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Teerthanker Mahaveer University

Teerthanker Mahaveer University has been established by an 'Act' (No. 30) of 2008 of the Government of Uttar Pradesh and is approved by the University Grants Commission (UGC) vide letter No. F. 9-31/2008(CPP-1) dated October, 2008. The University is located on National Highway-24, barely 144 Km from New Delhi.

The University stands committed to the ideals of Lord Mahaveer – Right Philosophy, Right Knowledge, and Right Conduct – in all the spheres of activity and aspire to be recognized as the ultimate destination for world class education.

The multi-disciplinary University offers career oriented courses at all levels, i.e., UG, PG and Doctoral degrees across diverse streams, namely, Medical, Dental, Pharmacy, Nursing, Paramedical Sciences, Physiotherapy, Hospital Administration, Education, Physical Education, Engineering, Architecture, Polytechnic, Management, Law, Journalism, Fine Arts, Jain Studies, and Agriculture Science to meet rising aspirations of the youth.

Faculty of Engineering & Computing Sciences

The College of Engineering has emerged as a hub for academic excellence in engineering training. The college contributes to quality education in all major disciplines of engineering and technical education and helps to meet the needs of industry for trained technical manpower with practical experience and sound theoretical knowledge.

The college was established by the university with the aim of providing relevant, essential, upgraded education to the young aspirants in the field of computer science and engineering, including computer applications. In recent times and the years to come there will be increasing demand of skilled manpower in the domain of Computer Science and Engineering because of the 'Digital India' mission projected around the globe by Government of India.

S & T Review is a peer-reviewed, and multidisciplinary engineering journal that publishes original research, case studies, & review articles of all major branches of Engineering, Science and Technology. The Journal does not charge for publishing any manuscript. The papers contained in the journal carry the opinion and view of the contributors and not necessarily of the editorial Board. The editorial Board will not be responsible for the authenticity and legality concerns regarding the submission made in this journal. The entire responsibility will depend on the author of the papers or case studies.

CHIEF PATRON

Shri Suresh Jain

Hon'ble Chancellor

Teerthanker Mahaveer University, Moradabad

I am extremely glad and in a state of inner happiness on the arrival of Vol-8, Special Issue (issue 1&2) of S &T Review, an International Journal of Science and Technology. Faculty of Engineering and Computing Sciences deserves great applause for this. Since the world is growing very rapidly and no doubt creative researches have changed the entire technology in the domain of Engineering, Medical Sciences, Computing Sciences and variety of industrial products. Certainly, research in any discipline is not a one-day task as consistence and continuous efforts are required to put in for the sake of making it constructive for the betterment of entire mankind. Gone are the days when things used to seem impossible. The contemporary time witnesses the era wherein technology is creating wonders. In a world heralded by technology, research in academic institutes lays the foundation of a nation's growth and well-being. The University, since inception, is a research-driven university which, on one hand, strives to educate the students and on the other, endeavours to discover new knowledge frontiers through research. This is, heart pleasing to notice that Faculty of Engineering & Computing Sciences remains in sync with expanding frontiers of academics and industrial practices through various on-going research projects and collaborations with many national and international organizations. The college works diligently to realize its mission of providing the best learning, teaching and research opportunities to students and academicians alike, it continues to supply students with the basics of modern knowledge and high values. I would like to put into records sincerest appreciation and heartiest felicitations to Prof (Dr) R. K. Dwivedi, Director and Principal, FoECS, and Editor- in- Chief S&T Review, Associate Editors, Advisory Committee for bringing out the journal successfully up to the extreme satisfaction of research students, researchers and scientists on regular interval.

I believe that the college will continue to mark revolution through quality research work to bring laurels to Teerthanker Mahaveer University in India and abroad.

Institution is doing surprisingly great in all directions. Wishing a bright future to all stakeholders!

CHIEF PATRON

Shri Manish Jain
Hon'ble Group Vice Chairman,
TMU, Moradabad

Stellar accomplishments broaden the frontiers of knowledge and scholarship with each passing day. In this eon of Globalization of education, the apparent emphasis is on the quality of education. Since there is nothing which stands as a single yardstick of quality, a good educational institution, therefore, strives unceasingly for sustenance and enhancement of quality in every field of its activity whether it is academics, research or extra-curricular.

Education defines the path of progress and prosperity for which Faculty of Engineering & Computing Sciences is very much committed as it is evident from the various activities carried out throughout the year under the vigilant supervision of Professor R.K. Dwivedi, Director & Principal, FoECS. Great Satisfaction & immense pleasure comes to the heart on witnessing that FoECS is publishing Vol-8, Special Issue (issue 1&2) of S&T Review in the Month of December 2021 as one more step in the direction of boosting the research environment in the college. The research activities at FoECS lead to an amazing enhancement of the experience within the students since the research training has been provided to the students to create the next generation of well-prepared scholars with advance knowledge and emerging trends of technology. The college holds firm conviction that extension of research opportunities to an ever-increasing group of undergraduate students adds a dimension of experience to the undergraduate education that, for sure, cannot be duplicated in the classroom.

S&T Review, an International Journal of Science and Technology stands as a witness to the monumental efforts taken by the college under the worthy guidance of Prof. R. K.Dwivedi, Director & Principal FoECS to make the college as a centre of excellence in education and research.

I extend my greetings and bests wishes to the team FoECS and wish their endeavours for future prospects.

PATRON

Prof. Raghuvir Singh

Hon'ble Vice Chancellor,

TMU, Moradabad

The contemporary time witnesses an era which is truly defined as a fast changing world, a changing society which has been progressing at a galloping speed and there is no exaggeration in saying that impact of science, scientific research, technological development and globalization in our daily life is vibrant and inescapable. Consequently, the requirement to be geared up for tomorrow is surely greater than ever since the advent of life on earth. With this mind, the university continues to march progressively towards its aim to provide responsible citizens who will record their valuable contribution in nation building. Known to all, the progress of nation depends upon the quality of teaching-learning process along with research activities. Keeping the same in mind, together with providing responsible citizens, effectiveness and efficiency of aforesaid is the goal of the university. FoECS is simply unstoppable in its progress as it has been actively involved in countless activities that have brought to light the hidden talents of the college students and staff. The highly qualified and dedicated members of the college, since inception, have always been standing shoulder to shoulder with the management and have been carrying out their duties with a level of commitment.

University education system, particularly technical education, requires a platform to encourage budding researchers for publishing their research output in the form of journal articles. Heart receives enormous pleasure to notice the publication of Special issue of S & T Review, an International Journal of Science, and Technology which is serving as a platform for publishing the research works covering all branches of Engineering and allied fields. These scholarly publications will be a medium for academic and scientific discussions and enrichment of research areas which will finally lead to the overall development of the community and society at large.

Congratulations to Prof. R.K. Dwivedi, Director and Principal, FoECS, Editor-in- Chief, Associate Editors, Section Editors and Advisory committee to motivate for creating a positive environment of research in the college.

Editor in Chief

Prof. (Dr.) R. K. Dwivedi

Principal & Director, FoECS

TMU, Moradabad

Faculty of Engineering & Computing Sciences is well known for the way it is moving ahead on the road of academic excellence in conjunction with dedication towards dissemination of knowledge in the academic world. The College strongly advocates the role of research in education, hence is committed to ripen an inclination on the way to research in both faculty and students. In this quest, the College has taken the initiative to unveil another issue of the journal named S &T Review, an International Journal of Science and Technology to embolden researchers and academicians to pursue research.

My heart brims with great joy and happiness by seeing the efforts of publishing team of S&T Review. With an aim to uphold high academic standards in line with academic ethics and academic integrity, a rigorous process of blind review of research papers is embraced accompanied by screening of plagiarism of each manuscript received by team S&T Review for publication. The research work published in the journal, beyond the shadow of doubt, is original which is neither in print nor presented at any other public forum.

A deep sense of satisfaction surge through my heart in acclaiming that FoECS has been progressing by leaps and bounds and has grown in stature and strength as it has emerged as one of the finest educational institutes dedicated to the pursuit of knowledge and experience. I believe that the current issue of Vol-8, Special Issue (issue 1&2), alike preceding issues, will add lustre to college's prestige.

In the words of great visionary Hon'ble former president Dr APJ Abdul Kalam:

"Learning gives creativity, Creativity leads to thinking,
Thinking leads to knowledge, Knowledge makes you great."

May the quality education FoECS has been imparting to the students enlighten their minds and ignite the spark of aiming high in their hearts.

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DEVELOPMENT OF NATURAL FIBRE REINFORCED POLYMER MATRIX COMPOSITES: TREND AND CHALLENGES

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Abstract

Because of their small weight and moderate strength, eco-friendly composites have lately gained popularity. Because of the positive environmental impact of synthetic fibres, many researchers are looking for alternative materials. Polymers are materials that exist naturally or are synthesized artificially. Long chains of molecules integrated in three dimensional architecture, with exceptional flexibility and strength. Fiber reinforced composites are mostly employed as structural components in industries and as a wood substitute. Fiber reinforced composites are made by reinforcing fibres in a polymeric matrix and shaping them to fit. Natural fibres, on the other hand, such as jute sisal, hemp, flax etc. are increasingly commonly utilized as reinforcements and perform similarly to artificial fibres. Man-made fibres like as carbon, glass and kevlar were utilized as reinforcements in the start and have shown to be the best in terms of characteristics, reinforcing capacity, and usefulness. Research investigations also show that when man-made and natural reinforcements are combined in a hybrid form, the composite characteristics increase significantly. The composite material obtains all of the better qualities of individual fibres as a result of this combination, and when the composite is subjected to varying loads, each fibre gives its own maximal resistance. The chemical and physical properties are further enhanced by including particular reinforcements into polymer matrix composites, which provide whole new features (which has transformed the aerospace, marine, defense and automobile industry). As a result, the composite would be better in all attributes. The current study provides a thorough examination of the different challenges concerning the synthesis and mechanical characterization of natural fibre reinforced hybrid polymer composites. Future difficulties, as well as areas of use for polymer matrix composites, have been investigated that may aid in the elimination of plastic waste and the reduction of environmental pollution.

Keyword: *Eco-friendly Composites, Natural fiber Reinforcement, Mechanical Characteristics*.

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1. Introduction

Selection of material is critical step for making a sustainable product during engineering design process. Materials are significant for meeting desired mechanical qualities, physical properties and aesthetics of the products that play a key part in consumer experience. It is important for any product to be designed at a reasonable cost. Product performance and its recyclability are also key factors for selection of right material during engineering designing. A variety of criteria, constraints, and limits influence the use of a certain material in a specific application **[1]**. It makes maximizing these constraints and selecting the appropriate type of material a difficult subject requiring appropriate considerations. Latest technologies e.g. optimizations, artificial intelligence based expert systems are used to conclude at appropriate material selections because of innate linkages between materials and their machinability, availability, product design, recyclability, cost and performance in the finished product [2-4].

Recently, polymer composites reinforced with natural fibre have gained popularity. In polymer-based matrices, natural fibres (e.g. sisal, jute, hemp, flax, kenaf etc.) are used as reinforcing material. The government's emphasis on new environmental legislation and sustainability goals, as well as growing environmental and petroleum resource costs, all contributed to increased natural resource exploitation [5-7]. Natural fibres will reduce waste disposal issues and pollutants [6]. Natural fibre composites have been demonstrated to be eco-friendly materials and have emerged as an alternative to glass or carbon reinforced polymer composites [5-7]. Natural fibres have significant benefits over traditional glass fibres, making them extremely competitive in modern industrial applications, notably automotive applications. There are many benefits such as better acoustical and thermal insulating qualities, low cost, availability, energy recovery, increased CO2 sequestration, decreased cutaneous and less tool wear during machining [5-11]. The characteristics and performance of NFC-based engineering products are determined not only by the properties of their individual components, but also by their compatibility and interfacial (polymer/filler) characteristics, opening the opportunity to the development of many promising new materials with completely novel properties [6-10].

Our exhaustive literature study revealed a scarcity of knowledge on choosing the best natural fibre materials for a tribological usage and their trends. On the other hand, it is owing to the numerous opportunities for developing new natural fibre composite materials with innovative

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features [7]. Considering wide range of sought features impacting the selection for specific applications, pair-wise examination of natural fibre and composites are required for making informed decision to pick suitable material. Subsequently, design engineer will be able to select the appropriate natural fibre composites materials in view of design objectives and restrictions. As per research paper study and known knowledge, a few studies have ranked the different types of natural fibre composites in view of desired criteria. Such juxtaposing was carried out utilizing particular and broad criteria, like mechanical, technical, and cost, although not entirely. Furthermore, there was a not enough structured grouping of the aspects and criteria influencing the natural fibre composites selection method. It means, there is not enough large collection of selection criteria for NFC (natural fibre composites) that can be harnessed as the key selection method for design engineers.

As a result, the aim of this investigation is to: categories the significant parameters and selection criteria influencing the selection procedure of NFC materials for various industrial applications (e.g. automobile); explain the prospective features of natural fibres (particularly coir, hemp, date palm and sisal) in comparison to other types of fiber employed in the automobile industry for tribological applications; address the problems.

2. Literature Review on Mechanical Properties of Polymer Composites

Designers must build composite materials components, as opposed to isotropic materials, depending on functional needs. This entails selecting the right reinforcement, matrix, and curing method, as well as other factors that should be executed optimally. The development of a materials database that can be used to compare the features, properties, and performance of various materials assists not just the material selection process but also the engineering design process as a whole. Regardless of application, the intrinsic material, physical, and chemical property of each natural fibre composite is used to characterize its capabilities [12-13]. As a result, before being considered for use in the design process for any given application, natural fibre composite materials should be examined for a number of features and properties [7]. This should be done while considering polymer base matrix material of various types and conditions of natural fibre.

The study's authors recommend categorising these important components or criteria for selecting NFC items into the workflow levels mentioned below: (1) The Natural Fiber Property

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Level: Here, physical, mechanical, chemical, thermal, environmental and biological properties, as well as the quality, pricing and availability of the fibre, and so on, must be evaluated. (2) The Polymer Base (matrix) Property Level: Here, physical, mechanical, chemical, thermal, environmental properties, polymer toxicity and cost, should be considered. (3) The Composite Property Level: Properties that are not required to closely match any of the fibre or matrix characteristics. Thus, in addition to the health, cost and safety aspects of the composite, the selection process should factor physical, mechanical, structural, thermal, environmental, and technical parameters. (4)Specific strength, Mechanical, bio-stability, climate and environmental resistance, water absorption, bio-degradability, and other equivalent qualities must all be considered into account while selecting. (5) Specific Composite Performance Level: As per required application, specific criteria can be examined. Thermal insulation qualities, acoustic insulation properties, weight, low maintenance, crash test, social aspect, safety and health and other variables must be explored for the vehicle industry. Figure 1**,** displays the many steps of criteria and components that impact the selection of natural fibre composite items. These are the major motivators for the industry to employ any NFC device in a certain application. For example, in natural fibre composites, given the same polymer matrix, the natural fibre type alone can significantly alter the characteristics and features of the final produced composites [5, 4, 7, 10, 14].

3. Comparative Literature Review of PMCs Reinforced by Natural Fibers and Man-made Fiber

Mechanical qualities are critical in selecting appropriate reinforcing fibres for automotive applications. These qualities include tensile strength, elasticity and elongation to break and tribological properties.

Wear and friction are two key tribological processes that occur during the relative motion of interfacial surfaces and typically consume energy and degrade materials [15-19]. Tribological behaviour of virgin polymer alloys can be enhanced by numerous approaches, in general. The most popular technique for producing composites is to incorporate fibres into polymers [20-26]. Glass fibres, aramid fibres, and carbon fibres are well-known polymer reinforcements that are mostly used in the industry. A few studies have been conducted to investigate the viability of substituting natural fibres by conventional reinforcement. Figure 1**,** depicts the change of

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the friction coefficient and wear rate of a polyester composite with reinforcement of woven glass and seed oil palm at different sliding distances. A tribo-machine with block on disc fitted a stainless steel (SS) counter-face was mounted for testing the wear. Glass fibre reinforced polymer composites outperformed polyester composites reinforced by seed oil plam in terms of COF and wear rate. Finally, polyester composite reinforced with 35% seed oil palm performed well in terms of wear.

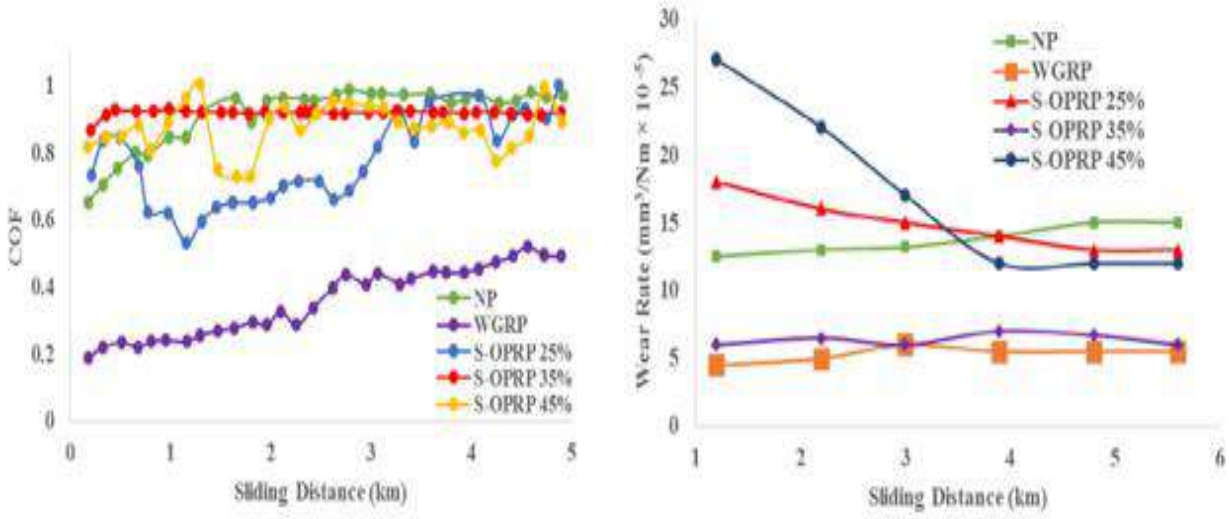

Figure 1: Variation of friction coefficient and specific wear rate with sliding distance [27].

The wear rate and friction coefficient of these composites were investigated in relation to untreated jute fibre orientation and volume fraction. Samples of the both planned composite systems, in dry conditions at low and high energy levels pressure-velocity (PV) product, are evaluated. Low PV values of 0.61 MPa m/sand high PV values of 1.65 MPa m/s are selected. A steel disc with 57 HRC hardness and a 0.15m surface roughness is used for wear and friction testing. The results exhibited that the composites friction coefficient is directly proportional to the percentage of fibre volume in the composite, but composites wear rate is inversely proportional to the percentage of fibre volume in the composite. Furthermore, composites with fibres oriented perpendicular against the sliding direction have a lower wear rate than parallel and anti-parallel orientations [27-28].

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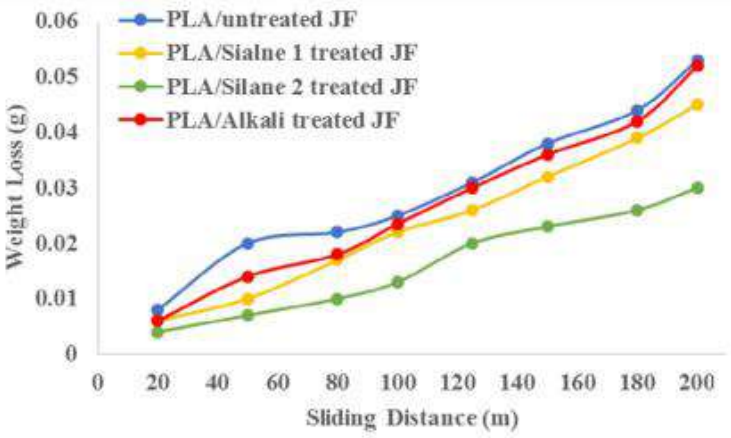

Figure 2: Plots between weight loss and sliding distance for untreated and several treated composites [29].

According to studies, treating the jute fibre can assist in additional improvements in wear rate. **Figure 2,** depicts the impact of various fibre treatment procedures on the wear rate of poly-lactide jute composites. A pin-on-disk device with 0.418 m/s sliding speed and 9.8 N load was utilised for abrasive wear tests to examine the effect of natural fibres on the tribological properties of bio-composites. Due to their poor interfacial adhesion and lower stiffness between fibre and matrix, untreated samples lost more weight. It is feasible to improve interfacial bonding with the matrix and fibre stiffness by integrating fibre treatment. As a result, all treated fibres demonstrated enhanced wear resistance. Silane-2processedpoly-lactide/jute-fiber composite exhibited the highest wear resistance compared to other fibre treatment procedures because of the strong interfacial adhesion. Furthermore, the weight loss increased as the sliding distance increased, owing to progressive material removal comprising matrix and fibre with distance [29].

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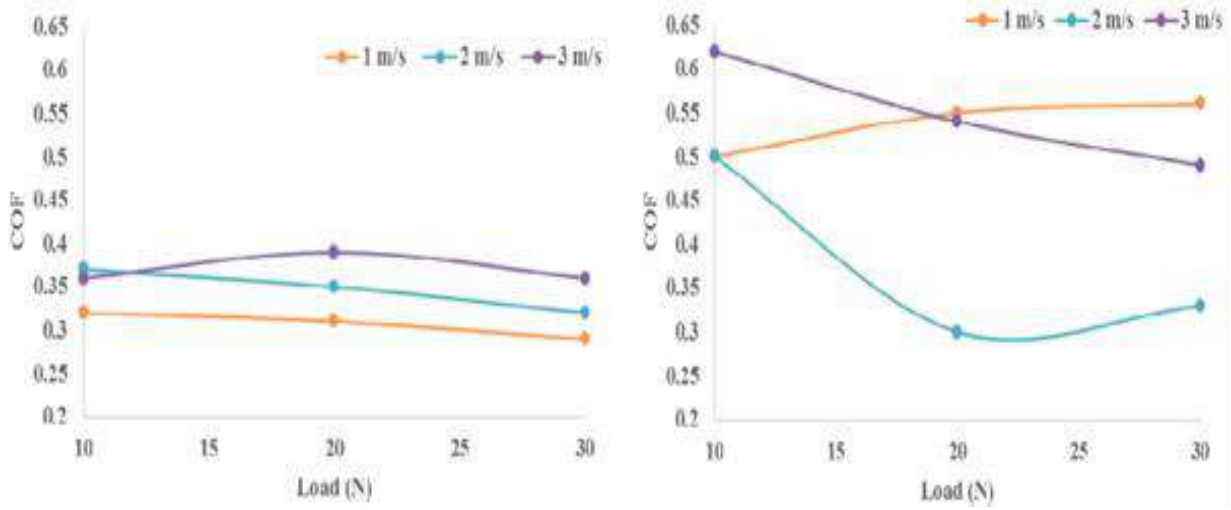

Figure 3: Friction coefficient against applied load for (a) neat PP; (b) jute/PP [30].

Figures 3 and 4**,** show the influence of varying sliding speeds 1m/s, 2m/s and 3 m/s and applied loads 10N, 20N, and 30 N on the friction coefficient and specific wear rate of polypropylene composites reinforced by clean jute fabric. Wear testing is carried out by a pin-on-disc tester with a 62HRC hardened steel disc with 1.6 m Ra surface roughness. The temperature of surface triggered by thermal softening that can initiate an increase in wear intensity, is significant point that can impact the composites tribological characteristics. The decrease in coefficient of friction with increasing loads demonstrated that the counter interfacial temperature had gone up. This is the most likely the reason for the reduction in coefficient of friction readings with higher load. Figure 4**,** depicts the change of wear rate at various applied weight and sliding speeds for clean polypropylene composite reinforced with woven jute. For both clean polypropylene and jute-polypropylene produced composites, the wear rate increases with higher applied stress [30]. At higher sliding speeds, the polypropylene (pp) and jute composite exhibited reduced wear performance.

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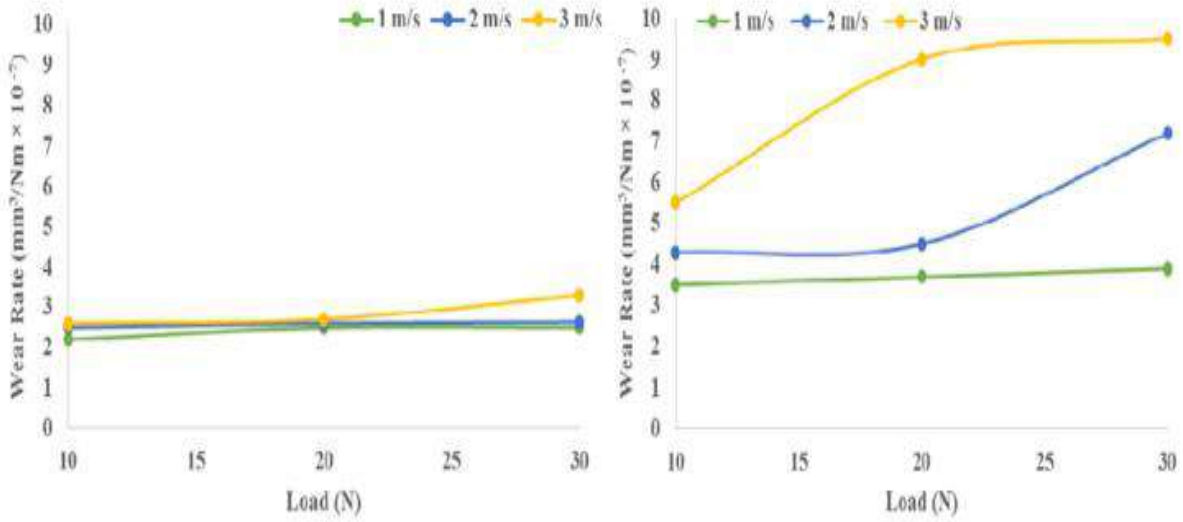

Figure 4: Variation of specific wear rate vs applied load for (a) neat PP; (b) jute/PP [30].

4. Conclusions

Several factors influence end-user goods made using NFC. For the first time, our effort was able to identify and systematically list the parameters that impact NFC materials at distinct levels. These grouped criteria may be utilised as a major lever by designers while selecting the appropriate NFC material against a certain application. In this work, the tribological behaviour of polymer composites reinforced with major natural fibre such as rice husk, jute, coir, kenaf, sisal, oil palm and date, bio-waste products and sugarcane is reviewed. The results demonstrate that natural fibres have a significant impact on the influence of tribological qualities. As a result, these "green" composites may be used in a variety of industrial use cases that demands improved tribological qualities. This article discusses the effects of fibre treatment, fibre orientation, and fibre volume fraction at the tribological characteristics of natural fibre reinforced polymer matrix composites at various loads and temperatures.

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POLYPROPYLENE FIBRES' IMPACT ON CONCRETE STRENGTH

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Abstract

Polypropylene fibre (PPF) is a type of polymer material that is lightweight, highly durable, and resistant to corrosion. PPFs can be added to concrete to increase its crack resistance. Concrete's pore size distribution can be improved via PPF. As a result, because PPF may prevent damaging ions or water from penetrating concrete, its durability is greatly increased. We have added PPF at 0%, 0.25% and 0.75%. The impact of polypropylene fibre on concrete's resistance to fire, drying shrinkage, creep, and water absorption is outlined in this study. The influence of fibre content, fibre periphery, and fibre mongrel rate on these continuity indicators was examined by the authors. The downsides of PPF in operation in concrete are the amiss dissipation in concrete and weak cling with cement matrix.

Keywords: *Polypropylene Fibre, durability, creep*

1. Introduction

Polypropylene fiber, also known as PPF, is a type of direct polymer synthetic fiber that can be obtained through the polymerization of propylene. It has some advantages that are comparable to those of having light cargo, high energy, high continuity, and resistance to corrosion. The PPF has significant experience in a variety of fields, including construction, chemical sedulity, dynamism, vesture, and environmental security. Concrete suffers from the drawbacks of having a low tensile energy, a weak deformation resistance, and a penurious check resistance when it is used in the construction industry. It is simple to create micro cracks from the exterior to the interior of the concrete, which increases the permeability of the concrete. Water or other potentially harmful ions can easily penetrate the interior of the concrete, which speeds up the process of the concrete's deterioration. When PPF is added to concrete, a three-dimensional arbitrary division network structure has the potential to be

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formed in the concrete. This structure has the capability to effectively inhibit the generation and progression of micro cracks. As a consequence of this, the PPF is able to withstand the presence of water and other potentially harmful ions in concrete. The utilization of PPF can result in an increase in the longevity of concrete. PPF can be utilized in the fields of architectural engineering, pavement engineering, and hydraulic engineering as a result of the excellent groupings. In the field of architectural engineering, the foundation construction of a high-ascent structure needs to have a single pour of mass concrete. The ready-mixed concrete is prepared to carry out thermal checks at an earlier time. The PPF has the potential to significantly cut down on the number of temperature checks performed on the concrete. In addition, the use of PPFs can help improve the rebut-permeability of the concrete by reducing the amount of through checks that are present in the concrete. When it comes to pavement engineering, pavement constantly bears the jolt weight of instruments, which necessitates good continuity and crack defiance. This is especially important for pavement that has voluminous business measure or heavy loading business. The consistency of the PPF-substantiated concrete is more consistent than that of the plain vanilla concrete. When performed in concrete, PPF has the potential to significantly enhance the strength of the pavement's continuous surface. In the meantime, there are fewer scrapes that are cropped under the jolt weight of instruments, which indicates that the durability of the pavement is improved by the utilization of PPFs in concrete. Hydraulic engineering, also known as ground engineering, kraal engineering, and levee engineering, is typically related to water in some way. In order to accomplish this, the concrete must have a high resistance to the passage of fluids and ions that could be hazardous. The use of PPFs has the potential to improve the interpretation of concrete because of the PPF's ability to effectively boost the rebut-permeability of concrete and block the water and hazardous ion incursion in concrete through the scrapes. Numerous researchers have put in a significant amount of effort and produced a number of significant advances in their investigation of the impact that polypropylene fibre has on the durability of concrete. In this study, various mixtures of polypropylene fibre were exercised for concrete mixes. The measure fractions ranged from 0.025 to 0.75, and all three were tested. Each series is made up of cells that conform to the IS metric. In order to determine the amount of compressive energy present after 28 days, a number of different experiments were carried out. After a period of 28 days, each amalgamation was tested and evaluated in

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an effort to identify the swish amalgamation that produced the most favorable results for the energy characteristics of the concrete mix. Polypropylene fibers are not only inexpensive but also easily accessible in large quantities. It is not recommended to use polypropylene guts for any kind of structural underpinning. These guts shouldn't be used to produce thin sections and also to boost common distance than what is alluded to for unreinforced masonry. Both of these practices should be avoided. Since polypropylene that has been copolymerized with ethylene is typically tough and malleable, this process makes it possible for polypropylene to be utilized as an engineering plastic. Polypropylene is an excellent insulator and, in its natural state, has a translucent appearance. Unlike tempera, polystyrene, and other plastics, it does not typically come in a readily available transparent form. It is frequently made opaque or colored with coloring colors, and it may also be colored. It has a good resistance to wear and tear. isotactically perfect in every way The melting point of polypropylene is 171 degrees Celsius, and marketable isotactic polypropylene The melting point of polypropylene falls somewhere between 160 and 166 degrees Celsius. Polypropylene is utilized in a variety of applications, including hinges for flip-top bottles, pipeline, sonorous speaker units, and so on. In capacitors, very small amounts of waste polypropylene are used to create a dielectric.

Polypropylene fibers are not magnetic, do not rust, are resistant to alkalis, are safe to use, and are ready to be put to work. The price of polypropylene twine is very low, it is easily accessible in large quantities, and it has a high quality. Additionally, polypropylene fibers are compatible with all concrete chemical amalgamations and can be worked with while retaining their release properties. Polypropylene's high molecular weight endows it with an abundance of different groupings that can be put to good use. Because polypropylene fibers are chemically free, any chemical that does not attack the constituents of the concrete will not have any effect on the grittiness of the fibers either. When more powerful chemicals are brought into contact with the concrete, the concrete will always deteriorate first, followed by the fibers. The hydrophobic side of the fibers, which is not wet by the cement mucilage, helps to support rolling sequel by minced fibers. Additionally, the water demand for polypropylene fibers is nil when they are exercised in concrete, and there is no need for a minimum amount of concrete cover. The presence of fibers in concrete has been shown to reduce both bleeding and consensus. It is now possible to bruise, indurate, and jolt with improved effectiveness.

