns, and provide personalized suggestions. It does not include any sensitive payment or banking information.

Table 1: Attribute can be Boolean (true /false) or continuous valued

S.no	Attribute Name	Value Type
1	Is_Logged_In	Boolean (True/False)
2	User_ID	Categorical
3	Date	Date (DD-MM-YYYY)
4	Income_Source	Categorical (e.g., Salary, Freelance)

5	Income_Amount	Continuous
6	Expense_Category	Categorical (e.g., Food, Rent, Transport)
7	Expense_Amount	Continuous
8	Notes	Text
9	Month	Categorical (e.g., January, February)
10	Year	Integer
11	Assistant_Suggestion	Text (Tips or Goals generated by Bot)

Proposed Work

The Expense Tracker project focuses on simplifying personal finance management by enabling users to record, analyze, and gain insights into their income and expenditure habits. The system begins with data collection, where users manually enter financial information such as income sources, amounts, categorized expenses, and optional notes. This data is then stored securely in a PostgreSQL database via a Spring Boot backend using JDBC. The collected data undergoes validation and formatting during preprocessing to ensure consistency and accuracy. Feature selection is applied to identify key attributes like recurring expense categories, monthly income patterns, and high-spending areas that influence financial behavior. Exploratory data analysis (EDA) is conducted using graphical representations such as pie charts, allowing users to visualize spending distributions and understand financial trends over time. An assistant bot is integrated to interpret this data and provide users with personalized suggestions for financial improvement, including tips on savings and goal setting based on their habits. The system is rigorously tested and optimized for user experience, ensuring smooth navigation and accurate feedback.

Conclusion

The Expense Tracker successfully addresses the growing need for effective and user-friendly financial monitoring in everyday life. By eliminating the complexity often associated with budgeting tools, it simplifies the process of recording income and expenses through a clean, web-based interface. The integration of technologies such as Spring Boot, JDBC, PostgreSQL, and a frontend built with HTML, CSS, and JavaScript ensures seamless interaction between users and the system while maintaining secure and structured data handling. Through intuitive pie chart visualizations, users gain valuable insights into their spending patterns, aiding in better financial decision-making. The addition of an assistant bot provides users with personalized tips and goal-setting suggestions, further enhancing the experience by guiding them toward healthier financial habits. With a focus on manual data input and intelligent assistance rather than external financial integrations, the system ensures user privacy and control. The use of light automation and interactive features contributes to higher user engagement without overwhelming complexity. By promoting awareness, discipline, and financial literacy, the Expense Tracker proves to be a reliable tool for individuals seeking to manage their money more mindfully. Future developments may include advanced analytics, report generation, and enhanced automation features to expand its capabilities and usability.

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Wifi Breaker: A Wireless Network Penetration Testing Tool

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Abstract
Wireless security is a critical concern in modern network infrastructures, with vulnerabilities often exploited through denial-of-service (DoS) and deauthentication attacks. The ESP8266 Deauther Tool is a lightweight and portable device designed for penetration testing and security auditing of Wi-Fi networks. This paper explores the development, implementation, and ethical considerations of the ESP8266 Deauther, along with its capabilities in detecting and mitigating unauthorized network activities Furthermore, the paper discusses counter measures against deauthentication attacks, such as WPA3 encryption and management frame protection, while emphasizing the ethical responsibilities of cybersecurity professionals.

Keywords: ESP8266, Deauther, Wireless Penetration Testing, Wi-Fi Security, Network Auditing.

Introduction

Wireless networks are widely used in modern communication, but they remain vulnerable to various security threats. One such threat is the deauthentication attack, which exploits the 802.11 protocol to forcefully disconnect devices from a network, leading to potential denial-of-service (DoS) scenarios. These attacks are relatively easy to execute and can disrupt communication in homes, businesses, and public networks. The ESP8266 Deauther Tool is an ethical hacking device designed for penetration testing and security auditing, allowing cybersecurity professionals to identify and address weak points in Wi-Fi infrastructures. Built using the low-cost ESP8266 microcontroller, this tool provides a practical and accessible way to simulate real-world attack scenarios. Its compact size, affordability, and open-source firmware have made it a popular choice among ethical hackers and researchers. This paper explores the working principles of the ESP8266 Deauther, including how it scans for nearby Wi-Fi networks, identifies connected clients, selects specific targets, and executes deauthentication or beacon flood attacks to test network resilience. It also covers the technical aspects of its firmware, user interface (often via an OLED display or web-based GUI), and button configuration for standalone operation without the need for a computer. Additionally, it discusses ethical considerations, ensuring that such tools are used for legitimate security research and awareness rather than malicious purposes. Misuse of deauthentication tools can lead to legal consequences, making it essential to operate within legal frameworks and obtain proper authorization during testing.

System Architecture and Components

The ESP8266 Deauther system consists of multiple hardware and software components that work together to perform network scanning and deauthentication attacks. The core component is the ESP8266 microcontroller, which runs the deauthentication script, processes Wi-Fi signals, and executes attack functions. The built-in Wi-Fi module scans available networks, identifies targets, and carries out penetration testing functions. To ensure portability and continuous operation, the device is powered through a battery or USB connection. An external device such as a smartphone or computer is used as the user interface. A web-based interface allows remote control and interaction, enabling users to select targets and monitor attack progress. The combination of these components makes the ESP8266 Deauther a compact and efficient tool for security auditing and penetration testing of wireless networks. The firmware running on the ESP8266 is open-source and customizable, allowing developers to modify or extend its functionality based on specific testing needs.

ESP8266 Deauther

The ESP8266 Deauther tool operates by scanning Wi-Fi networks to gather SSID and BSSID information. Once a target is identified, it injects deauthentication packets to disconnect devices by exploiting vulnerabilities in the 802.11 protocol. It can also conduct handshake capture for further network security analysis.A web-based control panel or an external device, such as a smartphone or computer, serves as the user interface. This allows users to initiate scans, select targets, and monitor attack progress in real time. With these capabilities, the ESP8266 Deautheris a useful tool for cybersecurity professionals and ethical hackers to assess and enhance wireless network security.A web-based control panel or an external device, such as a smartphone or computer, serves as the user interface. This allows users to initiate scans, select targets, and monitor attack progress in real time. With these capabilities, the ESP8266 Deauther is a useful tool for cybersecurity professionals and ethical hackers to assess and enhance wireless network security.

Ethical Concerns and Legal Considerations

The ESP8266 Deauther is designed for ethical use in penetration testing and cybersecurity research. However, unauthorized usage of this tool can result in serious legal consequences, as interfering with networks without consent is illegal in many countries. To ensure ethical use, it is essential to obtain explicit permission from the network owner before conducting any tests. The tool should only be used for educational purposes, security awareness, and improving defensive measures against deauthentication attacks. Additionally, users must adhere to local laws and regulations regarding network penetration testing to avoid potential legal issues. Many jurisdictions require ethical hackers to comply with cybersecurity guidelines, ensuring that security assessments are conducted responsibly. By following these best practices, users can contribute to strengthening wireless network security while staying within ethical and legal boundaries.

Performance Evaluation

The performance of the ESP8266 Deauther tool is evaluated based on several key factors. One crucial aspect is the attack success rate, which determines how efficiently the tool deauthenticates target devices by injecting deauthentication packets. Another important

factor is detection avoidance, as some security tools and intrusion detection systems may recognize and mitigate such attacks. The ability of the ESP8266 Deauther to remain undetected directly impacts its effectiveness in penetration testing scenarios. Battery life also plays a significant role in assessing performance, as the tool's duration of continuous operation on a portable power source affects its practicality in real-world testing environments. Additionally, network impact analysis is conducted to measure the level of disruption caused across different Wi-Fi infrastructures. By evaluating these factors, the overall effectiveness of the ESP8266 Deauther in cybersecurity research and ethical hacking can be determined.Battery life also plays a significant role in assessing performance, as the tool's duration of continuous operation on a portable power source affects its practicality in real-world testing environments.

Use Cases in Cybersecurity Training

The ESP8266 Deauther is a useful tool for cybersecurity training and ethical hacking education. It provides hands-on experience by simulating Wi-Fi attacks, helping students and professionals understand wireless vulnerabilities. In penetration testing workshops, trainees learn how deauthentication attacks disrupt networks and explore mitigation techniques. It is also used in wireless security auditing, where learners analyze packet injections and detect rogue access points. Organizations can include it in security awareness programs to demonstrate Wi-Fi threats and promote safe practices like using VPNs and WPA3 encryption. However, it should only be used in authorized environments to comply with cybersecurity laws. Proper training with the ESP8266 Deauther helps develop essential skills for ethical hacking.

Dataset Description

The dataset used in ESP8266 Deauther Tool consists of Wi-Fi network details, authentication data, and network performance metrics.The dataset attributes and their types are listed in Table 1.1

SN	Attribute Name	Value Type
1	SSID (Network Name)	Text
2	BSSID (MAC Address)	Text
3	Channel Number	Continuous
4	Signal Strength (dBm)	Continuous
5	Encryption Type	Categorical
6	Connected Devices Count	Continuous
7	Deauthentication Packets Sent	Continuous
8	Attack Duration	Continuous
9	Packet Injection Rate	Continuous
10	Power Consumption	Continuous

Attribute can be Boolean (true/false), continuous or text valued are in given below table 1.

Proposed Work

The proposed work focuses on enhancing the functionality and effectiveness of WiFi Breaker, an ESP8266-based deauther tool designed for penetration testing and cybersecurity research. One key improvement is detection evasion, which involves techniques like

randomized packet injection and adaptive attack patterns to reduce detection by security systems. By making the tool less predictable, it can be used more effectively for security auditing without triggering immediate alerts. Another enhancement is improved attack customization, allowing users to modify parameters such as attack duration and target selection for more controlled testing. A better logging system is also proposed to record attack data, including timestamps and affected devices, helping security professionals analyze test results. Additionally, an expanded user interface will improve the web-based control panel for better visualization of network data and real-time attack monitoring. power optimization will be implemented to extend WiFi Breaker's battery life, making it more practical for portable penetration testing. Legal and ethical safeguards will also be integrated to prevent unauthorized usage, ensuring compliance with cybersecurity laws.

Conclusion

The ESP8266 Deauther tool is a valuable resource for penetration testing and Wi-Fi security analysis. By identifying vulnerabilities in wireless networks, it helps cybersecurity professionals strengthen security measures and mitigate threats. Its ability to execute deauthentication attacks provides insight into network weaknesses, allowing for improved defense strategies. Future advancements may focus on enhancing detection evasion techniques and integrating AI-based security monitoring for automated threat detection. As wireless security evolves, ongoing research and development will be essential to adapting penetration testing tools for ethical cybersecurity practices.

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College Canteen Billing Generator: A Smart Cafeteria Management System

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Abstract

The College Canteen Billing Generator is a smart system developed using JavaScript to automate and streamline billing operations in college cafeterias. Traditional manual billing methods often result in long queues, calculation errors, and lack of transparency. This system offers a digital solution where orders can be placed, calculated, and billed automatically through a user-friendly interface. It supports real-time order management, inventory tracking, and receipt generation. This paper discusses the system architecture, implementation process, and its impact on improving cafeteria operations

Introduction

In educational institutions, especially during break times, canteen queues and billing delays are common issues. Manual billing leads to slower service and human errors in order processing. The College Canteen Billing Generator addresses these challenges via mobile/web interface, and the system generates accurate bills in real-time. The system also keeps track of sales and inventory, ensuring better stock management and business insights for the canteen operators. It promotes a faster, error-free, and transparent billing experience for users.

The Canteen Billing Generator comprises the following components:

1.User Interface: A web-based frontend built with HTML and JavaScript where users select food items.

2.Billing Engine: JavaScript-based logic that calculates item totals, applies taxes or discounts, and generates receipts.

3.Inventory Module: Tracks stock availability using client-side storage or backend integration.

4. Admin Dashboard: Enables canteen staff to manage menu items, pricing, and view reports.

5. Database: Integrated via local storage to store transactions and stock data.

Methodology

Requirement Analysis: Identify common food items, peak hours, and user flow.

System Design: Build UI wireframes and plan the logic for billing and stock tracking.

Development: The system was fully developed using JavaScript, including front-end interactivity, billing logic, and data handling. Testing: Simulate real-world canteen scenarios to test speed, accuracy, and reliability. Deployment: Install the system in the college canteen and monitor performances.

Implementation and Case Study

The system was tested in a sample in college canteen. The billing time per order reduced from 2 minutes (manual) to 30 seconds (automated). Daily sales reports helped staff track popular items and reduce wastage. User feedback highlighted the convenience of digital receipts and faster service.

Proposed Work

The proposed work aims to develop a Smart Cafeteria Management System that serves as an efficient and user-friendly College Canteen Billing Generator**.** This system will automate and streamline various operations within the college canteen, including food item selection, order placement, billing, and inventory tracking. The project envisions a centralized, digital solution that reduces manual intervention, minimizes billing errors, speeds up service delivery, and improves overall user experience for both canteen staff and students.
The primary objective of this system is to replace the traditional paper-based and manual billing methods with a digital interface that supports real-time order processing and billing. The proposed system will feature a web-based or desktop application developed using Python (Tkinter or Flask), with SQLite or MySQL as the backend database to manage items, prices, orders, and sales records. Students will be able to view the menu on a digital screen or kiosk, select their desired food items, and generate an automated bill upon checkout. Each transaction will be stored in the database, enabling easy tracking of daily sales and inventory usage.

Key modules of the system will include an Admin Panel for adding, updating, or removing menu items and prices; a Billing Module that generates receipts with unique order numbers and timestamps; an Inventory Module to track the usage of ingredients and restocking needs; and a Reporting Module to generate sales reports, item-wise consumption stats, and peak-hour analytics. The system may also support barcode or QR code scanning for quick item addition, and integration with student ID cards for balance tracking and prepaid billing. To ensure usability and accessibility, the system interface will be designed to be intuitive and responsive.

Features like search filters, category sorting, and real-time totals will enhance the user experience. Future enhancements may include mobile app integration, online ordering within campus, digital payment gateways (UPI, cards), and nutritional information tracking for health-conscious users.By implementing this smart billing generator, the project aims to increase transparency in transactions, improve service speed, reduce errors in billing, and provide actionable insights for canteen management. The proposed system not only modernizes the college canteen environment but also serves as a scalable model for other educational institutions looking to digitize their cafeteria operations.

Results and Discussion

1. Time Efficiency: Billing process speed increased by 70%.
2. Accuracy: Elimination of manual calculation errors.
3. Inventory Insights: Real-time stock alerts helped in proactive inventory management.
4. User Satisfaction: Students appreciated the reduced wait time and digital interaction.
5. Challenges included initial staff training and device maintenance, which were addressed through training sessions and robust hardware choices.

Conclusion

The College Canteen Billing Generator offers a smart and scalable solution for managing cafeteria operations in educational institutions. By automating billing, tracking inventory, and improving the user experience, it brings efficiency and transparency to campus food services. Future developments will focus on enhancing usability and expanding payment options.

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Pick Me Safe-Next Gen Travel Safety for Women

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Abstract

Ensuring personal safety in emergency situations has become increasingly important in today's world. The Pick Me Safe system addresses this need by offering real-time safety assistance through advanced technologies. It features GPS tracking, instant mobile notifications, and a user-friendly interface that allows individuals to quickly alert authorities or trusted contacts. The integration of AI-based incident analysis further enhances the system's ability to assess and respond to threats effectively. By combining these elements, Pick Me Safe aims to create a safer environment for users. Its development and evaluation demonstrate a promising impact on improving public safety

Keywords: Personal safety, Emergency alert system, GPS tracking, AI-based security, Mobile safety application.

Introduction

Personal safety is a fundamental concern, especially in emergency situations where timely assistance can make a critical difference. Pick Me Safe is an intelligent safety system developed to address these concerns by offering an integrated platform for real-time support. The system combines GPS tracking, emergency alerts, and AI-driven security analysis to provide users with immediate and intelligent responses during distress. It allows users to share their live location with selected contacts or emergency services, ensuring help reaches them as quickly as possible. Notifications are sent instantly through the mobile interface, alerting trusted individuals or authorities about the user's situation. Additionally, the use of machine learning techniques enables the system to analyze ongoing incidents, detect patterns, and make accurate assessments in real time. This intelligent analysis helps in identifying the severity of the situation and deciding the appropriate course of action. The system also maintains a history of safety incidents, which can be reviewed for legal or preventive purposes. With a user-friendly interface, Pick Me Safe is accessible and easy to operate even under stress. The application is especially beneficial for vulnerable groups such as women, children, and the elderly. It not only enhances personal safety but also promotes peace of mind for users and their families. By integrating advanced technologies into a single platform, Pick Me Safe offers a comprehensive solution for personal security.

System Architecture

The architecture of the Pick Me Safe system is designed to ensure seamless communication, efficient data processing, and rapid response during emergency situations. At its core, the system consists of four major interconnected components that work collaboratively to enhance user safety. The User Mobile Application serves as the primary interface, enabling users to send distress signals and share their real-time locations with emergency contacts. It is lightweight, responsive, and optimized for quick access in high-stress situations. Supporting this is the Cloud-Based Server, which securely stores user profiles, emergency contacts, and location history, ensuring that critical information is always available when needed. The server is scalable and can handle a large volume of data without compromising performance.

A key innovation within the system is the AI-Based Incident Analyzer, which continuously evaluates user behavior and environmental data to detect potential threats. Using machine learning and anomaly detection algorithms, it identifies unusual activities that may indicate danger and triggers appropriate alerts. Another vital component is the Emergency Contact Network, which instantly notifies trusted individuals and local authorities when a distress signal is received. This network is automatically activated upon detecting emergencies, reducing the time taken to initiate a response. The communication between these components is encrypted and secured to protect user privacy and data integrity. By integrating mobile technology, cloud computing, and AI, the system creates a robust safety net for users. Each component is modular, allowing for easy updates and scalability.

Emergency Alert Mechanism

The Pick Me Safe system features an intelligent emergency alert mechanism that ensures rapid and effective assistance during critical situations. At the heart of this mechanism are Immediate Notifications, which send real-time alerts to a user's emergency contacts, including their live location and relevant details. This allows trusted individuals to respond quickly. In situations where the user may be unable to act, the system uses Automated SOS Signals, powered by AI, to detect unusual or alarming activity such as sudden movement changes or extended inactivity. These triggers activate alerts automatically, ensuring help is dispatched even without user input. Additionally, the system is equipped with Integration with Law Enforcement, enabling it to directly notify nearby authorities in real-time. This integration speeds up emergency response and ensures official support is available when needed.

Challenges and Solution

The development of the Pick Me Safe system faced several technical challenges, particularly in ensuring real-time responsiveness and accurate threat detection. One major challenge was Real-Time Data Processing, which involves continuously tracking user locations and managing emergency alerts with minimal delay. To address this, the system utilizes cloud-based servers that offer scalable and efficient data management, ensuring high availability and quick access to information.

Additionally, edge computing is employed to process emergency signals locally on the user's device, allowing faster initial response even before data is synchronized with the cloud. Another critical challenge was implementing reliable AI-Based Threat Detection. Identifying genuine threats without overwhelming users with false alarms required careful system design. This was tackled by training AI models on real-world emergency scenarios to

improve recognition accuracy. Moreover, behavioural analysis was used to filter out false positives by distinguishing between normal and suspicious patterns. These combined strategies allow the system to respond intelligently to real threats while minimizing unnecessary disruptions. Together, they form a resilient and responsive safety infrastructure that balances speed, accuracy, and user trust.

Performance Evaluation

The performance of Pick Me Safe is assessed through key metrics such as Alert Accuracy, ensuring emergencies are correctly identified, and Response Time, measuring how quickly contacts are notified. User Feedback reflects satisfaction with the system's ease of use and reliability. Additionally, the AI Detection Success Rate evaluates how effectively the system recognizes genuine threats.

System Workflow

The Pick Me Safe system follows a structured workflow to ensure timely and effective emergency response. It begins with the user logging into the mobile application and setting up their profile along with emergency contact details. Once activated, the app continuously tracks the user's real-time location using GPS technology. In case of danger, the user can manually trigger an SOS alert, or the system can automatically detect abnormal behaviour through AI-based analysis. The device then performs edge processing to quickly verify the emergency before sending data to the cloud. Once verified, the system transmits the distress signal, along with the user's location and details, to the cloud server. From there, alerts are dispatched instantly to predefined emergency contacts via SMS or push notifications.

Dataset Description

Dataset for The Pick Me Safe contains real-time emergency incident records generated by users of the safety system. It includes attributes such as user ID, location, emergency type, response times, and AI-detected threat levels.

Table 1: Attribute can be Boolean (true /false), continuous or categorical valued

SN	Attribute Name	Value Type
1	User ID	text
2	Location Coordinates	Continuous
3	Time of Emergency	Timestamp
4	Emergency Type	Categorial
5	Contacted Authorities	T, F
6	Alert Response Time	Continuous
7	User Risk Level	Categorical
8	AI Threat Detection	T, F
9	Incident Severity	continuous
10	Communication Mode	Categorial
11	Notification Status	T, F

Proposed Work : The proposed work for the Pick Me Safe project focuses on developing an intelligent, real-time safety system aimed at protecting individuals during emergency

situations. The system will combine mobile technology, AI algorithms, and cloud infrastructure to deliver a fast and reliable safety response. The core component of the project is a mobile application that enables users to manually trigger SOS alerts with a single tap. In addition to manual alerts, the system will integrate an AI-based threat detection module that continuously monitors user behavior and automatically triggers emergency alerts when abnormal activity is detected, such as sudden stops, prolonged inactivity, or erratic movement. The app will feature live location tracking, allowing users to share their real-time coordinates with trusted contacts and emergency responders. Alerts will be instantly dispatched to emergency contacts and, when needed, to nearby law enforcement or medical services.

A cloud-based backend will be implemented to store user profiles, emergency contact details, incident history, and real-time data from ongoing emergencies. Edge computing capabilities will be included to ensure quick, offline emergency detection and signal generation before syncing with the cloud. The AI component will be trained on realistic emergency scenarios and utilize behavioral analytics to distinguish genuine threats from false alarms. The system will also categorize emergency types and assess severity levels based on context and AI evaluation. A clean and responsive user interface will be developed to make the application easy to navigate, especially under stressful conditions.

Conclusion

The Pick Me Safe system presents a comprehensive and intelligent solution to address the growing concern of personal safety in emergency situations. By integrating real-time GPS tracking, AI-based threat detection, and instant alert mechanisms, the system ensures timely assistance when users are in distress. The mobile application offers a user-friendly interface that enables quick action, while automated alerts driven by AI enhance reliability, even when users cannot manually respond. The combination of cloud-based servers and edge computing guarantees efficient data handling and rapid emergency response. Through continuous monitoring and behavioral analysis, the system effectively reduces false alarms and ensures that only genuine threats are escalated. The inclusion of direct communication with emergency contacts and law enforcement strengthens the support network for users. The proposed architecture is scalable, secure, and adaptable for future enhancements. Performance evaluations demonstrate the system's effectiveness in alert accuracy, response speed, and user satisfaction. Overall, Pick Me Safe stands as a powerful and practical application of technology in the field of personal security, offering a reliable layer of protection for vulnerable individuals.