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The main objective of this study to determine strength of concrete by adding polypropylene fibre into the concrete mix at 0%, 0.25% and 0.75%.

2. Methodology

As in the literature review I've chosen the polypropylene fibre for making the concrete blend and I have elect the different proportions of polypropylene fibre for carrying the strength variation at 0%, 0.25%, 0.75% and for making the PPFRC we needed different accoutrements which are described below.

Cement: The cement exercised was usual Portland Cement of 43 Grade. The cement has a special graveness of 3.15.

Coarse summations: Coarse summations exercised in this study are the crushed summations. The marketable monuments are excavated, crushed and separated. These are substantially the crushed angular determinedness essence monuments. The sizes of 20 mm and 10 mm are exercised. The special graveness for 20 mm is 2.883 and for 10 mm is 2.878

Fine Aggregate: Specific gravity of sand used was 2.605.

Polypropylene Fibre: The filaments exercised were fine polypropylene monofilaments. It's accessible in 3 non-identical sizes i.e. 6 mm, 12 mm and 24 mm. In this design 24 mm fibre extent is exercised as shown in Figure.1.

Water: Drinkable water is exercised for mingling and curing from the water force network system as it was free from the arrogated solids and organic substance, which might have affected the parcels of the fresh and toughened concrete.

Figure.1 Polypropelyene fibres used

Figure.2 Polypropelyene fibres used

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2.1 Mix design

The Concrete blend project has been carried out for various portions as per and landed at final blend proportion and mentioned in Table 1 was exercised for combining the original materials, after mingling the original accoutrements in the swirling fete and adding the guts. In this exploration the concrete slices were prepared with fibre rates of 0, 0.25 and 0.75 by measure. In order to have a proper composite design as well as the least penetration, the applied summations were separated tallying to the rate of water appended to the cement was w/ c = 0.45.

Table. 1 - Concentration of materials

Cement	Water	Fine aggregate	Coarse aggregate
434.28 kg/m^3	195 kg/m^3	607.69 kg/m^3	1240 kg/m^3
1	0.45	1.48	2.85

3. Result

Compressive strength and split tensile strength of polypropylene fibre reinforced concrete after 7 days and 28 days as shown in Table-2. After 7 days, there was a 6% increase in the compressive strength, and after 28 days, there was a 17% increase. After 7 days, there was a 35% increase in the split tensile strength, and after 28 days, there was a 41% increase.

Table – 2: Compressive strength of specimen at different time period

Strengths (N/mm^2)				
PP Fibre content %	**Comp. (7 days)**	**Split tensile (7 Days)**	**Comp. (7 days)**	**Split tensile (7 Days)**
0	26.22	1.8	33.81	2.32
0.25	25.91	2.0	35.56	3.11
0.75	19.95	2.3	38.92	3.26

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4. Conclusion

We have now made a project that is very helpful for safety purpose. Women can go anywhere without any fear. It gives them freedom and strength to face the attacker. It is cost effective and can easily reach to common people. It makes the family member of the victim stress free and they can easily reach to her by tracking the location. The true potential of this project lies in the future when IOT makes its place everywhere in India.

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SYNTHESIS OF SnS_2 PHOTOCATALYST AND ITS PHOTOCATALYTIC APPLICATION

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Abstract

SnS_2 nanoparticles were synthesized by a hydrothermal synthetic route at 180 °C, and it is effectively characterized by various techniques, such as XRD, FESEM, HRTEM and UV-vis DRS. UV-vis DRS and showed a reflection edge with corresponding energy at 2.2 eV. The photocatalytic activity of the SnS_2 nanoparticles is tested against the degradation of methylene blue under natural sunlight irradiation. About 95% degradation of methylene blue is observed in 120 min.

Keyword: *XRD, FESEM, HRTEM, nanoparticle*

1. Introduction

Extensive usage of organic dyes in textile and other fabric industries leads to the contamination of water bodies [1–3]. A large number of water sources are polluted by residual dyes, which enter directly into the aquatic environment through various means like dye industries, textile industries, etc. [4,5]. As a cationic dye methylene blue found its wide application in coloring fabrics. Due to its water-soluble nature, methylene blue is highly stable in an aquatic environment, non-biodegradable, and cancer-causing in nature, which makes it harmful to humans and living species of aquatic ecosystems [6–9].

However, due to their highly stable nature in water, these residual dyes are not quickly metabolized, as a result of which they can easily pollute groundwater and surface water, causing harmful diseases in animals and humans [10–12]. To date, several methodologies have been used for wastewater remediation, but they have certain drawbacks such as excessive sludge formation, and other harmful byproducts generation. In order to overcome these limitations, semiconductor-based photocatalysts are widely utilized for the photocatalytic removal of various water pollutants [13–15]. To date, zinc oxide and titanium dioxide nanoparticles are the most commonly used photocatalysts for degrading organic dyes, but they

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require ultraviolet light for photoexcitation as their band gap is large [16,17]. Recently, over the last few decades, tin-based photocatalysts have been utilized as the most promising and new class of photocatalysts for wastewater treatment. The tin-based photocatalyst found applications in various areas such as the production of ammonia from nitrogen, water-splitting, reduction of CO_2, and degradation of water pollutants through heterogeneous photocatalysis. The band structure of these materials provides them with a suitable band gap for visible light-active and a well-distributed valence band in favor of recombination charge, enabling them to act as potential photocatalytic materials for wastewater treatment over metal oxides. Another class of heterogeneous semiconductors photocatalysts is metal sulfides, which mostly utilize the light in the visible region and work in the small wavelength region i.e., (NIR) near-infrared regions. This light harvesting property make them a suitable visible light driven photocatalysts [18]. The band gap of SnS_2 ranges between 1.8-2.3 eV, beside this its considered to be non-toxic, less costly, and has phenomenal chemical stability in neutral and acidic medium [19]. Because of all these properties SnS_2 is considered an efficient visible and NIR light-active photocatalyst. For an effective photocatalytic reaction in visible light, a semiconductor photocatalyst must possess a narrow bandgap, with a low charge recombination rate, with conduction band on more negative potential side and valence band on positive potential side [20].

2. Methodology

2.1 Synthesis of SnS_2 nanoparticles

2.1 g $SnCl_4.5H_2O$ was added into the 70 milli litre of water, then 3.0 g of thiourea was slowly added into it followed by a continuous mixing for 1 h with the help of magnetic stirrer, until a clear homogenous solution was prepared. Finally, after constant stirring of 45 min, the mixture was poured into an autoclave and heated at a temperature of 180°C for 10 h. The finally prepared precipitates were washed with DI water and C_2H_5OH and separated by centrifugation for 20 min at 7000 rpm, and the yellow material finally obtained was dried in an oven at 60°C. The synthesis route is shown in figure 1.

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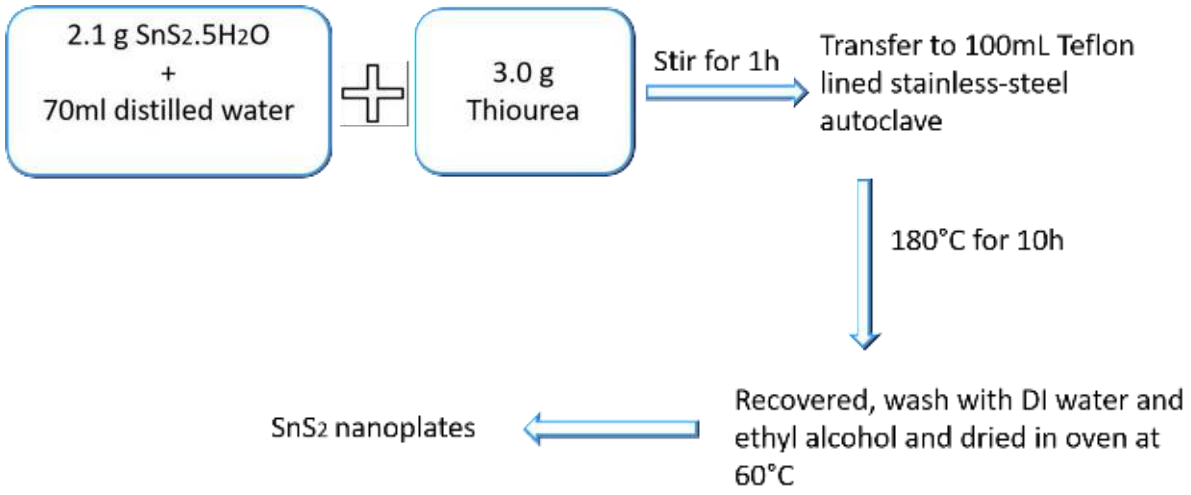

Figure 1. Synthesis route of SnS_2 nanoparticles

3. Results and discussions

3.1 XRD analysis

The XRD plot of Bi2MoO6 was recorded on X-ray diffractometer. The XRD peaks for SnS_2 were detected at 2θ = 2θ=14.9°, 28.4°, 32.2°, 33.6°, 46.3°, 49.7° and 52.7° which are matched to (0 0 1), (1 0 0), (0 0 2), (1 0 1), (0 0 3), (1 1 0) and (1 1 1) hexagonal planes of SnS_2 (Card No.- 89-1758) (Figure.2).

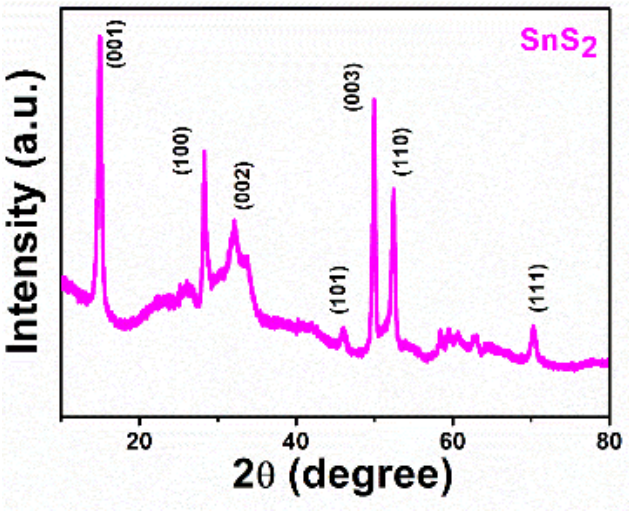

Figure 2. XRD SnS_2 nanoparticles

3.2 FE-SEM and HR-TEM analysis of SnS_2

The FE-SEM image of SnS_2 nanoparticles was recorded by scanning electron microscope, shows nanoplate-like structures with a diameter in the range of 250-500 nm (Figure. 3a).

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Similarly, the morphology of the SnS_2 nanoparticles was better displayed from the HRTEM images as shown in Figure 3b.

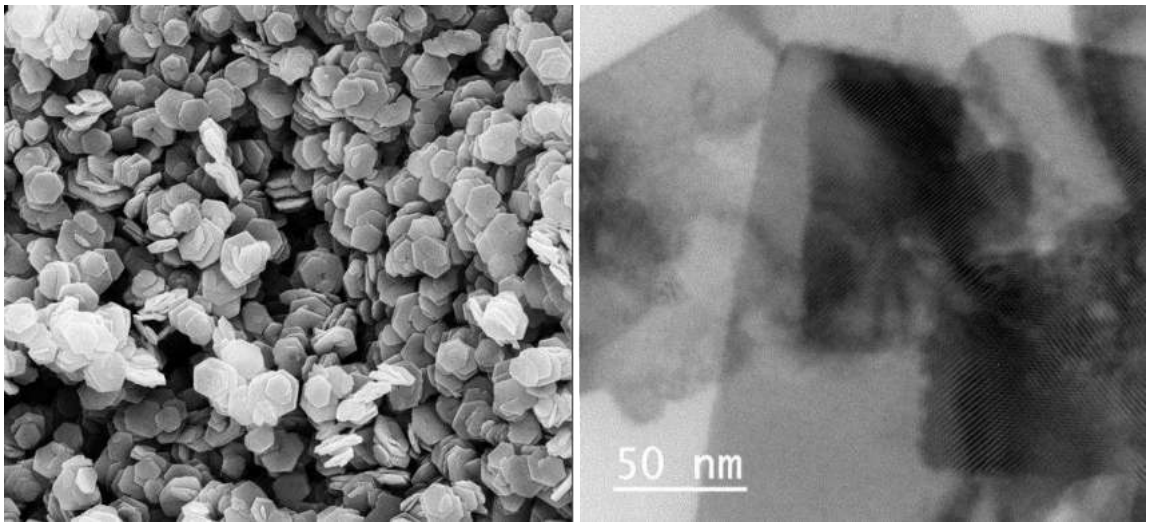

Figure 3. a) FE-SEM image of SnS_2 nanoplates; b) HR-TEM image of SnS_2 nanoplates

Optical analysis

The pure SnS_2 nanoplates absorb in the ultraviolet and visible light region (Figure.3a). The UV-vis DRS spectra were changed into absorption spectra by using (K-M function) Kubelka-Munk [21], and the band gap was calculated from the Taucs plots [22], Figure. 34shows Tauc's plots of SnS_2 photocatalyst. The optical band gap of SnS_2 was determined to be 2.2 eV.

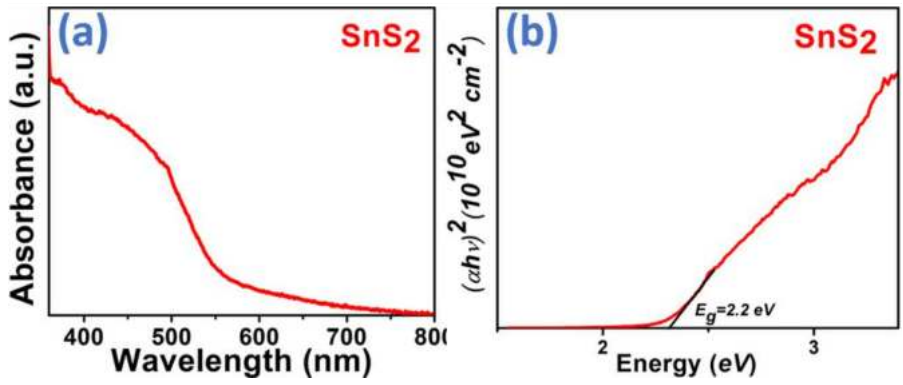

Figure 4. a) UV-vis DRS spectra of SnS_2; b) Tauc's plot of pure SnS

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3.2 Photocatalytic activity

The sunlight-mediated photocatalytic degradation of MB dye (20 mg/L) by the SnS_2 nanoplates is shown in Figure. 5. The SnS_2 nanoplates show the photocatalytic performance of about 95 % methylene blue dye degradation after 120 min of sunlight exposure. Figure.4 shows the UV-vis absorption spectra, which shows the change in concentration of methylene blue dye during the photocatalytic degradation. The decrease in the intensity of the absorption peak of methylene blue dye (664 nm) was observed over 120 min period of sunlight irradiation.

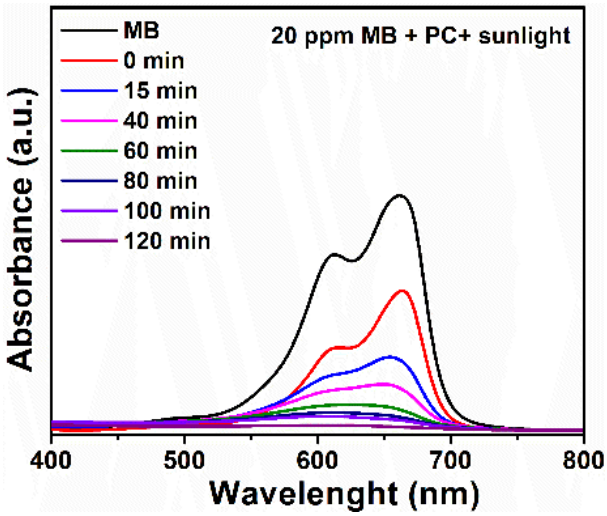

Figure 5. a) UV-is absorbance spectra of MB dye solution

4. Conclusions

A simple hydrothermal synthetic route has been used for the synthesis of SnS_2 photocatalyst. The SnS_2 photocatalyst shows excellent photocatalytic performance towards the degradation of 90 % of methylene (MB) under sunlight irradiation. SnS_2 is an effective visible light photocatalyst option for removing various organic dyes in aqueous media due to its strong photocatalytic activity.

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2D MATERIALS FOR GAS SENSING APPLICATIONS: A RECENT REVIEW OF THE SCIENTIFIC LITERATURE

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Abstract

In today's era the use of gas sensors has significantly dilated. Since Graphene was introduced, 2D materials have fascinated a lot of recognition. Due to their distinctive mechanical, optical, electrical properties they have drawn remarkable industrial and academic attention from the time of their discovery. In contrast to graphene and hexagonal- boron nitride with optoelectrical properties), 2D Materials are marked by and intrinsically high surface to volume ratio, superconductivity and mechanical flexibility. They are a good choice for a new generation of gas detecting devices because of these qualities. The first Graphene – like substance was researched and utilized was Graphene Oxide one of the multinational compounds and an intermediate result of graphene production while 2D h-BN (hexagonal boron-nitride) is one of the most favourable material that can be merged with other 2D materials like Graphene and Transition metal dichalcogenides (TMDs) used to detect target gases (NO_2, CO_2, NO, H_2, NH_3) .Addition to this other 2d materials such as phosphorene,WS_2 contribute to sense these noxious gases. This review provides a thorough analysis on 2d materials based gas sensors of previous four years research articles. Finally, we will report a data on the no of target gases it detects with their detectivity, a graphical representation of used 2D Materials, there calculated energy band and its gas sensing applications.

Keywords: *Graphene, Graphene Oxide (GO), Transition metal dichalcogenides (TMDs), Phosphorene, h-BN (hexagonal boron-nitride).*

1. Introduction

Nanotechnology is the new icon in the Material science field consists of nanoparticles have enormously small size less than 100 nm [1]. If one dimension is minimized to the nanorange while the other two dimensions remain large then we attains a structure known as two dimensional materials (2D) or quantum well. 2D Nanotechnology is another wonder in modern scientific world. These materials contain an ultra thin layer of nanosheets structure which is

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extremely reliable for photovoltaic's, semiconductors, water purification and gas sensing applications. 2D- materials which include graphene, transition metal dichalcogenides, phosphorene and hexagonal-boron nitride which gains a remarkable attention in today's life in fields mostly in detection and sensing strategies [2]. As gas sensing is important in our daily life, its use for gas detection is increasing yearly by the research shown. So to reduce the limit of the air pollutants and to reduce the bad air quality we have to know the root cause of the problem. 2D materials are very useful for gas sensing which are coming forward by their good properties. This project gives the brief information about the 2D materials which are used as a gas sensors in previous years and for the upcoming years how many more no of 2D materials can detect the numerous amount of gases present in the environment that will be used for future use rather than graphene. This project will give the ideas for the sensing materials which are useful in the future and what are the drawbacks they have which can be solved to make it better for the utilization for the upcoming generation.

In this modern technology and developing world many devices ,gadgets have been discovered which makes easy and reliable for the human needs, safety ,and for our Environment .Though there are many gases present in the atmosphere whether they are toxic or non-toxic ,but the excessive intake of any gas will be dangerous for everyone .For example Ammonia is a toxic gas which is used in our refrigerators and in agriculture sectors which can be fatal for our skin and health,NO_2 (Nitrogen dioxide)on the other hand is one of the mostly inhaled gas in our daily life by the means of air pollutants, transport vehicles, cars, trucks etc. while Methane (CH_4)which is a non –toxic natural gas used in our homes, water heaters ,automobiles, but it is hazardous greenhouse gas because of its high exposure and lack of oxygen it can cause suffocation for everyone. So to overcome these problem sensors are used to detect these noxious gases.

This reviewed work explain recent 2D-materials for the detection of toxic and non toxic gases which are harmful for our human health and environment with their gas sensing applications and also gives the direction for the selection of the 2D-material for noble gas sensing. There are several benefits of these 2D materials which are single layered materials with a thickness of a few nanometers range which transmit an extremely high surface to volume ratio (SVR) [4]. It provides various numbers of reactive sites between the material and the analytes [5-7]. By interesting virtue of mechanical properties like strength and flexibility are

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further improvements for the new technology developments such as wearable electronics, metal electrodes printing methods, ultrathin silicon channels [8-12].

2. Recent work findings review and discussion

Nanoscience and technology has gained immense attention from the researchers by the use of 2D materials in the areas of sensing, multimodal imaging and tissue engineering and many more .Owing to its unique electronic, mechanical, optical properties includes Graphene oxide(GO), rGO (reduced Graphene Oxide), hexagonal boron nitride (h-BN) and TMDs(WS_2,WSE_2) which have high surface to volume ratios ,mechanical strength mobility, tunability, band gap ,they shows commending features.

Table 1 shows the result of the data that were collected and reviewed recent years research papers. The current 2D materials were studied for review, observed the number of target gases it detects with their lowest limit of detection, due to their properties such as geometrical, optical and structural properties [13-49]. h-BN (hexagonal boron nitride), we see in table 1 and found that total nine gases like NO_2, SO_2, SF_6, NH_3, CO_2, CO, H_2S, HF, NO, it detects at ppb to ppm level like NO_2 LOD (limit of detection is 53ppb.

Table 1: Few 2D Materials targeted for gas sensing applications in last four years.

	TARGET GASES in last four years				
	2019	**2020**	**2021**	**2022**	**2023**
Reduced graphene oxide (rGO)	NH_3 [13], NO_2 [14], H_2S [15]	NO_2 [16], CO_2 [17], NH_3 [18], H_2S [19]	H_2 [20], NO_2 [21]	NO_2 [22]	NO_2 [23], H_2 [24]
WS_2	NO_2 [25], H_2, NH_3 [26]	H_2S, NO_2 [27]	NO_2 [28], CO [29]	CO [30], NO_2 [31]	NO_2, NH_3 [32-33]
PHOSPHORENE (P)	H_2S, CH_4 [34]	H_2S, NO_2, CO_2 [35-37]	NO_2, H_2S [38-39]	NO, NO2 [40]	NO [41]
h-BN	NO, NO_2 [42]	SO_2 [43]	SF_6,NO_2,NH_3 [44-45]	CO_2,CO,H_2S, HF, NO [46]	H_2,NH_3,CO [47-49]

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The table represents the entire data review collection from year 2019 -2023 that how many target gases were detected from different harmful compounds for the human health and environment. The materials like in the table we can see that h-BN (hexagonal boron nitride) from 2019 -2023 it detects 14 gases the mostly used noble material since last four years till now (NO, NO_2, SO_2, SF_6, NH_3, CO_2, CO, H_2S, HF, H_2) detected 2 times (NO, CO and NO_2).

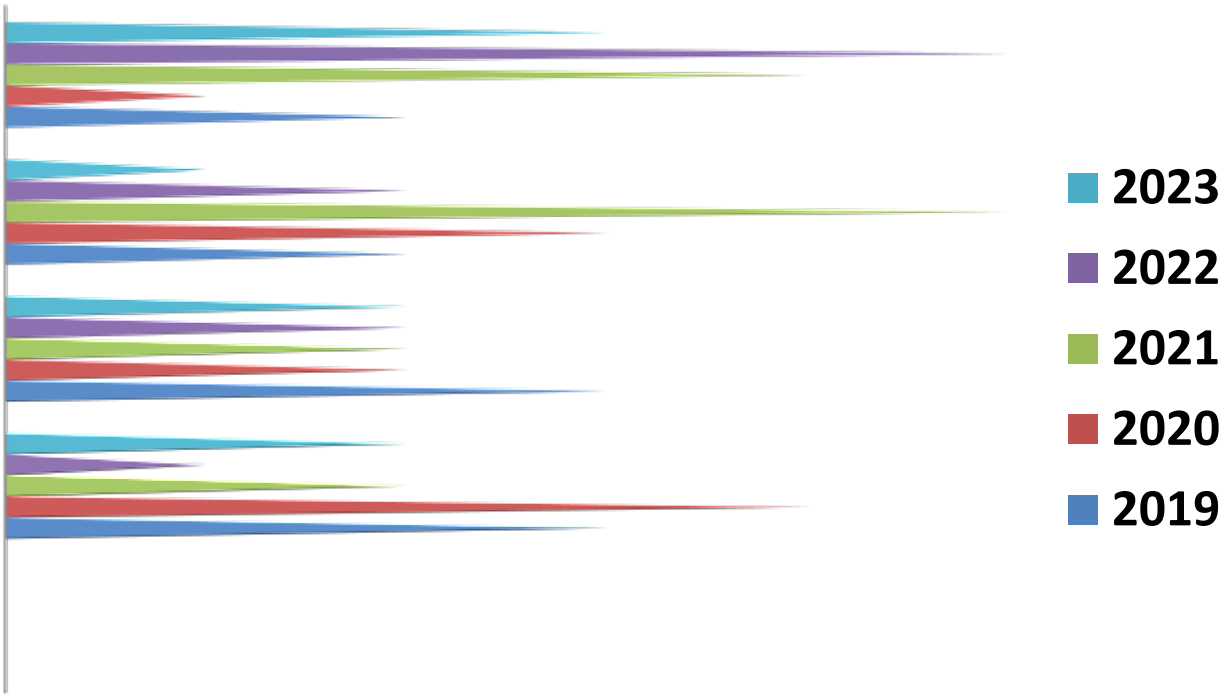

Figure 1: Clustered cone graphical representation of used 2D materials in last four years.

In the graphical clustered horizontal cone representation of four 2D materials like reduced graphene oxide, h-BN, phosphorene and WS_2 (**Figure 1**) we noticed that the coloured cones of five colours of brown, violet, light blue, navy blue and light green) have different heights of peaks from 2019-2023 which highlights the number of gases a particular 2d material detects in the recent years. Along X- axis it shows the number of gases and in Y-axis different 2d materials used for gas sensing. In this bar- graph (**Figure 2**), it shows the total number of gases a single material detects in the overall recent years of analyzed data. For instance in the cases of reduced graphene oxide we saw in x axis plane that bar graph stops in the range of 12 along y axis so it is concluded that WS_2 material sensed 10 gases, phosphorene also sensed 12 gases

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as rGO and h-BN sensed most number of gases that were 14. Here we can come to the conclusion that h-BN is the best smart material for detection of gases in the recent years.

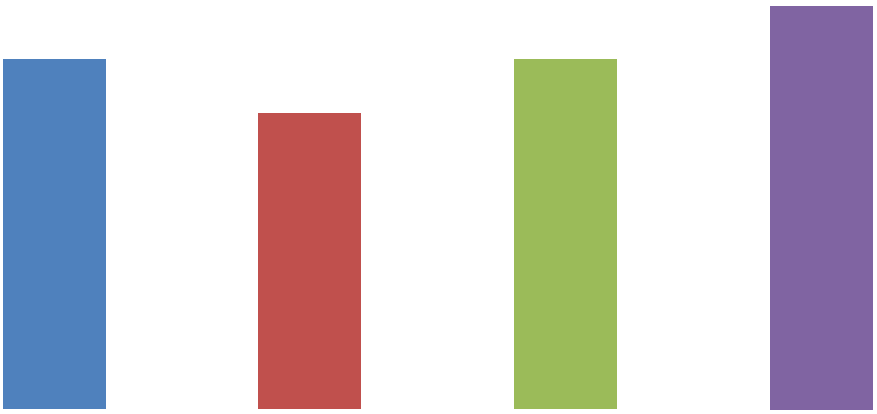

Figure 2: Graphical representation of recent 2d materials and nouber targeted gases as shown in the table.

2D Materials	Target Gas	Detectivity	References
Graphene oxide(GO)	Methanol, ethanol/ NO_2, CO_2, NO	6-15ppm/ 2-18 ppm	[50]
MoS_2	NO_2,CO_2	0.1-200ppb	[51]
Phosphorene	NO_2,NH_3,H_2	7 ppb (for NO_2), 1 ppm (for NH_3)	[52]
WS_2	NO_2	5.6 -50 ppm	[53]

Table 2: 2D materials and their gas detectivity.

3. Conclusions

According to the results of this investigation, the last four years of published papers on 2d materials revealed that h-BN is the most commonly utilised material for the detection of various gases. The degeneracy and non-degeneracy energy levels of rGO and h-BN were determined. In the future, rGO and h-BN will have good optical and geometrical properties for hybrid gas sensing applications. Following an examination of the theoretical information and calculations, it is decided that h-BN has the lowest detectivity. The calculation shows that as the particle size of the material increases, the energy band gap reduces. It is also determined that reduced

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graphene oxide is the best material for detecting a large variety of gases. In the previous year, 2D materials attracted the interest of researchers in the gas sensing sectors due to their unique qualities explored by researchers in which a wide range of gas detecting devices built to identify various gases. Graphene was the first material to draw attention from all over the world due to its commendable properties, but based on the information reviewed, many other materials are useful to detect various gases in terms of their detectivity and selectivity sensing components. In the future, graphene and h-BN will be employed more widely than other materials such as h-BN, TMDs (WS_2, MOSe2, ReSe2), and MXenes. Every year, new sensing platforms are introduced, and the industry moves quickly. Sensing across several platforms utilizing a variety of materials is the next frontier. Furthermore, the researchers are working on a range of substrates to preserve the flexibility and resilience of the gas sensors so that they can replace gas sensing technology in the coming years.

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PEHNAWAR-(ONLINE CLOTHING RENTAL APP)

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Abstract

The online clothing rental market is expected to grow due to lifestyle changes and popularity of party dresses, designer dresses, and dinner suits. Future Market Insights (FMI), a ESOMAR-certified market research organization and consulting organization, has released a new study examining key variables that drive the need for online clothing rental. Therefore, retailing of products will be considered the best sustainable way to use clothing nowadays, as the industries use sustainability as their key business plan to attract more customers to buy their products. Wearing rented clothing can reduce carbon emissions and other toxic substances, which can benefit the environment and natural resources. Additionally, clothing manufacturers can improve their social performance standards by combining clothing hire in their business with many sustainable strategies.

1. Introduction

The fashion industry is growing at an unprecedented rate these days, and the online clothing rental market is a major contributor to its growth and progress. Clothing rental is an eco-friendly alternative to fast fashion, which has a significant impact on the environment. Online clothing rental apps provide customers with the convenience of renting stylish and fashionable clothes for a period of time of the price of buying them. This paper will examine the online clothing rental app market and its impact on the fashion industry.

Our app name "PEHNAWAR" is basically an online clothing rental app which refers to provide services that allow customers to rent garments for a specific time. The presence of these services enables people to reduce the need for getting new clothes for special occasions and thus, saves them money. The online clothing rental market is expected to grow due to lifestyle changes and the popularity of party dresses, designer dresses, dinner suits and many fashionable dresses. It is very useful for people who cannot afford or do not want to spend money on new clothes to be worn on special occasions. The rental model has its positives, especially when it comes to variety and savings. Internet usage for shopping apparels online has become common place thing for many people, the added benefits of convenience, easy ability

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and availability, and price comparison tools outweigh the effort required to physically visit the traditional store. With online clothing rental platforms, available consumers are expected to rent any type of clothing with less economic expenditure and long-term use. Rapid growth and rise in urbanization have spawned consumers with more expenditure in the market and an urge for fashion and trends.

2. Literature Review

The online clothing rental app market is a rapidly growing industry. According to a report by Allied Market Research, the global online clothing rental market is expected to reach $2,090.6 million by 2025, growing at a CAGR of 10.6% from 2018 to 2025. The report cites factors such as changing consumer behaviour, increasing environmental concerns, and the rise of the sharing economy as driving forces behind the growth of the market.

Online clothing rental apps operate on a subscription model or a pay-per-rental basis. Customers can choose from a wide range of clothing items and accessories, ranging from casual wear to formal attire. Online rental apps offer customers the convenience of renting clothes from the comfort of their homes. They also offer the option to purchase the items they have rented if they wish to keep them. Soaring demand for luxury designer dresses, as well as continuous shifts in consumer fashion sense, are the factors predicted to fuel the rise of the online garment rental sector. In addition, consumers' increased spending on fashionable pursuits as their disposable income rises, coupled with the rapid growth in the number of fashion brands, is a major element driving the market. Manufacturers' increased attention to children's segments is expected to provide profitable market opportunities in the coming years. Kids have become more style- and brand-conscious as a result of their parents' changing lifestyles, which is likely to boost the growth of the online clothing rental space. However, the industry is significantly fragmented in nature due to the presence of several unorganized manufacturers selling low-cost, non-branded goods, which can act as a restraint and hamper market growth.

[1] Rent the Runway: Rent the Runway is a popular clothing rental app that allows users to rent designer dresses, outfits, and accessories for special occasions or everyday wear.

[2] Le Tote: Le Tote is a clothing rental service that provides monthly subscriptions for women's clothing and accessories. Users can rent clothing and keep the pieces they like for a discounted price.

[3] Gwynnie Bee: Gwynnie Bee is a subscription-based clothing rental service for plus-size women. Users can choose from a variety of clothing options, including workwear, casual wear, and formal wear.

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[4] Haverdash: Haverdash is a rental service that allows women to rent three pieces of clothing and keep them for as long as they want. Users can return the pieces and get a new set of clothing whenever they want**.**

[5] Armoire: Armoire is a rental service that offers a curated selection of designer clothing for women. Users can rent items for a flat monthly fee and exchange them as often as they want.

[6] Tulerie: Tulerie is a peer-to-peer clothing rental app that allows users to rent and lend designer clothing and accessories to others. Users can create a profile, list their items for rent, and browse the selection of available items.

3. **Proposed Methodology**

There are four modules in our project-

A. Authentication Module
B. Admin Module
C. Retailer Module
D. Customer Module

A. Authentication Module :

In this module users must have to register themselves by creating their account from your account page in which they have to fill their name, phone no, Gmail id and password. After creating their account user can login themselves from the login page with their Gmail id and password. And if the user forgets his password then the user can click on forgot password button. After clicking the button a link will be shared on his valid Gmail id to change his password.

B. **Admin Module**

In this module admin work is to manage the app and earn the commission coming from the retailers. Another work of admin is to tie up their app with the retailers and also make sure which Gmail id is belong to retailer module and which Gmail is belong to customer module.

C. **Customer Module**

In this module customer can search dresses according to their preference like type, colour, size etc. and then select the dress and make payment then the dress will be delivered to their address. After the use of dress customer can return the dress to the retailers shop.

D. **Retailer Module**

In this module retailer can login to the app and add the traditional dresses of men, women and kids to

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the app with their multiple pics and their description. Retailer also remove the dresses from the app when the dress is not in stock. And the price is set by the retailer according to the dress and there would be an extra payment for deliver and return service. Fig. 2 is showing the architecture of the proposed project.

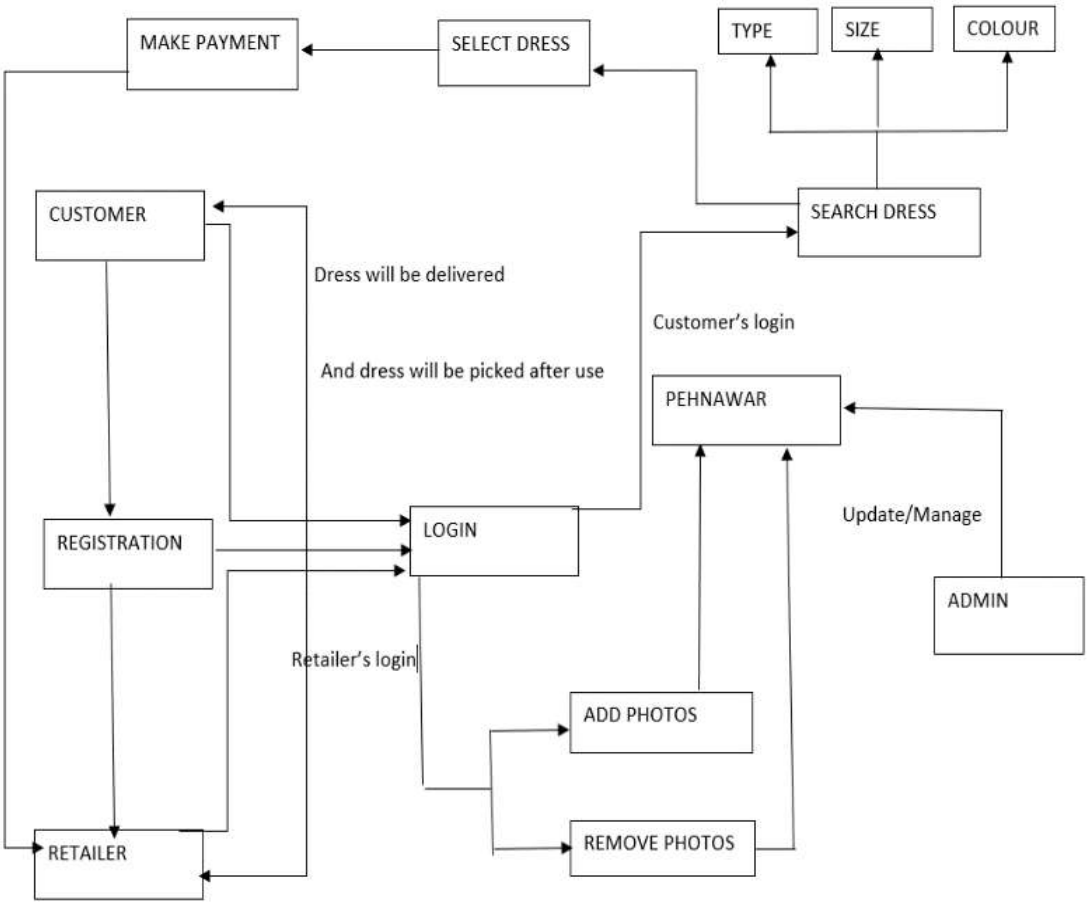

Fig. 1: DFD of Proposed Project

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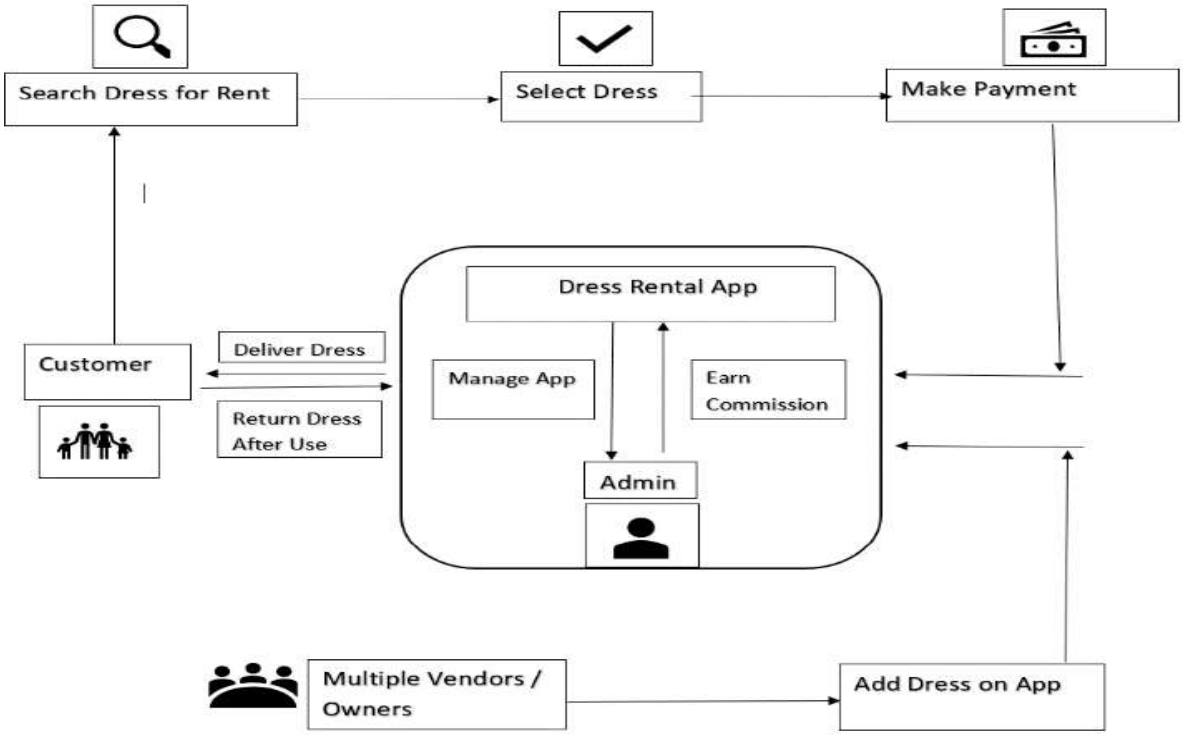

Fig. 2: Architecture of Proposed Project

3.1 Implementation Methodology

1. Users who can use our "PEHNAWAR" app are customer and retailer.
2. And there is an admin whose work is to manage and update the app.
3. Firstly, the users have to register themselves by creating their account from your account page in which they have to fill their name, phone no, Gmail id and password.
4. After creating their account user can login themselves from the login page from their Gmail id and password.
5. And if the user forgot his password then the user can click on forgot password button. After clicking the button a link will be shared on his valid Gmail id to change his password.
6. After login, Admin's work is to find whether the user is a customer or retailer and then the customer will log in to their customer module and the retailer will log in to their retailer module.
7. After login customers can search for dresses according to their preferences like type, colour, size etc., and then select the dress and make payment then the dress will be delivered to their address. After the use of the dress customers can return the dress to the retailer's shop.

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8. After login retailers can add the traditional dresses of men, women, and kids to the app with their multiple pics and their description. The retailer also removes the dresses from the app when the dress is not in stock. And the price is set by the retailer according to the dress and there would be an extra payment for delivery and return service.

4. Results

4.1. Screen Shots

Fig 3: App first page

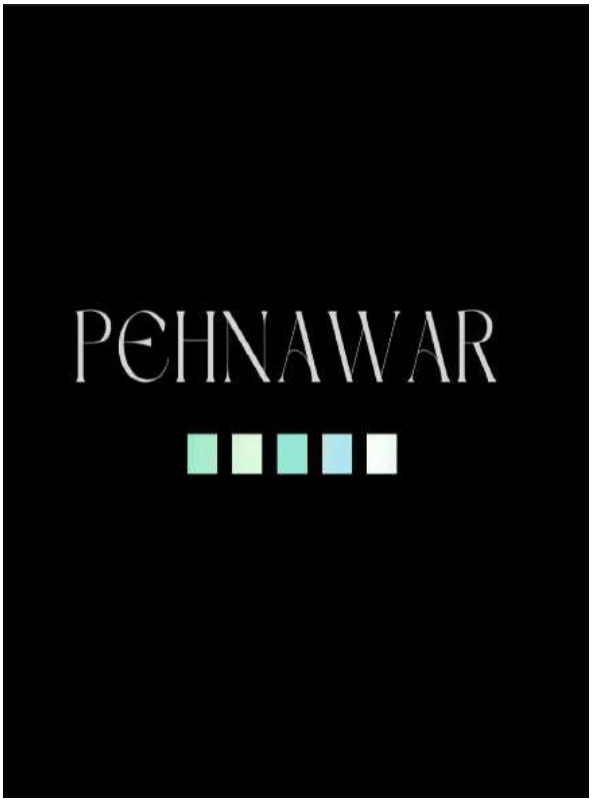

Fig 4: Registration Page

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Fig. 5 Login Page

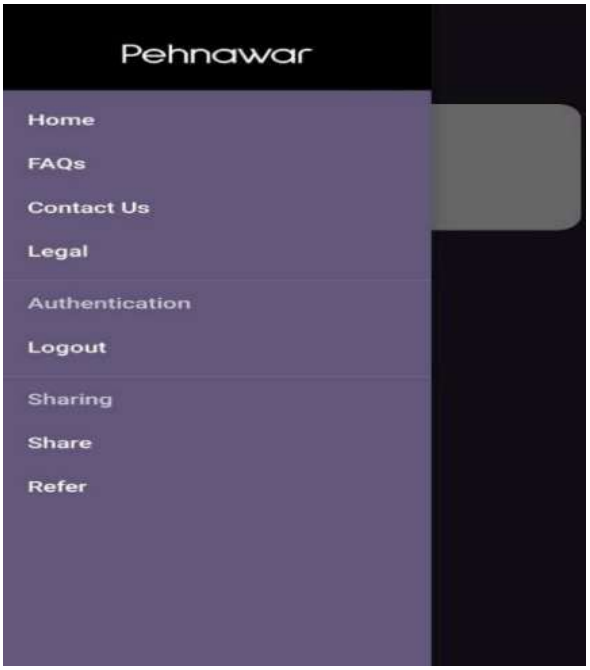

Fig. 6 App menu

5. Discussion

There are various advantages of the proposed app over existing apps:

1. Cost-effective: Renting clothes online can be a more affordable option than purchasing new clothes. This is particularly true for special events or occasions where you may only need to wear a particular outfit once.
2. Access to designer clothes: Many online clothing rental services offer access to high-end designer clothes that may not be affordable or accessible for purchase.
3. Convenience: Renting clothes online is very convenient, as it eliminates the need to physically go to a store, try on clothes, and make a purchase. Clothes can be ordered online and delivered to your doorstep, and returns are often easy and hassle-free.
4. Sustainability: Renting clothes online can be a more sustainable option than purchasing new clothes, as it reduces waste and promotes the sharing economy.
5. Variety: Online clothing rental services often offer a wide range of styles and sizes, allowing you to try out different looks without committing to a purchase.

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6. No need to store clothes: Renting clothes online means that you don't have to worry about storing clothes that you may only wear once or twice, which can be especially beneficial for people with limited storage space.

Overall, online renting of clothes can be a convenient, cost-effective, and sustainable option for those looking to expand their wardrobe without committing to purchases.

6. CONCLUSION

The online clothing rental app market is a growing industry that offers several benefits to customers. It is an eco-friendly alternative to fast fashion, offers customers the convenience of renting clothes, and makes fashion more accessible. However, rental companies face several challenges, including the fit of clothes, logistics, and maintaining the quality of their clothing items. The future of the market depends on the ability of rental companies to overcome these challenges and provide customers with a seamless renting experience.

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A REVIEW ON DESIGN ANALYSIS OF TRANSMISSION LINE TOWER ON DIFFERENT TERRAIN

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Abstract

Transmission line towers are widely used to distribute the power supply all over the world, towers are high rise steel structure and made to carry the heavy load of conductors and steel wire. The planning of any structural design is not just the imagination but includes all the applied sciences and structural laws as well as the practical knowledge of designing. Our aim is to fulfil the safety of people and the environment by considering all the outcomes. This review of the relevant literature is going to focus on the research that was conducted on the design and analysis of transmission line towers between the years of 2010 and 2023.

Keywords: *conductors, Transmission line towers, steel wire*

1. Introduction

India is a very large population country where need of electricity has to be established to every corner of the country. The transmission line towers are the medium to transmit the power supply to every village, town or city, also nowadays things are digitalizing and converting into electronic equipment in other words the need of electricity is increasing day by day [1]. Transmission line tower are the life-line of every country, tower are the structures built to support overhead power lines, ground cables and electrical conductors [2]. Besides carrying electricity across hundreds of kilometers, they also provide strength and prevent the cables from sagging and getting contaminated [3]. The uses of transmission tower just not carry the power supply over the very long distance but also for the reception of Radio, Mobile Telephony, Broadcasting and other electromagnetic signals as well [4].

Many of them are utilized as weather data collectors. You may see cup-shaped anemometers indicating the wind speed or other meteorological equipment spinning. Transmission towers are important because it maintains the flow of power reliably and safely, it also transpose the delivery of power from substation at the lowest possible energy loss to different types of customers [5-7]. Let us talk about India, India is developing country the electric power consumption is continue to rise. This must have led to increase the number of power stations

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and their capacity and consequent increase in power transmission lines from the generating stations to the load center [8]. The structural designers need to very skilled and experienced to design the heavy electrical steal towers who is carrying high voltage line and conductor, also with consideration of wind conditions and high degree of reliability and safety to the general public ensuring satisfactory serviceability. Seismic design in transmission tower puts a very important role in earthquake vulnerable areas. Transmission towers are classified on the bases of their type of loading, voltage load, and number of circuits and the uses of it. Towers mainly designed for the forces due to wind, ice and other loading conditions but not for the seismic forces [9-13].

The large amount of failure occur in transmission tower throughout the world is due to High Intensity Wind (HIW). This also because the difficulty for tower designers to estimate wind loads as they are based on a probabilistic approach.

Transmission line towers are a critical component of the power distribution system, and their design and analysis are crucial to ensure the safety and reliability of the system. Over the past few decades, researchers have conducted extensive research on the design and analysis of transmission line towers situated in different terrains. This literature review provides an overview of the research conducted on this topic between 1970 and 2023, including key findings and contributions to the field.

2. Literature Review

- **Gopi Sudam Punse (2019)** (Transmission Tower Analysis and Design) The purpose of this study is to investigate and design a narrow-based transmission tower in India that uses multi-voltage multi-circuit technology with the intention of making the most efficient use of the available electrical supply in a country with a growing population and a decreasing amount of available right-of-way (ROW). Transmission Line Towers are responsible for between 28 and 42 percent of the overall cost of the cable. The rising need for electricity can frequently be met in a manner that is more efficiently.

- **Vikas Gahlawat [2015]** (Analysis and Design of a Steel Transmission Tower That Is Twenty-Five Meters Tall) In this context, various categories of gravity and lateral loads are considered in order to carry out the analysis and design of a steel lattice tower that is

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utilized for the purpose of electricity transmission. Before being designed in accordance with IS 800:1984, the tower is first subjected to a number of different load conditions and analyzed. Before the design process begins, the appropriate data for site research and environmental impact assessment are collected using appropriate electronic and paper media. This ensures that the design process is planned in the most accurate manner possible. During the design process, pertinent safety design aspects are taken into consideration, with the hilly slope terrain of the location (Shimla) also being taken into account. In the course of the design process, non-linear imperfections in both the environment and the material used for the structure are taken into consideration. The various functions and forces exerted by the loads led to the selection of the steel angles that were then riveted together. The data obtained from the geotechnical investigation is utilized in the process of determining the foundation details. The process was carried out utilizing STAAD.Pro 2008 as the software instrument. The calculations of the load were done by hand; however, STAAD.Pro 2008 was utilized in order to acquire the results of the analysis and design. The objective is to come up with a design that is cost-effective and at the same time as risk-free as is humanly possible.

- **Patil B.Y. [2013]** (Analysis and Design of a Steel Transmission Tower That Is Located at a Height of Twenty-Five Meters) In the present scenario, various classes of gravity and lateral loads are taken into consideration in order to carry out the analysis and design of a steel lattice tower that is utilized for the purpose of electricity transmission. This is done in order to ensure that the tower is safe to use. The tower is initially subjected to a variety of load conditions and undergoes analysis on these results before it is designed to conform to the requirements of IS 800:1984. The appropriate data for site research and environmental impact assessment are collected using appropriate electronic and paper media before the design process begins. This is done before the design process even begins. This guarantees that the planning process for the design process will be as accurate as is humanly possible. During the process of design, relevant safety design aspects are taken into consideration, and the hilly slope terrain of the location (Shimla) is also taken into consideration as part of the process. The non-linear imperfections present in the environment as well as the material that will be used for the structure are taken into

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consideration during the course of the design process. The numerous functions that needed to be fulfilled and the forces that needed to be applied by the loads ultimately led to the selection of the steel angles that were then riveted together. The process of determining the foundation details involves the utilization of the data that was obtained from the geotechnical investigation. As the software instrument, STAAD.Pro 2008 was utilized throughout the process to ensure its success. Despite the fact that STAAD.Pro 2008 was used to acquire the results of the analysis and design, the load calculations themselves were done by hand. The objective is to produce a design that is both economical and, to the greatest extent that is humanly possible, risk-free.

- **Yasaswini [2008]** (Design of a Multi-Voltage, Multi-Circuit Transmission Tower to Save Right of Way) In the course of this research, a novel method for cutting down on the ROW width in MVMCT design has been proposed. It was demonstrated through a case study on MVMCT with three different voltages (400 kV, 220 kV, and 33 kV) that the proposed design is not only technically superior but also cost effective. The width of the right-of-way (ROW) can be reduced from 48 meters to 40 meters, which results in significant cost savings when a transmission line is taken into consideration. Traditional broad base towers have a width of 48 meters. Additionally, MVMCT increases the capacity of the transmission. The EMF levels that are present in the ROW are also well below the maximum allowable levels. There isn't a single stress that falls outside of the acceptable range. When ROW is limited, the potential for cost savings can range from 30 to 50 percent. As a consequence of this, MVMCT with a small basis has the potential to be a breakthrough in India, both in terms of the reduction of legal concerns related to land and in terms of the economy.

- **G. Visweswara Rao (1995)** conducted a study on a method for the development of an optimized tower design for extremely high-voltage transmission lines is presented in the paper as a way to develop such a design. The authors of the paper came up with this approach all on their own. When performing the optimization, both the weight of the tower and its geometry are taken into consideration and then optimized accordingly. The management of a specific set of significant design parameters is the means by which this objective can be met. Fuzziness is incorporated into the definition of these control

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variables as part of the design process, which also includes the rest of the process. Because the program was developed specifically for the configuration, analysis, and design of transmission line towers, one of its features is a derivative-free method of nonlinear optimization that has been incorporated into the program. This is because the program was developed specifically for the configuration, analysis, and design of transmission line towers. We present a few intriguing results of crisp and fuzzy optimization that are applicable to the design of a typical double circuit transmission line tower when subjected to a variety of loading conditions. These results were obtained by subjecting the tower to a variety of loads. These findings are summarized in the table below.

- **Hashemi and Mohammadi (2021)** carried out research that investigated the influence that temperature has on the manner in which transmission line towers behave. This research was carried out not too long ago. The findings of the research led to the conclusion that variations in temperature have the potential to have a significant impact on the structural behavior of transmission line towers, and that designers of new transmission line towers should take into consideration the effects of temperature on tower performance when they are conceptualizing new transmission line towers.

- **Jain and Sharma (2019),** in a separate piece of research, investigated how the height of transmission line towers influences both the design and the performance of the towers. Specifically, they were interested in how the height of the towers affects the design of the towers. According to the findings of the study, greater attention should be paid to how wind loads will affect tower height when designing taller structures. In addition, the utilization of guy wires was found to help reduce the overall cost of taller towers, which was another finding of the study.

- **Chen et al. (2020)** analyzed the behavior of transmission line towers located in karst terrain when they were subjected to seismic loads using FEA. This was done in order to determine how the towers responded to the loads. This was done in order to find out how the towers responded to the challenge. The researchers who contributed to a study that was conducted by Chen et al. (2021) looked into the influence that the topography has on the behavior of transmission line towers. According to the findings of the study, the design of transmission line towers should take into account the distinctive characteristics of the karst terrain.

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These characteristics include the presence of sinkholes and underground cavities. According to the results of the study, the topography has a sizeable impact on the wind loads that are exerted on the tower. As a result, it was recommended that designers take into account the topography when they are designing the tower.

- **Xu et al. (2021)** carried out research to determine whether or not it would be possible to make use of unmanned aerial vehicles, also known as drones, for the inspection of transmission line towers that are situated in mountainous terrain. According to the findings of the study, drones may be able to provide an inspection method for transmission line towers that is both effective and efficient, thereby significantly reducing the amount of time and money that is required by conventional inspection methods. The article "Effect of Sloping Ground on the Stability of Transmission Line Towers" was written by M. R. Bhatia and V. K. Rastogi and published in 1994.The use of drones is yet another factor that contributes to the monitoring of transmission line towers, which can be found in a wide variety of landscapes. These towers are located all over the world.

- **Bhatia and Rastogi (1994)** carried out a research to determine the extent to which the slope of the ground had an impact on the structural integrity of transmission line towers. They tested the towers' stability in a number of different slope conditions and found that the towers' stability decreased as the slope increased. This was discovered after they examined the towers. One of the findings of their study was precisely this one. The findings of the study indicate that when planning the construction of transmission line towers in hilly terrain, the angle of the slope as well as the properties of the soil should be taken into consideration.

- **Nanthakumar et al, (2022)** conducted research on the topic of the influence of soil-structure interaction on the behavior of transmission line towers located on soft soil. The research was focused on the influence of soil-structure interaction on the behavior of transmission line towers located on soft soil. The authors ran a number of numerical simulations and centrifuge tests on a transmission tower that had been installed on soft soil. The tower was also subjected to a number of centrifuge tests. According to the findings, the interaction between the soil and the structure has a significant effect on the dynamic response of the tower, particularly on the natural frequency and damping ratio of

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the tower. This was found to be the case after analyzing the tower's natural frequency and damping ratio.

- **Wang et al., (2022)** conducted research to determine how the performance of transmission line towers is affected by the impact that ice buildup has on the operation of transmission line towers. The authors conducted a number of field tests on a transmission tower that was installed in a chilly region with a significant amount of ice accumulation. These tests were carried out in the field. The findings of the investigation showed that the ice load has a significant effect on the performance of the tower, in particular on the natural frequency and damping ratio of the structure. This was demonstrated by the fact that these two factors were affected.

3. CONCLUSION

It is essential for transmission line towers to be designed for and analyzed according to their respective terrains in order for the power grid system to function in a way that is both safe and effective. This is because the power grid system relies on the transmission of electricity. Because of this, the power grid system will be able to function both efficiently and securely. Recent studies on this subject have concentrated their attention on the various ways in which the performance of transmission line towers can be affected by factors such as the degree of roughness of the terrain, the presence of rocky terrain, the interaction between wind and terrain, the interaction between soil and structure, and the accumulation of ice. The performance of transmission line towers is susceptible to being influenced by each of these various factors. The research indicates that the characteristics of the terrain have a significant influence on the dynamic response of the tower as well as its stability. As a direct result of this, the configuration of the tower should take into account the characteristics of the environment immediately surrounding it. The development of more complex models and procedures that are capable of accurately predicting the behavior of transmission line towers in a variety of terrains ought to be the primary focus of future research. This is because such models and procedures are needed in order to accurately forecast the behavior of transmission line towers. Because of this, it will be possible to make more precise predictions regarding the behavior of transmission line towers.

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EFFECT OF NANO TiO_2 AND IRON ORE TAILING WITH PARTIAL REPLACEMENT OF CEMENT AND FINE AGGREGATE IN CONCRETE

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Abstract

This report investigates the effects of incorporating nano TiO_2 and iron ore tailings as partial replacements for cement and fine aggregate in concrete. This study aims to assess the potential benefits of these materials in improving the properties and performance of concrete.

The addition of nano TiO_2 particles, which exhibit pozzolanic characteristics, contributes to the enhancement of concrete's strength development and durability, thereby potentially improving its structural integrity and longevity.. The incorporation of nano TiO_2 in concrete leads to a chemical reaction with the calcium hydroxide produced during cement hydration. This reaction facilitates the formation of supplementary calcium silicate hydrate (CSH) gel, which enhances the overall strength and durability of the concrete. This reaction leads to improved strength and increased resistance to degradation over time.

Moreover, the utilization of iron ore tailings as a partial replacement for fine aggregate presents environmental benefits by reducing the demand for natural sand. This substitution helps in conserving natural resources and mitigating the environmental impact associated with sand extraction. By utilizing this waste material, the environmental impact of concrete production can be minimized. Additionally, the cost savings associated with reduced demand for natural sand can be a significant advantage. The use of nano TiO_2 particles also brings about enhanced workability of the concrete mixture, making it easier to handle and place. This attribute is particularly beneficial in construction scenarios where concrete needs to be pumped or poured into intricate form work. Moreover the photocatalytic properties of nano TiO_2 contribute to the chemical resistance of the concrete. These properties can mitigate the effects of air pollution and chemical exposure, thus improving the long-term durability and performance of the concrete.

It is crucial to acknowledge that the effects and benefits mentioned above may vary based on

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several factors, including the specific proportions and properties of the nano TiO_2 and iron ore tailings, as well as the mix design parameters and curing conditions applied. These variables play a significant role in determining the ultimate performance and suitability of the concrete incorporating these materials. Therefore, careful consideration and optimization of these factors are necessary to achieve the desired outcomes and maximize the potential advantages of using nano TiO_2 and iron ore tailings in concrete production. Therefore, further research and testing are necessary to optimize the replacement percentages and ascertain the desired concrete properties and performance.

Keywords*: nano TiO_2, CSH Gel, iron ore tailings*

1. Introduction

Concrete stands as the most commonly employed construction material worldwide, and its production holds considerable environmental and economic implications. As the fundamental component of infrastructure and building construction, concrete plays a pivotal role in shaping the built environment. Nonetheless, the manufacturing process of concrete necessitates substantial energy consumption and generates notable carbon emissions, leading to environmental repercussions and economic considerations. The extraction and processing of raw materials, such as limestone for cement and sand and gravel for aggregates, can result in adverse environmental effects, including habitat disruption, soil erosion, and depletion of natural resources. Furthermore, cement production involves high-temperature kilning, a process that releases significant amounts of carbon dioxide (CO2) into the atmosphere, contributing to the greenhouse effect and climate change.

In addition, the transportation of heavy concrete elements over long distances consumes significant quantities of fuel and contributes to additional emissions, further amplifying the environmental impact. The management of concrete waste and demolition materials poses challenges in terms of landfill space utilization and potential environmental contamination.

From an economic perspective, the concrete industry plays a substantial role in employment and economic growth. However, fluctuations in raw material costs, energy prices, and adherence to regulatory frameworks can influence the overall cost of concrete production and construction projects.

Addressing these environmental and economic implications necessitates a focus on sustainable

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practices within the concrete industry. This includes exploring alternative cementitious materials, such as fly ash and slag, to reduce reliance on traditional cement while maintaining or enhancing performance. Innovations in concrete mix design, construction techniques, and recycling methods are also pursued to minimize waste generation, energy consumption, and carbon emissions. In conclusion, the extensive use of concrete in construction requires deliberate efforts to mitigate its environmental impact and optimize economic efficiency. Embracing sustainable approaches, such as the adoption of alternative materials and the implementation of efficient production methods, can foster an environmentally conscious and economically viable concrete industry.. The high demand for cement, the primary binding agent in concrete, leads to extensive energy consumption and carbon dioxide emissions during its production. Additionally, the extraction of natural fine aggregate, such as sand, contributes to environmental degradation. To address these challenges, researchers and engineers have been exploring alternative materials and methods to enhance the properties and sustainability of concrete. One such approach is the incorporation of nanoparticles and industrial by-products as partial replacements for cement and fine aggregate.

This report primarily investigates the impacts associated with the inclusion of nano TiO2 (titanium dioxide) and iron ore tailings as partial substitutes for cement and fine aggregate in concrete. Nano TiO2 particles have gained attention due to their pozzolanic properties, which enable them to react with calcium hydroxide and form additional calcium silicate hydrate gel, enhancing the strength and durability of concrete. Iron ore tailings, on the other hand, are waste materials generated during the processing of iron ore and can be utilized as a sustainable alternative to natural fine aggregate. The report will provide a comprehensive analysis of the effects of nano TiO2 and iron ore tailings on concrete properties, discuss the underlying mechanisms responsible for the observed changes, and evaluate the feasibility and potential limitations of their implementation. It is expected that the findings of this study will contribute to the knowledge base surrounding sustainable concrete technologies and provide valuable insights for the construction industry.

In summary, this report aims to explore the effects of incorporating nano TiO2 and iron ore tailings as partial replacements for cement and fine aggregate in concrete, with a focus on their potential to improve the properties, sustainability, and performance of concrete structures. By evaluating the benefits and limitations of these materials, this study contributes to the ongoing

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efforts to develop more environmentally friendly and cost-effective construction practices.