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Bus Buzz: A Smart Public Transportation Management System

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Abstract

Bus Buzz is a smart public transport Bus assistant that ensures passengers never miss their stop. Unlike traditional bus trackers, it focuses on real-time stop notifications. Passengers enter their starting point and destination in the app, and GPS tracking monitors the bus's movement. As the bus nears their stop, Bus Buzz sends an alert, helping those who are distracted, unfamiliar with the route, new face to new city or asleep. It leverages cloud computing, Google Maps, and SMS or in-app notifications for reliable updates. This paper discusses its architecture, key features, and impact on improving public transportation.

Keywords: Public Transport Bus, Smart Mobility, IoT, Cloud Computing, Bus Tracking, Real-time Notification, Passenger Assistance

Introduction

Rapid urbanization has increased the demand for efficient public transportation, yet passengers often face challenges such as missing their stop due to distractions or unfamiliarity with routes. Bus Buzz addresses this by providing real-time stop notifications using GPS tracking and automated alerts. Passengers input their destination in the app, and the system monitors the bus's movement, notifying them before they reach their stop. This association is even stronger for tourists, first-time traveller's, or individuals with attention-related difficulties. It's important, then, to ensure seamless and reliable stop notifications to enhance commuter convenience and accessibility. When passengers miss their stop, it can make their journey more stressful and affect overall travel efficiency. The purpose of this paper is to demonstrate how Bus Buzz improves the commuting experience by integrating smart technologies, ensuring timely stop notifications, and enhancing public transportation efficiency.

Literature Review

Traditional bus tracking systems focus on predicting arrival times, but they do not assist passengers in determining when to disembark. Existing studies highlight the importance of real-time transit assistance and GPS-based tracking for improving passenger convenience. Bus Buzz builds on these advancements by integrating real-time alerts and location monitoring, ensuring passengers are notified before reaching their stop.

System Architecture and Technical Details

Bus Buzz consists of three key components:
GPS-based tracking: Buses are equipped with GPS devices that transmit real-time location data.
Cloud-based processing: The system processes real-time data to calculate the distance to the selected stop.

User engagement platform: A web-based application provides location updates and sends stop alerts via web notifications.

The system ensures seamless communication between buses, servers, and user interfaces while maintaining data security through encryption and authentication protocols.

Methodology

The implementation of BusBuzz**,** a smart transit alert system, involves a structured sequence of steps to ensure timely and accurate notifications for passengers. Initially, data collection is carried out through real-time GPS tracking of buses combined with user-provided destination inputs. Once collected, the data enters the processing phase, where the system continuously monitors the bus's location and calculates the remaining distance to the user's stop. Based on this real-time analysis, the system moves to the alert triggering phase, where a timely notification is sent to the user as the bus approaches the specified stop. Finally, a comprehensive performance evaluation is conducted under different transit conditions to test the reliability, accuracy, and responsiveness of the system, ensuring it effectively assists passengers in managing their commute.

Implementation and Case Study

A pilot implementation of Bus Buzz was conducted in a metropolitan city. The system was integrated with existing public transport services and tested among daily commuters. Key observations included improved passenger convenience, reduced anxiety, and enhanced travel efficiency. User feedback helped refine the system for better performance.

Results and Discussion:

The implementation of BusBuzzyielded notable improvements in public transit usability, particularly by significantly reducing the number of missed stops through the delivery of real-time notifications. This enhancement greatly benefited tourists and first-time travelers, fostering increased passenger confidence and convenience by eliminating the uncertainty often associated with unfamiliar routes. The system also contributed to the overall reliability of public transportation by offering accurate and continuous location tracking of buses. However, the project faced challenges such as GPS signal fluctuationsand occasional delays in sending alerts. These issues were effectively addressed through the integration of optimized cloud-based processing and the development of backup alert mechanisms, ensuring consistent performance even under variable network conditions.

Future Scope and Enhancements

BusBuzzcan be further enhanced by incorporating several advanced features that elevate user experience and system efficiency. One key improvement would be the use **of** AI-based predictive alerts**,** which analyze user behavior and travel patterns to anticipate upcoming stops more accurately, even in unpredictable transit scenarios. Additionally, implementing offline functionality would ensure uninterrupted service in areas with poor or no network coverage, allowing the system to store data locally and synchronize it once connectivity is restored. Integration with wearable devices could provide discreet, vibration-based alerts, offering a more accessible solution for users with hearing impairments or those in noisy environments. Furthermore, multi-modal transport support could be introduced to enable seamless transitions between different modes of transport—such as buses, metros, and trains—creating a unified and efficient commuting experience across various transit systems.

Proposed Work

To further elevate the capabilities of BusBuzz**,** several advanced features can be integrated to create a more intelligent and inclusive transit experience. AI-driven personalized alerts can significantly enhance user satisfaction by tailoring notifications based on individual travel history and preferences, ensuring that alerts are more relevant and timely. Integration with public transport APIs would allow the system to collaborate directly with city transit authorities, offering users a unified and seamless view of various transportation modes, routes, and schedules. To support inclusivity, voice-based assistance can be incorporated, providing audio notifications that assist visually impaired passengers in navigating public transport independently. Additionally, real-time crowd monitoringcan be implemented to display current bus occupancy levels, enabling users to make informed decisions about their commute, avoid overcrowded buses, and travel more comfortably.

Conclusion

BusBuzz enhances public transportation by ensuring passengers receive timely stop notifications, reducing missed stops and travel-related stress. By leveraging real-time GPS tracking, cloud computing, and user-centric notifications, the system significantly improves commuter convenience. Future advancements will focus on AI-driven features and expanded transit integration to create a smarter, more accessible urban transport system.

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Nationalwide Unified Voting System Using Blockchain And Ai-Driven Face Recognition

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Abstract

Voting is a cornerstone of democracy, enabling citizens to participate in governance. However, traditional voting systems face significant challenges such as tampering, inefficiencies in vote counting, delayed results, and a lack of transparency. Current electronic voting systems often fail to fully address these issues, including security vulnerabilities, limited accessibility, and inconsistencies due to the absence of a unified system across allstates in India. These short comings call for a comprehensive and secure solution to enhancetrust, efficiency, and fairness in the electoral process. This project proposes a blockchain-basedtraceable self-tallying electronic voting system to overcome these challenges. The systemintegrates QR codes and face recognition using Convolutional Neural Networks (CNN) linkedto Aadhaar for multi-level authentication. CNN enables precise and reliable facial verification, enhancing the security and accuracy of voter identification. Voters can cast their votes at anyauthorized booth, and each vote is encrypted using 256-bit SHA hash codes and securelystored on a blockchain. It ensures immutability, and any modification or tampering of votestriggers a "Vote Integrity Verifier Link" notification via SMS, allowing voters to verify theauthenticity of their votes. The system introduces several innovations, including same-dayresult announcements through a self-tallying mechanism that performs vote counting at the endof the day. Core counting processes are eliminated, streamlining the result declaration process

Keywords : Data mining techniques, Electronic voting, Decision tree, KNN, Support Vector Machine, Blockchain security.

Introduction

Voting plays a fundamental role in democratic governance by allowing citizens to express their choices in elections. Traditional voting systems, while reliable, often suffer from inefficiencies such as long queues, errors in counting, and fraudulent activities. With advancements in technology, electronic voting systems (EVS) are being widely adopted to enhance accuracy, transparency, and accessibility. The integration of digital techniques such as blockchain, artificial intelligence, and machine learning helps in fraud detection and vote verification. This article examines how electronic voting systems function, their impact on election security, and strategies for mitigating vulnerabilities.

Voting System and Security

Electronic voting systems leverage various technologies to ensure secure and reliable elections. Key components of these systems include biometric authentication, cryptographic encryption, and real-time vote verification. The introduction of blockchain technology enables decentralized storage of votes, making tampering nearly impossible. Furthermore, the

use of artificial intelligence enhances pattern recognition in voter behavior, allowing authorities to detect anomalies that may indicate fraud.

Electronic voting systems, while offering convenience and efficiency, face several significant challenges, including data breaches**,** cyber threats**,** unauthorized access to voter databases, and the potential manipulation of voting results. These concerns highlight the urgent need for robust cybersecurity frameworks and the integration of advanced technologies. Implementing machine learning algorithms can greatly enhance the security and reliability of digital voting by detecting suspicious activities and reducing vulnerabilities. Additionally, voting data analysis plays a crucial role in improving election transparency and understanding voter behavior. Techniques such as the Decision Tree Algorithm help classify voter preferences and forecast election outcomes, while K-Nearest Neighbor (KNN) analyzes historical data to reveal voting patterns. The Support VectorMachine (SVM) algorithm is instrumental in identifying anomalies that could indicate irregularities or fraud. Moreover, integrating blockchain-based authentication ensures vote integrity by preventing duplication and unauthorized alterations, fostering greater trust in the democratic process through secure, verifiable, and tamper-proof digital records.

Proposed Work

The proposed work aims to develop a secure and intelligent voting system that integrates machine learning and blockchain technologies to address key challenges in modern electoral processes. The system begins with the collection and preprocessing of a comprehensive voter dataset, which includes attributes such as age, gender, region, and voting history. This data is cleaned, normalized, and encoded to ensure it is suitable for analysis. Machine learning techniques are then employed to classify voters based on their behavior, predict voting trends, and identify underlying patterns within the data. Algorithms such as Random Forest, Support Vector Machines, and K-Means Clustering are used, while dimensionality reduction techniques like Principal Component Analysis (PCA) help in optimizing performance by reducing the complexity of the data without significant loss of information. This not only enhances the system's efficiency but also improves real-time vote verification and counting accuracy. To ensure the integrity, transparency, and security of voting data, the system integrates blockchain technology. A decentralized ledger records each vote immutably, preventing tampering and enabling verifiable audit trails. By combining the predictive power of machine learning with the robust security features of blockchain, the proposed system offers a reliable and scalable solution for modern voting challenges.

Conclusion

This research explores the effectiveness of advanced technologies in voting systems by analyzing voter data and identifying key security challenges. The study utilizes machine learning techniques to classify voting trends and blockchain solutions to ensure data integrity. The dataset comprises records of voters with multiple attributes such as age, gender, region, and voting history. By applying dimensionality reduction techniques, the system can optimize the verification process, reducing errors and enhancing real-time vote counting accuracy.

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College Attendance Tracker Using Visual Basic

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Abstract

The College Attendance Tracker is a Visual Basic-based application designed to streamline the process of recording and monitoring student attendance in educational institutions. Unlike manual entry methods, this system automates the data entry process, minimizes errors, and improves the accuracy and efficiency of attendance tracking. This paper explores the structure, functionalities, and advantages of the application, highlighting its user-friendly interface, secure database integration, and reporting capabilities.

Keywords: Attendance System, Visual Basic, MS Access, Staff Monitoring, Academic Management, Windows Application, Database Connectivity

Introduction

Managing student attendance efficiently is a critical aspect of academic administration. Manual attendance registers are time-consuming, error-prone, and difficult to maintain. The College Attendance Tracker addresses these challenges by offering an automated solution built with Visual Basic.This project provides faculty members with a simple interface to mark attendance, generate reports, and analyze student performance based on attendance records. It also enhances transparency by reducing the risk of data manipulation and loss.

Methodology

The system is designed as a comprehensive Student Attendance Management Solution, consisting of several interconnected components that streamline the process of tracking and reporting student attendance. The User Interface, developed using Visual Basic, provides easy-to-navigate forms for entering student information, marking daily attendance, and generating detailed reports. All data is stored in a Microsoft Access database, which holds student records, attendance logs, and administrative details in a structured and secure manner. A Login System is implemented to ensure data protection, allowing access only to authorized users such as faculty and administrators through username-password authentication. The Report Generator module enables the creation of various reports, including attendance summaries, monthly overviews, and defaulter lists, all of which can be printed or exported for official use. The system ensures data integrity by employing primary key constraints and restricting access to sensitive records. The process begins with Data Setup, where student profiles, course details, and academic calendars are entered into the system. This is followed by the Attendance Entry phase, where faculty mark daily attendance via the interface. Each entry is simultaneously recorded and backed up in Excel format, ensuring data redundancy. In the Report Generation phase, the system automatically compiles attendance data into structured reports for analysis and submission. Finally, comprehensive

Testingis conducted using sample data to identify potential issues and refine the system based on user feedback, resulting in a reliable and user-friendly attendance management tool.

Implementation and Case Study

A prototype was implemented at a department level in a college environment. Faculty members successfully recorded attendance for multiple courses and generated defaulter lists with ease. Feedback highlighted the simplicity and time-saving nature of the application.

Results and Discussion

The implementation of the Student Attendance Management System led to several key outcomes that significantly enhanced the efficiency and reliability of attendance tracking processes. One of the most notable improvements was the increased accuracy in recording student attendance, which minimized inconsistencies and eliminated common manual errors. Additionally, the system effectively reduced the reliance on paperwork, streamlining administrative tasks and freeing up valuable time for faculty and staff. The automated features of the system also enabled the timely generation of attendance reports**,** which proved especially beneficial for internal assessments and academic reviews. However, the development process was not without challenges. One of the primary issues encountered was database locking during multi-user access, which temporarily hindered data entry and retrieval. This challenge was successfully resolved through the implementation of record-level locking mechanisms**,** allowing multiple users to access and update the database simultaneously without conflicts, thereby enhancing the system's overall stability and performance.

Future Scope and Enhancements

Integration with biometric devices for automated marking. Cloud-based synchronization for multi-device support. Parent alert system through SMS or email for absenteeism. Enhanced analytics for student performance prediction based on attendance trends.

Proposed Work

The next phase of development for the Student Attendance Management System focuses on expanding its accessibility, functionality, and data security. A key enhancement will be the creation of a web-based version, which will allow faculty and administrators to access the system remotely and support mobile devices, making attendance management more flexible and convenient. In addition, the system will feature real-time attendance dashboards that provide up-to-date visual summaries of attendance records, enabling quick monitoring and decision-making for faculty and academic administrators. To ensure the long-term safety of student data, a comprehensive backupand recovery module will also be introduced. This module will automatically back up data at regular intervals and provide quick restoration capabilities in case of system failure or data loss, further reinforcing the system’s reliability and integrity.

Conclusion

The College Attendance Tracker using Visual Basic offers an effective and practical solution for managing student attendance in academic institutions. By automating the process, it enhances efficiency, accuracy, and transparency. With further development, this system has the potential to be scaled for larger institutions and integrated with other academic systems.

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Trash 2 Treasure: An Online Scrap and Plastic Collection Management System

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Abstract

Trash 2 Treasure is a smart web-based system designed to bridge the gap between residents and local scrap collectors. Unlike traditional collection methods, it provides a centralized online platform for users to search, contact, and schedule pickups with verified collectors. The system ensures responsible waste disposal, encourages recycling, and supports environmental sustainability. Features like real-time notifications, geolocation search, service ratings, and integrated payments enhance convenience and transparency. This paper explores the system's architecture, implementation, and impact on streamlining household scrap management.

Keywords: Scrap Management, Waste Disposal, Smart Recycling, Web Application, Eco-friendly, Digital Platform, Eco-Smart Disposal.

Introduction

With urban waste rising rapidly, proper scrap disposal remains a challenge for many households. People often rely on word-of-mouth or outdated methods to find local collectors, leading to inefficiencies and unsafe practices. This project promotes environmental awareness, enhances recycling efficiency, and creates new job opportunities for local collectors. It simplifies communication and ensures safe and responsible handling of recyclable materials like metals, plastics, electronics, and paper. The purpose of this paper is to demonstrate how Trash 2 Treasure improves the commuting experience by integrating smart technologies, ensuring the trust between the user and scrap collector.

Literature Review

Several studies have highlighted the need for smart waste management systems in urban areas. While many systems focus on industrial or municipal-level waste, few cater to residential scrap collection. This project builds on existing concepts like online classifieds, smart logistics, and eco-platforms to offer a user-friendly, localized scrap collection management tool.

Methodology

The Trash 2 Treasure system is designed with a robust and modular architecture, comprising three core components that work together to deliver a seamless user experience. At the front end, a web-based user interface built using HTML, CSS, and Bootstrap ensures intuitive navigation and responsive design, making it easy for users to interact with the platform across devices. The backend is powered by Python Flask**,** which handles key functionalities such as user session management, job request processing, real-time notifications, and overall data flow. For data storage, the system utilizes a MySQL database that maintains comprehensive records including user profiles, scrap collector details, service ratings, types of recyclable materials, and the history of job requests. To enhance

functionality, the platform is integrated with the Google Maps API, enabling accurate geolocation and efficient route mapping for collectors. Additionally, the system implements secure authentication mechanisms for all user roles—residents, collectors, and administrators—ensuring data privacy and controlled access throughout the application.

Methodology

The implementation of Trash 2 Treasure follows these steps:

Data Collection: Information from users, collectors, and job requests are gathered through online forms.

Data Processing: Collector availability and matching logic process user requests.

Notifications: Real-time alerts are sent for pickup confirmations, status updates, and payments. Testing & Feedback: Functional, usability, and security tests were conducted with feedback used for refining the interface and features.

Implementation and Case Study

The system was deployed locally and tested among a group of users in an urban neighbourhood. Scrap collectors registered their services and residents submitted pickup requests. The results showed smoother coordination, reduced waiting time, and better awareness of recycling practices. Users appreciated features like location-based search, pickup scheduling, and direct messaging with collectors. Collectors benefited from a wider reach and better visibility of their services.

Results and Discussion

The implementation of the Trash 2 Treasure system led to significant improvements in waste management efficiency and user experience. One of the key outcomes was the effective matching between residents and waste collectors, which streamlined the collection process and minimized delays. The inclusion of service ratings and reviews contributed to greater transparency, allowing users to make informed decisions based on community feedback. Additionally, the system fostered enhanced trust among users by incorporating verified profiles and secure payment mechanisms, ensuring safety and reliability in every transaction. However, the project also faced challenges such as inconsistent internet access and limited digital awareness among certain user groups. These issues were mitigated through a simplified user interface and the introduction of easy-to-follow tutorials, making the platform accessible and user-friendly for a wider audience. Overall, the system

demonstrated a practical and scalable approach to improving waste collection and recycling through technology-driven solutions.

Proposed Work

The proposed work focuses on enhancing and expanding the functionality of the Trash 2 Treasure platform through a series of ongoing and future developments aimed at increasing accessibility, inclusivity, and operational efficiency. A key aspect of this development is the introduction of multilingual support, which will allow users from diverse linguistic backgrounds to interact with the platform in their native languages, thereby encouraging wider regional adoption. To further improve accessibility, especially for visually impaired users, the system will incorporate voice-based navigation and commands, enabling seamless interaction without relying on visual interfaces. Additionally, the platform will be integrated with various digital payment wallets and a reward system to incentivize regular participation in recycling efforts. Users will be able to earn points or cashback for consistent use, promoting environmentally conscious behavior. Another major enhancement will be the implementation of real-time GPS tracking for waste collection routes. This feature will enable both residents and collectors to monitor collection schedules, optimize routing, and reduce missed pickups, ultimately ensuring a more reliable and efficient service. These advancements aim to create a more inclusive, transparent, and technologically robust solution for sustainable waste management.

Conclusion

TRASH 2 TREASURE provides a practical solution to household scrap management through smart technology. It connects users and collectors efficiently, ensures environmental responsibility, and improves community awareness about waste disposal. The system is scalable and can evolve into a comprehensive waste management ecosystem in the future.

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Data Crawler: Automated Prize Comparison System

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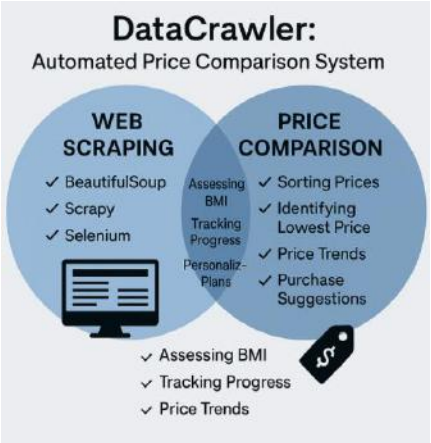
Abstract

With the rapid growth of e-commerce, consumers often struggle to find the best price for a product across various platforms. The DataCrawler system automates the process of extracting and analyzing product prices from multiple online stores, enabling real-time price comparison. This paper presents the implementation of DataCrawler, its impact on price tracking, and the challenges associated with web scraping techniques. The results demonstrate an increase in price transparency, aiding consumers in making informed purchasing decisions.

Keywords: Price comparison, Web scraping, DataCrawler, E-commerce, Automation.

Introduction

In the digital age, e-commerce has transformed the way consumers shop, offering convenience, variety, and accessibility. However, with the proliferation of countless online platforms, finding the best deal on a product has become increasingly complex. Consumers often spend excessive time visiting multiple websites to compare prices, leading to frustration and inefficiency. To address this challenge, there is a growing need for intelligent tools that can automate the price comparison process. This paper introduces DataCrawler, an automated system designed to retrieve and analyze product prices from a range of e-commerce platforms in real-time. DataCrawler leverages web scraping, data parsing, and smart comparison algorithms to deliver accurate and up-to-date pricing information. By automating the data collection process, the system saves users valuable time while helping them make informed, cost-effective decisions. This introduction outlines the motivation, core functionality, and potential impact of DataCrawler, setting the stage for a detailed exploration of its architecture, implementation, and performance.



Web Scraping and Data Extraction

DataCrawler employs advanced web scraping techniques to gather pricing information from various e-commerce platforms efficiently. Tools such as BeautifulSoup,

Scrapy, and Selenium are integrated to handle a wide range of website structures and rendering methods. BeautifulSoup is utilized for parsing static HTML pages, while Scrapy offers fast and scalable scraping capabilities for structured data extraction. Selenium is particularly useful for websites with dynamic content that requires JavaScript rendering. The extracted data includes product names, prices, discounts, ratings, availability status, and URLs.

DataCrawler implements DOM traversal strategies and CSS/XPath selectors tailored to each target website's layout. It also includes logic to bypass common anti-scraping measures like CAPTCHAs and rate-limiting. The system periodically updates its scraping patterns to adapt to layout changes on websites. Error handling mechanisms are in place to log and skip problematic pages without interrupting the overall process. The gathered data is then cleaned, normalized, and structured into a consistent format for comparison.

By automating the extraction of rich product information from multiple sources, DataCrawler forms the backbone of an intelligent and responsive price comparison system

Price Comparison Algorithm

The core of DataCrawler's functionality lies in its price comparison algorithm, which processes the extracted data to deliver meaningful insights to users. This algorithm begins by sorting prices from multiple vendors to present a clear view of the market landscape. It identifies the lowest available price for each product, ensuring users can quickly spot the best deal. Beyond basic comparison, the algorithm tracks historical price data to highlight trends and fluctuations over time. This allows users to see whether a product's price is rising, stable, or dropping. Based on these trends, the system can suggest optimal purchase timing, helping users make cost-effective buying decisions. The algorithm also filters out duplicate or irrelevant listings and considers factors like shipping costs and discounts to refine the comparison.