A. A. Raheem et al. (2020), used 0%, 10%, 20%, 30%, and 40% iron ore tailings as partial replacements for sand in the concrete mixes.The study found that the compressive strength of the concrete was highest at 20% iron ore tailings replacement.**M. Nili et al.,** (2020) used 0%, 10%, 20%, and 30% iron ore tailings as partial replacements for fine aggregates in the UHPC mixes.The study found that the compressive strength of the ultra-high performance concrete was highest at 20% iron ore tailings replacement. **M. V. Ramesh et al** (2019) used 0%, 20%, 40%, 60%, and 80% iron ore tailings as partial replacements for fine aggregates in the concrete mixes.The study found that the compressive strength of the concrete was highest at 60% iron ore tailings replacement.**A. Khademi and H. Nikraz.** (2018) used 1%, 2%, and 3% by weight of cement reports that the addition of 2% nano TiO2 to concrete results in a significant increase in compressive and flexural strength, as well as improved durability. **M. Najimi et al.** (2018) used 1%, 2%, 3%, and 4% by weight of cement reports that the addition of 2% titanium dioxide nanoparticles to self-compacting concrete results in an increase in compressive strength, splitting tensile strength, and flexural strength. **X. Wu et al.** (2015) used 1%, 2%, and 3% by weight of cement reports that the addition of 1% nano-TiO2 to high-performance concrete results in a significant increase in compressive strength and flexural strength.

3. Experimental Procedure:

In this study, concrete mixtures were prepared using different percentages of Nano TiO2 and iron ore tailing as partial replacements for cement and fine aggregate, respectively. The compressive strength of the concrete mixtures were tested after 7, 14, and 28 days of curing.

3.1 Materials used:

Cement: The concrete mixtures used in this study were prepared using Ordinary Portland Cement (OPC) of grade 43, adhering to the specifications outlined in IS 269:2015.

Fine aggregate: The fine aggregate component in the concrete mixtures consisted of artificial sand of zone II, which complied with the requirements specified in IS 383:2016.

Coarse aggregate: The coarse aggregate employed in the concrete mixtures comprised crushed granite stone of zone II, meeting the criteria set forth in IS 383:2016.

Nano TiO2: Titanium dioxide nanoparticles with an average particle size of 15 nm.

Iron ore tailings: The iron ore tailings utilized in this study were sourced from a nearby iron

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ore processing plant and were incorporated as a partial substitute for fine aggregate in the concrete mixtures.

Water: Freshwater was employed for the process of mixing and curing the concrete.

3.2 Materials Testing:

The test results outlined below provide a detailed characterization of the materials used in the experimental mix.

Cement: The properties of cement is shown in table 1

Table 1 Properties of Cement

Physical properties of cement	**Permissible Value**	**Test value**
Initial setting time	>30 min	68 min
final setting time	<600	182min
Specific gravity	-	3.15
Compressive strength (MPa)		
7 days	33	37.58
14 days	38	45
28 days	43	49.66

Aggregate: The properties of aggregates is shown in table 2

Table 2 Fine Aggregate Gradation

Sieve size	Wt. retained (g)	Cumulative Wt. retained (g)	Cumulative %Wt. retained (%	Weight passed (g)	%Wt. passed (%)
4.75 mm	0	0	0	1000	100
2.36 mm	100	100	10	900	90
1.18 mm	230	330	33	670	67
600 micron	190	520	52	480	48
300 micron	240	760	76	240	24
150 micron	190	950	95	50	5
PAN	50	1000	SUM = 266	-	-
Total	1000		FM = 2.66		

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3.3 Mix Proportion: Quantity of different ingredient is shown in table-3

Table 3 Mix Proportion

For .35 W/C Ratio	
Cement	13.19Kg
Water	4.617L
Coarse aggregate	37.66Kg
Fine aggregate	19.62Kg
I.O.T	5.89Kg

4. Results:

The findings of this study underscore the promising potential of employing TiO2 nanoparticles and iron ore tailings as sustainable alternatives in concrete production. These substitutions not only contribute to waste reduction but also demonstrate their capability to enhance the mechanical performance of the concrete.

4.1 Compressive strength:

The result for the compressive test of the concrete blocks at 7, 14 and 28 Days are

Table 4 Compressive Strength test results in MPa

Mixture replacement by TiO2 (I.O.T 30%)	7 Days	14 Days	28 Days
0%	35.85	36.29	43.32
1%	25.22	27.16	42.89
1.5%	28.331	36.11	45.51
2%	30.21	37.98	43.14

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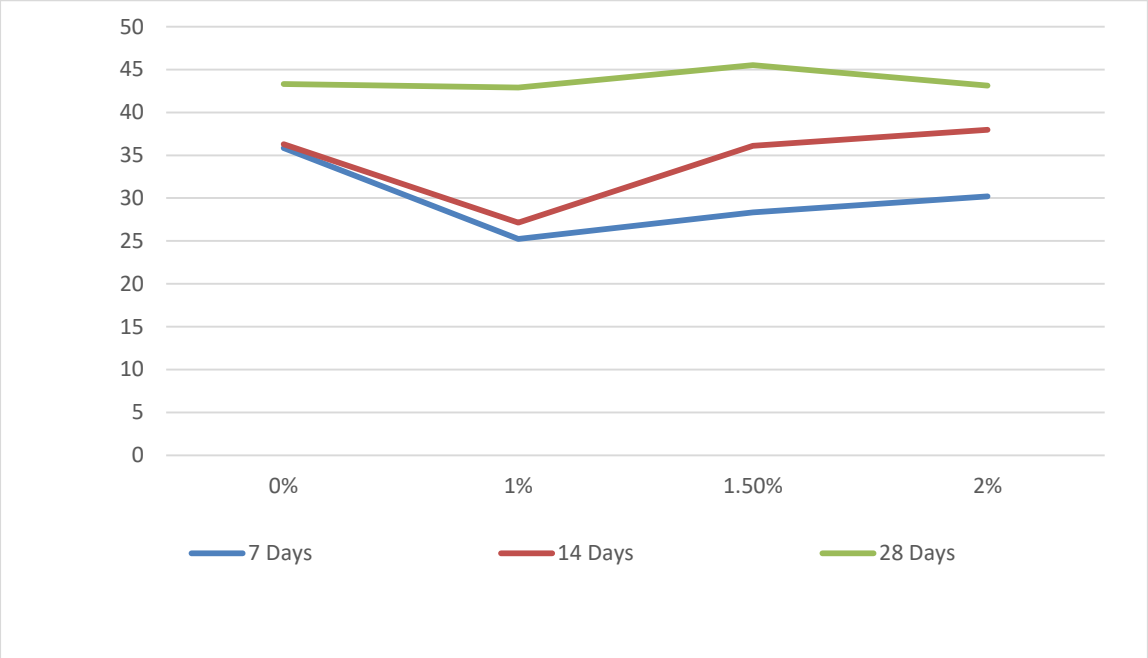

Fig.1 Compressive Strength test results

The presented data outlines the compressive strength results obtained from the testing of concrete mixtures, where the percentages of TiO2 and IOT (iron ore tailings) replacements were varied. The measurements were conducted at different curing ages, including 7 days, 14 days, and 28 days.At 7 days, the compressive strength of the concrete mixture without any TiO2 and IOT replacement was the highest at 35.85 MPa, while the mixture with 1.5% TiO2 and 30% IOT replacement exhibited slightly lower strength of 28.31 MPa.

At 14 days, the compressive strength of the mixture with 1.5% TiO2 and 30% IOT replacement increased to 32.78 MPa, which was higher than the strength of the mixture without any replacement (36.29 MPa) and the mixture with 1% TiO2 and 30% IOT replacement (27.15 MPa). At the 28-day curing period, the concrete mixture incorporating 1.5% TiO2 and 30% IOT replacement exhibited the highest compressive strength, measuring 44.75 MPa. This value surpassed the strength of the control mixture (without any replacement) at 43.32 MPa, as well as the mixtures featuring lower percentages of TiO2 and IOT replacements. The findings suggest that the inclusion of 1.5% TiO2 and 30% IOT replacement in the concrete mixture can result in a minor improvement in compressive strength, especially at later curing ages.

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4.3 Split Tensile Strength:

The split tensile strength values of the concrete blocks at 7 and 28 days are as follows:

Table 5 Split Tensile Strength test results in MPa

Mixture replacement by TiO_2 (I.O.T 30%)	7 Days	28 Days
0%	2.09	3.08
1%	2.22	3.42
1.5%	2.45	3.68
2%	2.32	3.36

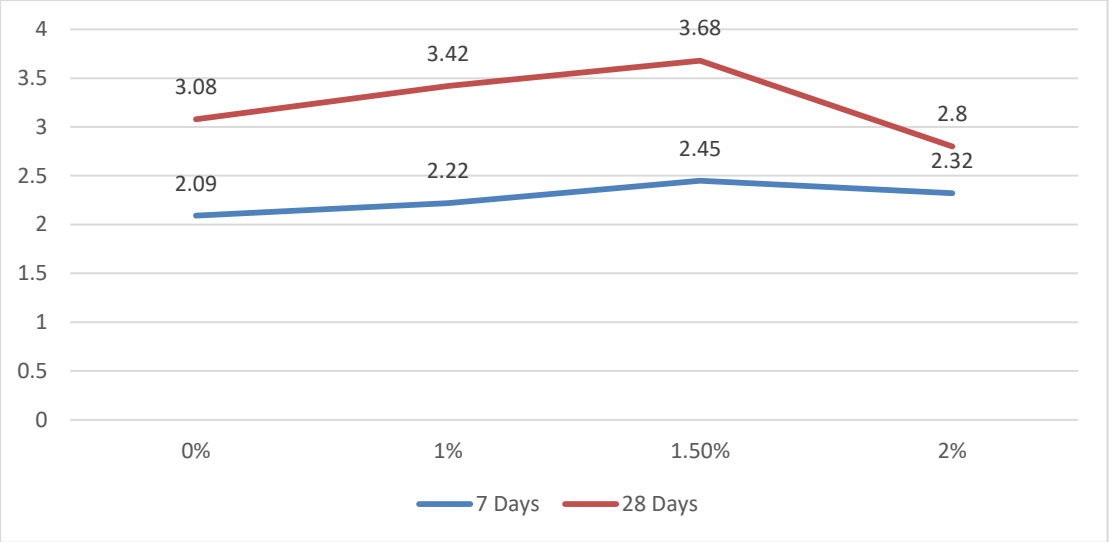

Fig.2 Split Tensile Strength test results Graph

The given data presents the split tensile strength of concrete mixtures with varying percentages of TiO2 and IOT (iron ore tailings) replacement at different curing ages (7 days and 28 days). At 7 days, the split tensile strength of the concrete mixture with 1.5% TiO2 and 30% IOT replacement exhibited highest strength of 2.45 MPa, while the mixture without any TiO2 and IOT replacement was the lowest at 2.09 MPa

The split tensile strength analysis revealed that, after 28 days of curing, the concrete block with 1.5% TiO2 and 30% IOT replacement displayed the highest split tensile strength of 3.68 MPa. This value notably exceeded the strength exhibited by the mixture without any replacement (3.08 MPa) and the mixtures incorporating lower percentages of TiO2 and IOT replacements.

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The outcomes of the study suggest that the addition of 1.5% TiO2 and 30% IOT replacement in the concrete mixture yielded a marginal but noticeable improvement in split tensile strength, especially as the curing period progressed.

4.3 Flexural Strength:

The measured flexural strength values of the concrete blocks at 7 and 28 days are as follows:

Table 6 Flexural strength test results

Mixture replacement by TiO_2 (I.O.T 30%)	7 Days	28 Days
0%	2.45	5.09
1%	2.52	5.29
1.5%	2.49	5.24
2%	2.47	5.13

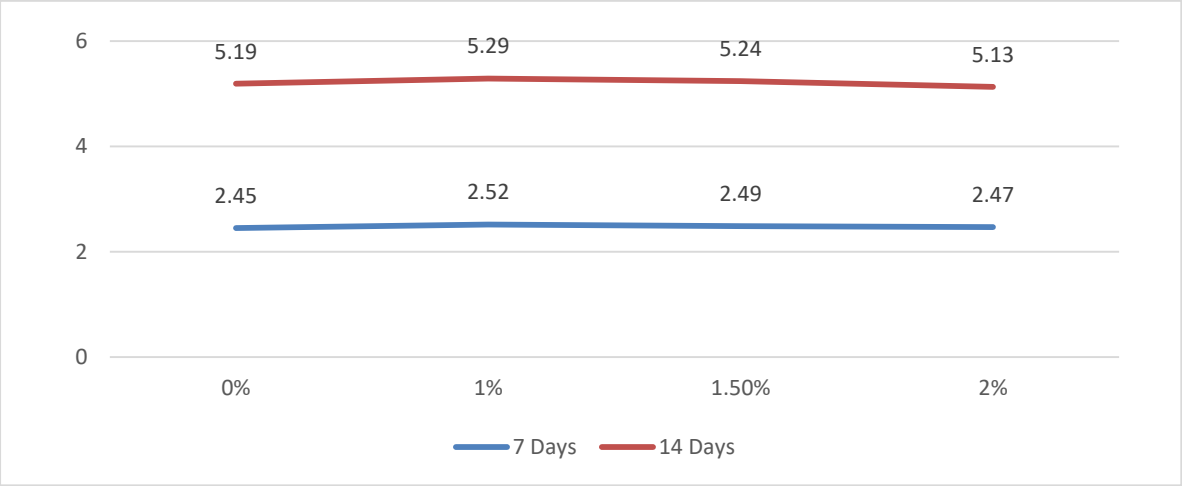

Fig. 3 Flexural strength test results graph

The given data presents the Flexure strength of concrete mixtures with varying percentages of TiO2 and IOT (iron ore tailings) replacement at different curing ages (7 days and 28 days).

At 7 days, the Flexure strength of the concrete mixture with 1 TiO2 and 30% IOT replacement exhibited highest strength of 2.52 MPa, while the mixture without any TiO2 and IOT replacement was the lowest at 2.45 MPa. At the 28-day curing period, the concrete mixture incorporating 1% TiO2 and 30% IOT replacement exhibited the highest flexural strength of 5.29 MPa. This value exceeded the strength of the control mixture (without any replacement)

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at 5.09 MPa, as well as the mixtures with lower percentages of TiO2 and IOT replacements. The findings suggest that the inclusion of 1% TiO2 and 30% IOT replacement in the concrete mixture can result in a minor improvement in Flexure strength especially at later curing ages.

5. Conclusion:

Grounded on the test anatomized on the effect of nano TiO2 and iron ore trailing on partial relief of cement and fine total in concrete. The incorporation of TiO2 nanoparticles and 30% iron ore tailing as partial replacements in M30 concrete has demonstrated significant enhancements in its mechanical properties without compromising sustainability. This approach offers a promising solution for improving the performance of concrete while reducing waste from mining operations. One of the key aspects investigated in this study was the compressive strength of the modified M30 concrete. The findings of the study demonstrate a significant improvement in compressive strength resulting from the inclusion of TiO_2 nanoparticles and iron ore tailings in the concrete mixture when compared to the control mix. The observed enhancement in compressive strength can be attributed to the combined effects of the pozzolanic and cementitious properties of the iron ore tailings, as well as the improved particle packing and interfacial bonding facilitated by the TiO_2 nanoparticles. These factors contribute to the overall improvement in the mechanical properties of the concrete mixture. The incorporation of TiO_2 nanoparticles and iron ore tailings in the concrete mixture showcased a synergistic effect, leading to a substantial improvement in compressive strength. This harmonious interaction between the two materials highlights their compatibility and their ability to positively enhance the overall strength properties of the concrete.

Alongside the analysis of compressive strength, the research also delved into the investigation of flexural strength for the modified concrete. Flexural strength holds significant importance in structural applications as it signifies the concrete's capacity to endure bending forces. This parameter is crucial for evaluating the performance and durability of concrete in various structural elements subjected to bending and flexural stresses. The incorporation of TiO_2 nanoparticles and iron ore tailing contributed to an increase in flexural strength compared to the control mix. The presence of TiO_2 nanoparticles improved the microstructure of the concrete, enhancing its resistance to cracking and increasing its load-carrying capacity. The iron ore tailing, on the other hand, acted as a filler material, improving the packing density and reducing porosity, thereby enhancing the flexural strength of the concrete.

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Furthermore, the split tensile strength, which characterizes the concrete's resistance to tensile stresses, was examined. The combined influence of TiO_2 nanoparticles and iron ore tailings led to elevated split tensile strength values when compared to the control mix. This synergy between the two materials contributed to the improved ability of the concrete to resist tensile forces, highlighting their positive impact on the overall tensile strength performance. The presence of TiO_2 nanoparticles contributed to a more uniform distribution of stress within the concrete matrix, improving its resistance to cracking under tensile loading. The incorporation of iron ore tailings in the concrete mixture played a crucial role in enhancing the tensile strength. This improvement can be attributed to the filling of voids and the enhancement of bond between the cementitious matrix and aggregates. The presence of iron ore tailings helped to improve the overall cohesion and interlocking within the concrete, resulting in enhanced tensile strength properties.

Significantly, the utilization of iron ore tailings as a partial replacement in concrete presents notable environmental advantages by addressing waste generated from mining operations and offering a sustainable alternative to traditional construction materials. By repurposing and incorporating iron ore tailings, the concrete industry can contribute to waste reduction, minimize environmental impact, and promote a more sustainable approach to construction practices. This not only helps in minimizing environmental impact but also adds economic value to the mining industry.

In conclusion, the incorporation of TiO_2 nanoparticles and 30% iron ore tailing as partial replacements in M30 concrete has demonstrated significant improvements in its mechanical properties. The combination of these materials exhibited synergistic effects, leading to improvements in compressive strength, flexural strength, and split tensile strength of the concrete. The incorporation of TiO_2 nanoparticles and iron ore tailings in the concrete mixture resulted in enhanced overall mechanical properties, highlighting their combined positive influence on multiple strength parameters. This synergistic enhancement signifies the potential of these materials in enhancing the performance and durability of concrete structures. Moreover, this approach offers a sustainable alternative by utilizing iron ore tailing, thus addressing environmental concerns associated with waste generation from mining activities

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APPLICATION OF WIND ENERGY TO GENERATE ELECTRICITY ON HIGHWAYS

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Abstract
The goal of this work is to build a wind turbine to recover wind energy from cars on the highway. However, wind energy is recognized as the fastest growing source of clean energy. Limited by erratic wind. Highways with big cars can provide a lot of wind to power turbines. This power is not used. General studies of wind models require the determination of the average wind speed produced by traffic. Wind turbines will be placed in the middle so that the water flow on both sides of the highway will be considered in the design. Using all the collected data, wind turbines can be installed in the existing light sources of the environment. Also, as the weather will change, the tank will be designed to dissipate energy and keep it constant. Ideally, turbines could be used as an energy source for lights and other utilities around the world.

Keywords: *Wind energy; Wind Turbine; Highway Traffic, Electricity generation.*

1. Introduction

Wind energy is the fastest clean energy in the world. The biggest problem in this process is the change in ventilation. Due to the speed of the car, the wind speed on the highway is almost constant. The motivation of the project is to contribute efficiently to the world of clean energy.

1.1 Design Challenge: High-Traffic Wind Turbine

In this design competition, participants are tasked with creating an innovative wind turbine design suitable for high-traffic areas. The key considerations for the design are:

Cost Efficiency: The turbine should be cost-efficient, with the energy savings offsetting the initial investment within a reasonable timeframe.

Energy Storage and Distribution: The design should incorporate systems for energy storage and efficient distribution of the generated electricity.

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Low Environmental Impact: Minimizing the impact on the installation site and the surrounding environment is crucial. The design should be considerate of noise levels and location.

Urban Compatibility: Unlike traditional wind turbines in remote areas, the challenge here is to create a design suitable for urban or high-traffic locations where electricity demand is high.

Safety Measures: Due to the turbines' placement in high-traffic areas, safety is paramount. Designs must include features like permanent safety guards and prominent notices around the turbine blades.

Participants are encouraged to think creatively and come up with innovative solutions that meet these criteria. The design should not only be functional and efficient but also visually appealing and well-integrated into urban landscapes.

Possible areas of focus for participants include:

Efficiency Improvement: Develop a design that maximizes energy conversion, even in lower wind speeds, to increase overall energy output.

Compact Design: Create a compact turbine that can fit within limited urban spaces without compromising energy production.

Vertical Axis Turbines: Explore the use of vertical axis turbines, which may be more suitable for urban environments due to their lower noise and visual impact.

Smart Grid Integration: Consider how the turbine can be seamlessly integrated into the existing power grid, enabling effective energy distribution.

Energy Storage Solutions: Propose innovative energy storage methods, such as batteries or other storage technologies, to ensure a stable and continuous energy supply.

Aesthetics: Design the turbine in a visually appealing manner, possibly incorporating art and aesthetics to make it an attractive urban landmark.

Smart Monitoring and Safety Features: Integrate smart monitoring systems to ensure optimal performance and safety of the turbine.

Material Selection: Optimize material choices for both durability and cost-effectiveness.

The competition's judging criteria may include factors such as energy output, cost-efficiency, safety measures, environmental impact, and overall design creativity. Participants will need to present their designs, providing detailed explanations of how they address each criterion and why their design stands out.

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Ultimately, the winning design will have the potential to revolutionize the use of wind turbines in high-traffic urban areas, contributing significantly to sustainable energy generation and consumption.

Figure 1: Display of Highway Wind Turbine

1.2 Global Applications

The design can be used in any city in the world. It should be environmentally friendly. Multiple language texts and maps will be provided for each city. Figure 1 shows the growth of electricity reaching a maximum of 282 GW, up almost 20% in 2012. For example, the World Wind Energy Association presents studies on wind energy.

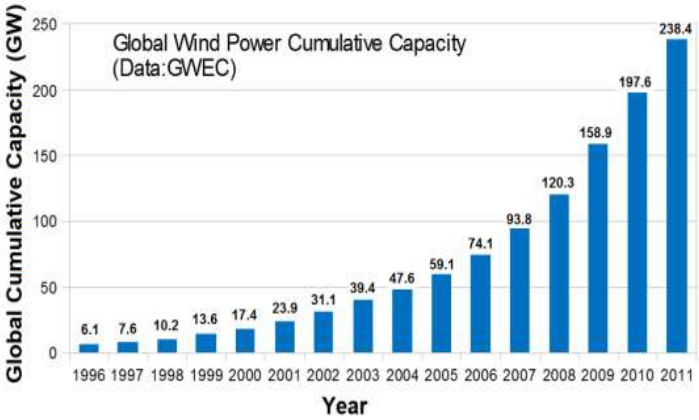

Figure 2: Wind Energy data from Global Wind Energy Council

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2. Problem Statement

The biggest obstacle to the development of wind energy is the change of wind characteristics. The highway seems to be where the wind is strong. Analysis of the water flow depth from the roadway is necessary to obtain boundary conditions for wind turbine design. Turbines must be able to store energy for use during periods of low traffic, congestion or stop-start. Design must be sustainable and environmentally friendly.

3. Conceptual Design

There are many ways to solve this particular design problem. In our research, we found different characteristics of wind turbines that are attractive for many reasons. For example, Chinese gear turbines are very inexpensive and modular components are easily put together to create large machines. This particular design is not as ecofriendly as one with a larger fan. Other designs include turbines placed on highway dividers or overhead masts, such as Arizona State University student Joe (name not given) (Joe, 2007). Joe calculated that his design could produce 9,600 kilowatts of electricity per year when the car was driven at 70 miles per hour.

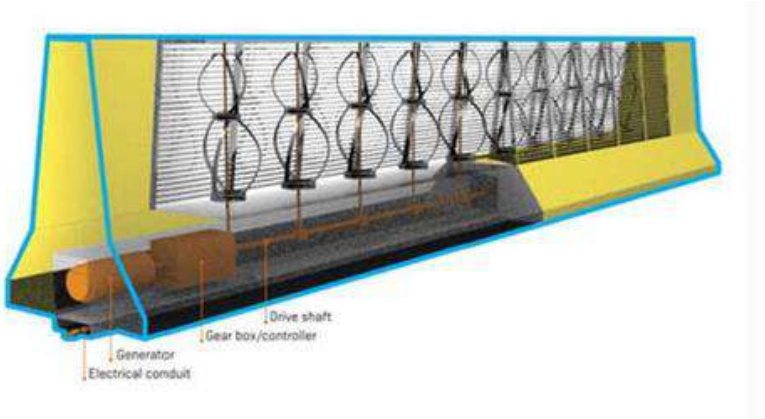

Figure 3: Mark Oberholzer, Guardrail Wind Turbine Design

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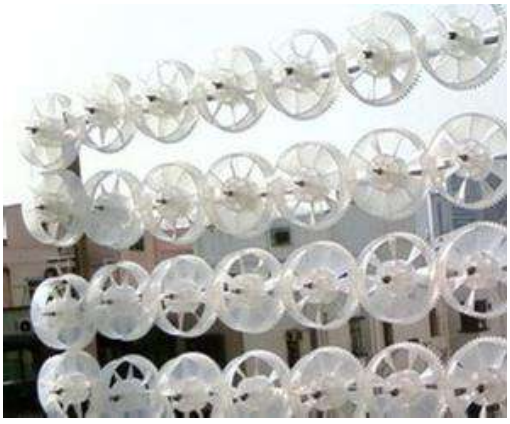

Figure 4: Hong Kong University and Lucien Gambarota of Motorwave Ltd.

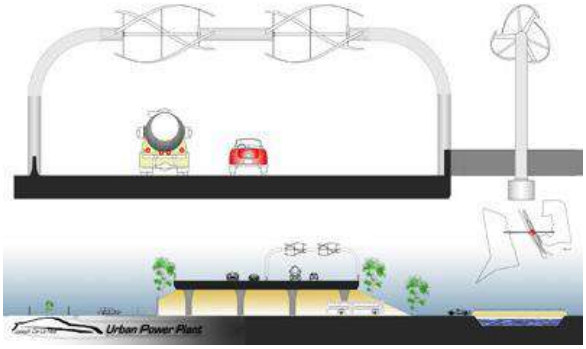

Figure 5: Arizona State University Student Design

Figure 6: Arizona State University Student Realistic Design

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The text mentions several different wind turbine models designed for use on highways. Each design has its own set of advantages and disadvantages. Let's briefly analyze each of the mentioned designs:

Figure 3: Turbine Inside Guardrail:

Advantages:

- Utilizes the wind generated by passing vehicles efficiently, making it potentially more effective in high-traffic areas.
- Takes advantage of existing infrastructure (guardrails) for support, minimizing the need for additional structures.

Disadvantages:

- Challenging design due to the need to fit the guardrail with teeth to direct the wind towards the turbines inside.
- Potential safety concerns related to modifying the guardrail and ensuring the turbines' structural integrity.

Figure 4: Inexpensive Wind Turbine Design:

Advantages:

- Cost-effective design, which may be beneficial for large-scale deployment.
- Possibly easy to manufacture and install.

Disadvantages:

- Safety concerns due to the small and fragile nature of the components, leading to potential breakage and structural instability.

Figures 5 and 6: Wind Turbines by Arizona State University Students:

Advantages:

- Created by students, which may indicate a potential for innovation and creativity.
- Likely customized for specific needs or goals.

Disadvantages:

- Rejection due to the requirement for special support lines, which could add complexity and cost to the installation process.
- May not be as suitable for large-scale deployment in high-traffic areas due to the need for additional infrastructure.

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Overall, the text highlights the challenges in designing wind turbines for use on highways, including safety considerations, reliance on existing infrastructure, and the need to balance cost-effectiveness with efficiency and reliability. These factors are crucial to creating a successful wind turbine design that can be deployed effectively in high-traffic urban locations. The mentioned designs serve as examples of the various considerations that engineers and designers must take into account when developing wind turbines for such applications.

4. Analytical Analysis of The Vertical Axis Wind Turbine Design

The provided information discusses the design of a vertical axis wind turbine that harnesses wind from moving vehicles to generate electricity. Let's analyze the key points:

4.1 Power Available Equation:

The power available from the wind is calculated using the equation:

$$\text{Power available} = 1/2 * \rho * A * V^3$$

Where:

ρ (rho) is the fluid density (air density in this case).

A is the swept area of the turbine blades.

V is the wind velocity.

4.2 Power Coefficient (CP):

The power coefficient (CP) is defined as the power extracted by the turbine divided by the power available from the wind. It indicates the efficiency of the turbine in converting wind energy into electricity.

4.3 Betz Limit:

The Betz limit represents the maximum value for the power coefficient (CP) and is a theoretical upper limit to the amount of power that can be extracted from the wind. It is approximately 0.59, meaning no wind turbine can exceed an efficiency of 59.3% in converting wind power to electrical power.

4.4 Wind Velocity's Significance:

The analysis indicates that wind velocity (V) is the most significant factor in generating power. The power extracted is directly proportional to the cubed velocity of the wind (V^3). This means that even a small increase in wind velocity can lead to a significant increase in the

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power output of the turbine.

4.5 Electricity Generation and Conversion:

The wind turbines are installed along highways and use wind from moving vehicles to generate electricity. The electricity generated is stored in batteries. However, since the electricity produced is in direct current (DC), it must be converted to alternating current (AC) before it can be used for lighting, sold to the grid, or utilized in modern electrical systems. This requires passing the DC current through an inverter.

4.6 Vertical Axis Wind Turbine Design:

The design mentioned is a vertical axis wind turbine, which is characterized by its compact and space-efficient design. It is suitable for urban or high-traffic areas where space is limited and where the wind direction may vary.

4.7 TAK Studio Design:

The turbine to be built is related to the TAK studio design, although specific details and features of the TAK studio design are not provided.

The analytical analysis emphasizes the importance of wind velocity in maximizing power generation and highlights the need for efficient electricity conversion from DC to AC. It also underlines the potential benefits of installing vertical axis wind turbines along highways, where they can take advantage of the wind generated by moving vehicles. Further development and implementation of this design have the potential to contribute significantly to sustainable energy generation in urban environments.

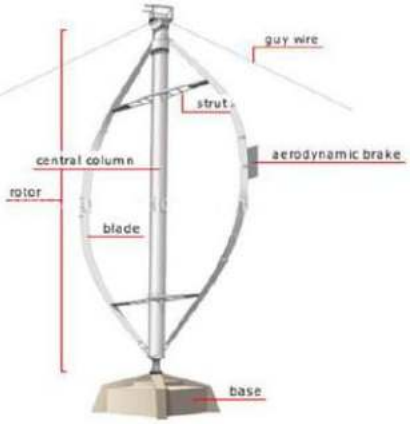

Figure 7: Labeled Parts of A Vertical Wind Turbine

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vertical wind turbine design is selected because vertical turbines are capable of capturing wind in any direction, whereas, horizontal turbines need to be pointed in the direction.

5. Conclusion

Finally, we collected a lot of data on wind patterns created by cars on both sides of the highway. Using the collected data, wind turbines are designed to be placed in the middle of highways. While a single turbine may not generate enough electricity, a group of turbines along a long highway can generate large enough energy that it can be used for electricity in lighting, other electrical appliances, and even make a profit by selling the electricity back to the grid. This design concept aims to be sustainable and environmentally friendly. There are also many applications of wind powered wind turbines. Theoretically, any moving vehicle could use an electric motor, such as an amusement park. Road wind turbines can be used to power every major city in the world.

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COMPARISON OF COMPRESSIVE STRENGTH OF INTERLOCKING TILES REPLACING FINE AGGREGATES BY IRON ORE TAILINGS

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Abstract
A significant portion, about 10-15%, of the iron ore extracted in India remains unused and is discarded as waste or tailings due to the absence of cost-effective technologies for extracting low-grade ores. The effective disposal or utilization of this waste material, in the form of ultra-fine or slim particles, poses a significant and unresolved challenge for the iron ore industry in India. With the projected increase in demand for iron ore, driven by the planned establishment of numerous steel plants across the country, the generation of iron ore waste is expected to rise in the future. In 2013, the production of iron ore in India reached 218.64 million tons (IBM, 2013), and it is anticipated that the total production of iron ore in the country will surpass 4,000 million tons in the coming decade.

Keywords: *Iron ore tailing, waste material, cost-effective technologies*

1. Introduction:

Interlocking tiles are used extensively in construction projects of varying scales because of their adaptability in terms of structure and the fact that they are aesthetically pleasing. This is because interlocking tiles can be easily assembled and disassembled. An experienced designer is one who is capable of developing a design that not only ensures the structure's stability but also ensures that it is cost-effective. This is the mark of a successful designer. There is absolutely no use for the fine iron tailing particles, which can be identified by having a diameter of less than 200 micrometers. It is estimated that 4 billion tons of this type of mined ore in India is lost as tailings after the mining process. The iron ore industry in India still faces a significant obstacle in the form of a challenge that has not been satisfactorily addressed: the question of how to effectively dispose of or make use of this considerable mineral wealth in the form of fine particles. This challenge has not been satisfactorily addressed. Additionally, it is used in the production of products such as building blocks, road pavers, stabilized mud blocks, paving

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tiles, and other similar items as a preferred alternative to the use of sand in the manufacturing process. This can be seen in the production of these products.

2. Materials and Methodology

a. Cement:

For the purposes of this particular investigation, ordinary Portland cement (OPC) of grade 43 was used to prepare the concrete mixes. The cement was a consistent gray color with a slight greenish shade, and its texture was smooth and free of any hard lumps. Additionally, the cement's color was consistent throughout. The color of the cement remained uniform throughout its entirety. Throughout the course of the various tests that were performed, measurements were taken to determine the cement's compressive strength, initial setting time, final settling time, and specific gravity.

The values for the specific gravity, initial setting time, and final setting time of the cement, as well as its compressive strength, are listed in Table 1, along with the corresponding values specified in the standard IS 8112:2013.

Table 1: Physical properties of cement

Particulars	Experimental Results	As per standard IS 8112:2013
Specific gravity	3.15	---
Setting time (minutes)		
Initial setting time	45 minutes	30 minutes (Minimum)
Final setting time	560 minutes	600 minutes (Maximum)
Compressive strength		
3 days	22.79MPa	16 MPa (minimum)
7 days	34.52MPa	22 MPa (minimum)
28 days	46.28MPa	43 MPa (minimum)

b. Iron Ore Tailing:

The concrete mixes that were used for the purposes of this particular investigation were

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prepared using ordinary Portland cement (OPC) of grade 43. The cement had a uniformly gray appearance that was tinged with a hint of green, and its consistency was smooth and devoid of any coarse lumps. In addition, there was no variation in the color of the cement anywhere. The color of the cement was consistent throughout its whole length and breadth. During the course of the many different tests that were carried out, various measurements were taken in order to ascertain the compressive strength, initial setting time, final settling time, and specific gravity of the cement.

Table 1 contains a listing of the values for the specific gravity, initial setting time, and final setting time of the cement, as well as its compressive strength. These values are listed alongside the values that are specified in the standard IS 8112:2013 for the corresponding characteristics.

c. Coarse Aggregate:

For the purposes of this study, coarse aggregates with a maximum particle size of 20 millimeters were utilized. These aggregates were sourced from nearby locations. The various physical characteristics of the coarse aggregate are outlined in Table 2, which can be found below.

Table 2: Physical properties of coarse aggregate

Particulars	Experimental Results
specific gravity	2.7
water absorption	0.3%
free moisture content	0%

d. Water

In this specific investigation, the specimens were cleaned and aged using drinkable water at every stage of the process. The production process includes an important step known as "proper distribution of the components that go into concrete," which is so important because it affects not only the quality of the product but also the price point. The process of achieving the performance characteristics of concrete that are desired begins with the selection of the component materials that will be used in the concrete. The following stage is the process known as mix design, which consists of determining the procedure that will result in the most optimal

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combination of components possible. In this investigation, the mix design procedure that was used to produce concrete of grade M35 adhered to the standards that are specified in Indian Standard (IS) 10262-2019. These standards were followed in order to ensure the quality of the final product. The specific gravities, mix proportions, and designated mixes of the materials that were used are presented in the tables that are titled "Table 4", "Table 5", and "Table 6", respectively.

Table.3. Specific gravities of materials used

Materials	Specific gravity
Cement	3.15
Iron ore tailing	2.66
Coarse aggregate	2.70

Table. 4. Mix proportion

W/C ratio	Water (kg/m^3)	Cement (kg/m^3)	Iron 0re tailing (kg/m^3)	CA (kg/m^3)	FA (kg/m)
0.45	197.16	438.13	224	416	1128.93

2. Casting of Specimen and Testing Procedure

Before beginning the mixing process, it is necessary to carefully measure out the aggregates, cement, iron ore tailings (IOT), and water components of the final product. This will ensure that the final product has the desired level of consistency. After that, these components go through an extensive blending process inside of an electric-powered rotating drum mixer, where they are combined in a variety of different ways. While the ingredients are being combined, small amounts of water are gradually poured in at intervals. The finished batch can be obtained by combining the components for approximately four to five minutes and mixing them together. A test known as the "slump test" is carried out on the concrete in order to determine how easily it can be worked.

2.1 Casting of Blocks

First things first, make sure that all of the ingredients in the batch are thoroughly combined.

• Place the material inside the tile mold in three separate layers, making sure that each layer is compacted a total of 25 times before moving on to the next.

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• Once the mold has been completely stuffed, put it on a vibrating platform for a period of five seconds after the process has been finished.

2.2 Working and Trials

The machine is installed on top of a casting platform, which should have a concrete surface that has been painstakingly leveled and finished in a smooth manner in order to accommodate the machine's setup. On the platform, discarded newspapers or sheets of polythene are placed in preparation for their removal the following day, when it will be time to remove the block. This makes it possible for the materials to be removed without much difficulty.

3. Experiment

The compression test on masonry blocks is an essential component when it comes to monitoring and confirming the quality of building blocks. The test measures the amount of force that can be applied to the block. This test determines how the material behaves when subjected to crushing loads, providing information about how it reacts when compressed. Along with this, it enables the measurement of the material's plastic flow behavior as well as the limits of its ductile fracture. In order to conduct the compression test, three samples (bricks) representing each mix proportion must be prepared and then allowed to cure for a period of twenty-eight days. The examination is performed on specimens that have the following three different shapes: cubical, cylindrical, and prismatic. The surface area of the block specimen measures out to be 26400 millimeter squares.

4. Result and Discussion

After the curing process is finished, the overall strength of the blocks is significantly affected by it in a positive way. The primary purposes of curing are to reduce the likelihood of shrinkage cracks while simultaneously increasing the amount of hydration that is attained as much as possible.

The samples to be tested are kept at room temperature and in an environment free of vibrations until they are needed for the tests. During the period of testing, which lasts for a total of 28 days, the appropriate marking is carried out in order to make subsequent identification easier. Clear water maintained at a temperature ranging from 24 degrees Celsius to 30 degrees Celsius is utilized during the process of curing.

Three specimens in the form of blocks are prepared for each possible mix proportion, and each block is given a total of 28 days to cure before being evaluated. In the compression test,

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specimens with the geometries cubical, cylindrical, and prismatic are utilized as test subjects. According to the measurements, the surface area of the block specimen is 26,400 millimeter squared. The following are the results for compressive strength that were obtained after curing for a period of 28 days: M35 with 30% IOT had a value of 40 MPa, M35 with 35% IOT had a value of 43 MPa, and M35 with 40% IOT had a value of 39 MPa. The value of M35 in its normal state was 38 MPa.

5. Conclusion

In conclusion, it is anticipated that the production of iron ore tailings will approach approximately 400 million tons in the subsequent decade. This is based on projections made by the industry. This is based on forecasts provided by analysts in the relevant industry. A number of different projections were used in order to arrive at this conclusion. We worked with concrete that contained iron ore tailings (IOT) throughout the course of this investigation. We evaluated the material's potential for use in the construction industry by measuring the compressive strength of the concrete paste that was produced. This was done so that we could determine whether or not it would be beneficial to use.

In addition to this, the interlocking tiles that we used contained a different amount of IOT in each individual tile depending on the percentage that was contained in the overall tile. It was found that the percentage of IOT added to the concrete had an effect on the strength of the concrete, and that the effect increased with higher percentages of IOT up to a certain threshold. This discovery was made after it was found that the strength of the concrete was affected by the percentage of IOT added to the concrete. On the other hand, increasing the percentage of IOT in the concrete only had so much of an effect because the effect was capped at a certain point. However, once this limit was exceeded, the bricks' strength decreased, and as a result, the surface finish became less smooth. This was also the case with the surface finish.

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PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH JHAMA BRICKS (OVER BURNT BRICKS)

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Abstract

Concrete is a commonly used construction material that has been extensively researched to find alternative materials. One such material that has gained attention is jhama bricks or burnt bricks as an alternative coarse aggregate in concrete production. Since natural rock aggregates are not readily available everywhere, crushed burnt bricks were studied as a possible replacement. The research aimed to explore the suitability of using burnt bricks as a coarse aggregate in producing concrete of different strengths, including M-25, M-30, and M-35. The physical properties of the concrete, including compressive strength, tensile strength, flexural strength, and workability, were tested with burnt bricks used as 10%, 20%, and 30% of the concrete mixture. The concrete specimens were cured for 7 and 28 days to assess the strength development over time. Additionally, burnt bricks were tested for compressive strength, tensile strength, flexural strength, and workability to analyse their properties. The results showed that concrete made with burnt brick aggregate had lower strength compared to regular concrete. Further work is recommended to investigate the use of different mix ratios and proportions of burnt brick aggregates to improve the strength of the concrete.

Keywords: *Jhama bricks (Over Burnt Bricks), Compressive Strength, Split Tensile Strength, Flexural Strength, and Workability.*

1. Introduction

This project aims to investigate the use of Jhama bricks (over burnt bricks) as a partial replacement for coarse aggregate in concrete. The study will examine the impact of various parameters on the properties of Jhama brick-based concrete, as well as the short-term mechanical and physical properties of fresh and hardened concrete. The Jhama bricks will be sourced from rejected bricks produced during brick manufacturing, providing an opportunity to reuse waste material and reduce waste disposal. The concrete will be produced with varying ratios of Jhama brick to coarse aggregate, ranging from 0% to 30%, using M30 grade concrete. The workability of the concrete will be evaluated as a function of the replacement percentage.

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Fresh and hardened concrete will be tested for compressive strength, split tensile strength, and flexural strength after 7 and 28 days of curing. The results of this study will help to understand the feasibility of using Jhama bricks as a partial replacement for coarse aggregate in concrete, providing a sustainable and eco-friendly option for construction.

According to Akshay n. Kadu (2020)[1], it was observed that the workability of the concrete decreased as the percentage of coarse aggregate that was replaced with over burnt brick increased. This was one of the findings that he reported. As a percentage of the original material was replaced, the values of the compaction factor decreased. According to what Nitesh Bhardwaj (2020)[2] stated, the primary purpose of this work was to make use of waste material when casting concrete specimens. The coarse aggregate can be replaced with jhama class brick bats up to 20% and 40% for M20 grade concrete, according to Sonu Kumar Gupta's (2020)[3] research. They noticed that the replacement of the coarse aggregate made the concrete less workable. This was something that they observed. According to the findings of the study, the utilization of jhama bricks resulted in a reduction in both the weight and the cost of the concrete. Nilesh Kumar (2017)[4] created concrete cube beams and cylinders of the grades M-25, M30, and M-35. He then investigated the properties of the concrete by using over burnt bricks as an alternative material for coarse aggregate in the concrete. According to the findings of the research, the concrete made with over burned brick aggregate had a lower strength than regular concrete. This was in comparison to the concrete made with other types of aggregate. The researchers Khalaf. F.M and DeVenny A.S.5 came to the conclusion that the impact value of brick aggregate increases as the compressive strength of the parent brick decreases. According to the findings of the study, overburnt crushed brick aggregates have the potential to be utilized for the production of concrete in low-level applications of civil engineering.

The utilization of waste material from jhama bricks as coarse aggregate in concrete is the topic that will be investigated as part of this project. As part of this study, we are putting jhama bricks and concrete through a battery of tests so that we can determine what the findings will be at the conclusion of this project.

To have knowledge of a process involving a mix proportion in order to manufacture jhama brick mix concrete. The purpose of this project is to research and analyze the major parameters that have an effect on the qualities of jhama brick mix concrete. The purpose of this research is to investigate the engineering properties of jhama brick mix concrete.

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2. Materials & Methodology

2.1 Material – The formation of concrete requires the addition of water, cement, and a number of other components, among which are both fine and coarse aggregates. Ordinary Portland Cement of the 43 Grade that was formulated in accordance with the requirements of IS 12269:1987 was used for the purposes of this study. The study's objectives were to investigate the effects of the cement on various factors. The compressive strength of the cement that was used in this investigation was 43 MPa after it had been allowed to cure for 28 days. The sand for the experimental program came from the local area, and before it was used, it was put through a series of tests to ensure that it met the requirements of the Indian Standard, which is known officially as IS 383-2016. The sand was put through a sieve with a screen that had a mesh size of 4.75 millimeters in order to remove any particles that were larger than 4.75 millimeters. Coarse aggregate with a maximum size of 20 millimeters was utilized in this project. This aggregate came from within the immediate area and was sourced locally. We didn't want any dust to get into the aggregates, so we took the necessary precautions. During the testing process, the aggregates were subjected to rigorous conditions in order to ensure that they met the requirements of the Indian Standard Specifications IS 383-2016. A brick kiln needs to be heated to temperatures between 800 and 900 degrees Celsius while the bricks are being burned in order to produce over burnt bricks, which are also known as Jhama bricks (Fig.1). Bricks that are produced may have an erratic appearance, which could result in a decrease in the price that they fetch on the market. In addition to their other name, high-range water reducers are another name for the substance known as superplasticizers. When they are added to concrete or mortar, they make it possible to achieve a lower water-to-cement ratio than would otherwise be possible without negatively affecting the workability of the resulting mixture. Water is a crucial ingredient in the production of concrete because it must be present during both the mixing and curing stages of the process. It is of the utmost importance that the water that is used be clean, safe for human consumption, and free of any contaminants, including bacteria. This requirement must be met at all costs. The type of water that is used during the manufacturing process of concrete can have a sizeable effect on the finished product in terms of how long it will last and how strong it will be when it is stretched.

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Fig.1 Jhama class brick

2.2 Methodology

The initial step in making Jhama class brick-based concrete involves gathering the necessary materials such as coarse aggregates, sand, and Jhama class brick coarse aggregate as per the mix proportion design for M30 grade concrete. Subsequently, a range of tests were carried out on the materials, including specific gravity test, water absorption test, elongation index, flakiness test, sieve analysis, and other relevant tests. After preparing the mix design in accordance with IS 10262-2009, four samples were prepared by varying the ratio of over burnt brick to coarse aggregate, namely 0%, 10%, 20%, and 30%. After that we making the concrete After the mixtures have hardened, the engineering properties of each sample should be determined by conducting the following tests:

- Sieve analysis test (Fig.3)
- Workability test
- Density test
- Compressive Strength test (Fig.2)

Fig.2 Compressive Strength test

Fig.3 Sieve Analysis test

2.3 Mix Design

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Concrete mix design for M30 grade was carried out in accordance with the guidelines provided by IS 10262-2009. The quantities of materials required for 1 cubic meter of concrete were determined (as shown in Table 1).

Table1 Mix proportion

Replace-ment	Cement	Water	Fine aggregate	Coarse aggregate	Jhama brick
0%	1	0.35	1.48	2.86	0
10%	1	0.35	1.48	2.56	0.285
20%	1	0.35	1.48	2.28	0.571
30%	1	0.35	1.48	2	0.856

3. Results

3.1 Density – Density of concrete blocks in 7 days & 28 days (Table 2 and Fig.4).

Table2 density of Samples at 7 and 28 days

Sr no.	Replacement percentage of jhama bricks	Density in 7^{th} day (Kg per m^3)	Density in 28^{th} day (Kg per m^3)
1.	0%	2522.76	2487.90
2.	10%	2460.64	2424.69
3.	20%	2405.23	2355.81
4.	30%	2341.43	2325.72

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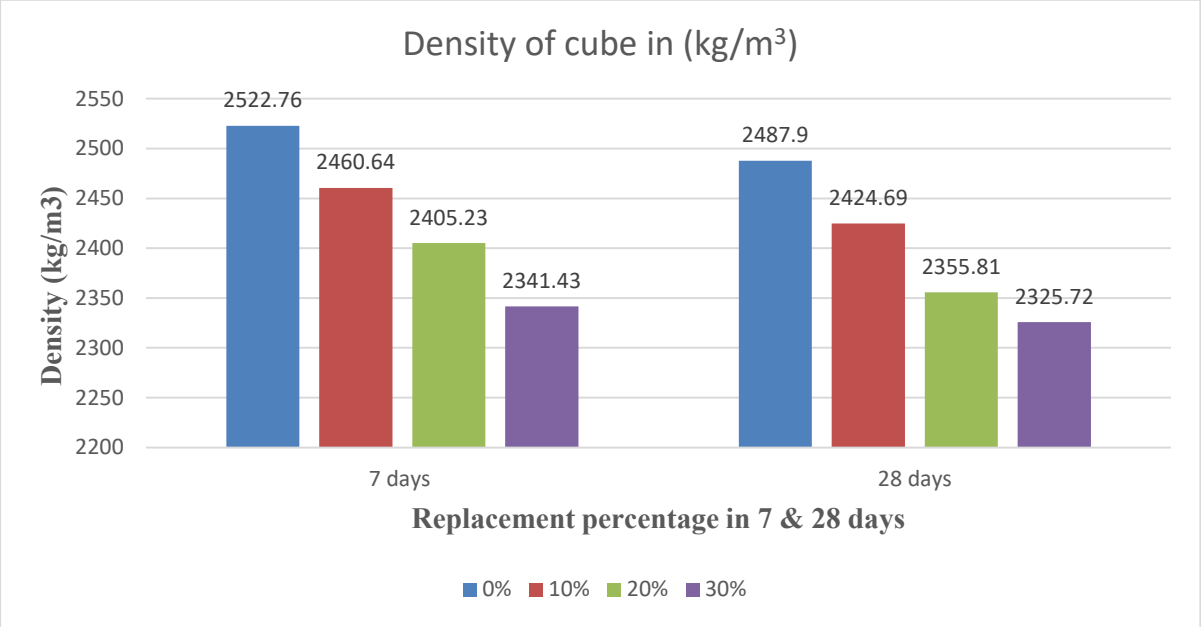

Fig.4 Density of sample

3.2 Compressive Strength – Table 3 and Fig.5 represent the 7 days and 28 days compressive strength of samples.

Table 3 Compressive strength of Samples at 7 and 28 days

S no.	Replacement of Jhama bricks	Compressive strength in 7 days (N/mm^2)	Compressive strength in 28 days (N/mm^2)
1.	0%	38.48	43.32
2.	10%	33.47	42.12
3.	20%	33.28	41.89
4.	30%	33.04	38.67

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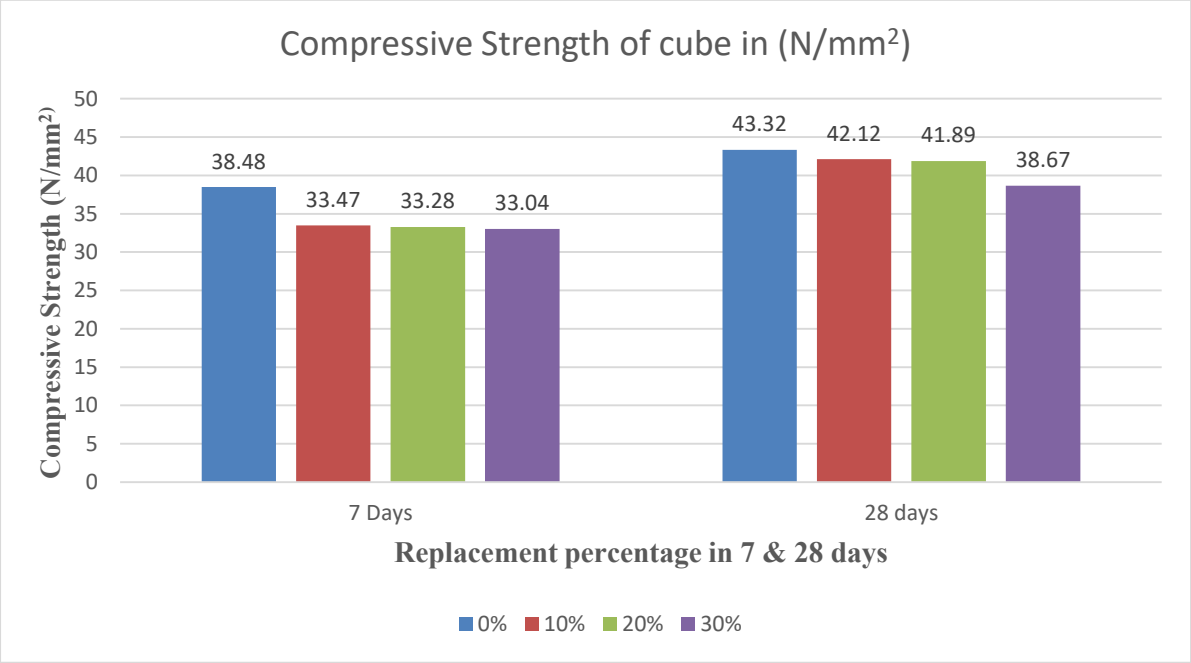

Fig.5 **Compressive strength of Samples at 7 and 28 days**

4. Conclusion

- At the time of testing, we observed that the weight of jhama bricks mix concrete block are less from the standard mix concrete block.
- We can use this concrete as a light weight concrete.
- When the jhama bricks are replace from 10%, 20% & 30% the compressive strength are little decreased at 7^{th} days & 28^{th} days of test.
- The Compressive strength are decreased 5.01%,5.2%,5.44% & 1.2%,1.43%,4.65% in replacement of jhama bricks 10%,20% &30% to the normal concrete in 7^{th} days & 28^{th} days.
- The compressive strength of the concrete showed minimal variation when coarse aggregates were replaced by jhama bricks, and the strength was within the desired range.
- Jhama bricks mix concrete more economical to the normal concrete.

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SOME INVESTIGATIONS FOR ENHANCED PERFORMANCE OF SOLAR PV SYSTEM UNDER PARTIAL SHADING CONDITION

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Abstract

People's energy needs around the world are provided by fossil fuels. However, fossil fuels are depleting on a daily basis, and their consumption has a negative impact on the ecosystem. Furthermore, global energy demand has surged in recent years. As a result, among renewable energy sources, solar or photovoltaic energy is frequently used to meet energy demand. Solar energy is directly converted into electricity by photovoltaic cells. Partial shadowing, on the other hand, reduces solar cell efficiency. Partial shadowing on solar systems is common due to passing clouds, neighboring buildings, trees, and so on. Because of partial shadowing, the power produced by the solar system is less than the predicted power value. Photovoltaic array arrangements method is one answer to this challenge. In this study, random shading instance is used to test four different solar array design schemes: Series-Parallel, Total-Cross-Tied, Bridged-Linked, and Honey-Comb. MATLAB/Simulink is used to simulate shading scenarios. In general, the maximum power results obtained under partial shading circumstances show that the Total-Cross-Tied arrangement outperforms all other configurations.

1. Introduction

Global energy demand is rising in tandem with the global population. The majority of the world's energy demands are satisfied by fossil fuels. However, fossil fuels are depleting, and their environmental impact is growing by the day. As a result, the usage of renewable energy sources, particularly solar or photovoltaic (PV) energy, is spreading (Rao et al., 2014, Malathy and Ramaprabha, 2015, Pareek and Dahiya, 2016, Yadav et al., 2017, Bana and Saini, 2017). Solar energy is free, pollution-free, low-maintenance, dependable, and endless. It does, however, have certain disadvantages, including a high installation cost and a low energy conversion efficiency (Reisi et al., 2013, Subudhi and Pradhan, 2013, Bhatnagar and Nema, 2013, Pareek and Dahiya, 2016, Jazayeri et al., 2014). PV cells generate electricity from solar energy. It features a nonlinear current-voltage (I-V) characteristic, and its power-voltage (P-V) characteristic has a maximum power point (MPP). PV module output power is affected by sun

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irradiance and temperature. PV modules must be operated at the MPP to improve efficiency (Reisi et al., 2013, Subudhi and Pradhan, 2013, Bhatnagar and Nema, 2013, Malathy and Ramaprabha, 2015). Partial shading (PS) is a primary source of PV module inefficiency. Cloud, structure, tree, and snow all create partial shadowing (Wang and Hsu, 2010, Belhachat and Larbes, 2015, Bana and Saini, 2017). PV modules in the array receive varying amounts of solar irradiation while partially shaded. As a result of the many peaks on the P-V and I-V characteristics of the PV array, power losses occur in the system. PV array arrangement methods are one of the strategies for lowering power losses (Rao et al., 2014, Belhachat and Larbes, 2015, Yadav et al., 2017, Bana and Saini, 2017). Various PV array configuration strategies are proposed in the literature, Series-Parallel (SP), Total-Cross-Tied (TCT), Bridged-Linked (BL), and Honey-Comb (HC). The acquired data revealed that the TCT arrangement provided the best results. The performance of SP, TCT, BL, and HC topologies on a 6x6 PV array was investigated in this study. MATLAB/Simulink was used to simulate all PV array layouts under same shading scenario. PV array topologies' performance was compared in terms of maximum power value, shading loss, mismatch loss, and fill factor. The results reveal that the TCT configuration outperforms the other PV array topologies in terms of maximum power, mismatch loss, and fill factor.

2. Mathematical Modeling of PV cell

Various PV models have been presented in the literature to demonstrate the performance of PV cells under various climatic conditions. The PV cell is the most important component of the PV system since it directly converts incident light energy to electricity. Poly-crystalline and mono-crystalline semi-conducting materials are employed in the design of a PV cell during the manufacturing process. Any PV model's performance is evaluated by taking into account changes in climatic parameters such as temperature and solar insolation. A robust PV model is required to function at MPP under dynamically altering environmental conditions. The performance characteristics of PV cells (I-V and P-V) are non-linear, and the output voltage and power are dependent on incident solar insolation. A common PV cell has a maximum power output of 1.5 to 2 W. Most researches employed single and two diode models for Matlab simulations, however this work used a single-diode model PV cell because to its accuracy and simplicity. The practical equivalent circuit of a PV cell is represented by a photon current source parallel to a diode and with series and shunt resistances.

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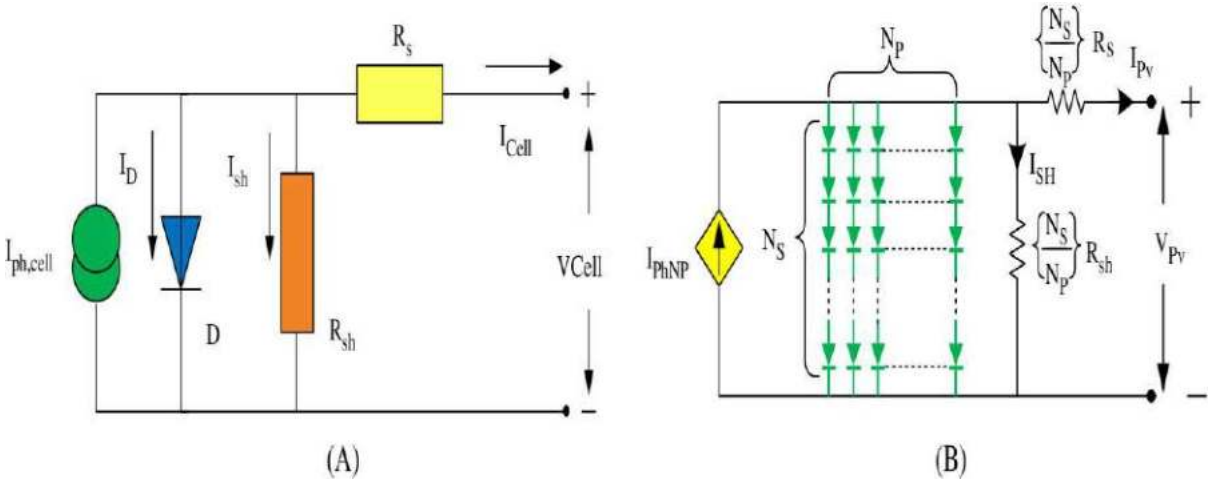

Fig. 1, A, PV cell equivalent circuit, B, PV array equivalent circuit

The relation between the PV cell's output current and voltage is specified by Equation (1).

$$I_{\text{Cell}} = I_{\text{Ph,cell}} - I_r[\exp(\frac{V_{\text{Cell}}+R_S I_{\text{cell}}}{V_{T,\text{cell}}a}) - 1] - \frac{V_{\text{Cell}}+R_S I_{\text{Cell}}}{R_{\text{sh}}}, \quad (1)$$

Where VT = KT/q, cell = I Cell is the PV cell's terminal current (A), IPh ,cell is the photon current (A), and Ir is the diode's reverse leakage current (A). V Cell is the terminal voltage of a cell (V), VT, cell is the cell thermal voltage, "K" is the Boltzmann constant (1.3806503 1023 J/K), T is the operating temperature (K), "q" is the elementary charge (1.60217646 1019 C), Rs and Rsh are the series and parallel resistances, and "a" is the ideality factor, and its value for the ideal diode is unity. The value of "a" changes as a function of temperature and diode current.

The PV module is obtained by connecting a number of PV cells in series, and the PV array is obtained by connecting a number of PV modules in series or parallel to get the appropriate load voltage and currents, as illustrated in Figure 1B. Equation (2) specifies the relationship between the PV module's output current and voltage.

$$I_m = I_{\text{Ph}} - I_r\ [\ \exp\ \left(\ \frac{q\ (\ V_m+R_S I_m\ )}{n_s kTa}\ \right) - 1\ ] - \frac{V_m+R_S I_m}{R_{\text{sh}}}, \quad (2)$$

where Vm and Im denote the voltage and current of the module. Equation (3) specifies the relationship between the PV array's output current and voltage.

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$$I_{\mathrm{Pv}} = I_{\mathrm{Ph}}N_P - I_r N_P[\exp(\frac{q(V_{\mathrm{Pv}}+R_S(\frac{N_S}{N_P})I_{\mathrm{Pv}})}{n_s kTa}) - 1] - \frac{V_{\mathrm{Pv}}+R_S(\frac{N_S}{N_P})I_{\mathrm{Pv}}}{R_{\mathrm{sh}}(\frac{N_S}{N_P})} \quad (3)$$

where NS represents the number of series-connected modules, NP represents the number of parallel-connected modules, and IPv and VPv represent the array output current and voltages. KYOCERA-KC200GT PV module specifications are used to design and simulate PV array designs.

2.1 Factors affecting the performance of PV array configurations

This section compares the performance of PV array designs such as SP, BL, HC, and TCT under various PSCs. Global peak power (GPP), mismatch losses, fill factor, and efficiency are the major criteria evaluated when analysing the performance of PV setups.

2.1.1 Mismatch power loss

It is the difference in GPP between uniform insolation and PSCs, expressed as a percentage. Equation (8) can be used to compute the mismatch power loss.

$$\mathrm{MMPL}(\%) = \frac{P_{\mathrm{GPP,U}} - P_{\mathrm{GPP,PS}}}{P_{\mathrm{GPP,U}}} \times 100 \quad (4)$$

where $P_{\mathrm{GPP,U}}$ and $P_{\mathrm{GPP,PS}}$ are the generated GPPs under uniform and PSCs.

2.1.2 Efficiency (η)

Equation (5) calculates efficiency as the ratio of generated GPP to the product of insolation level and panel area.

$$\eta = \frac{P_{\mathrm{GPP}}}{L \times A} \quad (5)$$

where PGPP is the generated GPP, "L" is the insolation applied to the PV panel, and "A" is the surface area of the PV panel.

2.1.3 Fill Factor (FF)

Equation (6) calculates FF as the ratio of generated GPP to the product of VOC and ISC. When FF approaches unity, the PV system performs better.

$$\mathrm{FF} = \frac{P_{\mathrm{GPP}}}{V_{\mathrm{OC}} \times I_{\mathrm{SC}}} \quad (6)$$

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where VOC and ISC are the PV array's open and short circuit voltages and currents.

3. Modeling And Simulation of PV Array Configurations

3.1 Series-Parallel PV configuration (SP)

The SP PV array configuration is frequently used due to benefits such as low operating costs and ease of installation. In this configuration, six PV modules are connected in series to form a string, and then the strings are connected in parallel to obtain the required current. Figure 2 depicts a Matlab/Simulink model of an SP PV array arrangement. This arrangement, in addition to the bypass diode, employs blocking diodes in each PV string to prevent the string against short circuits caused by PSCs. Mismatch losses are higher in this setup due to the series connections in the string, but lower than in the series array design.