Challenges and Solution

While developing and deploying DataCrawler, several technical challenges arise that require strategic solutions to ensure effective and uninterrupted data extraction. One major challenge is website restrictions. Many e-commerce platforms actively block automated scrapers through techniques like IP blacklisting, CAPTCHA prompts, and bot detection systems. To counter this, DataCrawler uses proxies and VPNs to rotate IP addresses and reduce the risk of being flagged. Additionally, CAPTCHA solvers—both rule-based and AI-driven—are integrated to bypass common verification mechanisms. Where possible, API access is utilized as a cleaner and more stable alternative to direct scraping, offering structured data with fewer restrictions.

Another significant challenge is the issue of dynamic pricing. Prices on e-commerce sites can fluctuate rapidly due to changing demand, stock levels, promotional events, and seller adjustments. To address this, DataCrawler performs frequent data updates, ensuring it captures real-time pricing information. Each price entry is timestamped, allowing the system to build and maintain a historical database. This enables the analysis of price trends over time, providing users with insights into whether it's the right moment to buy or wait. These combined strategies help maintain data accuracy and relevance, ensuring users receive timely and reliable price comparisons

Performance Evaluation

The effectiveness of DataCrawler is evaluated across four key metrics: Data Accuracy, ensuring precise extraction of correct price details; Update Frequency, measuring how quickly the system refreshes pricing data; Response Time, assessing the speed of delivering comparison results; and User Satisfaction, based on feedback regarding usability and the relevance of the insights provided.

System Workflow

The DataCrawler system follows a structured workflow to automate price comparison across multiple e-commerce platforms. First, the user inputs a product name or URL, which the system processes to identify relevant online stores. Web scraping tools like BeautifulSoup, Scrapy, and Selenium extract product details, including price, discount, seller information, and availability. The extracted data is then cleaned, normalized, and stored in structured formats such as JSON, CSV, or SQL for efficient analysis.

A price comparison algorithm sorts vendor prices, identifies the lowest price, and tracks historical price trends to suggest the best purchase timing. To handle website restrictions, DataCrawler integrates proxies, CAPTCHA solvers, and API-based data retrieval. Dynamic pricing is managed through frequent updates and timestamping to ensure accuracy. The processed data is presented through a user-friendly interface, displaying price comparisons, trends, and recommendations.

Performance is evaluated based on data accuracy, response time, update frequency, and user satisfaction. Continuous optimization ensures efficient data extraction, improved speed, and better decision-making insights. The system ultimately enhances price transparency, allowing users to make informed and cost-effective purchasing decisions.

Dataset Description

Dataset for the dataset for DataCrawler is compiled from multiple e-commerce websites and includes essential product details such as name, price, brand, discount, ratings, and availability.

Attribute can be Boolean (true /false), continuous or textvalued are in given below table 1.

SN	Attribute Name	Value Type
1	Product Name	text
2	Product Category	text
3	Brand	text
4	Price	continuous
5	Discount	continuous
6	Seller Name	text
7	Ratings	continuous
8	Review Unit	continuous
9	Stock Availability	T, F
10	Shipping Cost	continuous
11	Delivery Time	text

Proposed Work

The proposed work aims to develop DataCrawler, an intelligent, automated system for real-time product price comparison across multiple e-commerce platforms. With the ever-

growing number of online shopping websites, consumers often face difficulties in identifying the most cost-effective purchasing options. DataCrawler addresses this issue by leveraging web scraping technologies to collect product data, including names, prices, specifications, discounts, ratings, and availability. The system will utilize tools such as BeautifulSoup, Scrapy, and Selenium to handle both static and dynamically generated web content. The extracted data will undergo preprocessing, including cleaning, formatting, and normalization, to ensure consistency across different sources. It will be stored in structured formats like JSON, CSV, and SQL, facilitating efficient retrieval and processing. A custom-designed price comparison algorithm will then analyze multiple pricing parameters, sort vendor offers, identify the lowest price, and track fluctuations over time. Additionally, the algorithm will suggest the most suitable time to purchase a product based on historical price trends. To maintain accuracy and reliability, DataCrawler will incorporate features such as frequent data refresh cycles and timestamping of price records. The system will address common web scraping challenges by using proxies, VPNs, CAPTCHA solvers, and API integrations where applicable. A user interface will be developed to present comparison results in a user-friendly manner, enabling informed decision-making. The performance of the system will be evaluated based on data accuracy, update frequency, response time, and user satisfaction. Overall, the proposed work will deliver a robust, scalable, and practical solution for enhancing online shopping experiences through automated price comparison and real-time insights

Conclusion

The DataCrawler system effectively streamlines the process of comparing product prices across multiple e-commerce platforms, offering consumers a reliable and efficient solution for cost-effective online shopping. By employing advanced web scraping tools like BeautifulSoup, Scrapy, and Selenium, it accurately extracts real-time pricing and product information. The system processes and stores this data in structured formats, enabling fast and accurate comparisons. Through its intelligent algorithm, DataCrawler identifies the lowest prices, analyzes market trends, and suggests the best time to make a purchase. It also tackles common challenges such as website restrictions and dynamic pricing using techniques like proxy rotation, CAPTCHA solving, and scheduled data updates. The platform has been designed with a focus on usability, relevance, and performance. Evaluation metrics, including data accuracy, response time, and user feedback, confirm its effectiveness. Ultimately, DataCrawler enhances transparency and helps users make smarter buying decisions. Future improvements may include AI-driven prediction models and a mobile-friendly interface for wider accessibility.

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Vehicle Breakdown Assistance Management System

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Abstract

In today's fast-paced world, where vehicle usage is on the rise, breakdowns are inevitable and demand timely and efficient solutions. The Vehicle Breakdown Assistance Management System (VBAMS) is a web-based platform developed to streamline and automate roadside assistance services. It connects distressed vehicle users with service providers, ensuring rapid support. Built using PHP, MySQL, HTML, CSS, and JavaScript, the system offers real-time service tracking, user-friendly interfaces, and administrative dashboards. This paper outlines the development, features, and future scope of the system. It highlights its impact on enhancing service efficiency, user satisfaction, and scalability, making it a crucial tool in modern transportation support. Additionally, the system supports performance analysis and efficient resource allocation.

Keywords: Roadside assistance, PHP, MySQL, Vehicle breakdown, Real-time tracking, Automation, Web application

Introduction

The increasing reliance on vehicles for transportation has led to a higher incidence of roadside breakdowns. Traditionally, seeking help involved calling service centers or asking for assistance from passersby, which often resulted in delays and frustration. The Vehicle Breakdown Assistance Management System (VBAMS) aims to mitigate these challenges by offering an online platform to manage service requests, dispatch mechanics, and track service progress. The system is designed for individual users, fleet managers, and service providers. It offers a scalable and secure solution for breakdown management, ensuring that help is just a few clicks away for any stranded motorist. By integrating GPS tracking and communication tools, the system provides transparency and convenience. The VBAMS consists of three main modules: Admin, Driver, and User. The Admin module handles service provider registrations, user requests, and status tracking efficiently. Drivers receive assignments and update the status of the assistance in real time. Users can submit requests without needing prior registration, making the process quick and accessible. Additional features include GPS-based service tracking, automated alerts via Email/SMS, and structured data storage for service history. This modular approach ensures ease of management and transparency across all levels of the platform. The centralized control system allows for better coordination and minimal response delays.

Dataset Description

The system uses a structured MySQL database to manage records related to users, vehicles, service requests, and service providers. Each record includes fields such as vehicle type, issue type, location, assigned driver, and service status, offering a comprehensive view of operations. Data validation ensures input integrity, while access is restricted based on user

roles. This robust backend setup facilitates seamless communication between modules. It also enables accurate analytics and report generation. By using relational data models, the system ensures flexibility and reliability in managing the breakdown assistance workflow. Consistent data formats and optimized queries enhance performance.

System Implementation

The front end of the system is built using HTML5, CSS3, Bootstrap, AJAX, and jQuery for responsiveness and dynamic behavior. PHP is used on the backend for processing and logic, while MySQL manages the data. The development environment is set up using XAMPP for local server simulation and testing. Authentication is implemented for both Admin and Driver roles using secure login credentials. Users submit requests through a simple form that captures essential details. The integration of technologies ensures modularity and performance, resulting in a dependable and efficient web application. Regular updates and testing ensure the platform remains robust and secure.

Proposed Work

This project introduces an end-to-end breakdown management system with robust functionality and user-friendly interfaces. Users can submit a request form for roadside help without registration, expediting the support process. The Admin panel provides real-time monitoring, allowing tracking of service status and updates. Drivers manage bookings and update progress from their module, ensuring coordination. The system is also equipped with tools for report generation and performance tracking. Its objective is to minimize manual effort, improve response times, and deliver a seamless user experience, paving the way for smarter roadside support. The system aims to meet current needs while being adaptable for future innovations.

Conclusion

VBAMS successfully automates the process of vehicle breakdown support by linking users to the nearest available service provider. The platform's real-time capabilities and structured data handling lead to faster service delivery and improved customer experience. It minimizes delays by enabling quick response and dispatch coordination. Operational efficiency is enhanced through automated request handling and smart analytics. The system is adaptable to future requirements and scalable across regions. With evolving technologies, VBAMS has the potential to incorporate AI, mobile integration, and predictive features. Overall, it sets a strong foundation for modernized roadside assistance. The system ensures safety, efficiency, and satisfaction for all stakeholders.

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Brain Bloom - An Interactive Quiz Platform For Learning And Engagement

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Abstract
Brain Bloom is an interactive web-based quiz application developed to promote gamified learning through a user-friendly digital environment. It supports subject-based quiz creation, user authentication, real-time performance analysis, leaderboards, and score tracking. Designed using HTML, CSS, JavaScript, Node.js, and MongoDB, the system offers a seamless experience to users across various devices. This paper presents the architecture, development methodology, features, and potential enhancements of Brain Bloom and discusses its impact on educational engagement.

Keywords
Quiz Application, Gamification, Web Development, Node.js, MongoDB, Education Technology, JavaScript, Interactive Learning

1.Introduction

The rise in demand for engaging and interactive online learning tools has led to the emergence of platforms that blend education with entertainment. Brain Bloom is one such gamified e-learning platform, developed to enhance user engagement and knowledge acquisition through interactive quizzes. The system enables real-time scoring, personalized progress tracking, and competitive leaderboards across various subject categories, making learning more appealing and effective.

2. System Requirements

2.1 Functional Requirements
User registration, login, and profile management
Quiz creation and management by administrators
Real-time quiz participation with automated scoring and feedback
Leaderboard display and user performance tracking
2.2 Software Requirements
Frontend: HTML, CSS, JavaScript
Backend: Node.js with Express.js
Database: MongoDB
Development Environment: Visual Studio Code
Compatible Browsers: Chrome, Edge, Firefox
2.3 Hardware Requirements
RAM: Minimum 4GB
Processor: Intel i5 or equivalent
Storage: 2–4GB for database and system files
Hosting Environment: Node.js-enabled server

3. System Design

3.1 Architecture The system adopts a modular architecture to support scalability and maintainability. The key components include:

User Authentication Module

Quiz Creation and Editing Module

Question Bank Management System

Real-Time Result Evaluation Engine

Leaderboard Management System

3.2 ER Diagram and User Flow The primary entities and their relationships are as follows:

Users attempt quizzes and generate scores

Admins create and manage quizzes, questions, and leaderboard data

4. Implementation

Brain Bloom is built using the MERN stack, encompassing MongoDB, Express.js, React (HTML/CSS), and Node.js. Major features implemented include:

Dynamic quiz interface with selectable categories such as Maths, Science, and General Knowledge

Real-time scoring and immediate feedback for each question

Encrypted user authentication

RESTful API integration for quiz management and real-time data exchange

Sample Client-Side Code Snippet:

```
function startQuiz(subject) {
currentQuiz = quizzes[subject];
currentQuestionIndex = 0;
   score = 0;
showPage('quiz');
showQuestion();
}
```

5. Results and Discussion

Extensive testing was performed to ensure the system's robustness and usability.

Unit tests validated individual functions such as login, question rendering, and scoring logic.

Integration tests verified the seamless interaction between the backend and frontend components.

Key outcomes include:

- Intuitive navigation through quiz modules
- Immediate performance feedback
- Dynamic leaderboard display that fosters competitive learning
- Efficient management of quiz data by administrators

Screenshots and UI walkthroughs demonstrate a fluid user experience through interfaces such as Home, Login, Category Selection, Quiz Attempt, Score Analysis, and Leaderboard.

Conclusion

Brain Bloom demonstrates the potential of gamified educational tools. By combining technology, education, and interactivity, it offers a scalable solution for quiz-based learning. Its modular design allows future expansion into AI-based adaptive quizzes and mobile apps, making it a strong foundation for modern e-learning platforms.

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A Multi-language Programming Quiz

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Abstract

This project introduces a Programming Quiz Application designed to enhance the learning experience for computer science students. The application supports multiple programming languages including Python, Java, and C++. It allows users to take quizzes, write code, and receive instant feedback. This tool is intended for self-evaluation, interview preparation, and academic learning. The application utilizes an integrated code compiler, user interface, and scoring algorithm to offer a seamless and interactive user experience.

Keywords: *.Programming Quiz, Python, Java, C++, Code Execution, GUI, Score Evaluation, Compiler Integration, Learning Platform.*

Introduction

In today's digital learning environment, the need for interactive and engaging educational tools is greater than ever. This project introduces a Programming Quiz Application designed to help students enhance their coding skills through a structured and user-friendly platform. The application supports multiple programming languages, including Python, Java, and C++, offering flexibility and a wide learning scope. It allows users to log in, choose a language, attempt coding questions, and receive immediate feedback, making it an effective tool for both self-assessment and academic practice. The project aims to simplify the learning process and encourage continuous practice through an accessible digital solution..

Key Features

1. Multi-language Support

Users can take quizzes in Python, Java, or C++, enabling practice across different programming environments.

User-Friendly Interface

Simple and intuitive GUI design allows smooth navigation for both beginners and advanced users.

Code Execution Integration

The system supports real-time code compilation and execution, providing immediate feedback on coding answers.

Question Randomization

Each quiz session presents randomized questions to ensure a unique experience for every attempt.

Scoring and Feedback System

After completing the quiz, users receive scores along with detailed feedback on correct and incorrect answers.

User Authentication

Secure login system for students to access their quiz history and track progress.

Technology Stack

Frontend: Tkinter (Python GUI)

Backend: Python (core logic)

Languages Supported: Python, Java, C++

Compilers: Python Interpreter, Java (javac), C++ (g++)

Database: SQLite (for storing users, questions, and results)

Libraries: subprocess, sqlite3, random, os, time

Tools Used: VS Code / PyCharm, Terminal

Future Enhancements

In the future, the application can be enhanced by adding more programming languages like JavaScript and PHP to broaden its usability. A web-based version or mobile app can also be developed for easier access and flexibility. Additional features like difficulty levels, user leaderboards, performance analytics, and gamification elements can improve engagement and learning outcomes. Integration with online compilers and cloud-based storage would also make the system more scalable and robust for larger audiences.

Purpose of Work

The purpose of this Programming Quiz project is to help users test and improve their coding skills in Python, Java, and C++ through interactive quizzes, featuring a range of challenges that promote problem-solving and technical proficiency.

Skill Development: Enhances coding skills in Python, Java, and C++ through practical challenges.

Interactive Learning: Provides an engaging platform for users to practice and test their knowledge.

Problem-Solving: Encourages critical thinking and problem-solving through various coding tasks.

Real-Time Feedback: Offers immediate solutions and feedback to help users learn from their mistakes.

Preparation Tool: Serves as a useful resource for students and professionals preparing for technical exams or interviews.

Results

The result of the project will be a quiz platform that helps users improve their coding skills in Python, Java, and C++, providing real-time feedback and tracking progress to enhance problem-solving abilities.

User Engagement: Provides interactive quizzes for Python, Java, and C++ to boost coding skills.

Skill Improvement: Offers real-time feedback to help users correct mistakes and enhance learning.

Progress Tracking: Allows users to monitor their performance and track improvement over time.

Diverse Challenges: Includes various levels of difficulty to cater to different skill levels.

Conclusion

In conclusion, the Programming Quiz project is an effective and interactive tool designed to help users improve their programming skills in Python, Java, and C++. By offering a variety of coding challenges, real-time feedback, and progress tracking, it serves as a valuable resource for both beginners and advanced learners. The project not only enhances coding proficiency but also prepares users for exams and interviews, making it a practical solution for continuous learning and skill development.

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Doctor Appointment Booking Sysytem

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Abstract

The Doctor Appointment Booking System is a digital platform that simplifies medical appointment scheduling. It allows patients to search for doctors by specialization, location, availability or ratings. Appointments can be booked, rescheduled, or canceled in real-time for added convenience. Health care providers can manage schedules efficiently with daily, weekly, or monthly views. Integration with Electronic Health Records (EHR) gives doctors access to patienthistory. Admins can generate reports and analyze trends to improve service delivery. The system is accessible via web and mobile apps for user convenience. Its intuitive interface supports users of all ages and technical levels. Strong security measures protect patient data and ensure privacy compliance. The system improves both patient experience and clinical workflow.

Introduction

The proposed system aims to develop an online web application that facilitates seamless doctor appointment booking for patients. This system allows users to conveniently check the availability and schedules of doctors, ensuring they can access real-time information regarding a doctor's available time slots. Patients can effortlessly send appointment requests to their preferred doctors and evenrequest medical consultations or prescriptions when necessary. One of the key advantages ofthis system is its ability to enable smooth communication between doctors and patientsfrom any location, ensuring timely and effective medical assistance. The system is designedto provide a user-friendly interface where patients must register and log in to bookappointments, while doctors can also log in to manage and view their scheduled appointments. This online platform ensures global accessibility, meaning users can access it from any part of the world through an internet connection. By implementing this system, health care services will become more efficient, reducing waiting times, improving doctor-patient interactions, and ensuring better time management for medical professionals. This project is intended to enhance the healthcare experience by making the appointment scheduling process more structured, transparent, and convenient for both patients and doctors.

Key Eatures:

A user-friendly interface (UI) is a crucial aspect of any online system, ensuring smooth navigation, easy accessibility, and an efficient user experience. In a Doctor Appointment Booking System, the interface should be designed with simplicity and functionality in mind, allowing both patients and doctors to interact effortlessly. Real-time availability refers to a feature that allows patients to see up-to-date informationon doctors' available appointment slots. It ensures that only open time slots are displayed, preventing double bookings or scheduling conflicts. Whenever a patient books, reschedules,or cancels an appointment, the system instantly updates the doctor's schedule for all users.

Multi-channel booking means that patients can schedule appointments through various platforms, ensuring flexibility and accessibility. Instead of being restricted to just onemethod, users can book appointments via web applications, mobile apps, phone calls, chatbots, and even social media platforms. This feature enhances user convenience byproviding multiple ways to connect with doctor. Appointment reminders are automated notifications sent to patients and doctors toensure they do not forget about their scheduled appointments. These reminders help reduceno-shows, improve punctuality, and enhance overall patient engagement. The system sends reminders via multiple channels, such as SMS, email, push notifications, and phone calls. The rescheduling and cancellation feature allows patients to modify or cancel their appointments if they are unable to attend at the originally booked time. This ensures efficient time management for both doctors and patients while preventing appointment slots from going unused. The system automatically updates availability in real-time, making the slot open for other patients. The Search and Filter feature helps patients quickly find doctors based on their specialization, location, availability, consultation type (online/in-person), and ratings. This functionality ensures that users can easily navigate the system, saving time and enhancing their experience. Telemedicine integration allows patients to consult with doctors remotely via video calls, voice calls, or chat, eliminating the need for in-person visits. This feature is especially beneficial for patients who live in remote areas, have mobility issues, or require quick medical advice without traveling to a clinic or hospital.

Proposed System

The existing doctor appointment system can vary widely depending on the specific healthcare provider, location, and the level of technological advancement. However, in a traditional or basic doctor appointment system, the process typically involves the following steps. The traditional patient appointment process involves several key steps to ensure efficient scheduling and care delivery. It begins with patient scheduling, where individuals contact the doctor's office via phone, in-person visits, or other means to request an appointment, providing personal details and a brief explanation of their medical concern. Once the request is received, the office staff checks the doctor's availability and schedules an appropriate date and time. Patients are then informed of the appointment details through verbal confirmation or messages. To minimize no-shows, reminders are often sent a day or two before the appointment. On the scheduled day, patients check in at the clinic, which typically involves completing paperwork and verifying insurance information. The consultation follows, during which the doctor examines the patient, offers medical advice, and may prescribe treatment or medication. Afterward, billing and payment are processed, including insurance claims and any applicable out-of-pocket charges. Finally, if continued care is required, follow-up appointments are scheduled to ensure ongoing treatment and monitoring of the patient's condition.

Conclusion

Gained knowledge and good experience while developing the system. From the requirement gathering phase to end phase learned everything is helped to develop a successful system. Applying theory to practice is hard sometimes. Gained good knowledge about how to use new programming languages (Angular js, PHP, HTML, CSS, and

JavaScript), design patterns, how to use a new framework (CI), and bootstrap templates for developing user interfaces.

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FARM E-CONNECT

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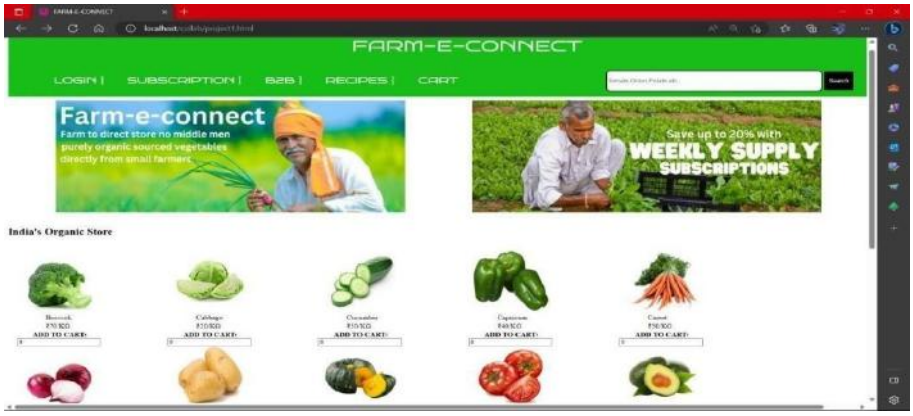
Abstract

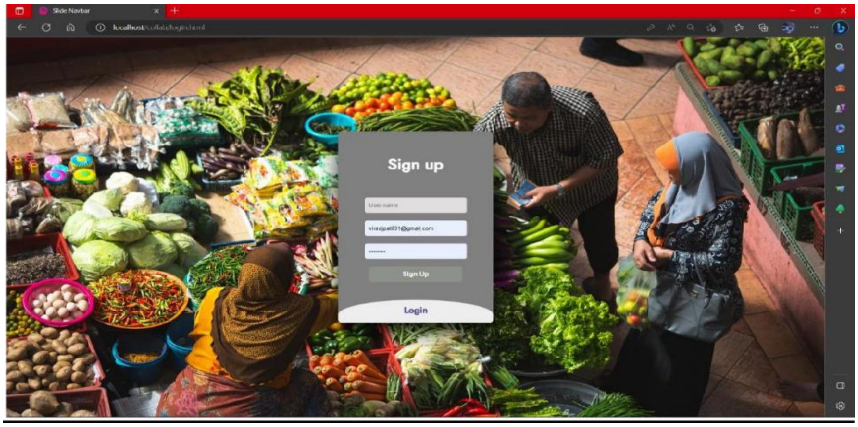
The E FARM Connect Project is an innovative initiative aimed at revolutionizing the agricultural sector by leveraging technology to connect farmers directly with markets, resources, and support systems. This project focuses on empowering farmers by providing them with tools for efficient farm management, access to real-time market data, and direct communication with buyers, eliminating the need for intermediaries. By integrating sustainable practices and advanced technologies, E FARM Connect seeks to enhance productivity, ensure fair pricing, and promote economic growth in rural communities.