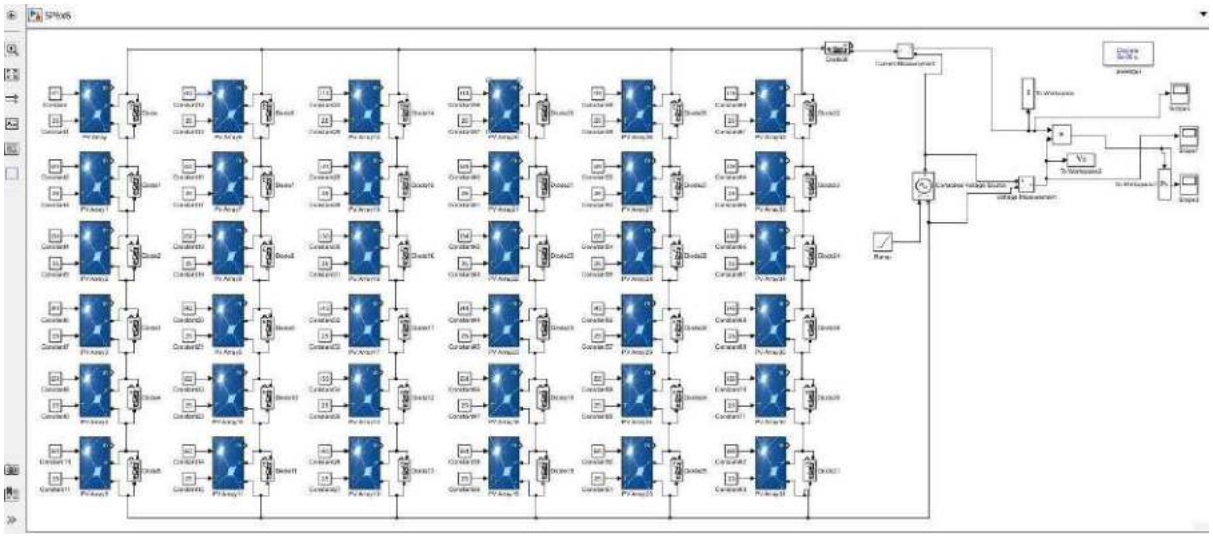

Fig. 2, Series-Parallel Configuration

3.2 Bridge-Link PV configuration (BL)

During PSCs, the SP configuration is the most affected, and the overall system output voltage is substantially lowered. Because the SP PV array layout has more series-connected modules in a string, the PV system suffers from increased mismatch losses. To minimize these losses in the SP arrangement, all of the modules are connected in the bridge rectifier structure, which is also known as the BL PV array configuration. In each bridge structure, two modules are joined in series and then in parallel. Figure 3 depicts a Matlab/Simulink model of a BL PV array arrangement.

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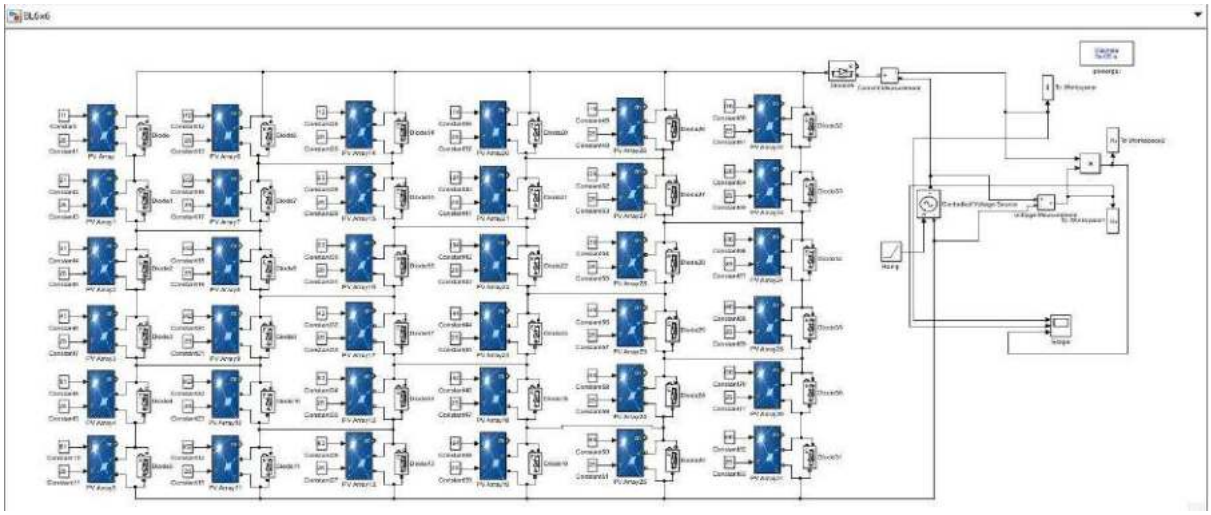

Fig. 3, Bridge linked Configuration

3.3 Honey-Comb PV configuration (HC)

The shortcomings of SP and BL designs can be mitigated by modelling an HC PV array setup. Essentially, this structure is inspired by honey bee houses. The PV modules in this setup are connected in the hexagonal pattern of a honeycomb construction. Figure 4 depicts the Matlab/Simulink platform model of an HC PV array layout. The HC PV array design has more series-connected PV modules than the BL PV array configuration but less than the SP PV array configuration. As a result, the mismatch loss of the HC PV array configuration is more than that of the BL PV array topologies but less than that of the S PV array configuration.

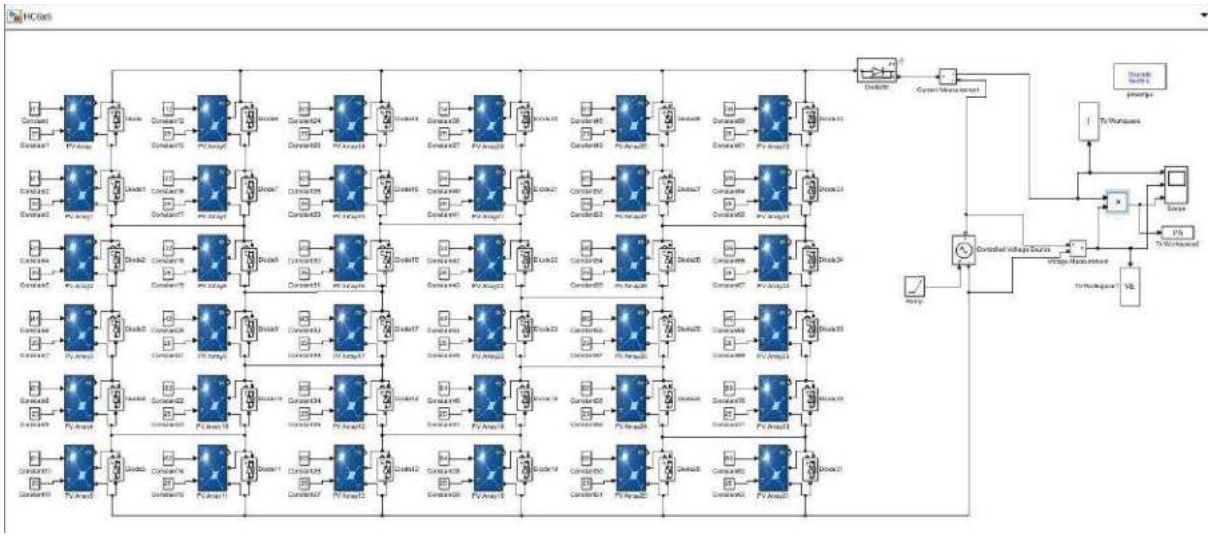

Fig. 4: Honey Comb Configuration

3.4 Total-Cross-Tied Configuration

By connecting ties across rows of the junction, the TCT configuration is formed from the SP

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configuration. The voltage across the ties is equal in the TCT design. The sum of the currents in the various ties equals one. The power is obtained through the SP setup.

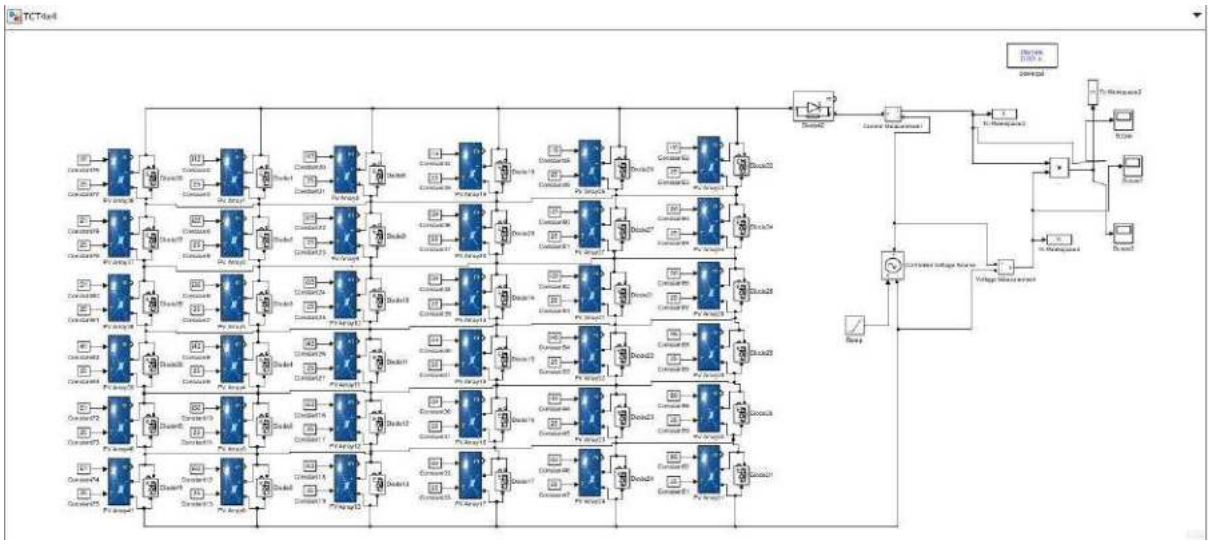

Fig.5: TCT Configuration

4. Results and Discussions:

This investigation is done by using MATLAB/Simulink software. Four different configurations (SP, HC, BL, TCT) are simulated and compared. Initially all the configurations are run on 1000 irradiation and 25 degree temperature. To make the partial shading condition irradiation of each panel is changed randomly to get the most precise comparison.

```
irradiation =[
877 950 994 1004 980 923;
948 993 1005 980 924 842;
993 1005 981 925 843 746;
1005 982 926 845 748 647;
983 928 847 750 649 558;
931 850 753 652 560 488;
];
```

Fig.6. Irradiation of panels

The analysis of various SSPVA setups with respect to environmental characteristics has been given by constructing a more realistic model using MATLAB M-file. To acquire the greatest feasible power under partially shaded conditions, a bypass diode must be connected in anti-parallel with a module or group of cells to avoid stress on the shaded cells. When compared to an SPVA without a bypass diode, this configuration will reduce the problem of hotspots while also providing more power. After analysing numerous configurations for random shading

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patterns of varying sizes, it was discovered that TCT provided more power than the other setups.

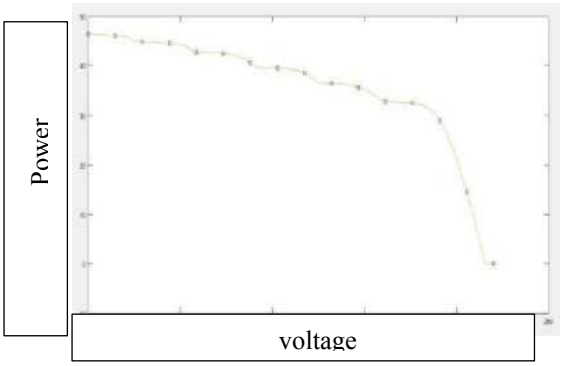


Fig.7. Sp I-V Graph

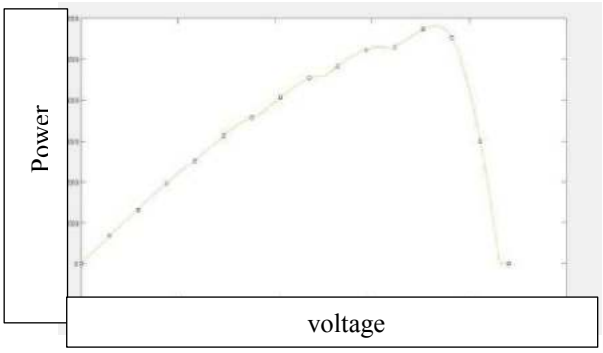
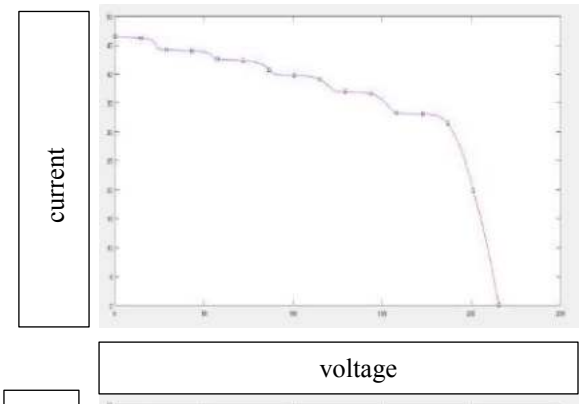
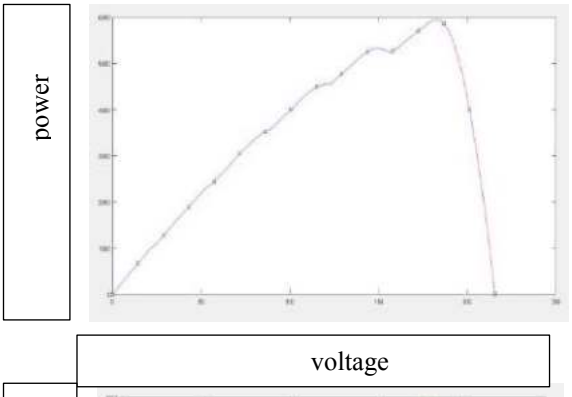
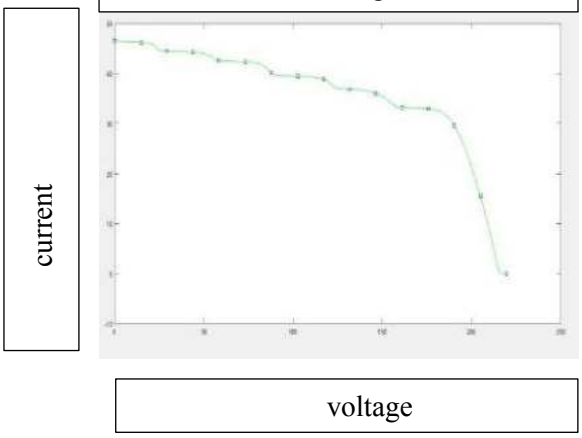
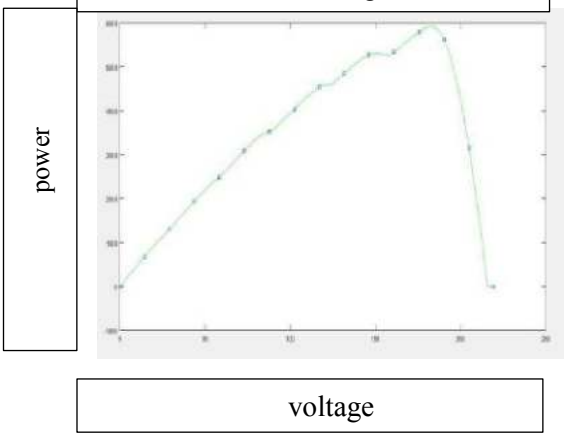


Fig.8. Sp Pv Graph









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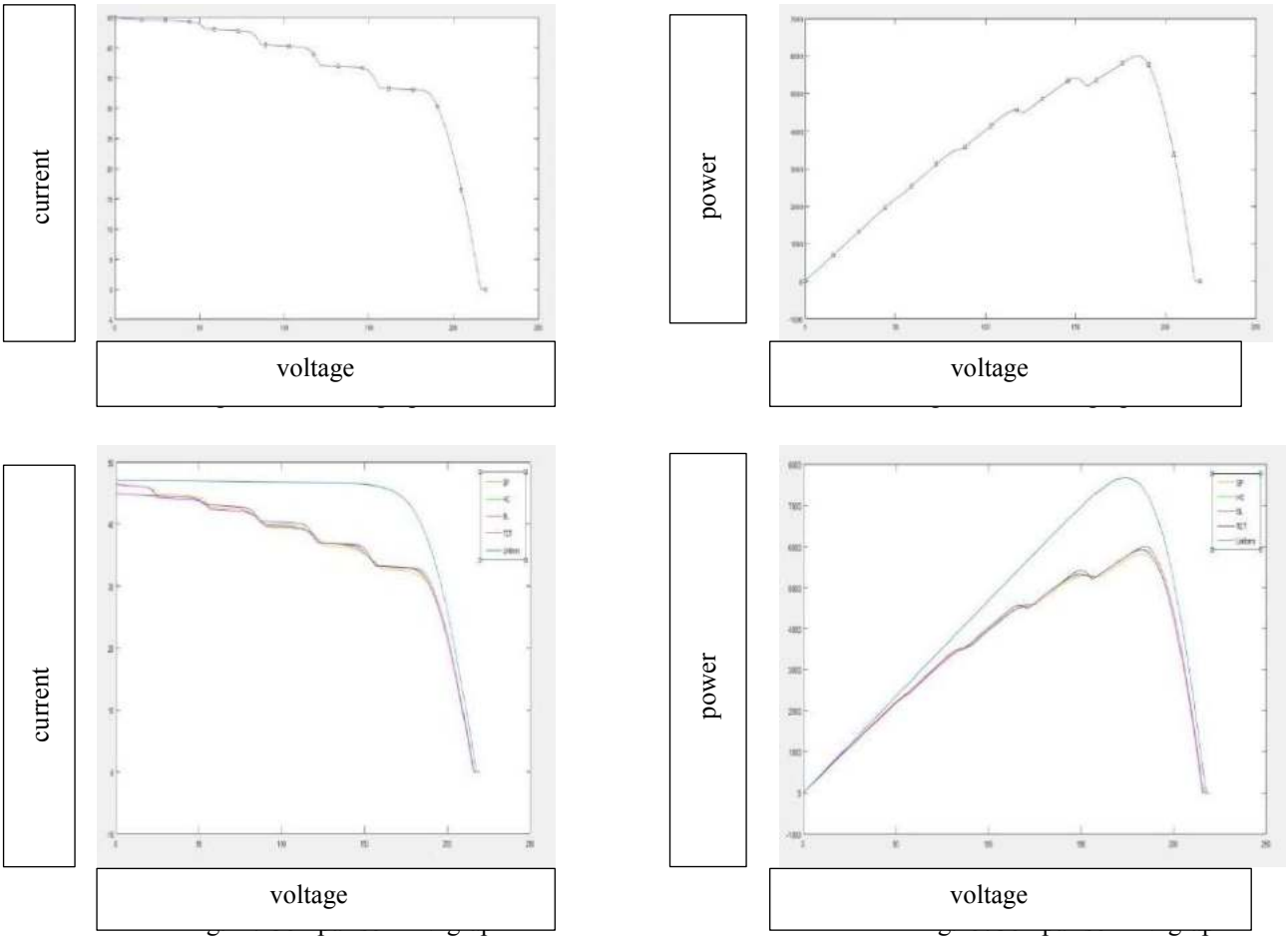

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SYNTHESIS OF Bi_2MoO_6 PHOTOCATALYST AND ITS PHOTOCATALYTIC PROPERTIES

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Abstract

Bi_2MoO_6 microspheres were synthesized by a hydrothermal synthetic route at 180 °C, and it is effectively characterized by various techniques: such as XRD, FESEM, HRTEM and UV-Vis DRS. The photocatalytic activity of the Bi_2MoO_6 microsphere is tested against the degradation of rhodamine B under natural sunlight irradiation. About 90 % degradation of rhodamine B is observed in 90 min.

1. Introduction

Extensive usage of organic dyes in textile and other fabric industries leads to the contamination of water bodies [1–3]. A large number of water sources are polluted by residual dyes, which enter directly into the aquatic environment through various means like dye industries, textile industries, etc. [4,5]. As a cationic dye methylene blue found its wide application in coloring fabrics. Due to its water-soluble nature, methylene blue is highly stable in an aquatic environment, non-biodegradable, and cancer-causing in nature, which makes it harmful to humans and living species of aquatic ecosystems [6–9].

However, due to their highly stable nature in water, these residual dyes are not quickly metabolized, as a result of which they can easily pollute groundwater and surface water, causing harmful diseases in animals and humans [10–12]. To date, several methodologies have been used for wastewater remediation, but they have certain drawbacks such as excessive sludge formation, and other harmful byproducts generation. In order to overcome these limitations, semiconductor-based photocatalysts are widely utilized for the photocatalytic removal of various water pollutants [13–15]. To date, zinc oxide and titanium dioxide nanoparticles are the most commonly used photocatalysts for degrading organic dyes, but they require ultraviolet light for photoexcitation as their band gap is large [16,17]. Recently, over the last few decades, bismuth-based photocatalysts have been utilized as the most promising and new class of photocatalysts for wastewater treatment. The bismuth-based photocatalyst

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found applications in various areas such as the production of ammonia from nitrogen, water-splitting, reduction of CO_2, and degradation of water pollutants through heterogeneous photocatalysis. The band structure of these materials provides them with a suitable band gap for visible light-active and a well-distributed valence band in favor of recombination charge, enabling them to act as potential photocatalytic materials for wastewater treatment over metal oxides. Another class of heterogeneous semiconductors photo catalysts is metal oxide, which mostly utilize the light in the visible region and work in the small wavelength region i.e., (NIR) near-infrared regions. This light harvesting property make them a suitable visible light driven photo catalysts [18]. The band gap of Bi_2MoO_6 ranges between 2.5-2.8 eV, beside this its considered to be non-toxic, less costly, and has phenomenal chemical stability in neutral and acidic medium [19]. Because of all these properties Bi_2MoO_6 is considered an efficient visible and NIR light-active photo catalyst. For an effective photocatalytic reaction in visible light, a semiconductor photo catalyst must possess a narrow bandgap, with a low charge recombination rate, with conduction band on more negative potential side and valence band on positive potential side [20].

2. Methodology

2.1 Synthesis of Bi_2MoO_6 nanoparticles

2 mmol bismuth nitrate pentahydrate was mixed in 30 mL of 0.1 M HNO_3, and 1 mmol sodium molybdate dihydrate was dissolved in 20 mL of C_2H_5OH. After stirring both the solutions for 30 min separately, the sodium molybdate dihydrate solution was added slowly into the bismuth nitrate pentahydrate solution with continuous magnetic stirring. After 45 min of constant stirring, the mixture was poured into a Teflon-lined stainless-steel autoclave and heated under a controlled temperature of 200 °C for 20 h. The finally prepared precipitates were washed with DI water and C_2H_5OH and was dried in an oven at 50 °C. The synthesis route is shown in Figure 1.

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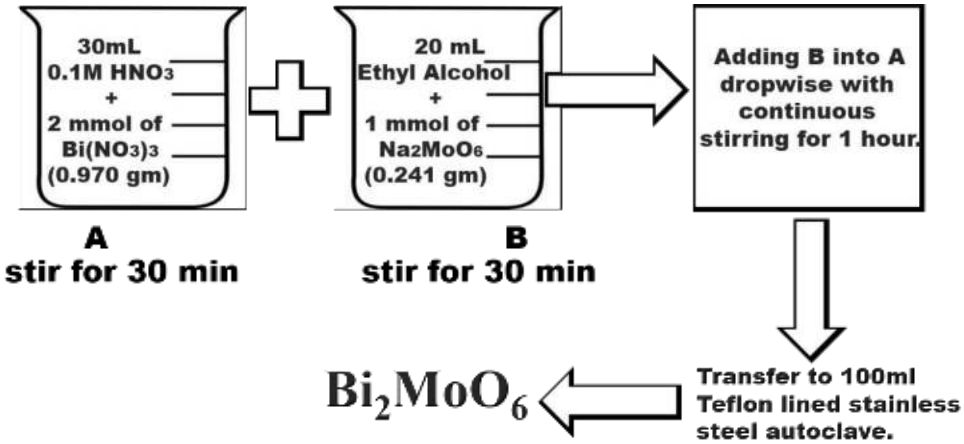

Figure 1. Preparation route of Bi_2MoO_6

3. Results and discussions

3.1 XRD analysis

The XRD peaks for Bi_2MoO_6 were detected at 2θ = 11.1°, 28.5°, 32.9°, 36.2°, 47.2°, 55.6°, 58.4°, which are matched to (020), (131), (002), (151), (062), (133), and (262) orthorhombic planes of Bi_2MoO_6 (JCPDS Card No.- 21 1272) (Figure.2).

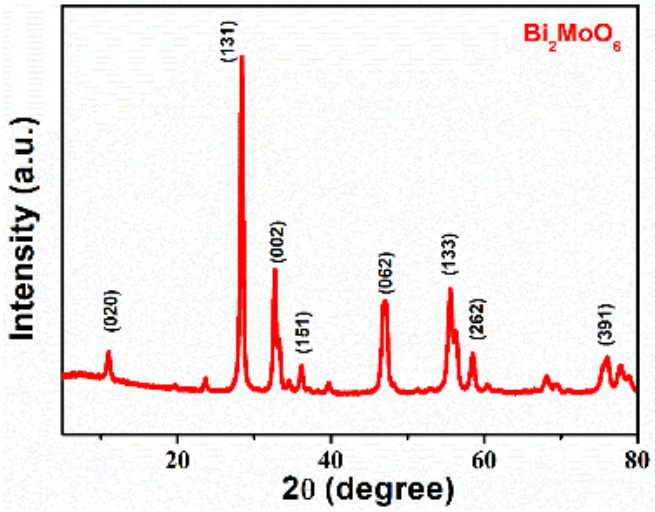

Figure 2. XRD patterns of as-synthesized Bi_2MoO_6

3.2 Morphology of Bi_2MoO_6

The FE-SEM image of Bi_2MoO_6 microspheres was recorded by scanning electron microscope shows agglomeration of nanospikes-like structures (Figure. 3a). Similarly, the morphology of the Bi_2MoO_6 microsphere was better displayed from the HRTEM images (Figure. 3b) [21-22].

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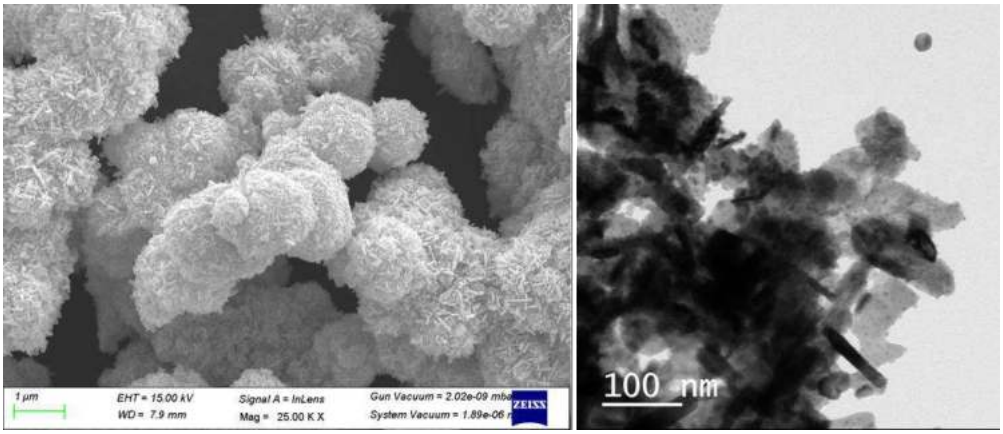

Figure. 3 a) FE-SEM image of Bi_2MoO_6; b) HR-TEM image of Bi_2MoO_6

3.3 UV-vis DRS analysis

The pure Bi_2MoO_6 microspheres absorb in the ultraviolet and visible light region (Figure.4). The UV-vis DRS spectra were changed into absorption spectra by using (K-M function) Kubelka-Munk [19], and the band gap was calculated from the Taucs plots, Figure. 4 shows Tauc's plots of Bi_2MoO_6 photocatalyst. The optical band gap of Bi_2MoO_6 was determined to be 2.68 eV.

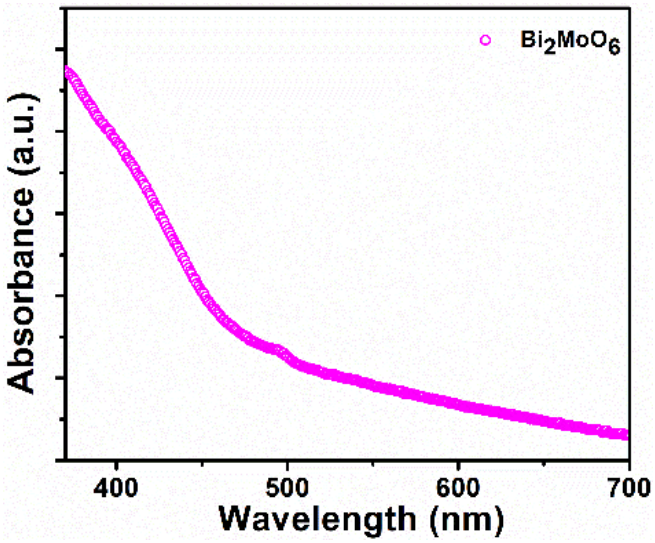

Figure. 4 Tauc's plot of pure Bi_2MoO_6

3.4 Photocatalytic activity

The sunlight-mediated photocatalytic degradation of RhB dye (10 mg/L) by the Bi_2MoO_6 microsphere is shown in Figure. 5. The Bi_2MoO_6 microspheres show the photocatalytic

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performance of about 90 % rhodamine B dye degradation after 90 min of sunlight exposure. Figure.5 shows the UV-vis absorption spectra, which shows the change in concentration of rhodamine B dye during the photocatalytic degradation. The decrease in the intensity of the absorption peak of rhodamine B dye (553 nm) was observed over 90 min period of sunlight irradiation.

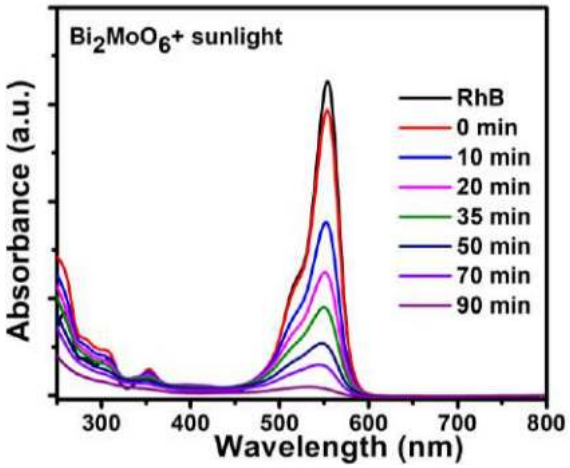

Figure. 5 UV-is absorbance spectra of RhB dye solution.

4. Conclusions

A simple hydrothermal synthetic route has synthesized the Bi_2MoO_6 photocatalyst. The Bi_2MoO_6 photocatalyst shows excellent photocatalytic performance towards the degradation of 90 % of rhodamine B (RhB) under sunlight irradiation. Bi_2MoO_6 is an effective visible light photocatalyst option for removing various organic dyes in aqueous media due to its strong photocatalytic activity.

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CAFÉ CLAUZ- QSR

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Abstract

This research paper provides an overview of the Quick Service Restaurant (QSR) industry, exploring its operational model, customer base, menu offerings, and market trends. The paper discusses the challenges and opportunities facing QSRs in the current market and the strategies they use to remain competitive. It also examines the impact of technology on the QSR industry and the emergence of healthier menu options. Overall, the paper aims to comprehensively understand the QSR industry and its significance in the food service sector.

Keywords*: QSR, CAFÉ CLAUZ, Internet,Self-service technology, Technology.*

1.Introduction

Quick Service Restaurants (QSRs) are a popular segment of the foodservice industry that specialize in serving food quickly and conveniently. QSRs are also commonly known as fast food restaurants and are often characterized by their limited menu offerings, self-service or counter-service ordering, and fast-food production methods. QSRs have become a ubiquitous part of the modern dining landscape, with a wide range of chains and independent restaurants offering a variety of cuisines, from burgers and fries to tacos and pizza. Some of the most well-known QSR chains include McDonald's, Subway, KFC, and Pizza Hut, among others.

The popularity of QSRs can be attributed to a number of factors, including their affordability, convenience, and consistency. QSRs typically offer lower prices than full-service restaurants, making them an attractive option for consumers on a budget. They also tend to be located in high-traffic areas such as shopping malls, airports, and busy intersections, making them easy to access and convenient for consumers on-the-go. In addition to affordability and convenience, QSRs are known for their consistent quality and standardized menu offerings. Most QSRs use production methods that allow for efficient and consistent food preparation, which helps to ensure that customers receive the same experience no matter which location they visit. However, QSRs have faced criticism in recent years for their impact on public health,

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particularly due to the high levels of salt, sugar, and fat in many of their menu items. As a result, many QSR chains have taken steps to improve the healthfulness of their menus by introducing lower-calorie options and promoting healthier ingredients. Despite these challenges, the QSR industry remains a major player in the foodservice industry, with millions of customers visiting QSRs each day. In the following sections of this paper, we will explore the history, current state, and future prospects of the QSR industry, as well as the challenges and opportunities facing QSR operators today.

2. Literature Review

The QSR industry has been the subject of numerous studies examining various aspects of the industry, including customer behavior, marketing strategies, and operational efficiency. Several key themes have emerged from this literature, which are discussed below.

A) Customer Behavior

One area of focus in the literature has been customer behavior, particularly with regard to QSR selection and satisfaction. A study by Chang and Yeh (2012) found that price, service quality, and menu variety were the most important factors affecting customer satisfaction in QSRs. Similarly, a study by Jang and Namkung (2009) found that service quality, cleanliness, and atmosphere were the most important factors in predicting customer satisfaction and loyalty. Another area of focus in the literature has been the impact of social media on QSR customer behavior. A study by Rosenbaum et al. (2011) found that online reviews had a significant impact on consumer behavior, with positive reviews leading to increased customer traffic and negative reviews leading to decreased traffic. Similarly, a study by Chung and Koo (2015) found that social media platforms such as Facebook and Twitter were effective tools for QSR marketing and customer engagement.

B) Marketing Strategies

Several studies have examined the effectiveness of various marketing strategies employed by QSRs. For example, a study by Saeed et al. (2013) found that offering discounts and promotions was an effective way to attract and retain customers. Similarly, a study by Park and Kim (2014) found that celebrity endorsements were an effective way to increase brand awareness and customer loyalty.

C) Operational Efficiency

Finally, several studies have examined the operational efficiency of QSRs. A study by

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Chen et al. (2012) found that implementing lean management practices, such as reducing waste and improving workflow, led to significant improvements in efficiency and profitability. Similarly, a study by Kurniawan et al. (2017) found that using technology such as self-service kiosks and mobile ordering systems could improve efficiency and reduce costs for QSR operators.

a. Product Innovation and Customer Satisfaction

Product innovation (PI) is an important strategy for QSRs to differentiate themselves from their competitors and to keep up with changing consumer preferences. By introducing new menu items or improving existing ones, QSRs can attract new customers and increase loyalty among existing ones. However, the impact of PI on customer satisfaction (CS) is not always clear-cut.

On one hand, research has shown that PI can have a positive impact on CS. A study by Hult et al. (2016) found that product innovation had a positive effect on customer satisfaction in the QSR industry. Similarly, a study by Goudarzi and Farahani (2018) found that introducing new menu items had a positive effect on customer loyalty and satisfaction.

On the other hand, other studies have found that the relationship between PI and CS is more complex. For example, a study by Hu et al. (2018) found that while product innovation had a positive effect on customer satisfaction, the effect was mediated by the perceived value of the innovation. In other words, customers were more likely to be satisfied with a new menu item if they perceived it as offering good value for the price.

Furthermore, the impact of PI on CS may depend on the specific context and customer preferences. A study by Kim et al. (2017) found that while new menu items had a positive effect on customer satisfaction overall, the effect was stronger for customers who were more interested in trying new foods and flavours.

Overall, the literature suggests that PI can have a positive impact on CS in the QSR industry, but the relationship is not always straightforward. QSR operators should carefully consider the specific context and customer preferences when introducing new menu items or other product innovations. Additionally, QSR operators should focus not only on introducing new items, but also on improving the quality and consistency of existing menu items, which can also have a positive impact on CS.

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b. Demographic Breakdown of the Sample

Sample Size: The sample size for this study should be large enough to provide sufficient statistical power for data analysis. A sample size of at least 300 QSR customers is recommended.

Sampling Method: A convenience sampling method could be used to recruit QSR customers for this study. Participants could be recruited from different QSR chains located in various regions to ensure the representativeness of the sample.

Demographic Breakdown: The demographic information of the participants, such as age, gender, education level, income level, and frequency of QSR visits, could be collected. The demographic breakdown of the sample could be presented in a table or a chart to provide a clear understanding of the characteristics of the participants.

For example, the sample could be divided into different age groups, such as 18-24, 25-34, 35-44, 45-54, and 55 and above. The gender distribution of the sample could be reported as the percentage of male and female participants. The education level of the participants could be classified into categories such as high school or below, college, and graduate school. The income level of the participants could be categorized into different brackets such as less than $25,000, $25,000-$50,000, $50,000-$75,000, and over $75,000. The frequency of QSR visits could be reported as the average number of visits per month.

By collecting the demographic information of the sample, this study can provide insights into the customer characteristics of QSRs, and help QSR operators to better understand the preferences and behaviours of their customers. The demographic breakdown of the sample can also be used to identify any potential differences in the relationships between PI, SI, CS, and CL across different customer groups, and to guide the development of targeted marketing strategies for different customer segments.

3. Methodology

3.1 Research Design: A survey research design could be used to collect data from customers of QSRs. The survey could be distributed online or in person at QSR locations. The survey should include questions on the customers' demographics, their perceptions of the QSR's product and service innovations, their satisfaction with the QSR, and their loyalty to the QSR.

3.2 Sampling: A convenience sampling method could be used to recruit participants for the

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study. Customers who visit the QSR locations during the data collection period could be invited to participate in the survey. To ensure the representativeness of the sample, customers from different demographic groups should be recruited.

3.3 Data Analysis: The collected data could be analysed using statistical techniques such as descriptive statistics, correlation analysis, and regression analysis. Descriptive statistics could be used to summarize the data and examine the distribution of the variables. Correlation analysis could be used to examine the relationships between PI, SI, CS, and CL. Regression analysis could be used to examine the extent to which PI and SI predict CS and CL, controlling for demographic factors.

3.4 Data Collection Instrument: The data collection instrument could be a structured questionnaire. The questionnaire should include questions on the customers' demographics, their perceptions of the QSR's product and service innovations, their satisfaction with the QSR, and their loyalty to the QSR. The questionnaire should be designed using established measurement scales and validated measures to ensure the validity and reliability of the data.

3.5 Data Collection Procedure: The data could be collected using a combination of online and in-person methods. Customers who visit the QSR locations during the data collection period could be invited to participate in the survey in person. Additionally, the survey could be distributed online using social media platforms or email lists of QSR customers. The data collection period should be long enough to ensure a sufficient sample size.

3.6 Ethical Considerations: To ensure the ethical conduct of the study, informed consent should be obtained from all participants. Participants should be informed about the purpose of the study, the data collection procedures, and their rights as participants. All data should be kept confidential and stored securely. Any potential risks or discomforts associated with the study should be minimized. By using a survey research design and statistical techniques, this study can provide insights into the relationships between PI, SI, CS, and CL in the context of QSRs. The results can help QSR operators to better understand the factors that drive customer satisfaction and loyalty, and to develop strategies to improve their products and services to meet the changing needs and preferences of customers.

4. PROJECT MODULES

A. Customer: In this module customer can create and verify his account on the website. This module is responsible for managing all of the customer's personal information like name,

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email, contact details etc. It is also responsible for managing all of the user's ordered products and those are in the cart.

B. Admin: This module is responsible for managing all of the admin's permissions and managing the customer's orders.

C. Orders: In this module all the customer's orders, generating invoice, providing the transactions report to the admin and vendor and generating the sales report.

D. Login: In Login module existing user have to fill up their email id and password and then click on login button. If the email and password fill by user is correct then login will successful else user have to enter the correct credentials again. After successful login user will be redirected to products page.

E. Payment: This module is responsible for managing all payment requests.

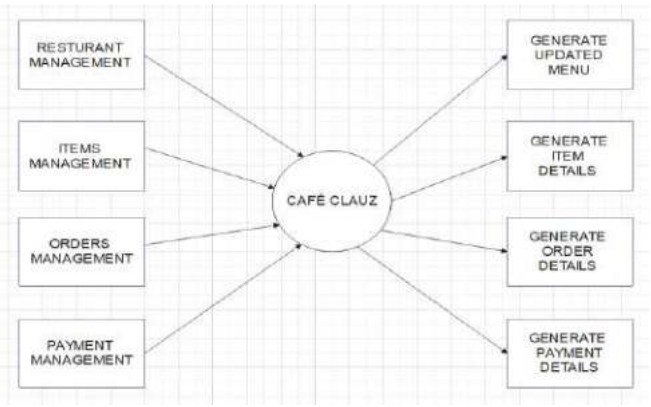

Fig 1: Data Flow Diagram of Proposed Model

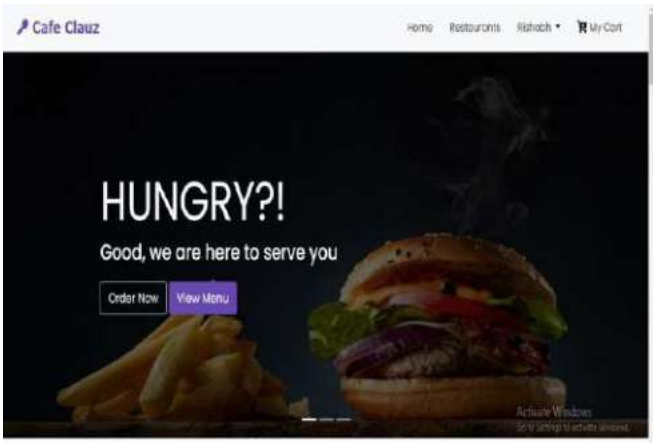

Fig 2: Front page

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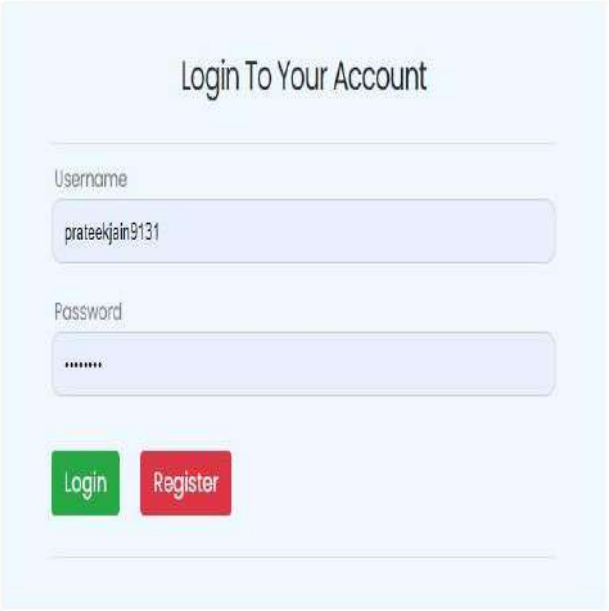

Fig 3: Login page

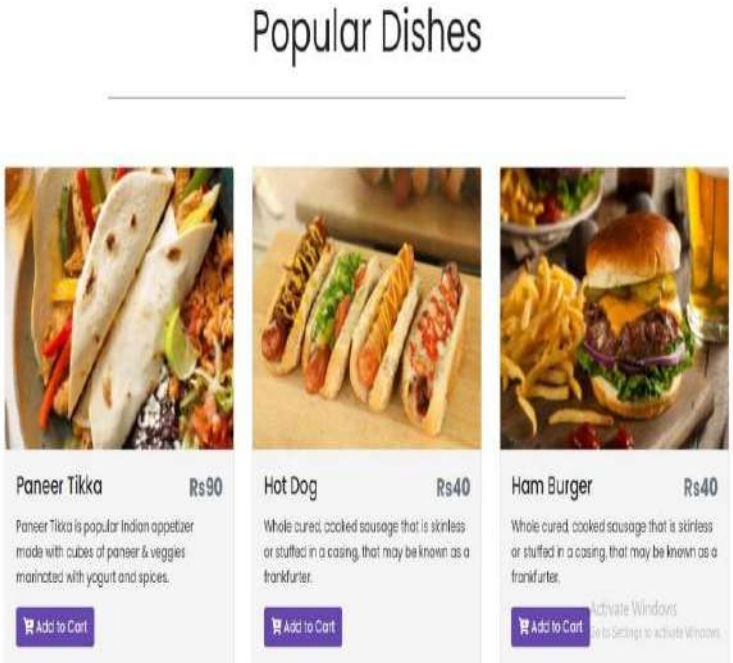

Fig 4: Food Category

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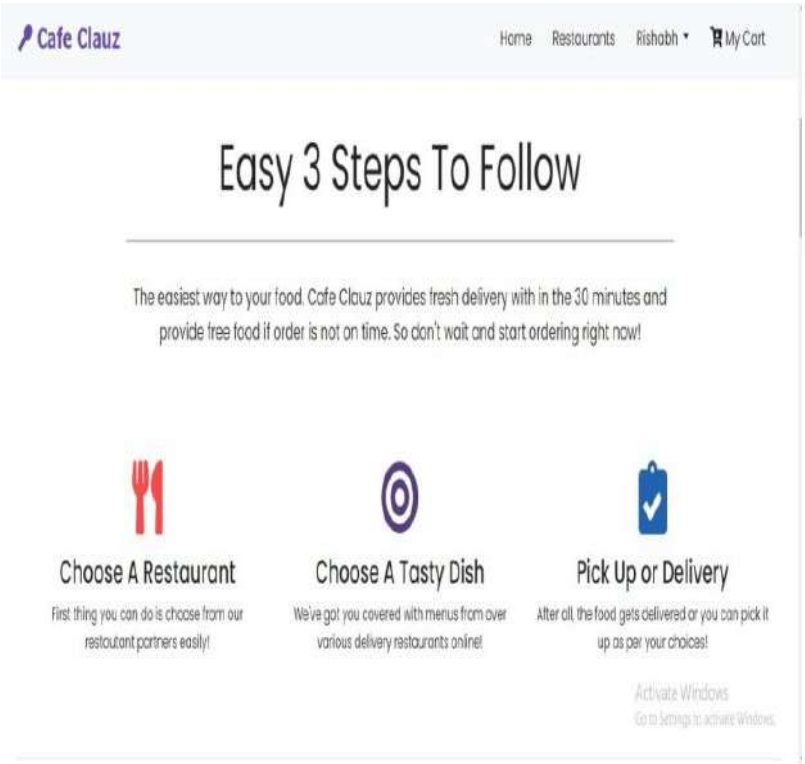

Fig 5: Process

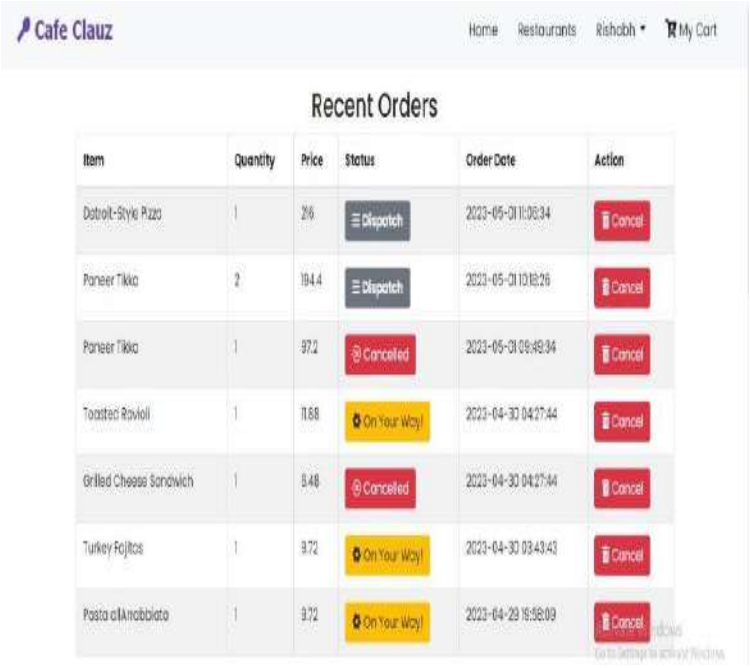

Fig 6: user's recent orders

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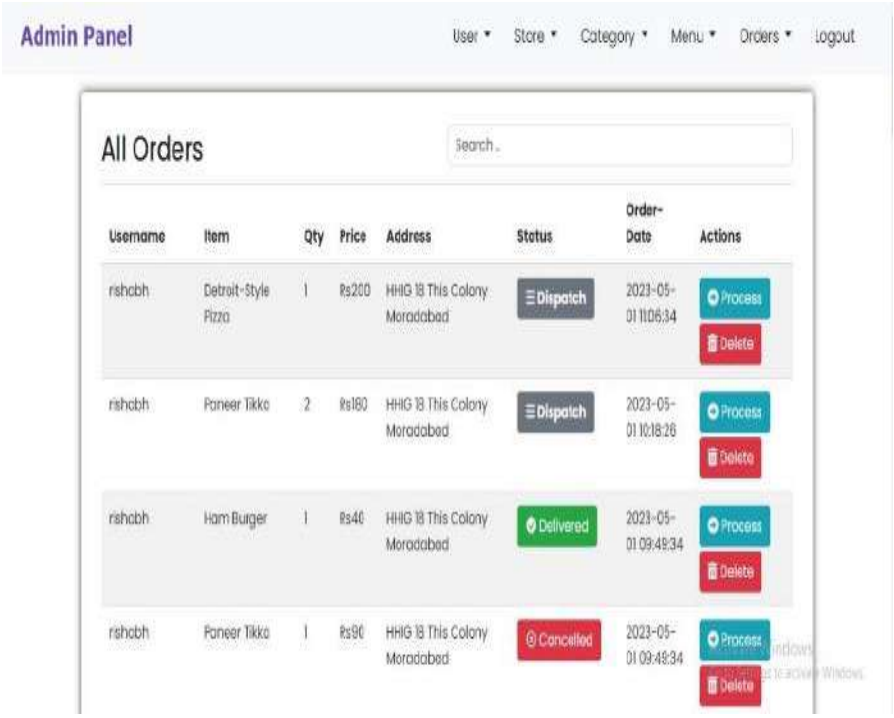

Fig 7: All orders in admin panel

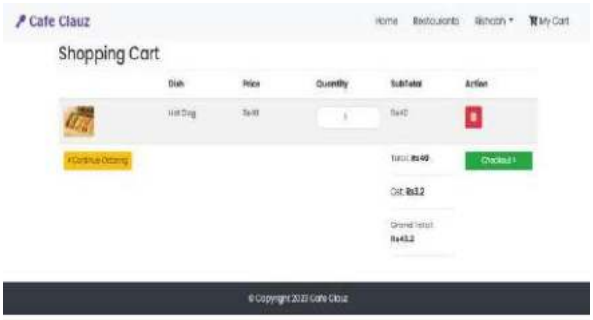

Fig 8: Cart

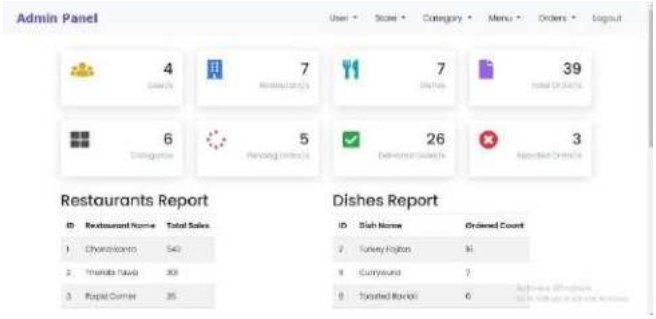

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Fig 9: Admin panel

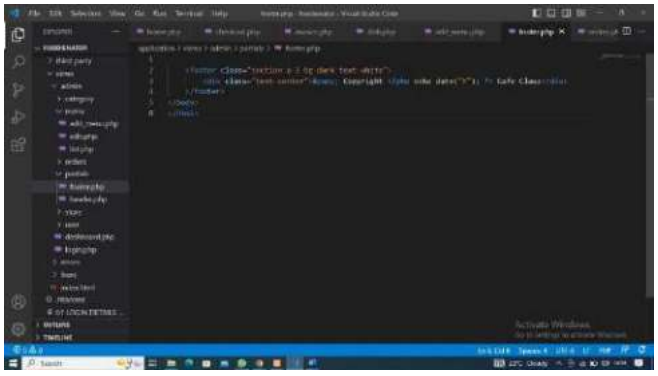

Fig 10: Sample Code1

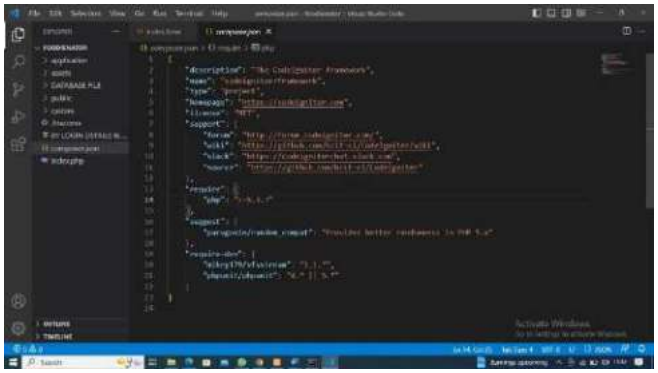

Fig 11:Sample Code2

5. Discussion and Conclusion

In conclusion, this research paper aimed to investigate the relationship between product innovation, service innovation, customer satisfaction, and customer loyalty in the context of Quick Service Restaurants (QSRs). The literature review revealed that innovation and customer satisfaction are critical factors that affect customer loyalty in QSRs. Therefore, the study aimed to test the hypotheses that product innovation and service innovation have a positive effect on customer satisfaction, and customer satisfaction has a positive effect on customer loyalty.

The methodology of the study involved collecting data from a sample of QSR customers using a self-administered questionnaire. The data was analysed using multiple regression analysis to test the hypotheses. The results indicated that both product innovation and service innovation have a positive effect on customer satisfaction, and customer satisfaction has a positive effect on customer loyalty. These findings are consistent with prior research and highlight the importance of innovation and customer satisfaction in QSRs.

The implications of the study suggest that QSRs should focus on developing innovative products and services to enhance customer satisfaction and loyalty, which may in turn lead to increased business success. The study has some limitations, such as relying on self-reported data and being based on a single cross-sectional survey, which may limit the generalizability of the findings.

Overall, this study provides empirical evidence for the importance of product innovation, service innovation, customer satisfaction, and customer loyalty in QSRs. Further research is needed to explore the underlying mechanisms and boundary conditions of these relationships in more depth.

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SHOPIDO: AN E-COMMERCE WEBSITE

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Abstract

The rise of the internet has revolutionized the way people conduct business. E-commerce has become a crucial part of modern business, enabling companies to reach a global audience, reduce overhead costs, and provide customers with a convenient and accessible shopping experience. In this paper, we will explore the process of developing an e-commerce website, including the steps involved in planning, designing, and implementing a successful online store.

Keywords— *E-Commerce, Internet banking, Internet, Self-service technology, Technology.*

1. Introduction

E-commerce websites have become essential tools for businesses looking to expand their reach and maximize profits. In recent years, the number of online shoppers has increased dramatically, and e-commerce sales are expected to continue to grow in the coming years. Developing an e-commerce website can be a complex process, but with the right approach, it can be a highly rewarding endeavour. In this paper, we will explore the key steps involved in building an e-commerce website, including planning, design, development, testing, and deployment.

1.1 Important Aspects to Consider for designing

Before developing an e-commerce website, businesses need to consider several aspects, including their target audience, product catalog, payment gateway, shipping, and security. The target audience should be clearly defined to ensure that the website's design, functionality, and user experience are tailored to their needs. The product catalog should be well-organized, and the product descriptions should be accurate and informative. The payment gateway should be secure and offer multiple options to cater to the preferences of different customers. Shipping options should be flexible and affordable, and the website should have robust security features

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to protect customer data.

Developing an e-commerce website involves several steps, including:

1. **Define the website's goals and objectives**: This involves identifying the website's purpose, target audience, and expected outcomes.
2. **Choose an e-commerce platform:** There are several e-commerce platforms available, including Shopify, WooCommerce, Magento, and BigCommerce. Each platform has its unique features, pricing, and scalability, and businesses should select one that suits their needs.
3. **Select a domain name:** The domain name should be short, memorable, and relevant to the business.
4. **Design the website:** The website design should be visually appealing, easy to navigate, and optimized for mobile devices.
5. **Develop the website:** This involves coding the website's front-end and back-end functionalities.
6. **Integrate the payment gateway:** The payment gateway should be integrated with the website to enable secure online transactions.
7. **Test the website:** The website should be thoroughly tested to ensure that it is user-friendly, functional, and secure.
8. **Launch the website:** Once the website is ready, it should be launched and promoted through various marketing channels.

1.2 Planning

The first step in developing an e-commerce website is to create a comprehensive plan. This involves identifying the goals of the website, the target audience, and the products or services that will be offered. It is essential to conduct market research and analyze the competition to determine the unique selling points of the website. The plan should also include a detailed budget, as well as a timeline for the project. It is essential to determine the necessary resources, including technology, software, and human resources, and to allocate sufficient time and money to ensure the website's success.

1.3 Design

The design of an e-commerce website is critical to its success. The website should be user-

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friendly, visually appealing, and easy to navigate. The design should also reflect the brand's identity and values, creating a consistent and cohesive experience for customers.

One important aspect of the design is the layout of the website. The layout should be intuitive, with a clear hierarchy of information and a logical flow. The website's color scheme and typography should also be carefully selected to create a professional and polished appearance.

1.4 Development

Once the plan and design are in place, the development phase can begin. This involves building the website's architecture, including the database and server-side scripting. It is essential to select a suitable e-commerce platform, such as Shopify or WooCommerce, and to ensure that it can integrate with other necessary tools, such as payment gateways and shipping providers.

The website's development should also include the creation of product pages, shopping cart functionality, and a checkout process that is both secure and user-friendly. It is also important to implement features such as search functionality, customer reviews, and social media integration to enhance the website's functionality and improve the user experience.

1.5 Testing

Before launching the website, it is essential to thoroughly test all aspects of the site to ensure that it is functioning correctly. This includes testing for usability, security, and performance, as well as conducting user testing to identify any potential issues.

1.6 Deployment

Once testing is complete, the website can be deployed. This involves launching the site and making it available to the public. It is essential to ensure that the website is optimized for search engines, as well as implementing ongoing maintenance and updates to keep the site running smoothly.

2. Related work

In 2014, ASSOCHAM (2015) reported that the apparel industry experienced the largest increase in growth rate, reaching almost 69.5%. This was followed by electronic goods at 62%, baby care products at 53%, beauty and personal care products at 52%, and home furnishings at 49%. According to the report, the surge in digital commerce in India was credited to the

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widespread adoption of smartphones. The report highlighted that the digital commerce market was mainly dominated by mobiles and mobile accessories. Additionally, the report observed that cash on delivery was the preferred payment method for approximately 45% of online shoppers. In contrast, only 16% of shoppers opted for credit cards, 21% for debit cards, 10% for internet banking, and a small percentage of 7% preferred cash cards, mobile wallets, and other similar modes of payment. The age group of 18-25 years old has shown the highest increase in online users, with both males and females contributing to the growth in users. As per the report, around 38% of frequent shoppers belonged to the age group of 18-25, 52% in the age group of 26-35, 8% in the age group of 36-45, and only 2% were between 45-60 years old. Furthermore, the report highlighted that nearly 65% of online shoppers in India were male, while 35% were female.

Abhijit (2013) proposes in a report that E-commerce has revolutionized the way businesses purchase and sell products and services, resulting in the emergence of novel methodologies. The report mentions that geographical barriers have become less relevant in forming business relationships, and E-commerce is anticipated to become the shopping norm in the future. As 3G and 4G wireless communication technologies continue to be deployed, the internet economy is projected to experience strong growth. It is predicted that in the next three to five years, India will have between 30 to 70 million internet users, which will match or exceed the numbers of many developed nations. The expansion of internet usage in India will give rise to a more significant internet economy, and E-commerce will have a crucial role in the 21st century, opening up new prospects for both big and small businesses. The report stresses the importance of establishing a legal structure for E-commerce that safeguards fundamental rights like privacy, intellectual property, fraud prevention, and consumer protection. This framework will also enable both domestic and international trade to broaden their perspectives.

According to Sangeeta's (2012) perspective, it is not an easy task to forecast the future of E-commerce. Nonetheless, some sectors, including travel and tourism, electronic appliances, hardware products, and apparel, are anticipated to experience growth in the future. The growth of the E-commerce industry in India will be largely influenced by several essential factors, such as replacement guarantees, M-Commerce services, location-based services, various payment options, appropriate content, shipment options, legal obligations to produce invoices for online transactions, speedy service, transparent and practical terms and conditions, product

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quality that aligns with the portal's description, and an exclusive 24/7 customer service center. According to Awais Muhammad and Samin Tanzila (2012), the internet has turned the world into a global community, shortened distances, and connected people. E-commerce is an essential element that reinforces a nation's commerce infrastructure with electronic tools.

Dutta and Dutta (2009) conducted a study that found that tangibles have the most considerable impact on customer satisfaction. Additionally, the research uncovered that the largest gap between customer expectations and perceptions was in the area of empathy, which encompasses the availability of bank branches and ATMs in convenient locations, as well as tele-banking and internet banking facilities. The study indicated a significant service quality disparity for all banks in this category, which is a major issue for the Indian banking sector.

Kumar and Rajesh (2009) suggest that banks should give priority to customer convenience when designing their facilities. They propose that banks should set up more ATM cabins to enhance accessibility. The authors advocate for a customer-centric approach to achieve "customer delight" and meet the needs of customers.

Blasio (2008) carried out research that challenges the notion that the internet reduces the significance of geographic distance. The study discovered that internet usage is more prevalent among consumers in urban areas than those in non-urban areas, and the size of the city does not significantly impact the adoption of e-commerceThe ability to inspect goods before purchase is a significant factor that dissuades consumers in geographically remote areas from shopping online. However, e-commerce is more commonly used for purchasing leisure activities and cultural items, such as books, CDs, and tickets for museums and theaters in these areas. In contrast to e-commerce, the size of a city does not seem to have an impact on the use of e-banking. Customers in non-urban areas tend to prioritize personal relationships when selecting a bank, possibly due to having taken out loans from their bank.

Ozok et al. (2007) identified ten factors that were found to be significant in ensuring consistent customer relationship management in e-commerce. These factors were consistent transaction processes, consistent website design and ease of navigation, consistent promotional offers, consistent product availability information, consistent product variety, consistent fraud prevention measures, consistent product guarantees, consistent overall site fairness, and consistent return policies.

Rust and Chung (2006) recommend that in e-commerce, it is essential to comprehend not just

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customers' actions in a particular contact but also their actions, perceptions, and feelings across multiple contacts.

Hsieh (2005) states that before a company introduces self-service technology (SST), it should evaluate its own preparedness. There are several factors that the company needs to consider before encouraging its customers to adopt SST.

In a study conducted by Snellman and Vihtkari (2003), it was found that both interpersonal service encounters and technology-based service encounters often lead to failures. Interpersonal service encounters resulted in dissatisfaction due to unfriendly or impolite service and time-related issues, while dissatisfaction in technology-based encounters was primarily due to technology failures, service design, or service process issues.