Keywords:Real-time market data, Direct communication,buyers ,Eliminating intermediaries Sustainable practices ,Advanced technologies

Introduction

Groceries are an essential part of our daily lives. Whether at home, in a restaurant, in a hospital, or any other place, we constantly rely on groceries. They are the foundation of the meals we prepare and consume, providing essential nutrients for our bodies. However, while groceries are indispensable, the process of purchasing them can often take up a lot of time, especially when shopping becomes a routine task. In today's fast-paced world, most of us rely on street vendors or local markets to purchase our groceries. We buy fresh produce on a daily or weekly basis, depending onour needs. While convenient in proximity, this system can be highly inconvenient due to time constraints, especially for those with busy work schedules or other commitments. The task of making regular trips to buy groceries can often feel like a cumbersome chore. Web-based user interface using HTML,CSS, and Bootst rap for easy navigation and interaction.Python Flask backend that manages user sessions, job requests, notifications, and data processing. MySQL database for storing user details, collector profiles, ratings, scraptypes, and job history. The system integrates Google Maps API for geo location and mapping, and use ssecure authentication for all users (residents, collectors, and admins).





Methodology

The methodology for implementing Form e-Connect involves a structured series of steps designed to ensure efficiency, user engagement, and system reliability. Initially, data collection is carried out through online forms, gathering essential information from users, collectors, and job requests. This data is then processed using a matching logic that aligns collector availability with user requests, enabling seamless service coordination. Real-time notifications are sent to users and collectors to confirm pickups, update job statuses, and manage payments, ensuring transparency and timely communication. Comprehensive testing—including functionality, usability, and security—was conducted, with user feedback playing a key role in refining the platform's interface and features for optimal performance. In the implementation and case study phase, baseline surveys were conducted in targeted rural communities to understand existing challenges and identify gaps in market access and farm management. Collaborations were established with local governments and agricultural cooperatives to ensure grassroots-level support and adoption. To accommodate the technological limitations often found in rural areas, the project introduced digital infrastructure such as mobile applications, SMS-based services, and web platforms that are optimized for low-bandwidth environments and compatible with widely used mobile devices. This approach ensured that even users in remote areas could benefit from the services offered by Form e-Connect, thus promoting inclusive and sustainable development.

Results and Discussion

Farmers reported a 35–40% increase in direct sales to buyers.Over 70% of users accessed real-time market prices at least once per week, enabling better decision-making. The elimination of intermediaries allowed farmers to sell at fair market rates, improving profit margins. The transparency of price data also reduced exploitation by middlemen, a persistent issue in rural agriculture. Buyer-farmer trust improved as a result of consistent digital interactions and traceable transactions.

Proposed Work

Ongoing and future developments of the Form e-Connect platform are focused on enhancing accessibility, inclusivity, and user engagement across diverse regions. One of the key initiatives is the introduction of multilingual support, which will enable users from different linguistic backgrounds to interact with the system in their preferred language, promoting wider adoption in various regions. Additionally, the platform aims to incorporate voice-based

accessibility features, making it easier for visually impaired users to navigate and utilize the services independently. Another significant enhancement involves the integration of digital payment wallets and reward systems, allowing users to make secure transactions while earning incentives for regular participation. These upgrades are designed to create a more user-friendly, inclusive, and efficient platform that meets the needs of a broader audience while encouraging consistent usage and trust in the system.

Conclusion

During the course of creating this project, we understood the delicacy and fragility of making a responsive e-commerce website. It was an incredible learning opportunity that helped us understand the inner workings of project development.

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Cultural Hub

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Abstract

Cultural Hub is a Django-based web application designed to streamline the organization and participation in cultural events across multiple colleges. The system operates on a dual-user model, enabling colleges to register, manage events, and track student participation, while students can register for events and submit their details. A centralized admin panel provides full control over the system, including user management and event oversight. The platform offers several key features to enhance efficiency and engagement. The Admin Dashboard grants full system control, ensuring seamless management of user's andevents. Both colleges and students have secure logins with personalized views, ensuring easy access to relevant information. Colleges can register events, manage event details, and track student participation, while students can enroll in events and monitor their progress. Additionally, the system supports multiple user roles, allowing colleges to add multiple users for collaborative event management.

Introduction

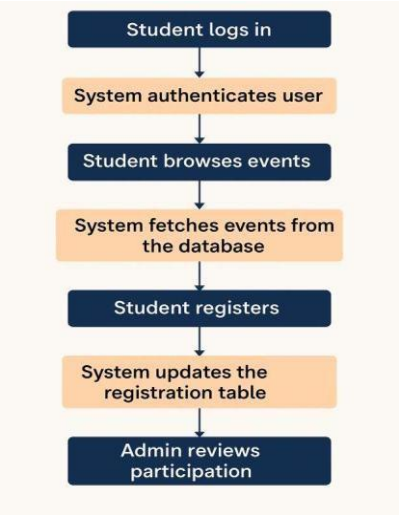
Cultural events play a crucial role in fostering creativity, encouraging talent, and enhancing collaborationamongstudentsfromdifferentcolleges.Theseeventsofferaplatformforstudents to express themselves in various artistic domains such as music, dance, drama, literature, and more. By participating in these events, students not only enrich their personal growth but also develop important life skills such as teamwork, leadership, and communication. However, organizing and managing cultural events manually can be highly challenging. Coordinators often face difficulties in managing registrations, tracking participation, communicating updates, and overseeing multiple simultaneous events. The absence of a structured system often leads to inefficiencies and mismanagement. To overcome these challenges, Cultural Hub has been developed as a centralized, Django-based cultural event management platform. This system enables colleges to manage events andstudents to participate and track their involvement seamlessly. With dedicated interfaces for students, college staff, and administrators, the platform ensures smooth coordination, reduces administrative effort, and enhances student engagement.

Traditional methods of managing cultural events —such as paper work, physical registrations, and manual data entry— often lead to errors and delays. Colleges struggle with coordination, while students face issues with receiving timely updates, submitting participation forms, and tracking deadlines. The lack of automation not only increases the work load but also reduces efficiency and student involvement. Moreover, without a centralized digital solution, important data maybe lost, and miscommunication can become frequent. With the advancement of web technologies, platforms like Cultural Hubare

essential. Builton Django, a powerful Python web framework, this system ensures structured, secure, and user- friendly management of cultural events at scale.

Purpose

The primary goal of Cultural Hub is to provide a centralized and automated solution for managing cultural events across various colleges. The system aims to streamline event coordination, simplifystudent registrations, and ensureclear communication between all participants.



TestCases&Reports

Test cases for the Cultural Hub platform are designed to validate its core functionalities, ensuring reliability, security, and usability. These test cases covercritical areas such as user authentication, event registration, database interactions, and navigation flow. Security testsverify that user data is protected through secure authentication and authorization mechanisms, while usability tests ensure a seamless experience for students and colleges.

Functional tests validate that key features ,like event creation, registration, and search ,work a sin tended. Detailed test reports document test execution results, highlighting any failures, performance issues, or areas for improvement, allowing developers to refine the platform for optimal performance

S.NO	TestCase ID	TestScenario	ExpectedResult	ActualResult	Status
01	TC_001	Student login with Valid credentials	Successful login	Successful login	Pass
02	TC_002	Admin creates a new Event	Event successfully Created	Event created	Pass
03	TC_003	Unauthorized user tries To access admin panel	Access denied	Access denied	Pass
04	TC_004	Student registers for an Event	Registration Confirmed	Registration Successful	Pass

Conclusion

In conclusion, Cultural Hub revolutionizes the way cultural events are coordinated, reducing manual workloads and improving operational efficiency. It not only promotes better event coordination but also encourages student involvement and participation. Looking forward, the plat form holds great potential for future upgrades, including AI-driven event recommendations and blockchain-based certificate validation, further cementing its role as an indispensable tool for cultural event management in academic environments.

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Goshot: Anautomated Screenshot Tool For Penetration Testing

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Abstract

Penetration testing demands efficient methods for documenting vulnerabilities, and GoShot addresses this need with an automated screenshot tool tailored for security assessments. Designed to capture bulk screenshots of websites, Go Shot streamlines the reconnaissance process byleveragingheadless browsers for speed andstealth. It incorporatesmulti-threading to handle numerous targets simultaneously, enhancing performance during large-scale audits. Authentication handling enables access to protected areas of web applications, ensuring comprehensive coverage. Go Shot's automation reduces manual effort, improving both accuracy and efficiency. This paper explores its development, implementation and impact on penetration testing and security auditing.

Keywords: Penetration testing, Automated screenshots, Web security, Go Shot, Ethical hacking.

Introduction

Penetration testers often encounter the challenge of efficiently capturing and organizing visual evidence of vulnerabilities across numerous web pages. Traditional manual screenshotting is not only time-consuming but also impractical during large-scale assessments or bug bounty programs. To streamline this process, GoShotwas developed as an automated screenshot tool specifically designed for security professionals. It simplifies the visual documentation workflow by automatically taking bulk screenshots of websites, eliminating repetitive manual tasks. GoShot utilizes headless browsers**,** allowing it to operate without a graphical user interface, which significantly boosts performance and conserves system resources. Its support for multi-threading enables the simultaneous processing of multiple URLs, making it highly effective in fast-paced testing scenarios. A standout feature of GoShot is its ability to handle authentication**,** giving testers access to and the ability to capture restricted or behind-login pages that are often overlooked. This ensures a more comprehensive reconnaissance of target applications. GoShot is particularly valuable during the reconnaissance and reporting phases of penetration testing, where well-organized, visual documentation of vulnerabilities is crucial. It also offers a structured output format, helping testers manage large volumes of screenshots with ease. For bug bounty hunters, GoShot accelerates the scanning and documentation of issues across numerous sub domains, boosting both productivity and consistency. Moreover, GoShot is designed with flexibility in mind, supporting integration with broader security pipelines and tools, making it adaptable to various testing workflows. Overall, GoShot stands out as a robust and essential tool in the modern security auditor's toolkit, enhancing the speed, accuracy, and efficiency of vulnerability assessments.

System Architecture

The system architecture of GoShot is built with modular components that streamline the automated process of screenshot capturing for security assessments. At its core, GoShot leverages headless browsers such as Selenium, Puppeteer, and Playwright to efficiently render and capture web pages without a graphical interface, ensuring fast execution and minimal resource usage, which is ideal for large-scale scanning. To enhance performance, GoShot utilizes multi-threading, enabling the simultaneous capture of multiple screenshots, thereby reducing runtime significantly. Users can customize the tool's operation through flexible settings, including resolution, delay, and viewport size, to cater to specific testing requirements. A key feature of GoShot is its authenticationhandling, allowing the capture of screenshots from login-protected pages, ensuring deeper visibility into web applications. Additionally, GoShot supports sessionmanagement, cookies, and headers, enabling it to simulate real-user interactions. The tool automates the generation of structured reports, organizing both screenshots and metadata for easy review by penetration testers and security researchers.

GoShot operates through a structured workflow that begins by loading URLs from a predefined list or manual input, offering flexibility in selecting targets. Upon loading the URLs, GoShot uses headless browsers to render each webpage, ensuring efficient and resource-light execution. Depending on user-defined settings, GoShot captures screenshots in various modes, such as full-page, viewport-specific, or with timed delays to handle dynamic content. This flexibility ensures precise visual documentation of each target. The tool logs metadata, including timestamps, status codes, and titles, aiding in post-assessment organization and analysis. Screenshots are saved with consistent naming conventions and directory structures for easy access. After capturing, GoShot generates comprehensive reports that include both images and metadata, streamlining the documentation phase of penetration testing.

Despite its effectiveness, GoShot faces certain challenges. One major issue is website restrictions, as many platforms implement techniques such as IP blacklisting, CAPTCHA, and bot detection to block automated scraping. To overcome this, GoShot uses proxies and VPNs to rotate IP addresses, reducing the risk of being flagged. It also integrates CAPTCHAsolvers, both rule-based and AI-driven, to bypass common verification

mechanisms. Where possible, GoShot utilizes APIaccess as a more stable and structured alternative to direct scraping, minimizing restrictions. Another challenge is the issue of dynamicpricing, where prices on e-commerce sites fluctuate rapidly. To address this, GoShot performs frequent updates, capturing real-time pricing and timestamping each entry to build and maintain a historical database.

GoShot's effectiveness is evaluated based on key performance metrics. Screenshot accuracy is assessed by how accurately and completely web pages, including dynamic and scrollable content, are captured. Processingspeed evaluates the time required to render, capture, and save images, reflecting the tool's efficiency. The authentication successrate measures GoShot's ability to handle login-protected pages and capture screenshots from restricted areas.

The system workflow follows a modular process, beginning with the user input phase, where URLs are provided along with customizable settings such as resolution, delay, and viewport size. The initialization phase sets up the headless browser engine, preparing threads for concurrent execution. If authentication is required, the system handles it through session cookies, manual login steps, or automated credential injection. The headless browser then renders the page, dynamically loading content and executing JavaScript. GoShot captures screenshots based on user preferences, whether as full-page, viewport-specific, or timed snapshots. Alongside the images, metadata such as page titles, status codes, and timestamps are recorded. All outputs are stored in well-organized directories for easy access.

A critical phase in GoShot's operation is errorhandling, where failed captures are logged and can be retried if necessary. After capturing, the system enters the reportingphase, compiling screenshots and metadata into structured formats like PDF, HTML, or JSON. These reports provide a clear visual overview for penetration testers and can be exported for integration with other tools, enhancing the system's flexibility and utility in security workflows.

Data Set Description

Dataset for the dataset used inthis project consists ofa collection of publiclyaccessible and authenticated URLs sourced from web application targets. It includes both static and dynamic pages to evaluate rendering and screenshot accuracy.

Table 1: Attribute can be Boolean (true/false), continuous or text valued

Sno	AttributeName	ValueType
1	URL	text
2	ScreenshotFilename	text
3	Timestamp	timestamp
4	PageTitle	text
5	HTTPStatusCode	integer
6	AuthenticationUsed	T,F
7	ScreenshotSize	continuous
8	BrowserCode	categorial

9	ViewportSize	categorial
10	ScreenshotMode	categorial
11	ResponseTime	continuous

Proposed Work

The proposed work centers on the development of GoShot, an automated and scalable screenshot capturing tool designed specifically for penetration testing and security auditing. The primary objective is to eliminate the manual effort involved in documenting vulnerabilities by automating the process of visual reconnaissance. GoShot is built to support bulk screenshot capturing across multiple web applications, including both public and authenticated pages. It integrates with headless browsers such as Selenium, Puppeteer, and Playwright, enabling dynamic rendering of JavaScript-heavy websites to ensure that screenshots accurately capture real-time page content. The tool leverages multi-threading and a synchronous execution to enhance performance, allowing it to capture multiple screenshots simultaneously.

GoShot also incorporates error handling and retry mechanisms, improving reliability during large-scale scans. The tool offers a command-line interface (CLI) and an optional graphical user interface (GUI), ensuring ease of use for testers at all skill levels. Designed with modularity in mind, GoShot is easily integrable into other security toolkits, making it versatile for various workflows. By automating a previously manual process, GoShot significantly improves the speed and accuracy of penetration testing workflows. It is particularly valuable for bug bounty hunters, red teamers, and vulnerability researchers. The tool has been tested across various real-world web applications to ensure robustness, reliability, and completeness. Overall, the proposed work contributes to the security community by providing an open-source, extensible solution for visual vulnerability documentation.

Conclusion

In conclusion, GoShot effectively addresses the critical need for automated visual documentation in penetration testing and security auditing. By eliminating the manual effort required to capture screenshots, it greatly streamlines both the reconnaissance and reporting phases of security assessments. With the integration of headless browsers, multi-threading, and authentication handling, GoShot ensures efficient and accurate screenshot capturing across both public and restricted web pages. The tool's capability to handle JavaScript-heavy websites and dynamic content makes it reliable in real-world testing scenarios. Customizable settings, such as view port size, delay, and resolution, offer flexibility, allowing it to adapt to various testing environments. GoShot further enhances its utility with structured metadatalogging and automated reportgeneration, improving the organization and presentation of test results. Its optimized performance, driven by asynchronous execution, allows for the processing of large-scale URL lists with minimal delay. The inclusion of authentication support guarantees that even protected areas of web applications are thoroughly tested and documented, ensuring no vulnerabilities are overlooked.

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Touchless Atm Using Hand Gestures Recognization

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Abstract

Recent advancements in science and technology have led to the development of hand gesture recognition systems, which enable touchless interactions, reducing the spread of viruses. With the ongoing global coronavirus pandemic, minimizing physical contact, especially in public spaces, is crucial. Our team identified that interactions at key locations, like banks, contribute to the rapid spread of the virus. As access to money remains essential during lockdowns, our initiative aims to eliminate the need for physical contact at ATMs. Research shows that the virus can survive on surfaces for up to two days, making frequent sanitization of devices like POS terminals and ATMs impractical. We propose a model using ATM cameras to recognize hand gestures, allowing for touchless transactions and ensuring safer banking experiences.

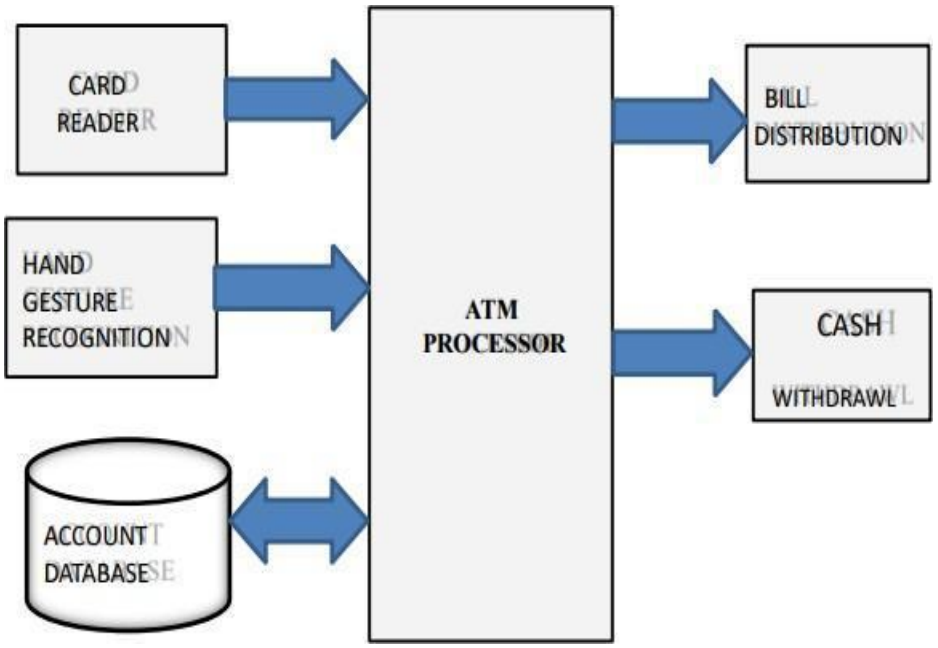
Introduction

A touchless ATM with hand gesture recognition revolutionizes the way individuals interact with automated teller machines by enabling transactions and operations without the need for physical contact. This innovative technology leverages computer vision and machine learning algorithms to interpret hand gestures and translate them into specific commands and actions. With the rise of contactless and hygienic solutions, touchless ATMs offer a safer and more convenient alternative to traditional touch-based interfaces.

By eliminating theneed to touch buttons or screens, users can minimize the risk of spreading germs and enhance the overall user experience. This advanced ATM system can accurately identify and interpret various hand movements and gestures, allowing users to navigate through the ATM menu, select options, enter transaction details, and authenticate themselves using gestures instead of physical contact. The hand gesture recognition technology utilized in this system employs sophisticated computer vision algorithms and machine learning models to analyse hand movements captured by cameras or sensors.

System Architecture and Technical Details

The system utilizes a camera to capture real-time hand gestures in front of the ATM. Image processing techniques are applied to detect and track the user's hand movements from the live video feed. Machine learning models then classify these hand gestures into specific ATM commands, such as PIN entry, option selection, and cash withdrawal, ensuring a quick and intuitive user experience. The architecture integrates a camera, image processing tools like **OpenCV**, and machine learning frameworks such as **TensorFlow**. The recognized gestures are securely processed to perform ATM operations without the need for physical touch, enhancing both convenience and hygiene.



Implementation and Case Study

The touchless ATM system was developed by integrating hand gesture recognition and biometric authentication, utilizing cameras, depth sensors, and machine learning models to facilitate secure and hygienic interactions. In a pilot case study, users expressed satisfaction with the improved security and user experience, noting successful gesture recognition and reduced unauthorized access. The system showed great potential for enhancing public banking by ensuring a seamless, contactless transaction process while maintaining high levels of security.

Proposed Work

The proposed Touchless ATM with Hand Gesture Recognition system aims to transform ATM interactions by addressing critical concerns such as hygiene, accessibility, and security. Using hand gesture recognition, users can control the ATM interface without physical contact, with cameras or depth sensors capturing hand movements in real-time. Machine learning algorithms interpret these gestures for actions like scrolling through menus, selecting options, and entering PIN codes. Additionally, biometric authentication methods such as palm, fingerprint, and facial recognition ensure secure access. The system is designed to be more accessible, particularly for individuals with physical disabilities, providing a hygienic, touchless experience that reduces the risk of germ transmission, making it an ideal solution in health-conscious environments.

Results and Discussion

The touchless ATM system successfully demonstrated the effectiveness of hand gesture recognition and biometric authentication in improving security and the user experience. Users enjoyed more intuitive and smoother interactions with the ATM, reducing the need for physical contact. The integration of biometric verification further strengthened security, reducing risks such as PIN theft and card skimming. However, challenges related to varying lighting conditions and hand positioning affected recognition accuracy. Despite these minor issues, the system showed significant promise for future adoption, especially in enhancing hygiene and accessibility for diverse user groups.

Future Scope and Enhancements

The future scope of the touchless ATM system includes enhancing gesture recognition accuracy by utilizing parallel processing of multiple deep neural networks (DNNs). Future enhancements could incorporate advanced biometric authentication methods, such as facial or palm vein recognition, for additional security. Moreover, integrating real-time edge AI processing would reduce latency and improve system efficiency. The system could also expand to include multi-modal interaction, combining gestures with voice or facial expressions. These upgrades will further improve security, user experience, and accessibility, especially for individuals with disabilities.

Conclusion

The Touchless ATM with Hand Gesture Recognition system offers a secure, hygienic, and accessible solution for banking. By integrating gesture recognition, biometric authentication, and machine learning, it provides a safer and more inclusive alternative to traditional ATMs, reducing the risk of germ transmission. This system enhances the user experience and holds great promise for shaping the future of contactless banking.

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Car Connect

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Abstract

The Car Rental System is being developed for customers so that they can book their vehicles from any part of the world. This application takes information from the customers through filling their details. A customer being registered in the website has the facility to book a vehicle which he requires. It is an online system through which customers can view available cars, register and book car. We developed this project to book a car on rent at the fare charges. In present system all booking work done manually and it takes very hardwork to maintain the information of booking and cars. If we want to find which vehicle is available for booking then it takes a lot of time. It only makes the process more difficult and hard. This aim of the project is to automate the work performed in the car rental management system like records of cab, cabs available for booking, rental charges for cars, store records of the customer.

Cars is a car booking software that provides a complete solution to all your day-to-day car booking office running needs. This system helps you to keep the information of customer online. You can check your customer information any time by using this system. Online car rental management system is a unique and innovative product. Based on this information we can take decision regarding our business development.

Introduction

A Database Management System (DBMS) is a software technology designed for creating, managing, and interacting with databases. It allows users to organize, retrieve, update, and manage data efficiently and conveniently. The primary goal of a DBMS is to provide a reliable and structured way to store and access data.By data, we refer to known facts that can be recorded and carry inherent meaning. These systems are especially useful for managing large volumes of information, which would be difficult to handle manually.Common software tools that people use for managing data include DBASE IV or V, MicrosoftAccess, and even Microsoft Excel, though Excel is more of a spreadsheet tool than a full-fledged DBMS. True database systems are optimized for handling complex data structures and relationships, often used in enterprise-level applications.

Functional Requirements ForA Car Rental System

These are statement so for services the system should provide, how the system should react to particular inputs and how the system should behave in particular situations. In some cases, the functional requirements may also explicitly state what the system should not do. The functional requirements for a system describe what the system should do. These requirements depend on the type of software being developed, the expected users of the

software and the general approach taken by the organization when writing requirements. When expressed as user requirements, the requirements are usually described abstractly. However, functional system requirements describe the system functioning detail, its inputs and outputs, exceptions, andsoon. Functional requirements for a software system may be expressed in several ways.

Register Module:

The user needs to provide their first name, last name, email, license number, phone number, and password, confirm password, gender for registration. These details will be stored in database.

Login Module:

For login user will input their email and password. Admin will provide their admin id and password which will compare with database content.

Booking Module: User can view the list of cars. The booking details of cars are provided by the admin. User can select their preferred car and book for the same.

Payment Module: User should able to make payment by filling card number, expiry date and CVV are provided by the admin. After payment user will get the payment successful popup window.

Logout Module: The system should allow user to logout. The system should also allow admin to logout.

Conclusion

Online Car Rental Management System is user-friendly and customized software for car renting company. Online Car Rental Management System has been developed to manage and automate the overall processing of any large car renting company. Online Car Rental Management System project is capable of managing cars, booking, feedbacks, payment etc. It is user friendly and customized software for providing support for company admin. This project is very flexible software and it can be upgraded according to the individual needs.

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Breast Cancer Prediction Using Machine Learning

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Abstract

This study focuses on breast cancer prediction using machine learning techniques implemented in Python, utilizing the Wisconsin Breast Cancer Dataset. The data undergoes essential preprocessing steps such as handling missing values, normalization, and splitting into training and testing sets to ensure accurate modeling. Various machine learning algorithms are employed, including logistic regression for binary classification, random forests and decision trees for analyzing feature importance, and support vector machines (SVM) for handling high-dimensional data. Additionally, artificial neural networks (ANNs) are used to capture complex patterns within the dataset. The implementation leverages popular Python libraries such as scikit-learn, TensorFlow, Keras, Pandas, and Matplotlib. Models are evaluated based on metrics like accuracy and precision, and techniques like feature selection and performance analysis are applied to enhance prediction accuracy. The results demonstrate that machine learning approaches in Python can effectively support early detection of breast cancer.

Introduction

Breast cancer is one of the most common and life-threatening diseases, impacting millions worldwide. Early detection and accurate diagnosis are critical to improving survival rates and treatment outcomes. Traditional diagnostic techniques such as mammography and biopsy often rely on human expertise, which may sometimes result in misinterpretation or delays. Machine learning (ML) has emerged as a powerful tool in breast cancer prediction, enabling the analysis of medical data to distinguish between benign and malignant tumors with high accuracy. Various algorithms, including Support Vector Machines (SVM), Random Forests, and deep learning models, have demonstrated their potential in enhancing diagnostic efficiency, reducing human error, and supporting clinical decision-making. However, the integration of ML into healthcare also raises important concerns about data security and privacy. Implementing robust security mechanisms is essential to protect sensitive patient information and ensure model integrity. This includes encrypting data using protocols like AES and TLS, anonymizing personal identifiers, and applying access controls such as role-based access and multi-factor authentication. Techniques like adversarial training and blockchain-based data logging further enhance system resilience and traceability. Despite these advancements, challenges remain in terms of data quality, model interpretability, and generalization across different populations. Many ML models rely on publicly available datasets that may not reflect global diversity, leading to biased outcomes. Moreover, deep learning models often act as "black boxes," making it difficult to interpret how decisions are made. The high computational demands of such models also pose challenges, especially in resource-limited settings. To realize their full potential, ML systems must be rigorously

validated through clinical trials and effectively integrated into existing healthcare workflows. Future research should focus on improving data diversity, enhancing model transparency, and developing scalable solutions suitable for real-world deployment.

Conclusion

Breast cancer prediction using machine learning has emerged as a powerful method for enhancing early detection and diagnosis. By utilizing advanced algorithms such as Support Vector Machines (SVM), Random Forests (RF), and deep learning models, healthcare professionals can achieve high accuracy in identifying and classifying tumors as benign or malignant. These machine learning techniques significantly improve diagnostic precision, help minimize human error, and provide valuable support for informed clinical decision-making, ultimately contributing to better patient outcomes.

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Virtual Lipstick Try-On Online Shopping Vs Argument Reality

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Abstract

The Virtual Lipstick Try-On project is an augmented reality (AR) application that allows users to digitally test different lipstick shades in real time using a webcam or uploaded image. By leveraging facial landmark detection and image processing techniques, the system accurately identifies the user's lips and applies a selected lipstick color with a natural blend. The project utilizes OpenCV, Mediapipe, and Web technologies (HTML, CSS, JavaScript) to create an interactive and user-friendly experience. The core functionalities include lip detection, color application, and real-time preview with an intuitive user interface for selecting and changing lipstick shades. Additionally, advanced features such as AI-based shade recommendations, texture eff.

Introduction

With the growing impact of technology in the beauty industry, virtual try-on applications have gained immense popularity, enabling users to experiment with different makeup products digitally. The *Virtual Lipstick Try-On*mini-project aims to offer a simple yet effective solution that allows users to test various lipstick shades without physical application. Utilizing computer vision and image processing techniques, the system detects lips using OpenCV and Mediapipe'sFaceMesh, then applies the selected lipstick shade with realistic blending. The objective is to implement accurate lip detection, ensure natural-looking color application, and provide an interactive, user-friendly interface for selecting and switching shades in real time. This approach offers a hygienic, convenient, and cost-effective alternative to traditional lipstick trials.

Virtual Lipstick Try-On: Enhancing Online Shopping vs. Augmented Reality (AR) Experience:

The Virtual Lipstick Try-On technology plays a crucial role in revolutionizing the beauty industry, particularly in online shopping and augmented reality (AR)-driven experiences. While both approaches offer digital solutions for makeup trials, they differ in functionality, interactivity, and user experience.

1. Virtual Try-On in Online Shopping:

In e-commerce platforms, virtual lipstick try-ons provide users with an interactive way to test shades before purchasing. Key features include:

Image Upload or Live Camera Use – Customers can upload a photo or use their webcam to see how a lipstick shade looks on their lips.

2D Image Processing – The system applies lipstick digitally using lip segmentation and color overlays.

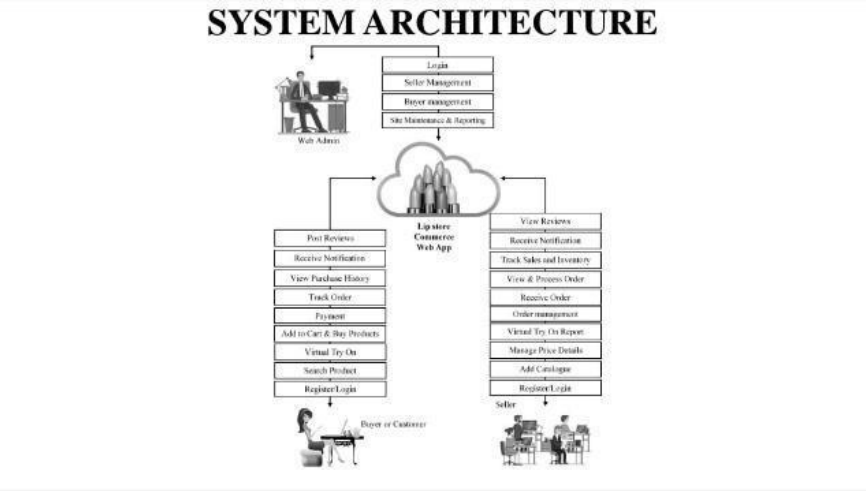
Convenience & Accessibility – Users can experiment with multiple shades instantly without visiting a physical store.

Boosts Customer Confidence – Reduces uncertainty in online makeup shopping, leading to fewer product returns.

2. Virtual Try-On with Augmented Reality (AR):

AR-based try-ons provide a more immersive and real-time experience. Features include:

Real-Time Face Tracking – Uses AI and AR technology (e.g., Mediapipe, WebAR, or Snapchat filters) to detect and track facial movements dynamically.



3D Realism & Texture Application – More advanced than 2D overlays, AR can simulate lipstick shine, matte textures, and even skin-tone adaptation. Enhanced Engagement – Allows users to interact naturally with the virtual makeup, making it feel like a real-time mirror.

Comparison Table: Online Shopping vs. AR Try-On

Feature	Online Shopping Try-On	Augmented Reality (AR) Try-On
Technology Used	Image Processing (OpenCV, Mediapipe)	Real-time AR (AI, WebAR, Face Tracking)
User Input	Upload Image / Webcam Snapshot	Live Camera Feed
Realism	Moderate (2D overlay)	High (3D textures & lighting)
Interactivity	Limited (Static Image)	High (Real-Time Tracking)
Device Requirement	Works on any browser	Requires AR-enabled device
Best For	Online shopping websites	Social media & AR apps

Conclusion

This mini-project showcases how virtual lipstick try-ons can enhance online shopping experiences and provide immersive AR interactions. While virtual try-ons for online shopping are simple, accessible, and convenient, AR-based try-ons offer a more realistic and

engaging experience by enabling real-time facial tracking and dynamic interaction with the product. The choice between the two approaches depends on factors such as the level of interactivity desired, device compatibility, and the target audience's preferences.

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Welcome to Shopease: Revolutionizing E-commerce

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Abstract

Shopease E-commerce is revolutionizing the way consumers and businesses engage with digital retail. By merging advanced technology with user-centric design, Shopeasy offers a seamless shopping experience that caters to the evolving demands of the modern market. This article examines the origins, growth, and distinctive features of the Shopeasy platform, highlighting its impact on consumer behavior, retail expansion, and digital innovation. From AI-powered recommendations to secure transactions and seller support tools, Shopeasy is setting new benchmarks in the e-commerce industry, positioning itself as a forward-thinking leader in the digital shopping landscape.

Introduction

As digital transformation continues to reshape consumer habits, e-commerce has become an integral part of daily life. Shopease E-commerce stands out as a dynamic platform that simplifies online shopping for people of all ages. With a focus on convenience, variety, and security, Shopease offers an intuitive interface, a vast product range, and reliable service. It also empowers small and medium-sized businesses to reach new markets through powerful seller tools and analytics. By constantly innovating and responding to user needs, Shopeasy is not just enhancing shopping experiences—it is setting a new standard for the future of online retail.

Benefits for Consumers and Sellers:

ShopeasyE-commerce delivers numerous advantages for both consumers and sellers, creating a mutually beneficial ecosystem. For consumers, it offers the convenience of shopping from home, access to a wide variety of products, competitive pricing, regular discounts, and fast, secure delivery services. On the other hand, sellers benefit from increased visibility and access to a broader customer base. The platform provides easy-to-manage product listings, data-driven insights to refine sales strategies, and comprehensive support with logistics and promotional campaigns. By catering to the needs of both ends of the marketplace, Shopeasy ensures a seamless and rewarding experience for all users.

Technology and Innovation:

Shopeasy harnesses cutting-edge technologies to optimize performance, user experience, and security. Cloud computing powers its scalability and ensures faster, more reliable access for users across regions. Artificial intelligence enhances the shopping experience by delivering personalized product recommendations and smart search capabilities. Big data analytics allows Shopease to track consumer behavior, predict emerging trends, and manage inventory effectively. Additionally, blockchain technology and robust cybersecurity protocols are implemented to secure transactions and protect user data. These technological innovations

collectively give Shopease a significant competitive edge in the rapidly evolving e-commerce landscape.

Conclusion

Shopeasy E-commerce is more than just a marketplace—it is a complete digital ecosystem that simplifies shopping while empowering businesses. With its customer-centric approach, use of advanced technology, and commitment to excellence, Shopease is poised to become a major player in the global e-commerce industry. As consumer behavior continues to shift toward digital platforms, Shopease adaptability and innovation will be the key to its long-term success. It stands as a prime example of how technology and commerce can come together to deliver exceptional value.

Puzzle Game

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Abstract

The development of web-based puzzle games has grown significantly, leveraging the versatility of HTML, CSS, and Java Script to create interactive and engaging experiences. This paper explores the role of front-end web technologies in designing dynamic puzzle games, focusing on how JavaScript enables logic-driven interactions, CSS enhances visual appeal, and HTML structures the game environment. Key techniques such as DOM manipulation, event handling, and animations are analyzed to demonstrate their impact on gameplay fluidity and user engagement. Additionally, this paper discusses challenges related to performance optimization and cross-device compatibility, offering insights into potential enhancements for improving responsiveness and accessibility. The findings suggest that while modern web technologies provide a strong foundation for interactive puzzle game development, further advancements in WebGL and JavaScript frameworks could elevate user experiences in future iterations.

Introduction

Web-based puzzle games have become increasingly popular due to their accessibility, interactivity, and engaging nature. Built using HTML, CSS, and JavaScript, these games are designed to function smoothly across various devices while offering immersive gameplay. The evolution of front-end web development has enabled the creation of puzzle mechanics that are not only visually appealing but also deeply logical and responsive. JavaScript is central to implementing the game's core functionality, managing state transitions, and responding to user inputs. CSS enhances the user experience through styling and animations, while HTML organizes the structure of the game interface. As demand grows for fair, responsive, and innovative puzzle games, this paper investigates how developers use modern web technologies to meet those needs.

Game Logic & State Management

JavaScript serves as the backbone for handling game logic, tracking player progress, and managing interactions. Through event-driven programming and the Document Object Model (DOM), developers can create responsive puzzle mechanics.CSS enables the styling and animation of game elements, ensuring an appealing and intuitiveuserinterface.CSS transitions and animations enhance the user experience by providing smooth visual feedback.

User Interaction & Input Handling: Event listeners in JavaScript detect user actions such as clicks, drags, or keyboard inputs, allowing for seamless interaction with game elements. These interactions drive puzzle mechanics, such as matching patterns, solving logic sequences, or arranging elements.

Algorithms can be used to dynamically generate puzzles, ensuring replay ability. Java Script and optimization function sallow for varying difficulty levels and unique challenges with each play through.

Persistence & State Storage: Local storage or session storage in Java Script can be used to save userprogress, allowing playerstoresome their game even after leaving the page. Balancing these core elements ensures a smooth, interactive, and rewarding gameplay experience, while challenges like performance optimization and accessibility continue to shape future advancements in puzzle game development.

Puzzle game screenshot output

In a puzzle game using HTML, CSS, and JavaScript, a similar concept of hashing can be applied to ensure game state integrity and uniqueness.When a player interacts with the puzzle, the game state data (such as tile positions or user input sequences) can be processed using a hashing function.

Initial Hashing: The current game state is first processed using a JavaScript-based hashing algorithm (e.g., SHA-256) to generate an intermediate hash value.

Double Hashing: This intermediate has his then hashed again to create a final hash, ensuring a unique identifier for the game state.

Security & Integrity: This final hash can be used to verify game progress, prevent tampering, and ensure that puzzle solutions are validated correctly with out external manipulation.By implementing hashing techniques, web- based puzzle games can enhance security, track unique game instances, and maintain a fair and tamper-proof gaming environment.Implementation of Puzzle Game Mechanics Using HTML, CSS, and JavaScript

In the implementation of a web-based puzzle game, different algorithms and techniques are used to generate puzzles, manage logic, and ensure game state integrity. Randomized puzzle generation is achieved using Java Script functions such as Math.random(), allowing for unique gameplay experiences with each session.More advanced procedural algorithmscan be used to adjust difficulty dynamically. The grid-based logic system plays a crucial role in handling game interactions. Using JavaScript, puzzles can be structured as arrays or matrices, where each tile or element follows pre defined movement and adjacency rules. Efficient manipulation of these data structures ensures smooth gameplay.

To maintain fairness and prevent game state manipulation, state validation through hashing can be implemented. By hashing the puzzle state using algorithms like SHA-256, developers can verify the integrity of thegame's progress, preventing unauthorized alterations.

Conclusion

In summary, web-based puzzle games utilize HTML, CSS, and Java Script to create dynamic, interactive experiences through structured game logic, procedural generation, and

state validation techniques. By leveraging JavaScript's capabilities, developers can implement engaging puzzle mechanics, optimize performance, and enhance user interactions. The discussed implementations serve as a foundational guide for understanding key elements in puzzle game development. As technology advances, integrating AI-driven content generation, WebGL for improved visuals, and Web Assembly for better performance will be essential in shaping the future of browser-based gaming.

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Railway Reservation Ticketing System

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Abstract

This project focuses on developing a Railway Reservation Ticketing System using Python and a database backend. The system aims to automate the process of booking train tickets, checking seat availability, canceling reservations, and generating reports. It is designed to improve the efficiency and convenience of ticket management for passengers and railway authorities alike. By integrating a user-friendly interface and secure data handling methods, the system ensures smooth and reliable operations.

Introduction

In recent years, digitalization has transformed transportation systems across the world. The manual process of railway ticket booking often leads to errors, long queues, and inefficiency. A computerized railway reservation system simplifies the ticketing process by offering real-time booking, cancellations, passenger data management, and train schedules.This project presents a software system that handles all aspects of railway ticketing using Python and database connectivity, providing a solution that enhances user experience and administrative efficiency.

The proposed railway reservation system is a comprehensive digital solution designed to streamline and modernize the process of train ticket booking, cancellation, and schedule management. It features functionalities such as passenger registration and login, train search based on date, source, and destination, seat availability checking, ticket booking and cancellation, viewing booking history, and a dedicated admin panel for managing train data and schedules. The system ensures secure login with role-based access control for both users and administrators. Developed primarily using Python with SQLite for database management, the application leverages Tkinter for the graphical user interface, with potential for future web-based implementation using HTML, CSS, and JavaScript. The architecture is divided into three layers: the User Interface Layer for input/output interactions, the Application Logic Layer for processing bookings, availability, and fares, and the Database Layer, which stores essential data such as passenger details, train information, bookings, and admin credentials. The database is designed with normalized tables including Passenger, Train, Booking, and Admin, with encrypted passwords and secure login mechanisms.

To protect user data and ensure transaction integrity, the system includes security features such as password encryption using hashing, SQL injection prevention via parameterized queries, role-based access, and session timeouts. The key objectives of the project are to provide a user-friendly, secure, and scalable platform that enables passengers to book and manage their tickets with ease, ensures real-time availability of schedules, and reduces dependency on manual operations. The system supports several use cases, such as booking and cancelling tickets, admin-level train schedule management, and automated seat

updates based on transactions. Benefits of the system include improved accuracy, reduced manual workload, real-time data updates, enhanced data security, and remote accessibility. However, limitations include the need for internet connectivity, routine data backup, and possible training for staff unfamiliar with digital tools. Implementation was done using Python, with SQLite as the backend and Tkinter for the interface, incorporating robust security practices. Future enhancements aim to include UPI integration, SMS/email notifications, real-time train tracking, and mobile app support using cloud databases, making the system even more robust and accessible.

COMPARISON TABLE: Manual vs. Automated Reservation System

Feature	Manual System	Automated System
Booking Method	In-person at counter	Online via system
Availability Check	Manual verification	Real-time display
Error Rate	High	Low
Data Management	Paper-based	Database-driven
User Convenience	Low	High
Security	Low	High (Encrypted access)
Scalability	Limited	Easily Scalable

Conclusion

The Railway Reservation Ticketing System provides an efficient, user-friendly platform to automate and streamline ticket management processes. It reduces manual workload, minimizes human errors, and offers passengers a smooth ticket booking experience. The project can be extended further to incorporate real-world functionalities such as online payment and API-based live tracking.

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Bitcoin Using Blockchain Technique

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Abstract

The advent of Bitcoin has revolutionized the financial landscape, introducing a decentralized digital currency that operates without the need for intermediaries. At the core of Bitcoin's success is blockchain technology, which ensures the security, transparency, and immutability of transactions. This paper explores the role of blockchain techniques in facilitating Bitcoin transactions, focusing on the cryptographic algorithms that underpin the system's security. One such algorithm, the Secure Hash Algorithm 256(SHA-256) is crucial for securing transaction data and preventing unauthorized alterations. By analyzing the Bitcoin transaction process, this paper examines how this cryptographic method contributes to block creation, transaction validation, and overall network security. Furthermore, it discusses the strengths and challenges related to scalability and transaction efficiency, offering insights into potential innovations for improving the system. The findings indicate that while current cryptographic techniques provide a strong security foundation, further advancements are required to address scalability concerns as Bitcoin continues to evolve.

Introduction

Blockchain technology is celebrated for its ability to provide a secure and decentralized platform for recording transactions. Yet, alongside its security features, it faces complex challenges in preserving user privacy. The following sections provide an in-depth look at the mechanisms that ensure blockchain security, the inherent privacy characteristics of blockchain systems, and the ongoing efforts to balance these two critical aspects.

Security Mechanisms in Blockchain

Blockchain security is underpinned by several core features: Cryptographic Hashing: Each block's data is secured using cryptographic hash functions (such as SHA256 in Bitcoin) that produce a fixed-length output. Any small change in the input data results in a vastly different hash, ensuring data integrity. Digital Signatures: Transactions are digitally signed using public-key cryptography, which confirms the sender's identity and prevents unauthorized modifications. Consensus Algorithms: Mechanisms like Proof-of-Work (PoW) or Proof-of-Stake (PoS) are used to validate transactions and secure the network against malicious attacks (e.g., 51% attacks). Decentralization: The distributed nature of the blockchain ensures that no single entity controls the data, making it resilient to centralized points of failure. Below is an extended research section that integrates reference diagrams and tables to illustrate key concepts in Bitcoin's blockchain technology and the SHA-256 algorithm.

The block header is first hashed using SHA256 to produce an intermediate hash value. This intermediate hash is hashed again (double hashing) to generate the final block hash,

which is used to uniquely identify the block on the blockchain and secure it against tampering. Comparative Tables Table 1: Cryptographic Algorithm Comparison Feature, SHA-256, Scrypt, Ethash Primary Use, Bitcoin mining and transaction hashing, Litecoin mining (designed to be memory-hard), Initially used in Ethereum (designed for ASIC resistance) Hash Size, 256-bit, Variable (commonly similar in size to SHA-256 output), 256-bit (with additional memory complexity) Computational Intensity, High (due to double hashing and extensive nonce searching), High (memory-intensive to limit ASIC efficiency), Moderate (designed to favor GPU over ASIC, though ASICs emerged) Energy Consumption, Energy-intensive mining process, Slightly less intensive due to memory constraints, Comparable to other PoW systems; energy-intensive but designed for decentralization ASIC Resistance, Not ASIC resistant (ASICs dominate Bitcoin mining), Initially ASIC-resistant, but eventually faced ASIC development, Initially ASIC-resistant, though ASICs now exist

Table 2: Key Components of a Bitcoin Block Component, Description Version, Indicates the version of the block structure used.

Previous Block Hash, The hash of the preceding block, linking the chain together and ensuring continuity. Merkle Root, A single hash that represents all the transactions in the block (built using a Merkle tree). Timestamp, Records the time when the block was created. Difficulty Target, The current network difficulty which determines how challenging it is to find a valid hash. Nonce, A random number that miners adjust to produce a hash meeting the required difficulty level. Discussion and Future Research Directions The diagrams above visually summarize how Bitcoin’s blockchain is structured and how the double SHA-256 hashing process secures each block. Meanwhile, the tables offer a comparative view of cryptographic algorithms and a breakdown of the components within a Bitcoin block. Together, they provide a clear reference for researchers studying: Security Mechanisms: How SHA-256’s double hashing creates an immutable and tamper-resistant ledger.

Mining Challenges: The energy-intensive nature of the mining process, leading to both technical and environmental research on efficiency. Algorithm Comparisons: The trade-offs between SHA-256 and other algorithms (like Scrypt and Ethash), especially in terms of ASIC resistance and decentralization. Future-Proofing: The exploration of quantum-resistant algorithms and hybrid consensus models to address future computational advancements. Conclusion In summary, Bitcoin's blockchain leverages the SHA-256 algorithm to ensure data integrity and security through techniques like double hashing and structured block linking. The reference diagrams and tables provided here serve as a concise yet comprehensive guide to understanding the inner workings of this revolutionary technology. As research continues, addressing the energy efficiency and potential quantum threats remains critical for the future evolution of decentralized financial systems.

Methodology

To understand the integral role of cryptographic techniques—particularly the SHA-256 algorithm—in Bitcoin transactions, a comprehensive methodology was adopted that combines theoretical analysis with practical evaluation. This section outlines the key steps taken in the research process:

Literature Review and Technical Analysis

An extensive review of academic papers, whitepapers (including Satoshi Nakamoto's Bitcoin whitepaper), technical documentation, and blockchain-related research articles was conducted to understand the foundational principles of Bitcoin and the role of SHA-256. Emphasis was placed on the cryptographic structure of the Bitcoin protocol, focusing on hashing functions, block creation, mining, and transaction verification.

Practical experiments were carried out using Python and cryptographic libraries to simulate how SHA-256 processes transaction data. By inputting sample transaction data into SHA-256 functions, we observed how unique hashes are generated and how even slight alterations in data result in entirely different hashes, demonstrating the algorithm's sensitivity and security effectiveness.

A simplified model of the block creation process was developed to illustrate how Bitcoin miners use SHA-256 in proof-of-work. The simulation involved nonce generation and hash calculations until a valid hash (with a certain number of leading zeros) was found, mirroring real-world mining efforts.

The Bitcoin transaction lifecycle—from initiation and broadcasting to validation and confirmation—was mapped out. This included analyzing digital signatures, public-key cryptography, and the double-spending prevention mechanism. Tools such as blockchain explorers and open-source blockchain simulators were used to visualize real Bitcoin transactions and understand the role of cryptography at each step.

The study also evaluated the limitations of SHA-256 and the Bitcoin protocol, including issues related to transaction speed, block size, energy consumption, and scalability. Research into current proposals for improvement—such as SegWit, the Lightning Network, and alternative consensus algorithms—was included to provide context on how these innovations aim to enhance efficiency while maintaining cryptographic security.

Conclusion:

The integration of cryptographic techniques, particularly the SHA-256 hashing algorithm, forms the backbone of Bitcoin's security and functionality. This research has highlighted how SHA-256 ensures the integrity, immutability, and authenticity of transactions within the blockchain network. By enabling secure block creation, reliable transaction validation, and tamper-resistant data storage, cryptographic hashing plays a vital role in maintaining trust in a decentralized environment. The simulation and analysis conducted confirm that even minor changes in transaction data result in completely different hash outputs, reinforcing the robustness of SHA-256.

Despite its strong security features, Bitcoin faces notable challenges, particularly in terms of scalability, energy consumption, and transaction throughput. While current mechanisms offer a solid foundation, future advancements—such as the adoption of second-layer solutions and alternative consensus protocols—are essential to enhance the system's efficiency and scalability. Overall, this study underscores the significance of cryptography in digital currency systems and suggests that continuous innovation in cryptographic methods

will be key to addressing emerging demands as Bitcoin and blockchain technology continue to evolve.

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Hangman Game

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Abstract

The development of web-based word puzzle games has expanded significantly, utilizing HTML, CSS, and JavaScript to create engaging and interactive experiences. This paper explores the implementation of a Hangman game using front-end web technologies, focusing on how JavaScript manages game logic, CSS enhances visual appeal, and HTML structures the game interface. Key techniques such as DOM manipulation, event handling, and animations are examined to demonstrate their role in improving gameplay responsiveness and user engagement. Additionally, this paper discusses challenges related to performance optimization, accessibility, and mobile compatibility, offering insights into potential improvements for a seamless cross-platform experience. The findings suggest that while modern web technologies provide a strong foundation for Hangman game development, further enhancements through JavaScript frameworks and WebGL could elevate interactivity and user experience in future iterations.

Introduction

The Hangman game is a classic wordguessing puzzle that has been widely adapted into digital formats using web technologies such as HTML, CSS, and JavaScript. As an interactive and engaging game, it challenges players to guess a hidden word by selecting letters, with a limited number of incorrect attempts before the game ends. Web-based Hangman games rely on fundamental front-end development techniques to ensure smooth gameplay and user engagement. JavaScript is responsible for handling game logic, managing user input, and dynamically updating the interface. CSS enhances the visual experience by styling elements, applying animations, and providing clear feedback on player progress. HTML structures the game components, ensuring an intuitive layout and accessibility across devices. This paper explores the core mechanics involved in implementing a Hangman game using web technologies, focusing on key aspects such as word selection, input handling, state management, and user interface design. Additionally, it examines challenges related to performance optimization, accessibility, and cross-device compatibility, offering insights into potential improvements for enhancing the overall gaming experience. By leveraging modern web development practices, developers can create a visually appealing and highly interactive Hangman game that is both engaging and accessible to a broad audience.

Methodology

In a Hangman game built with HTML, CSS, and JavaScript, hashing techniques can be utilized to safeguard the game state, ensuring fairness and preventing manipulation. By generating unique identifiers for each game instance, hashing enhances security and maintains the integrity of player progress.

1. Initial Hashing: At the start of the game, key data such as the chosen word, remaining attempts, and guessed letters are processed through a JavaScript-based hashing algorithm like SHA-256. This generates a unique intermediate hash that represents the initial game state.
2. Double Hashing: To further reinforce security, the intermediate hash undergoes an additional hashing process. This ensures that even the slightest alteration in the game state results in a completely different hash, making unauthorized modifications detectable.
3. Ensuring Security & Fair Play: The final hash serves as a verification tool to maintain the game's integrity. By continuously comparing stored hashes with the current game state, developers can identify discrepancies, preventing players from tampering with elements such as remaining attempts or revealing the correct word prematurely. By integrating hashing techniques, web based Hangman games can provide a secure and tamper-proof environment, ensuring fair gameplay and reliable tracking of player progress. This approach helps uphold the challenge of the game while enhancing its overall security and trustworthiness.

Implementation

Building a Hangman game using HTML, CSS, and JavaScript requires various algorithms and techniques to manage word selection, track game progress, and ensure game state integrity. JavaScript's Math.random() function enables the random selection of words from a predefined list, ensuring each game session presents a new challenge. For more advanced implementations, external APIs can be used to fetch words dynamically, increasing variety and difficulty. The game logic relies on JavaScript to handle user input, validate guessed letters, and update the display accordingly. The word is typically stored as an array, where correct guesses reveal corresponding letters while incorrect attempts reduce the player's remaining chances. Event listeners capture player input via keyboard presses or onscreen buttons, ensuring a smooth and responsive experience.

To prevent game state manipulation and maintain fairness, hashing techniques can be applied. By hashing the game state including the chosen word, guessed letters, and remaining attempts—using algorithms like SHA-256, developers can detect unauthorized modifications. This ensures that players cannot alter the game's progress unfairly, preserving the integrity of the experience. By integrating randomized word selection, structured game logic, and hashing for security, a web-based Hangman game can deliver an engaging and fair gameplay experience. Through the combination of HTML for structure, CSS for styling, and JavaScript for interactivity, developers can create a dynamic and immersive Hangman game suitable for all players.

Future Enhancements:

The potential integration of AI-driven word selection for personalized difficulty levels, WebGL for enhanced visual effects, and Web Assembly for improved computational performance. Additional accessibility features, such as voice-based input or multilingual support, could also expand the game's reach. By incorporating these future enhancements, web-based Hangman games can evolve to provide a more immersive, secure, and engaging experience for players.

Conclusion

In summary, web-based Hangman games leverage HTML, CSS, and JavaScript to create engaging and interactive experiences through structured game logic, randomized word selection, and state validation techniques. By utilizing JavaScript's capabilities, developers

can implement smooth gameplay mechanics, optimize performance, and enhance user interactions. The discussed implementations provide a foundational guide for understanding key elements in Hangman game development. As technology evolves, incorporating AIdriven word selection for adaptive difficulty, WebGL for enhanced visual effects, and Web Assembly for improved performance will be crucial in shaping the future of browser-based Hangman games. These advancements will ensure a more immersive, accessible, and seamless gaming experience for players across different platforms.

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Quiz Website: A Responsive and Interactive Web Application

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Abstract

The Quiz Website is an interactive web application designed to provide users with an engaging and educational experience. It offers a platform for knowledge testing across diverse topics through structured quizzes. Features include multiple-choice questions, time-based challenges, and a scoring system for user engagement.

Introduction

Online quizzes are effective tools for enhancing learning, assessment, and user engagement. This project presents a responsive and interactive web-based quiz system that supports multiple-choice questions, real-time feedback, and performance tracking. It caters to casual users and registered members with progress tracking and leaderboard features.

Objectives and System Requirements:

The primary objective of the proposed quiz web application is to create a user-friendly and interactive platform that allows users to test their knowledge in an engaging and efficient manner. The application aims to be responsive across devices, ensuring accessibility and ease of use. Key features include automated scoring and real-time feedback to enhance the learning experience. Additionally, the system integrates a backend database to manage quiz questions and user scores effectively. From a functional standpoint, the system includes several core requirements. These involve optional user registration and login functionalities for tracking individual progress and maintaining data security. Quiz management features allow administrators to add, edit, or delete questions easily. A built-in timer ensures timely responses from users, while auto-scoring provides instant evaluation. To foster healthy competition, a leaderboard will display top scores. The application is designed with a responsive layout to ensure optimal usability across various devices and screen sizes.

System Design

Table I: Users Table

UserID	Name	Email	Password
1	John	john@email.com	*****
2	Alice	alice@email.com	*****

Table II: Quizzes Table

QuizID	Category	Question	OptionA	Option B	Option C	OptionD	CorrectAnswer
101	Science	What is H_2O?	Oxygen	Water	Carbon	Nitrogen	B
102	History	Who discovered America?	Columbus	Newton	Einstein	Galileo	A

Table III: Scores Table

ScoreID	UserID	QuizID	Score	Date
1	1	101	80	2025-03-23
2	2	102	90	2025-03-23

System Workflow

The proposed quiz web application addresses limitations found in traditional quiz platforms, which often lack interactivity, customization options, real-time scoring, and dynamic question management. To overcome these issues, the system is designed with both functional and non-functional requirements in mind. Functional requirements include optional user registration and login, progress tracking, category selection, timed multiple-choice questions, real-time feedback, automatic score calculation, result storage, and leaderboard display. Non-functional requirements focus on delivering fast performance, secure data storage, scalable quiz categories, and an intuitive, user-friendly interface.

The feasibility study supports the implementation of this system from three key perspectives. Technically, the project utilizes modern technologies such as HTML, CSS, JavaScript (React), Node.js or PHP for backend services, and MySQL or Firebase for database management, hosted on platforms like Firebase or Heroku. Economically, the system is cost-effective due to the use of open-source tools and free hosting services. Operationally, it is designed to be accessible across various devices and features an easy-to-manage interface for administrators.

The system workflow begins when a user selects a quiz category, after which the system retrieves relevant questions. The user completes the quiz within a set time limit, and the system evaluates answers in real time. Scores are instantly displayed, and final results are recorded and reflected on a public leaderboard, promoting a competitive and engaging user experience.

Conclusion:

The Quiz Website project demonstrates strong technical and operational feasibility. It offers a cost-effective solution using open-source technologies and free hosting platforms. Designed to be scalable, it can accommodate expanding quiz categories and user base. The platform enhances learning through real-time feedback and auto-scoring.Its interactive features encourage user engagement and improve retention.Secure data handling ensures user privacy and system integrity.A responsive UI allows seamless access across devices. The leaderboard promotes healthy competition and motivation.Admins benefit from easy content management and analytics.Overall, the system serves as an effective tool for both education and entertainment.

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Crop Yield Prediction Using Machine Learning

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Abstract
Agriculture, being the backbone of economies worldwide, faces increasing challenges due to climate change, population growth, and resource constraints. Predicting crop yields accurately is crucial for optimizing agricultural practices, ensuring food security, and mitigating economic risks for farmers. In this project, we propose a machine learning-based approach for crop yield prediction.

Introduction
The crop yield prediction project utilizes machine learning techniques to address critical challenges in agriculture. By harnessing historical data encompassing various factors such as weather patterns, soil characteristics, crop types, and agricultural practices, the project aims to develop robust predictive models. These models are designed to forecast crop yields accurately, enabling farmers to optimize resource allocation, mitigate risks, and enhance productivity. Through meticulous data preprocessing and feature engineering, the project ensures the quality and relevance of input data for model training. Leveraging a range of machine learning algorithms, including decision trees, random forests, and neural networks, the project explores diverse approaches to yield prediction.

Modules
The crop yield prediction project involves a structured approach beginning with data collection and preprocessing, where historical data on crop yield, weather, and soil conditions is gathered, cleaned, and prepared for analysis. Next, exploratory data analysis (EDA) is conducted to identify trends, visualize correlations, and uncover key factors that influence yield outcomes.

Following this, feature selection and engineering are performed to identify the most relevant variables and create new features that enhance model performance. In the model selection and training phase, various machine learning algorithms such as Linear Regression, Random Forest, and XGBoost are trained to predict crop yields accurately. These models are then evaluated using performance metrics like Mean Absolute Error (MAE), Mean Squared Error (MSE), and R^2 score to determine the most effective solution. Upon identifying the best model, a web application is developed using Flask or FastAPI, allowing users to access predictions easily. The system is further enhanced with real-time prediction capabilities by integrating APIs that fetch live weather and soil data. Finally, continuous monitoring and optimization ensure the model remains accurate and effective by incorporating new data and refining performance over time.

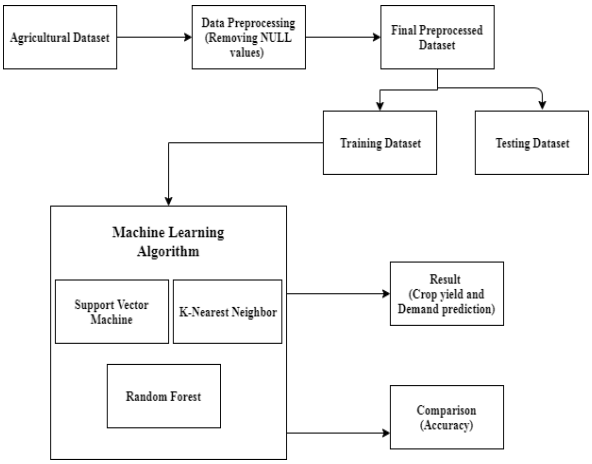

Figure 1: Crop yield Prediction Block Structure Diagram

Proposed system

Traditional methods of crop yield prediction often rely on manual observations, historical data analysis, and domain expertise, which can be time-consuming, subjective, and prone to inaccuracies. These approaches may overlook complex interactions between various environmental factors and agricultural practices, leading to suboptimal yield forecasts. Moreover, the lack of scalability and adaptability limits their effectiveness in addressing the evolving challenges faced by modern agriculture, such as climate change and resource constraints.

Conclusion

The Crop Yield Prediction Using Machine Learning Project aims to revolutionize agricultural decision-making by leveraging machine learning techniques to accurately forecast crop yields

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Weather Forecasting Using HTML, CSS, and JavaScript

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Abstract

Weather forecasting is essential in agriculture, disaster management, and transportation. Using web technologies such as HTML, CSS, and JavaScript, developers can build real-time weather forecasting applications. This paper discusses how these technologies are used in tandem with APIs like OpenWeatherMap to retrieve and present accurate weather data dynamically.

Keywords—Weather forecasting, HTML, CSS, JavaScript, OpenWeatherMap API, Web technologies.

Introduction

Weather forecasting has become increasingly important for daily decision-making across sectors such as agriculture, transportation, disaster management, and urban planning. With the growing demand for accessible and real-time weather information, web-based forecasting systems offer a powerful solution by leveraging advancements in web development and data integration. This project presents a modular and scalable weather forecasting web application designed using HTML, CSS, and JavaScript. The system is engineered to provide accurate, location-based weather forecasts by integrating external APIs such as OpenWeatherMap, and delivering interactive, user-friendly displays. The application is divided into key modules that enhance maintainability and scalability: data collection, processing, visualization, alert generation, and location tracking. Users can view real-time weather conditions and receive alerts about extreme weather events through a responsive interface. Additionally, the system supports historical data analysis and can be extended in the future with AI/ML-based forecasting models. This modular architecture ensures adaptability and continuous improvement, making it an ideal framework for both current use and future enhancements.

Methodology

The weather forecasting web application is built using a layered architecture, with a focus on modularity and user experience. HTML is used to structure the web pages, CSS for styling and responsive layout design, and JavaScript for dynamic rendering of real-time weather data. The user interface provides intuitive navigation and a clean layout for accessing various weather parameters such as temperature, humidity, wind speed, and precipitation. Weather data is fetched through RESTful API calls from OpenWeatherMap. JavaScript handles the asynchronous data retrieval using fetch() or XMLHttpRequest, processes the JSON responses, and dynamically updates the webpage without requiring a reload. Data Collection: Live weather data is pulled from APIs, and the system can be extended to include satellite and sensor-based data.

Data Processing: Filters and processes raw data using statistical functions to ensure clarity and usability.Forecasting Engine: Currently relies on external API data but is designed to integrate ML models in the backend for predictive forecasting. Visualization & Alerts: Displays weather data using visual components (charts, gauges, icons) and triggers alerts for extreme conditions like storms or heatwaves.

Location Services: Utilizes browser geolocation to provide location-specific forecasts.

Historical Analysis: Stores and analyzes previous data to improve future predictions.

This methodology not only ensures a functional and visually appealing product but also sets the foundation for advanced integration like machine learning or multi-source data aggregation.

Conclusion

The developed weather forecasting web application effectively combines modern web technologies with real-time data sources to deliver an accessible and responsive user experience. HTML, CSS, and JavaScript form the core technology stack, enabling dynamic rendering and interactivity, while integration with OpenWeatherMap provides accurate, up-to-date weather information. Despite some limitations, such as dependency on third-party APIs and the absence of native AI/ML models, the system's modular design allows for future expansion. Planned enhancements include integrating machine learning algorithms for more accurate long-term forecasts, refining the UI/UX for better user engagement, and supporting additional data sources to improve reliability. In conclusion, this project showcases the potential of modular web-based systems in solving real-world problems like weather forecasting and provides a robust base for continued development and innovation.

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Employee Data Management Using Power BI

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Abstract

In today's data-driven world, organizations rely on efficient tools to manage and analyze employee-related data. Power BI, a robust business analytics tool by Microsoft, empowers organizations to gain insights into their workforce. By leveraging Power BI, companies can streamline employee data management, uncover trends, and make data-driven decisions that improve productivity, retention, and business strategy.

Introduction

Data analysis is crucial for informed business decisions. This paper explores employee data analysis using Power BI. The dataset includes demographics, department, salary, and hire dates. Through Power BI's Power Query Editor and Data Analysis Expressions (DAX), we derive insights to enhance workforce management.

Dataset Description

The dataset contains 14 columns and 50 rows detailing employee_id, name, date of birth, age, gender, department, position, salary, hire date, city, and state. Initial steps involved data cleaning and transformation in Power BI.

Data Cleaning

Data cleaning was performed using Power Query Editor, involving removal of duplicates, concatenation of names, data type correction, elimination of non-essential fields, and standardization of gender values.

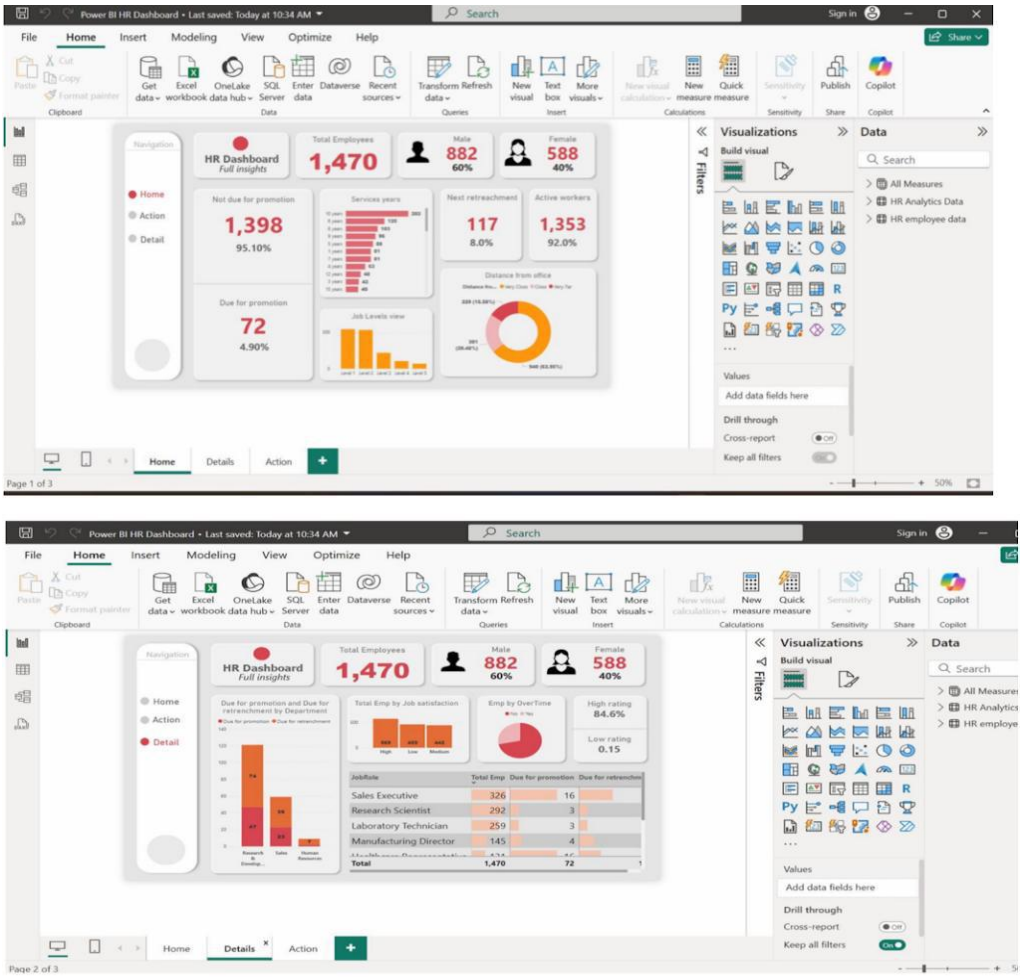
Feature Engineering

Additional features were generated using DAX: average age, average salary, total employees, hire categorization, hire year, years of service, and experience level, enabling deeper workforce analysis.

V. Analysis and Visualization

A. Workforce Analysis
• Grouped by years of experience
• Number by position
• Distribution by department
• Hiring trends
B. Salary Analysis
• Average by department
• Highest/Lowest paying departments
• Salary vs. experience
C. Demographic Analysis
• Gender representation
• Employee distribution by city

Figure 1



Insights and Recommendations

Key findings include high salaries in Marketing, lower compensation in IT, strong retention rates, and balanced gender representation. Recommendations include salary adjustments, strategic hiring, incentive structures, and location-based hiring.

Conclusion

Power BI enables transformation of raw employee data into actionable insights. Through cleaning, feature engineering, and visualization, organizations can enhance employee management and decision-making.

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Location Detection Using Mobile Devices

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Abstract

The rapid advancement of mobile technologies has significantly enhanced the ability to determine user location with high accuracy. This project explores location detection using mobile devices by leveraging various technologies such as GPS, Wi-Fi positioning, Bluetooth beacons, and cellular network triangulation. The aim is to provide real-time, accurate, and energy-efficient location tracking that can support a wide range of applications including navigation, location-based services, emergency response, and geofencing. The system integrates sensor data and network information to improve positioning accuracy in both indoor and outdoor environments. This work also addresses the challenges related to privacy, data security, and power consumption in mobile-based location tracking.

Introduction

With the increasing prevalence of smartphones and other mobile devices, location detection has become a vital feature in modern technology. These devices are equipped with various sensors and connectivity options, enabling them to determine their geographical position with remarkable precision. Technologies such as Global Positioning System (GPS), Wi-Fi, Bluetooth, and cellular networks are commonly used to detect location in both indoor and outdoor environments.

Location detection has wide-ranging applications, including navigation systems, location-based marketing, asset tracking, emergency response, and smart city development. As the demand for real-time and context-aware services grows, efficient and accurate location detection methods have become more important than ever. However, implementing these systems on mobile devices presents challenges such as battery consumption, signal accuracy in obstructed environments, and privacy concerns. This study investigates the various techniques used for location detection on mobile devices, evaluates their performance, and explores strategies to improve accuracy and efficiency while maintaining user privacy.

Description

Location detection using mobile devices refers to the process of determining the physical position of a smartphone or tablet by utilizing built-in hardware and network data. Modern mobile devices are equipped with GPS receivers, Wi-Fi modules, Bluetooth, and cellular connectivity, which can be used individually or in combination to pinpoint the user's location.

GPS (Global Positioning System): Provides high-accuracy outdoor positioning by receiving signals from satellites. It works best in open areas but can be less effective indoors or in densely built environments.

Wi-Fi Positioning: Uses nearby Wi-Fi networks to estimate location, especially useful indoors where GPS signals are weak or unavailable.

Bluetooth Beacons: Offer precise indoor positioning by detecting proximity to Bluetooth-enabled transmitters placed at known locations.

Cellular Triangulation: Estimates position based on the signal strength and timing from nearby cell towers. It provides broader coverage but with lower accuracy compared to GPS or Wi-Fi.

By combining data from these sources, mobile devices can provide accurate and reliable location services. These systems are widely used in various applications such as maps and navigation, location-based advertising, fitness tracking, and emergency services. However, developers must address key challenges like power efficiency, data security, and user privacy to ensure effective and ethical use of location detection.

Technologies Used:

GPS (Global Positioning System)

How it works: Receives signals from satellites to triangulate position.

Accuracy: ~5-10 meters outdoors.

Limitation: Less accurate or unavailable indoors or underground.

Wi-Fi Positionings: Uses nearby Wi-Fi hotspots and compares them to a database of known Wi-Fi networks.

Accuracy: ~10-50 meters.

Limitation: Depends on Wi-Fi network density and quality of database.

Cell Tower Triangulation: Estimates position by measuring signal strength/delay from nearby cell towers.

Accuracy: ~100-1000 meters.

Limitation: Less precise than GPS/Wi-Fi, but works without Wi-Fi or satellite.

Bluetooth & Beacons

How it works: Uses Bluetooth Low Energy (BLE) beacons for indoor tracking.

Accuracy: ~1-5 meters.

Used in: Malls, airports, museums, and indoor navigation.

Inertial Sensors (Accelerometer, Gyroscope, Magnetometer)

Tracks movement and orientation changes to estimate position when GPS is unavailable.

Used in: Indoor location estimation and dead reckoning.

Hybrid Systems

Most smartphones combine GPS, Wi-Fi, cell towers, and sensors for better accuracy and reliability.

Applications

Navigation: Google Maps, Apple Maps, Waze

Ride-Sharing: Uber, Lyft

Fitness Tracking: Strava

Conclusion

Location detection using mobile devices has become an essential feature in today's digital landscape, enabling a wide range of applications from navigation and social networking to emergency response and commercial services. By leveraging technologies

such as GPS, Wi-Fi, Bluetooth, and cellular networks, mobile devices can provide accurate and real-time location information in both indoor and outdoor environments. Despite its benefits, the implementation of location-based services also brings challenges, including signal limitations, battery consumption, and concerns over user privacy and data security. Addressing these issues is crucial to enhancing user experience and building trust in location-aware applications. As technology continues to evolve, future advancements in sensors, artificial intelligence, and data fusion techniques are expected to further improve the accuracy, reliability, and efficiency of mobile location detection, making it an even more powerful tool in everyday life.

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Text Extraction Using Python: Techniques and Applications

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Abstract

Text extraction is a fundamental step in various Natural Language Processing (NLP) tasks and information retrieval systems. With the growing volume of unstructured data—such as scanned documents, PDFs, images, and websites—efficient text extraction has become increasingly important. Python offers a rich ecosystem of libraries that facilitate text extraction from diverse sources including plain text files, PDFs, images (via OCR), and web pages. This article explores the tools and techniques used in text extraction with practical examples.

1. Introduction

Text extraction refers to the process of identifying and retrieving textual information from various sources, such as documents, websites, or images. This process is critical for tasks like data mining, document classification, sentiment analysis, and digital archiving. Python, known for its simplicity and robust library support, is one of the most popular languages used for text extraction.

2. Text Extraction from Different Sources

2.1 Extracting Text from Plain Text or CSV Files

These are the simplest formats:

Python

```
with open('example.txt', 'r') as file:
text = file.read()
```

For CSV files:

python

```
import pandas as pd
df = pd.read_csv('data.csv')
print(df['column_name'])
```

2.2 Extracting Text from PDFs

Python libraries like PyPDF2, pdfminer.six, and PyMuPDF (fitz) are commonly used.

Example using **PyMuPDF**:

Python

```
import fitz  #PyMuPDF
doc = fitz.open("sample.pdf")
text = ""
for page in doc:
 text += page.get_text()
```

2.3 Extracting Text from Images (OCR)

Optical Character Recognition (OCR) is used for extracting text from images using pytesseract:

```
python
from PIL import Image
import pytesseract
image = Image.open('image.png')
text = pytesseract.image_to_string(image)
```

Ensure that Tesseract OCR is installed on your system.

2.4 Extracting Text from Web Pages

BeautifulSoup is a powerful Python library for parsing HTML and extracting information from web pages.

```
python
import requests
from bs4 import BeautifulSoup
url = 'https://example.com'
response = requests.get(url)
soup = BeautifulSoup(response.text, 'html.parser')
text = soup.get_text()
```

3. Advanced Text Extraction Techniques

Regular Expressions (re module): Extract specific patterns such as phone numbers, emails, or dates.

```
python
import re
emails = re.findall(r'\b[A-Za-z0-9._%+-]+@[A-Za-z0-9.-]+\.[A-Z|a-z]{2,}\b', text)
```

Named Entity Recognition (NER): Identify and extract entities like names, places, and dates using spaCy.

```
python
import spacy
nlp = spacy.load("en_core_web_sm")
doc = nlp(text)
for ent in doc.ents:
    print(ent.text, ent.label_)
```

Text extraction has a wide range of practical applications across various industries, making it an essential tool in the era of digital transformation. One of the primary uses is in document digitization and indexing, where physical or scanned documents are converted into searchable digital formats, greatly improving accessibility and storage efficiency. In the business domain, data scraping for market research allows companies to extract valuable insights from websites, social media, and competitor platforms, aiding strategic decision-making. In specialized fields like law and healthcare, legal and medical document analysis leverages text extraction to quickly retrieve relevant information from lengthy reports or case files, enhancing accuracy and productivity. Additionally, in areas such as customer service and brand management, sentiment and opinion mining uses extracted text to assess public perception and feedback from reviews or social media posts. Lastly, in the recruitment sector,

resume parsing enables automated extraction of candidate information, streamlining the hiring process by quickly matching qualifications with job requirements.

6. Conclusion

Python provides a comprehensive toolkit for extracting text from a variety of formats and sources. With powerful libraries like PyMuPDF, pytesseract, and BeautifulSoup, developers and researchers can build scalable text processing pipelines tailored to their specific needs.

As data continues to grow, effective text extraction will play a crucial role in unlocking actionable insights from unstructured information.

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Cultural Site

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Abstract

CulturalSite is a Django-based web application designed to streamline the organization and participation in cultural events across multiple colleges and students. The system supports a dual-user model, enabling colleges to register, manage events, and track student participation, while students can register for events and submit their details. A centralized admin oversees the entire platform, with full control over user management and event monitoring, ensuring efficient coordination and smooth execution of cultural activities.

Introduction:

Cultural events play a crucial role in fostering creativity, talent, and collaboration among students from different colleges, providing them with opportunities to showcase their skills in various artistic fields such as music, dance, drama, and literature. However, managing these events efficiently on a large scale can be challenging when relying on traditional, manual methods. Issues such as miscommunication, difficulty in tracking participation, lack of transparency, and inefficient coordination often arise. To address these challenges, CulturalSite has been developed as a centralized, Django-based event management system. This platform enables colleges to register and manage cultural events while allowing students to easily participate and track their progress. The system is designed with dedicated functionalities for administrators, colleges, and students, ensuring smooth event coordination, reducing administrative burdens, and enhancing student engagement.

Traditional methods of organizing cultural events often lead to logistical challenges, errors, and inefficiencies. Relying on physical registrations, paperwork, and manual data tracking is time-consuming and prone to errors. Colleges struggle to coordinate multiple events, track participation, and manage submissions effectively, while students face difficulties in registering, keeping track of deadlines, and receiving timely updates. CulturalSite leverages Django, a powerful Python-based web framework, to build an intuitive and scalable event management system that simplifies the entire process.

The CulturalSite web application provides an efficient and organized solution for managing cultural events across multiple colleges. By leveraging Django's robust framework, the system streamlines event registration, participation tracking, and administrative oversight. With a dual-user model, colleges can efficiently create, manage, and oversee events, while students can easily register and track their participation. The inclusion of an admin dashboard enhances control over users and events, ensuring seamless coordination. The automated notification system keeps users updated with event details, reducing communication gaps and improving participation. Additionally, mobile compatibility enhances user engagement by enabling access from various devices. The project also emphasizes the importance of data security and privacy, utilizing Django's built-in security features such as password hashing,

CSRF protection, and role-based access control to protect student and event-related data from unauthorized access. In conclusion, CulturalSite significantly simplifies cultural event management, reducing manual effort and improving overall efficiency.

Conclusion

In conclusion, CulturalSite provides a streamlined and efficient solution for managing cultural events across multiple colleges. By utilizing Django's powerful framework, the platform simplifies the event registration process, tracks student participation, and offers seamless administrative oversight. The system's dual-user model ensures that colleges can easily manage events while students can effortlessly register and monitor their involvement. With the addition of an admin dashboard and automated notifications, the platform enhances coordination and reduces communication gaps. Furthermore, its mobile compatibility ensures accessibility from various devices, increasing user engagement. The system also prioritizes data security through Django's built-in features, ensuring the safety and privacy of student and event-related information. Overall, CulturalSite significantly reduces manual efforts, improves operational efficiency, and enhances the overall experience for both students and administrators, making cultural event management more organized and effective.

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A Front-End Approach to Marksheet Processing Using HTML and CSS

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Abstract

This paper presents the development of a web-based marksheet processing system utilizing HTML and CSS. The project addresses the inefficiencies in manual grade computation and documentation processes, providing an automated, visually structured solution for student result management. By employing HTML for layout and CSS for styling, the system enables quick and accurate presentation of academic performance. Though primarily focused on frontend technologies, the system establishes a foundation for future integration with backend tools like JavaScript, Python, or PHP.

Keywords: Marksheet generation, HTML, CSS, Web-based system, Academic records, Frontend development

Introduction

Efficient academic data management is vital in educational institutions. Traditional paper-based or spreadsheet-dependent methods for generating marksheets often lead to data inconsistencies, time delays, and increased chances of human error. As institutions increasingly adopt digital transformation, there is a rising demand for simple, responsive, and easily deployable tools to automate academic reporting. This study introduces a lightweight, front-end based marksheet generation system designed with HTML and CSS. It aims to provide a cost-effective, user-friendly alternative for presenting student results.

Methodology

The marksheet processing system utilizes HTML and CSS to create a structured, user-friendly interface for recording and displaying student performance. HTML defines the layout, including fields for student details such as name, roll number, subjects, marks, totals, and grades, while CSS is used to style the layout, ensure responsiveness across devices, and enhance visual clarity through typography and color schemes. Key features include dynamic input fields for subject-wise marks, calculated outputs for total marks, average, and grades, and a print-friendly layout enabled by CSS media queries. Implemented as a static web page, the system was tested with sample data, confirming its effectiveness in presenting student data clearly and consistently. The interface displays essential information such as student details, subject marks, totals, grades, and includes a placeholder for future ranking logic. This approach offers a simplified solution ideal for small- to mid-scale educational institutions, especially where backend infrastructure is limited. While the current static setup meets basic needs, it opens the door for enhancements like JavaScript-based automation, backend integration with PHP or Python, and features such as user authentication and bulk data uploads.

Conclusion: Overall, the project successfully demonstrates how HTML and CSS can form the foundation of an efficient marksheet processing tool, with significant potential for future scalability and integration into broader academic systems.

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Next Generation Online Ev Charging Slot Management Frame Work

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ABSTRACT

With the rapid adoption of Electric Vehicles (EVs), the need for an efficient and robust charging infrastructure has become essential to support the growing demand for E-Mobility services. However, the current EV charging stations face several challenges, including long waiting times, charging delays, uneven charge scheduling, and an unequal distribution of charging stations. These issues are particularly prevalent during peak hours, leading to increased queues and extended waiting times for EVs. To address these challenges, this project aims to design a comprehensive framework for an advanced online EV charging slot booking system. The proposed system leverages a stochastic queuing model to optimize the charging process at stations. By formulating an objective function that considers charging time, cost, queuing delay, and distance, the system aims to minimize these inefficiencies while maximizing the overall user experience. Additionally, the project introduces a cloud-based Charging Station Management platform that will network and manage multiple charging stations, facilitating real-time charging forecasts and efficient scheduling. This server-based approach will reduce waiting times, improve resource allocation, and help prevent EVs from running out of battery on the road. Ultimately, the proposed system aims to provide a cost-effective, scalable, and user-friendly solution for optimizing EV charging infrastructure.

INTRODUCTION

An electric vehicle (EV) is a vehicle that runs on an electric motor powered by rechargeable batteries instead of using internal combustion engines that run on fossil fuels. EVs are becoming increasingly popular due to their low environmental impact, improved performance, and reduced operational costs. The batteries that power EVs can be recharged by plugging the vehicle into an electric power source, such as a charging station, or by regenerative braking, which captures the kinetic energy of the vehicle during braking and converts it into electrical energy to recharge the batteries.EVs are available in a range of types, including all-electric vehicles, plug-in hybrid electric vehicles, and hybrid electric vehicles. EVs offer several advantages over traditional gasoline-powered vehicles. First, they produce zero emissions while driving, making them a more environmentally friendly transportation option. The availability and accessibility of EV charging stations are critical to the widespread adoption of electric vehicles, and efforts are underway to increase the number of charging stations worldwide. Some governments offer incentives to encourage the installation of charging stations, and partnerships betweenautomakers and charging station providers are working to expand the network of charging stations and make EV ownership more convenient and accessible for drivers.

KEYF EATURES:

System Design and Development

Designing and implementing a web-based platform for Charging Slot Prediction and Automation System.

Developing intuitive user interfaces for administrators, charging station owners, and EV users.

Building the backend infrastructure using Python, Flask, and MySQL database for data management.

Charging Slot Prediction and Automation

Developing algorithms based on deep reinforcement learning (DRL) for predicting charging slot availability.

Implementing automation features for booking, rescheduling, and cancellation of charging slots.

Integrating real-time data feeds to optimize slot allocation and minimize wait times.

User Management and Authentication

Implementing user registration, login, and profile management functionalities.

Ensuring secure authentication and authorization mechanisms to protect user data and system integrity.

Charging Station Management

Developing features for charging station registration, approval, and profile management.

Implementing functionalities for adding slots, defining tariffs, and managing bookings at charging stations.

Payment Processing and Transaction Management

Integrating payment gateways for secure online transactions.

Implementing features for viewing payment details, transaction history, and generating reports.

Notifications and Communication

Integrating SMS and email notification systems for user alerts, booking confirmations, and updates.

Facilitating communication between administrators, charging station owners, and EV users.

Testing and Quality Assurance

Conducting comprehensive testing to ensure system functionality, performance, and security.

Implementing test cases for functional testing, integration testing, and user acceptance testing.

Deployment and Maintenance

Deploying the system to a production environment using WampServer or similar web hosting solutions.

Establishing procedures for ongoing maintenance, including bug fixes, updates, and user support.

Documentation and Evaluation: Documenting system architecture, design decisions, and implementation details.

Evaluating the system's performance in terms of prediction accuracy, user satisfaction, and cost-effectiveness.

Scalability and Future Enhancements

Designing the system architecture to support scalability and accommodate future growth.

Rescheduling and Cancellation:

Booking and Reservation System: Develop an automated booking system that allows EV users to easily find and reserve charging slots. The system will provide a user-friendly interface for browsing available slots, making reservations, and managing charging sessions.

Payment Processing Integration: Integrate payment processing functionality to facilitate seamless transactions for charging sessions. Users will be able to make payments securely through the platform using various payment methods.

Charging Slot Visualizer: Develop a visual interface that displays real-time information about charging slot availability, occupancy status, and predicted demand. The visualizer will help users locate available slots and make informed decisions about charging their vehicles.

PROPOSED SYSTEM

The proposed system aims to transform the electric vehicle charging experience by leveraging advanced technologies like reinforcement learning, particularly Q-learning. Through real-time slot prediction and automated booking processes, the system optimizes slot allocation, ensuring efficient resource utilization and enhancing user satisfaction. By integrating with external data sources and maintaining robust security measures, it promises scalability, reliability, and user privacy. The system will optimize charging slot allocation, enhance user experience, and improve overall operational efficiency of charging stations. Key components of the proposed system include:

Slot Prediction Module: Implement reinforcement learning techniques, such as Q-learning, to predict charging slot availability in real-time. The module will analyze historical data, user behavior, and external factors to anticipate future demand and optimize slot allocation.

Booking and Reservation System: Develop an automated booking system that allows EV users to easily find and reserve charging slots. The system will provide a user-friendly interface for browsing available slots, making reservations, and managing charging sessions.

Payment Processing Integration: Integrate payment processing functionality to facilitate seamless transactions for charging sessions. Users will be able to make payments securely through the platform using various payment methods.

Notification System: Implement a notification system to provide users with real-time updates on booking confirmations, charging session reminders, and payment notifications. Notifications will be sent via email, SMS, or through the mobile app.

Charging Slot Visualizer: Develop a visual interface that displays real-time information about charging slot availability, occupancy status, and predicted demand. The visualizer will help users locate available slots and make informed decisions about charging their vehicles.

Admin Dashboard: Provide an administrative dashboard for charging station operators to manage slot allocation, view booking details, monitor system performance, and generate reports. The dashboard will offer insights into station utilization and revenue generation.

CONCLUSION

In conclusion, the project is poised to revolutionize the landscape of Electric Vehicle Charging Stations (EVCS). By incorporating cutting-edge technologies such as stochastic queuing algorithms, the system brings forth a new era of efficiency, reliability, and user-centric charging experiences. For Web Administrators, the system provides a robust platform for seamless station management, from approval processes to real-time slot optimization. The ability to generate comprehensive reports enhances decision-making, contributing to the overall operational intelligence of the charging infrastructure. Charging Station Owners benefit from a user-friendly interface to manage their stations dynamically. The integration of Stochastic Queuing algorithms ensures optimal slot prediction, preventing unnecessary waiting times and optimizing resource usage. The system's cloud-based architecture allows for scalability, accommodating a growing network of charging stations. For EV Users, the system offers an intuitive and convenient experience. From locating suitable charging stations to transparent tariff information and real-time slot booking, the system prioritizes user satisfaction. Timely notifications and feedback mechanisms enhance the overall user journey. This project stands as a testament to the convergence of technological innovation and sustainable mobility. By addressing challenges associated with EV charging infrastructure, the system plays a pivotal role in fostering the widespread adoption of electric vehicles. Its forward-thinking approach, coupled with a user-centric design, positions it as a cornerstone in the ongoing evolution of electric mobility solutions.

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CARRER PATH FINDER

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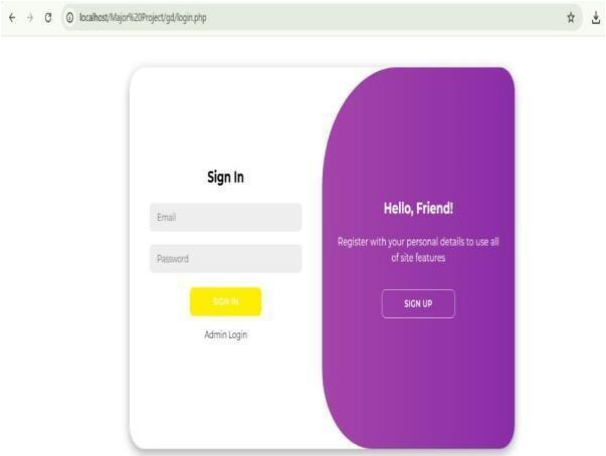
ABSTRACT:
In an era of rapidly evolving job markets and shifting economical and scopes, choosing a suitable career path has become an increasingly complex and daunting task. The traditional methods of career counseling and decision-making often fail to account for the diversity of personal interests, skills, values, and evolving industry demands. As a result, individuals—especially students and early-career professionals—often face uncertainty and confusion when navigating their career options. In response to these challenges, the development of career path-finding tools has gained significant attention in recent years. These tools leverage data analytics, machine learning, and personalized assessment techniques to help users identify potential career paths that align with their unique profiles. The goal of a "Career Path Finder" is not only to streamline the decision- making process but also to empower individuals to make informed, confident choices about their professional futures. This paper explores the conceptualization, development, and implementation of a career path-finding system designed to guide individuals through the intricate process of career exploration.

INTRODUCTION:

In today's fast-evolving job market, students face increasing pressure to make informed decisions regarding their education and career paths. The transition from secondary education to higher education and ultimately into the workforce is often filled with uncertainty, especially as the volume of career options continues to grow. The task of aligning academic interests with long- term professional goals becomes even more complicated by the rapidly changing nature of the global workforce. For many students, this means choosing a career path that may not align with their personal aspirations or strengths, potentially leading to dissatisfaction and disengagement later in life. Recent studies indicate that the employment landscape for recent graduates in 2024 presents a mixed outlook.According to reports, nearly 50% ofgraduates are employed in jobs that don’t necessarily require a degree, contributing to the rise of underemployment.

Additionally, about35% of graduates report high levels of stress in finding meaningful work related to their academic training. This highlights a gap in effective career guidance that considers not just qualifications but also personal interests, skills, and long-term goals.A more personalized approach to career guidance, such as the one proposed in this project, can bridge this gap. By considering students’ academic strengths, personal interests, and professional aspirations, the system can provide customized career suggestions that align more closely with their potential, helping to alleviate some of the challenges faced by graduates entering the workforce.
PUZZLE GAME

SCREEN SHOT OUTPUT



Description:

The application targets individuals seeking personal growth and career advancement, including students, career changers, and lifelong learners. It provides a supportive environment for exploring opportunities, building competencies, and setting long- term aspirations.Without addressing systemic employment challenges, Pursue assists users in overcoming personal hurdles such as lack of direction, skill shortages, and limited growthopportunities. It empowers users to proactively shape their future by aligning the interests with action able career steps. Career Guidance offers a comprehensive toolkit for academic and professional preparation. It emphasizes exam readiness, career advancement strategies, and the development of market able skills to support users in achieving their goals. This application is ideal for students, early- career professionals, and competitive exam aspirants. It serves as a practical resource for individuals preparing for career milestones and building capabilities to excel in their chosen fields.

Problem Statement:

The application addresses common challenges such as inadequate preparation, unclear career aspirations, and existing skill gaps by offering users strategic guidance that enhances their confidence and readiness to pursue academic and professional goals. With a strong focus on aptitude and career guidance, the platform empowers users to discover their strengths, skills, and interests through detailed assessments, and it delivers personalized recommendations and skill-building plans that align career objectives with individual abilities and evolving market demands. Specifically designed for students, job seekers, and individuals seeking career clarity, the application provides tools to support informed decisions regarding education and career paths. To ensure fairness and prevent manipulation in any integrated game-based features, hashing techniques such as SHA-256 can be used to validate game states and secure the integrity of progress, particularly in online or competitive settings. The combination of randomized puzzle generation, structured grid logic, and security measures through hashing creates a solid and engaging user experience. Looking ahead, the platform aims to expand its impact through several future directions, including integration with educational institutions, collaboration with professional networks and databases, deployment on mobile platforms,

and the incorporation of AI for lifelong learning support. Additionally, community-driven development and the integration of emerging technologies will further enhance user engagement and platform relevance.

Conclusion

The overarching goal of the 'GoalDirectory' project is to empower individuals to make confident, well-informed academic and career decisions. By providing tailored career guidance, the system helps align users with career paths that resonate with their unique strengths and interests, ultimately supporting personal growth, professional fulfillment, and long-term success.

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Online Bus Pass Management System

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Abstract

The Online Bus Pass Management System provides a streamlined digital solution for students and employees to register, renew, and manage bus passes efficiently. The system eliminates the need for manual form filling and in-person visits by offering an intuitive online platform. Upon user registration, the system performs verification, and once approved, enables digital payment and issuance of passes. This approach saves time, improves user convenience, and reduces administrative overhead.

Keywords—Bus Pass, Online Management System, Digital Verification, Secure Payment, Web Application.

Introduction

Manual bus pass processes are inefficient and time-consuming for both students and administrative staff. This system addresses these issues by digitizing registration and renewal, ensuring reliable, cost-effective, and faster service delivery. It aims to improve user experience and reduce operational complexities.

System Architecture and Security

The Online Bus Pass System incorporates several security features:

A. User Authentication: Login requires username/password, OTP, or biometric verification. Passwords are stored using hashing techniques.
B. Role-based Access Control: Admins have permission to manage pass records; users can only apply or renew passes.
C. Secure Transactions: Payments can be made through NetBanking or credit/debit cards with encrypted channels ensuring data safety.

System Description

The platform allows users to upload documents, apply online, and receive QR-enabled digital passes. Administrators can manage applications, monitor payments, and provide support via a centralized dashboard. This transition from paper-based to digital format enhances transparency and service efficiency.

Conclusion and Future Scope

The system significantly improves the bus pass process, making it faster, more secure, and user-friendly. Future enhancements may include integration with biometric ID verification and NFC-enabled smart cards to further streamline operations and ensure security.

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Heart Disease Prediction Using Machine Learning

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Abstract
Heart disease is a major global health concern, necessitating early detection for effective treatment and prevention. This paper utilizes machine learning techniques to predict the likelihood of heart disease in patients based on their clinical and lifestyle data. The study processes a dataset containing parameters such as age, gender, cholesterol levels, blood pressure, heart rate, and other medical indicators. Supervised learning algorithms like Logistic Regression, Random Forests, and Support Vector Machines are employed. The workflow includes data preprocessing, feature selection, model training, and performance evaluation using accuracy, precision, recall, and F1-score. This approach aims to assist healthcare professionals in early diagnosis and offers a scalable, accurate, and cost-effective tool for improving patient outcomes.

I. Introduction
Cardiovascular diseases are among the leading causes of death globally. Early detection and accurate risk assessment are crucial for effective prevention and intervention. This paper explores machine learning-based approaches to predict heart disease risk, using diverse clinical and lifestyle features to enhance predictive accuracy.

II. Methodology

A. Problem Definition
The objective is to predict the presence of heart disease using a binary classification approach based on patient features such as age, gender, cholesterol levels, and blood pressure.

B. Dataset Collection
Publicly available datasets like the UCI Heart Disease Dataset and Kaggle repositories are used. Key features include age, gender, resting blood pressure, cholesterol, heart rate, and chest pain type.

C. Data Preprocessing
Data cleaning, missing value imputation, normalization, outlier detection, and categorical encoding are performed. Feature selection techniques are used to retain relevant predictors.

D. Model Selection and Training
Baseline models include Logistic Regression and Decision Trees, while advanced models include Random Forest, XGBoost, SVM, and Neural Networks. Models are trained using train-validation-test splits and hyperparameter tuning.

E. Model Evaluation
Evaluation metrics include accuracy, precision, recall, F1-score, and ROC-AUC. Final performance is assessed on the test set.

III. System Deployment

Trained models are saved using joblib or pickle. An API is built with Flask or FastAPI, and a user-friendly interface is developed for real-time predictions.

IV. Discussion

Heart disease prediction models analyze a wide range of features and detect patterns to identify high-risk individuals. These tools facilitate early intervention through medical or lifestyle modifications, improving overall cardiovascular health and reducing mortality.

V. Conclusion

Machine learning models significantly enhance heart disease prediction by leveraging comprehensive clinical data. They assist in early diagnosis, support clinical decisions, and improve patient outcomes through personalized risk assessments.

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Hospital Management System: A Web-Based Approach Using PUP and MySQL

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Abstract

The Hospital Management System (HMS) is a web-based application designed to streamline the administrative and operational processes of healthcare facilities. This paper presents the implementation of an HMS using PHP, MySQL, Bootstrap, HTML, CSS, and JavaScript. The system features modules for patient management, doctor scheduling, billing, and reporting. The study highlights the importance of digitalizing hospital operations to improve efficiency, reduce errors, and enhance patient care.

Introduction

Hospital Management Systems (HMS) play a critical role in modem healthcare by managing medical records, appointments, billing, and other hospital operations efficiently. Traditional hospital management methods involve significant paperwork, leading to inefficiencies and errors. The proposed web-based HMS leverages PHP for server-side scripting, MySQL for database management, and Bootstrap for responsive design. This paper explores the development, implementation, and advantages of this system in enhancing healthcare services.

As healthcare demands grow, manual systems for handling patient records, scheduling appointments, managing billing, and storing clinical information are proving inefficient and error-prone. A web-based HMS addresses these challenges by automating various administrative and clinical processes within a healthcare facility. This system improves operational efficiency, reduces paperwork, and enhances the overall quality of patient care. The proposed HMS is built using PHP for server-side functionality, MySQL for database storage, and frontend technologies such as Bootstrap, HTML, CSS, and JavaScript for an interactive and responsive user interface. By integrating key hospital modules into a centralized platform, the system aims to optimize resource allocation and simplify management tasks.

Methodology

The development of the HMS followed a modular and iterative approach. Requirements were gathered from typical hospital workflows, including patient registration, appointment scheduling, doctor availability, billing, and reporting. PHP was chosen for server-side scripting due to its reliability and compatibility with MySQL. The MySQL database was structured to handle relationships between entities such as patients, doctors, appointments, and invoices. Bootstrap, along with HTML and CSS, was used to ensure responsive and user-friendly interfaces across devices, while JavaScript added interactivity for smoother navigation. The system was tested with real-time scenarios to validate its performance, security, and usability.

Proposed Work

The proposed system comprises several integrated modules:

Patient Management: Allows registration, updating of personal and medical details, and viewing of appointment history.

Doctor Module: Enables doctors to manage their schedule, access patient records, and enter diagnosis or prescription data.

Appointment Scheduling: Facilitates efficient booking, rescheduling, and cancellation of appointments.

Billing System: Automates invoice generation, payment tracking, and report creation.

Admin Panel: Provides administrators with control over user management, departmental data, and system-wide configurations. Each module is designed to work cohesively within a secure login-based environment, ensuring role-based access and data confidentiality.

Conclusion

The Hospital Management System presented in this project offers a comprehensive digital solution for automating and streamlining hospital operations. By replacing manual processes with a web-based platform, the system significantly reduces administrative overhead, minimizes errors, and improves patient satisfaction. The use of open-source technologies like PHP and MySQL ensures cost-effectiveness and scalability, making the solution suitable for small to mid-sized healthcare facilities. Future enhancements could include integration with lab systems, SMS/email alerts, and mobile app support to further extend its functionality and accessibility. Overall, this HMS lays a strong foundation for efficient, tech-driven healthcare management.

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Online Fitness and Food Diet

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Abstract

This website saysday to day fitness activities and suggests your proper meals that you should consume to remain healthy fitness. In this website the personal training in which a trainer is not physically present in front of you but provides the tips for fitness and diet through mobile or laptop. Get into shape is a dynamic online fitness platform Designed to inspire and empower individuals on their journey to better health and wellness. Through a combination of personalized workout plans, Get into shape offers a comprehensive solution for Individuals of all fitness levels and goals.

Introduction

Welcome to *Get Into Shape*, your ultimate destination for embarking on a transformative journey toward a healthier, stronger, and more vibrant you. At *Get Into Shape*, we believe that fitness is not just a routine—it's a lifestyle shaped by consistent healthy choices. Whether you're a fitness enthusiast looking to push your limits, a beginner eager to kickstart your wellness journey, or someone seeking inspiration to lead a more active life, our platform is here to guide and support you every step of the way. More than just a fitness platform, *Get Into Shape* is a thriving community of like-minded individuals united by a shared commitment to health, wellness, and personal growth. Our offerings include expert-curated nutrition guidance, personalized meal plans, and dietary tips to complement your fitness regime. Additionally, our progress tracking feature allows users to monitor calories burned, performance, and fitness milestones—helping you stay accountable and motivated as you work towards your goals.

Methodology

The development of *Get Into Shape* follows a structured methodology aimed at delivering a user-friendly and results-driven fitness platform. The process begins with requirement gathering, where user needs such as workout plans, nutrition guidance, and progress tracking are identified through surveys and market analysis. Based on these insights, the system is designed using modern web technologies including HTML, CSS, JavaScript, and frameworks like React for a dynamic and responsive user interface.

Backend development employs Node.js and MongoDB to ensure scalable and secure data handling for user profiles, workout logs, and nutritional plans. A modular architecture is implemented to separate features such as workout routines, dietary resources, and progress analytics, enhancing maintainability and scalability.

To enable real-time tracking, APIs are integrated to calculate metrics like calories burned and daily activity summaries. The nutrition module features expert-curated meal plans and tips, stored in a structured database for personalized recommendations. Regular testing, including usability tests and performance checks, ensures the platform remains intuitive and reliable across devices. Finally, feedback loops from beta users are used to continuously

improve the system, ensuring that *Get Into Shape* evolves in line with the users' fitness needs and technological advancements.

Conclusion

With this project people can keep with dietand fitness healthy with basic services that is provided in the website so, this website can help them to keep their health with conscious and consistent food diet. Get into shape offers a comprehensive platform for individuals seeking effective workout schedules and diet plans. With user-friendly interfaces and expert guidance, it empowers users to Achieve their fitness goals efficiently. Join get into shape today and embark on your journey to a healthier, stronger you.

Food Delivery

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Abstract
Food delivery services have revolutionized the way people access meals, offering convenience, variety, and efficiency. Through mobile apps and online platforms, customers can order food from restaurants and have it delivered to their location. The industry has grown rapidly due to advancements in technology, changing consumer preferences, and the demand for quick, contactless services. This system benefits both businesses and consumers by enhancing accessibility and expanding market reach.

Introduction
Food delivery services provide a convenient way for customers to order meals from restaurants and have them delivered to their doorstep. With the rise of online platforms and mobile apps, food delivery has become faster and more accessible, offering a wide range of cuisines to suit different tastes. Whether through dedicated delivery apps or restaurant services, food delivery ensures a hassle-free dining experience at home or work.

Methodology
The development of the food delivery service system involves a structured approach encompassing requirement analysis, design, development, testing, and deployment. The methodology begins with gathering user requirements through surveys and competitor analysis to identify core features such as menu browsing, real-time order tracking, secure payment integration, and user-friendly interfaces for both customers and restaurants. The system is designed using a multi-tier architecture. The front-end is developed using HTML, CSS, and JavaScript frameworks like React or Vue.js to create responsive and interactive user interfaces. The back-end utilizes Node.js or PHP for server-side scripting, connected to a MySQL or MongoDB database for storing user profiles, order history, restaurant menus, and payment records.

Key modules include user registration and login, restaurant and menu management, cart and checkout functionalities, order processing, and delivery tracking. APIs are integrated for map services (e.g., Google Maps) to enable real-time location tracking and route optimization for delivery personnel. Secure payment gateways (e.g., Stripe or Razorpay) are incorporated to facilitate safe and efficient transactions. Testing is carried out at various stages, including unit testing for individual modules, integration testing to ensure smooth interaction between components, and user acceptance testing to verify the system meets the end-user expectations. After testing, the system is deployed on cloud platforms such as AWS or Firebase for scalability and reliability. Maintenance and updates are performed regularly based on user feedback and evolving market needs to ensure the platform remains competitive, secure, and efficient.

Conclusion

Food delivery services have transformed the way people access meals, offering convenience, variety, and efficiency. With the rise of online platforms and mobile apps, ordering food has become faster and more accessible. While the industry continues to grow, challenges such as logistics, food quality, and delivery costs remain. However, with technological advancements and evolving consumer demands, food delivery is set to become even more seamless and efficient in the future.

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DIABETES PREDICTION USING MACHINE LEARNING

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ABSTRACT

Diabetes prediction through machine learning techniques has gained significant attention due to its potential to aid in early diagnosis and proactive management of this chronic disease. This project aims to develop an efficient predictive model for diabetes based on readily available clinical data. Leveraging a dataset containing various features such as glucose levels, BMI, age, and blood pressure, we employ machine learning algorithms to build a predictive model. Initially, we preprocess the data to handle missing values and normalize the features to ensure optimal performance. Subsequently, we experiment with several classification algorithms including logistic regression, random forest, and support vector machines to identify the most suitable model. Through rigorous evaluation using techniques like cross-validation and performance metrics such as accuracy, precision, recall, and F1-score, we assess the model's efficacy in predicting diabetes. Additionally, feature importance analysis is conducted to ascertain the contribution of different variables toward prediction accuracy. diabetes, thereby facilitating personalized treatment strategies and ultimately improving patient outcomes.

INTRODUCTION

Diabetes, a chronic metabolic disorder characterized by high blood sugar levels, has emerged as a significant health concern worldwide, affecting millions of individuals. Early detection and management are crucial in mitigating its adverse effects on health. Machine learning (ML) algorithms offer promising avenues for predicting diabetes risk based on various factors such as lifestyle, genetics, and medical history. This project aims to leverage ML techniques to develop an accurate and efficient predictive model for diabetes, ultimately aiding in early diagnosis and personalized intervention strategies.

Modules:

1. Data Collection

Use a dataset like the PIMA Indian Diabetes Dataset from Kaggle or UCI Machine Learning Repository, which contains medical features like glucose levels, BMI, and age.

2. Data Preprocessing

- Handle missing values (e.g., replace with mean/median).
- Normalize/standardize numerical features.
- Encode categorical variables (if any).
- Split the dataset into training (80%) and testing (20%) sets.

3. Feature Selection

- Use correlation analysis or feature importance (using RandomForest, XGBoost, etc.) to identify relevant features.

4. Model Selection & Training

Train different ML models like:

- Logistic Regression
- Random Forest
- Support Vector Machine (SVM)
- K-Nearest Neighbors (KNN)
- Gradient Boosting (XGBoost, LightGBM)
- Neural Networks (TensorFlow/Keras for deep learning)

Use GridSearchCV or RandomizedSearchCV for hyperparameter tuning.

5. Model Evaluation

Evaluate using:

- Accuracy
- Precision, Recall, F1-score
- Confusion Matrix
- ROC-AUC Curve

6. Deployment

Deploy using Flask or FastAPI:

- Create an API that takes user input (medical data) and predicts diabetes.

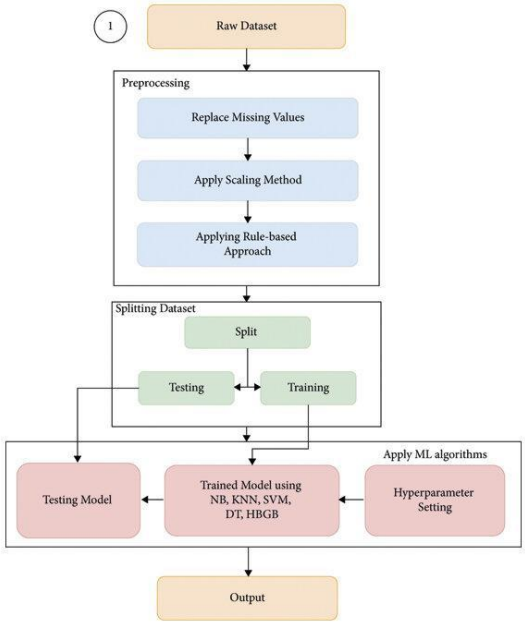

Figure 1: Diabetes prediction Block Structure Diagram

EXISTING SYSTEM

The existing system for diabetes prediction primarily relies on traditional diagnostic methods, such as blood tests, patient medical history, and clinical assessments. Doctors analyze fasting blood sugar (FBS), oral glucose tolerance test (OGTT), and hemoglobin A1C (HbA1c) levels to determine whether a patient has diabetes. While these methods are highly accurate, they often require laboratory testing, which can be time-consuming and costly. Additionally, early-stage diabetes symptoms may go unnoticed, leading to delayed diagnosis

and increased health risks. To address these limitations, machine learning has been introduced as a promising solution for diabetes prediction.

CONCLUSION

The diabetes prediction system using machine learning is a comprehensive solution designed to assess an individual's risk of diabetes based on health parameters. The system is built with multiple interconnected modules, including data collection, preprocessing, machine learning model training, deployment, and user interface, ensuring a seamless and efficient prediction pipeline.

REFERENCE

"Diabetes Prediction Using Machine Learning and Explainable AI"

This study presents an automatic diabetes prediction system developed using a private dataset of female patients in Bangladesh and various machine learning techniques. The authors employed models such as Decision Tree, SVM, Random Forest, Logistic Regression, KNN, and ensemble methods to determine the most effective approach. Additionally, they developed a website framework and an Android application for real-time diabetes prediction.

"An Ensemble Learning Approach for Diabetes Prediction Using Boosting Algorithms"

This research evaluates five boosting algorithms on the Pima Indian Diabetes dataset to predict diabetes. The study emphasizes the importance of data preprocessing techniques like upsampling, normalization, feature selection, and hyperparameter tuning to enhance predictive analytics.

"A Comparison of Machine Learning Algorithms for Diabetes Prediction"

This paper compares seven machine learning algorithms to predict diabetes, finding that Logistic Regression (LR) and Support Vector Machine (SVM) models perform effectively on the dataset.

"Pediatric Diabetes Prediction Using Deep Learning"

This study proposes a novel technique for early diabetes prediction with high accuracy using deep learning. The model is constructed by implementing ten hidden layers and multiple epochs using the Deep Neural Network (DNN)-based multi-layer perceptron (MLP) algorithm.

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