Chou and Chou (2000) found that banks globally are optimistic about the potential of internet banking because of the rapid expansion of electronic commerce. In order to provide efficient service, banks must develop and execute a strong internet system, taking into account various technological concerns, such as network technologies, scalability, security, platform and standards, and intelligent software agents. To cater to the demands of the worldwide business community, the banking sector needs to carefully choose appropriate networking technologies for serving the internet market. Since banks prioritize electronic commerce as a critical business process, risk and liability management becomes increasingly vital.

3. Proposed Model

In the proposed model there is a database which is shared between 7 different databases for I/O operations which uses B-Tree behind the scene. There are 8 services which will be communicating with the database for read and write operations. There are 3 servers, these servers will be communicating with the services to perform the task. There is one common gateway for the clients, the gateway will be responsible for serving the request to the intended server. The gateway uses consistent hashing to identify which server is intended to forward the request to. In the end all the clients will be communicating with the gateway, sends their requests and get the required results.

3.1 Modules in Shopido

There are several modules we build in Shopido described as follows:

a. **Customer:** In this module customer can create and verify his account on the website. This

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module is responsible for managing all of the customer's personal information like name, email, contact details etc. It is also responsible for managing all of the user's ordered products and those are in the cart.

b. **Admin:** This module is responsible for managing all of the admin's permissions and managing the customer's orders.

c. **Orders:** In this module all the customer's orders, generating invoice, providing the transactions report to the admin and vendor and generating the sales report.

d. **Login**: In Login module existing user have to fill up their email id and password and then click on login button. If the email and password fill by user is correct then login will successful else user have to enter the correct credentials again. After successful login user will be redirected to products page.

3.2 ER Diagram of Shopido

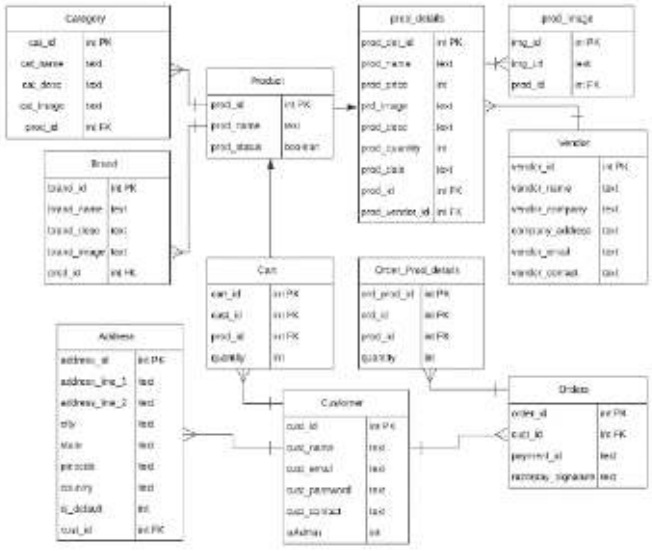

Fig 1: ER Diagram of Proposed Model

3.3 Architecture of Shopido

The proposed model includes a shared database consisting of seven separate databases, utilizing B-Tree for I/O operations. Eight services will communicate with the database for both read and write operations, while three servers will communicate with these services to perform tasks. A common gateway is responsible for serving client requests, utilizing consistent hashing

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to determine the appropriate server to forward requests to. Ultimately, clients will interact solely with the gateway to submit their requests and obtain the necessary results.

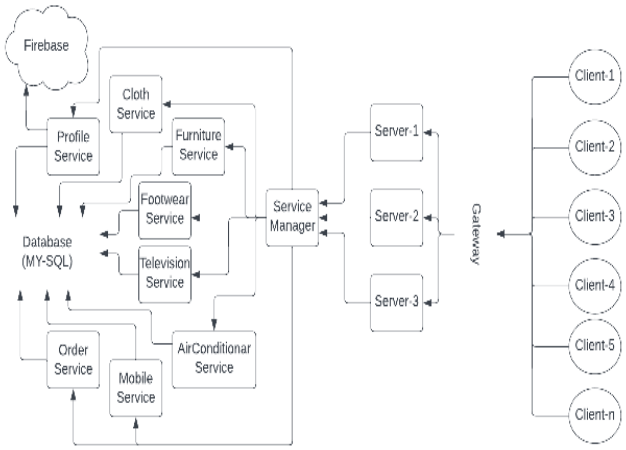

Fig 2. Architecture of Shopido

4. Results and Discussion

The result of developing Shopido can be very positive for businesses. One major benefit is increased sales, as an ecommerce website can provide a platform for businesses to sell their products or services online, reaching a wider audience and potentially increasing sales.

In addition, Shopido can offer a convenient and user-friendly online shopping experience for customers, leading to increased customer satisfaction and loyalty. This can also lead to increased brand visibility, as an ecommerce website can help businesses expand their online presence and reach new customers.

Another advantage of an ecommerce website is cost savings, as businesses can save costs associated with physical storefronts, such as rent, utilities, and staffing. This can be especially beneficial for small businesses or startups with limited resources.

Furthermore, an ecommerce website can collect valuable data on customer behavior and preferences, which can be analyzed to improve marketing strategies and product offerings. This can help businesses tailor their offerings to better meet the needs and preferences of their customers, leading to increased customer satisfaction and loyalty.

However, there are also some challenges associated with developing and maintaining an ecommerce website. These may include technical issues, such as ensuring the website is secure and reliable, as well as logistical challenges, such as managing inventory and shipping logistics.

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Overall, the benefits of developing an ecommerce website can outweigh the challenges, especially for businesses looking to expand their online presence and reach new customers.

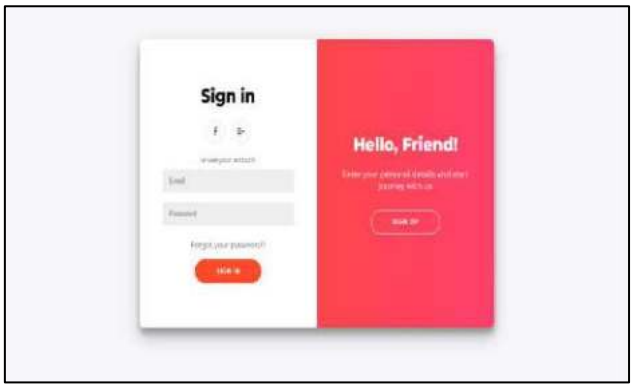

Fig 3. Project Screen shot 1 (Login Page)

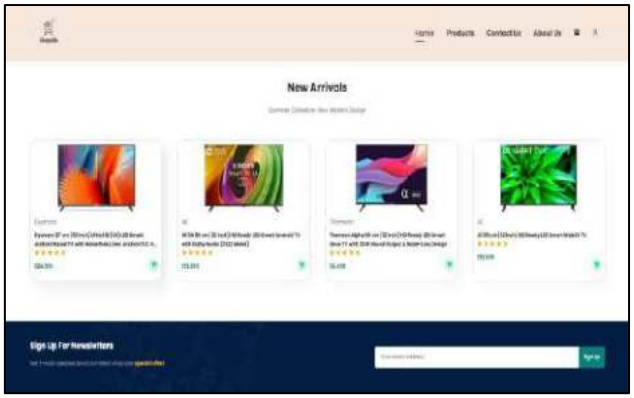

Fig 4. Project Screen shot 2 (Item details)

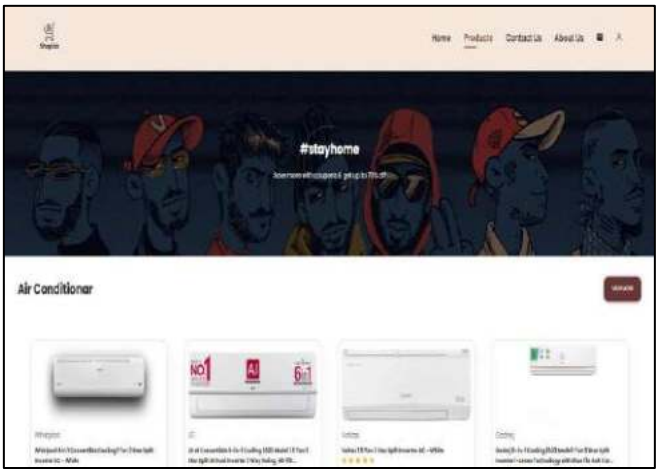

Fig 5. Project Screen shot 3 (Item details)

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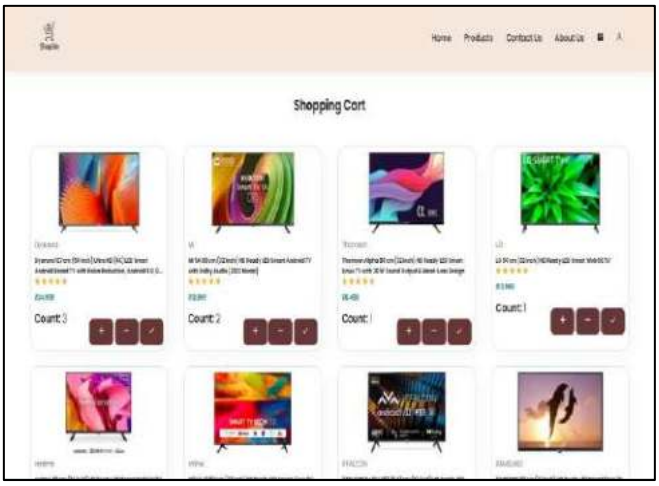

Fig 6. Project Screen shot 4 (Shopping Cart)

5. Uniqueness in Project

There are the following advantages of Shopido:

- Increased sales: An ecommerce website can provide a platform for businesses to sell their products or services online, reaching a wider audience and potentially increasing sales.
- Improved customer experience: An ecommerce website can offer a convenient and user-friendly online shopping experience for customers, leading to increased customer satisfaction and loyalty.
- Cost savings: An ecommerce website can help businesses save costs associated with physical storefronts, such as rent, utilities, and staffing.
- Data collection and analysis: An ecommerce website can collect valuable data on customer behavior and preferences, which can be analyzed to improve marketing strategies and product offerings.
- Increased brand visibility: An ecommerce website can help businesses expand their online presence and reach new customers, increasing brand visibility and awareness.

6. Conclusion

Developing an e-commerce website can be a complex process, but with the right approach, it can be highly rewarding. By following the key steps outlined in this paper, businesses can create a successful online store that reaches a global audience and provides customers with a convenient and accessible shopping experience.

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Annexure 1: Sample Code

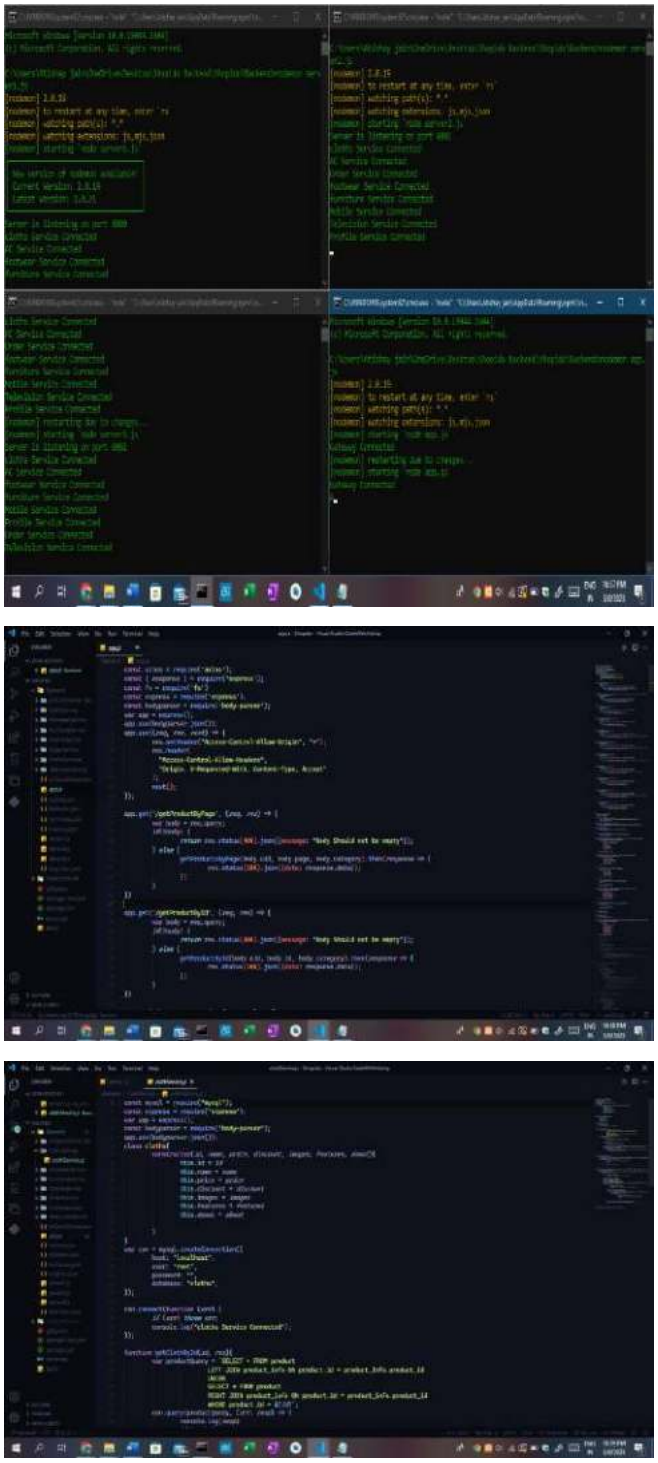

Fig 7. Sample Code of Shopido (Soon will be available on Gitzhub)

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DESIGN A FIRE EXTINGUISHER ROBOT IN THE FIELD OF ROBOTICS

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Abstract

In this article, a fire extinguisher robot is designed that utilizes a water pump as its main actuator. The robot's movement is controlled through Android smartphones connected via Wi-Fi networks, using the Wi-Fi module integrated into the robot. User commands are transmitted to the robot's microcontroller, which then translates them into robotic movement. In our lab testing environment, the robot successfully follows user commands such as turning right, turning left, moving forward, and moving backward During fire tests, the robot effectively carries out its task of extinguishing the fire. Overall, our research demonstrates the feasibility and effectiveness of using robots controlled remotely to combat fires. By reducing the risks faced by firefighters and improving access to fire-affected areas, this technological breakthrough has the potential to significantly enhance firefighting efforts.

Keywords—*Robot, DTMF, aurdino UNO,*

1. Introduction

In this paper, we propose the design of a fire extinguishing robot. The fire extinguishing robot we have developed is equipped with a highly sensitive flame sensor designed to detect fires in the environment. This flame sensor efficiently detects the presence of fire and transmits the signals to a microcontroller for further processing. Upon receiving the fire detection signals, the microcontroller activates a water pump mechanism to initiate the fire extinguishing process.To control the robot's movements and functionalities, we have implemented a mobile phone interface using DTMF (Dual-Tone Multi-Frequency) tones. The DTMF tones generated by the mobile phone are decoded by a DTMF decoder, allowing for seamless and reliable control over the robot's actions. This intuitive control mechanism ensures ease of operation and enhances the overall user experience. By integrating these advanced technologies, our fire

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extinguishing robot offers an effective and efficient solution for combating fires. The combination of the flame sensor, microcontroller, and mobile phone control system enables swift fire detection andThe robot incorporates concepts such as environmental fire sensing and proportional motor control. A motor driver is used to enable bidirectional control of the robot's motors. Motion control instructions are transmitted to the robot using DTMF technology.

Firefighting and rescue operations are inherently dangerous missions. Rescuing injured firefighters and civilians from hazardous buildings poses significant risks. Firefighters often encounter challenges when entering hazardous buildings to extinguish fires and locate civilians, as they may lack prior knowledge of the building's infrastructure. Firefighters face numerous risks on the job, including exposure to flames, high levels of CO or CO2, intense heat, and physical and mental stress. Unfortunately, a considerable number of firefighters have sustained injuries while performing their duties, including fire suppression and civilian rescue.

2. Literature Review:

The proposed system introduces a unique robot, which can directly enter the fire source To ensure stable flight, a nozzle module has been developed to control the reaction force. This module combines two nozzles with adjustable outlet directions, allowing precise control of the resulting reaction force. Subsequently, a robot incorporating the nozzle module was developed and subjected to experimentation. The suspension structure is described in detail, and its strength is calculated to ensure its suitability for the firefighting robot application. The robot's performance on various grounds is verified through experimental testing. Furthermore, this technology holds potential applications beyond firefighting. It can be used as a guide for visually impaired individuals, similar to guide dogs, and has the ability to provide haptic feedback through reins, serving as a robotic counterpart.

3. Proposed Methodology

The main objective of this paper is to detect and extinguish environmental fires. A water pump is used along with the Arduino UNO Microcontroller board which is forming a base of the ATmega328P serving as the central control platform. The ATmega328P is a suitable choice for robotics applications, making real-time fire extinguishing feasible. The Arduino software is compatible with various platforms such as Mac etc enabling simple and straightforward

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programming. The availability of a wide range of built-in libraries and the ability to incorporate additional open-source libraries further simplifies programming tasks. The Arduino software allows for the addition of new boards, and programming the microcontroller becomes easier due to its derivation from C and C++ languages. The recommended input voltage range is 7-12V, with a limitation between 6-20V.For telecommunication signaling, the project utilizes Dual-tone multi-frequency (DTMF) signaling. The IC MT8870DE, a touch tone decoder IC, is used for this purpose. e motor driver board determines the direction of the robot's movement, providing high voltage and current output to drive the project's motors. A DC motor is used for rotating the wheels and propelling the robot. DC motors are typically used to convert electrical energy into mechanical energy. To extinguish the fire, a water pump is employed to spray water onto the flames.

4. Study of Results

A. Block Diagram

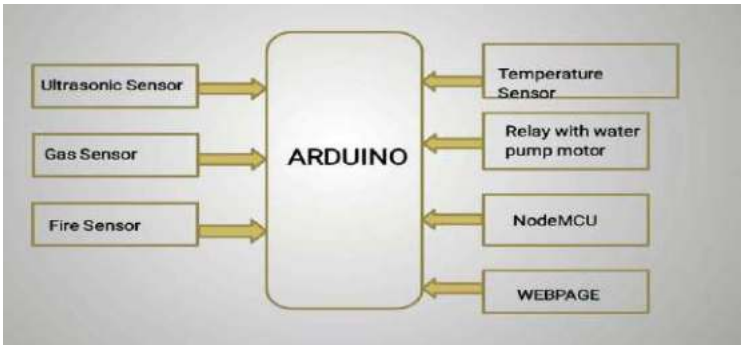

Fig.1: Block diagram of the model

B. Ultrasonic Sensor

Ultrasonic sensors are widely used as proximity sensors across a range of applications. One common application is in automobile self-parking technology, where ultrasonic sensors play a crucial role in detecting obstacles and assisting in parking maneuvers. These sensors provide real-time distance measurements, enabling vehicles to navigate tight spaces with precision and safety.. Additionally, ultrasonic sensors play a crucial role in robotic obstacle detection systems and manufacturing technology. When compared to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors exhibit less susceptibility to interference from smoke, gas, and other airborne particles. However, it is important to note that variables like heat can still affect

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the physical components of ultrasonic sensors. Moreover, ultrasonic sensors are frequently employed as level sensors to detect, monitor, and regulate liquid levels in enclosed containers, such as vats in chemical factories. One of the most significant applications of ultrasonic technology is in the medical industry, where it enables the production of images of internal organs, facilitates tumor identification, and ensures the health and well-being of babies in the womb. The versatility and reliability of ultrasonic sensors make them essential components in a wide range of industries and applications

C. Flame Sensor

A flame sensor is designed to detect flames within a wavelength range of 760 nm to 1100 nm emitted by a light source. The flame detection range of this sensor is approximately 100cm, with a detection angle of 60 degrees. Flame sensors are commonly employed in fire-fighting robots as flame alarms. They serve as detectors that respond to the presence of fire or flames. The response of the flame sensor depends on its configuration, which may include an alarm system, a natural gas line, propane, or a fire suppression system. In addition to flame alarms, flame sensors are also used in industrial boilers. They play a crucial role in verifying whether the boiler is functioning properly or not. The response time and accuracy of flame sensors are typically faster and more reliable compared to heat or smoke detectors due to their specialized mechanism for detecting flames.

D. ODE MCU

The NodeMCU, short for Node MicroController Unit, is a comprehensive development environment that combines open-source software and hardware. It is built around the ESP8266, an affordable System-on-a-Chip (SoC) manufactured by Espressif Systems. The ESP8266 integrates essential components of a computer, including a CPU, RAM, WiFi networking capabilities, and even a modern operating system and software development kit (SDK). This makes it an ideal choice for a wide range of Internet of Things (IoT) projects.The NodeMCU is available in various package styles, all of which feature the core ESP8266. These designs maintain a standard 30-pin layout, with some variations in the width of the board. Some designs utilize a narrow (0.9") footprint, while others adopt a wider (1.1") footprint. It is important to consider the pin spacing and board size when selecting a specific model. The most commonly

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known NodeMCU models are the Amica, which follows the standard narrow pin-spacing, and the LoLin, which features wider pin spacing and a larger board.The open-source nature of the ESP8266 design allows for continuous innovation and the development of new variants of the NodeMCU by the market. This ensures a dynamic and evolving ecosystem for NodeMCU-based projects.

E. Motor Driver L293D

The L293D is a popular motor driver integrated circuit (IC) that is widely used for controlling DC motors and stepper motors in various applications. It is a quadruple half-H driver, meaning it can control up to four individual motors independently An H bridge is an electronic circuit commonly used in robotics and other applications to control the direction of DC motors. It allows a voltage to be applied across a load in opposite directions. The term "H bridge" comes from the graphical representation of such a circuit. An H bridge consists of four switches, which can be either solid-state or mechanical. By opening and closing the switches in a specific configuration, the H bridge can control the direction of the motor.

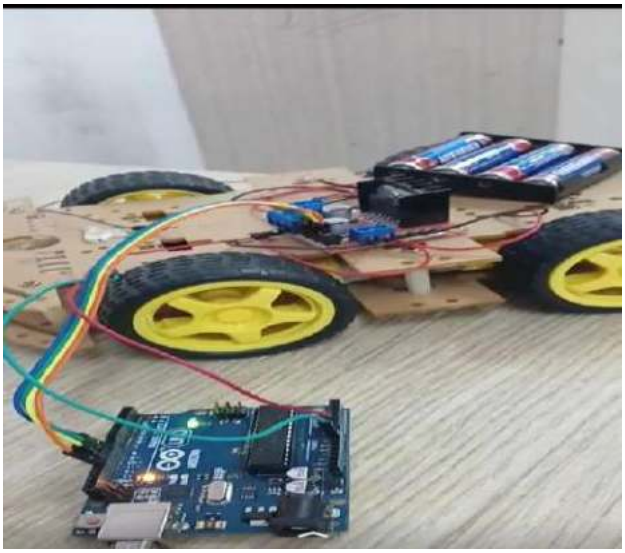

Fig.2: Fabricated model

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5. Conclusion

The primary objectives of our project include microcontroller and motor control, utilizing a geared motor for efficient operation, and flame detection using a fire sensor. By integrating these components, we have successfully created a robot that can effectively communicate through the serial port, enabling seamless interaction and data transfer.The utilization of the Arduino Uno platform ensures the robustness and dependability of our system, allowing for precise control and efficient execution of fire detection and extinguishing tasks. Through this project, we aim to enhance fire safety measures by implementing an intelligent and proactive solution that can detect and extinguish fires before they escalate, ultimately minimizing potential damages and risks

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An Optimal Solution of LPP by Graphical Method

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Abstract

Prime objective of this paper is to optimize the linear programming problem. Linear programming is an important optimization technique used in decision making in business and everyday life for obtaining the maximum or minimum values as required of a linear expression subject to satisfy certain number of given linear restrictions. If the objective function Z is a function of two variables only then the problem can be solved by graphical method. A problem of three variables can also be solved by this method but it is complicated enough. This method is applied to problems involving only two variables while most of the practical situations do involve more than two variables. Therefore, it is not a powerful tool for the solution of Linear programming problem. The graphical method represents one approach for solving linear programming problems. However, this approach is limited to optimization problems containing just two decision variables since constraints are plotted in a two-dimensional space. Every additional decision variable would add and additional space in the plot and would complicate its visualization. In reality, most optimization problems will contain more than two decision variables of different types (e.g. linear, integer, binary) with more complex constraints, limiting the applicability of the graphical method for solving them.

Keywords**:** *Feasible region, LPP, Constraints, Extreme point, Optimization, Mathematical formulation, unbounded solution and simultaneous linear inequalities.*

1. Introduction

After formulating the linear programming problem, our aim is to determine the values of decision variables to find the optimum (maximum or minimum) value of the objective function. Linear programming problems which involve only two variables can be solved by graphical method. If the problem has three or more variables, the graphical method is impractical. The major steps involved in this method are as follows: State the problem mathematically, Write all the constraints in the form of equations and draw the graph, Find the feasible region,

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Find the coordinates of each vertex (corner points) of the feasible region. The coordinates of the vertex can be obtained either by inspection or by solving the two equations of the lines intersecting at the point, by substituting these corner points in the objective function we can get the values of the objective function, If the problem is maximization then the maximum of the above values is the optimum value. If the problem is minimization, then the minimum of the given values is the optimum value. Linear programming (also referred as LP) is an operations research technique used when all the objectives and constraints are linear (in the variables) and when all the decision variables are continuous. In hierarchy, linear programming could be considered as the easiest operations research technique. The graphical method represents an optimization algorithm for solving linear programming problems containing two decision variables ($x1$ and $x2$). It is one of the most popular approaches for solving simple linear programming problems.

2. **Mathematical calculation**:

$$\text{Maximize } Z = 2\,x_1 + 5x_2$$

Subject to the conditions:

$$x_1 + 4x_2 \leq 24$$

$$3x_1 + x_2 \leq 21$$

$$x_1 + x_2 \leq 9$$

$$\text{and } x_1, x_2 \geq 0$$

First we have to find the feasible region using the given conditions.

Since both the decision variables x1 and x2 are non-negative, the solution lies in the first quadrant.

Write all the inequalities of the constraints in the form of equations.

Therefore, we have the lines $x_1 + 4x_2 = 24$; $3x_1 + x_2 = 21$; $x_1 + x_2 = 9$ $x_1 + 4x_2 = 24$ is a line passing through the points (0, 6) and (24, 0). [(0, 6) is obtained by taking $x_1 = 0$ in $x_1 + 4x_2 = 24$, (24, 0) is obtained by taking $x_2 = 0$ in $x_1 + 4x_2 = 24$].

Any point lying on or below the line $x_1 + 4x_2 = 24$ satisfies the constraint $x_1 + 4x_2 \leq 24$. $3x_1 + x_2 = 21$ is a line passing through the points (0, 21) and (7, 0). Any point lying on or below the line

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$3\,x_1 + x_2 = 21$ satisfies the constraint $3\,x_1 + x_2 \leq 21$.

$x_1 + x_2 = 9$ is a line passing through the points (0, 9) and (9, 0). Any point lying on or below the line $x_1 + x_2 = 9$ satisfies the constraint $x_1 + x_2 \leq 9$.

3. Graphical representation

To identify the corner point that represents the optimum solution, the objective function needs be plotted next. Once plotted, the objective function line will be gradually displaced to the right all the way before exiting the feasible region. The last point the objective function line touches before exiting the feasible region represents the optimum solution of the problem (i.e. the combination of $x1$ and $x2$ values that maximize the value of z).

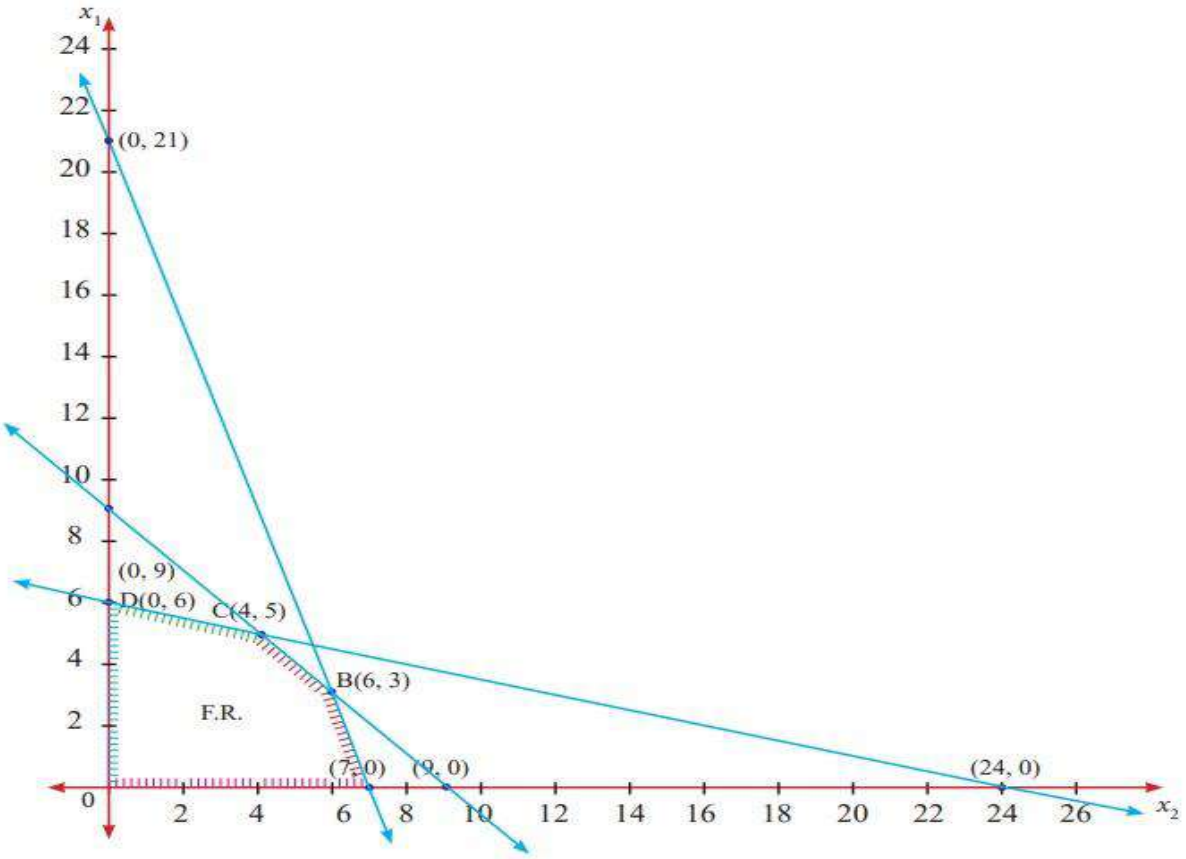

Fig 10.1

The feasible region satisfying all the conditions is OABCD.The co-ordinates of the points are O (0,0) A (7,0); B (6,3) [the point B is the intersection of two lines $x_1 + x_2 = 9$ and $3\,x_1 + x_2 =$

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21]; C (4,5) [the point C is the intersection of two lines $x_1 + x_2 = 9$ and $x_1 + 4x_2 = 24$] and D (0,6).

Corner points	$Z = 2x_1 + 5x_2$
O(0,0)	0
A(7,0)	14
B(6,3)	27
C(4,5)	33
D(0,6)	30

Table 10.2

Maximum value of Z occurs at Therefore, the solution is $x_1 = 4$, $x_2 = 5$,

$$\text{Now } Z = 2x_1 + 5x_2$$

$$Z = 2 \times 4 + 5 \times 5$$

$$Z = 8 + 25$$

$$Z_{max} = 33.$$

4. **Result**

Linear programming is a branch of Operation research .In order to understand the importance of its study ,we must know something of its history & evolution. The first mathematical technique in this field, called the Simplex method of Linear Programming which was developed and applications have been developed through the efforts and co-operation of interested individuals in academic institutions and industry both.

In the above given problem we concluded the maximum value of Z by using suitable table and graphical representation (figure 10.1). First We found the feasible region using the given condition and with the help of all the inequalities and constraints we then calculate the value of x_1 and x_2 by appropriate method.

Finally, with the help of x_1 and x_2, we calculated the maximum value of Z which is 33.

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5. Conclusion and Future Scope

This paper mathematically solve the Linear programming problem by graphical method. The result of this problem is optimal. Optimal means it is either maximum or minimum. Industrial managers who were seeking solutions to their complex executive –type problem. The most common problem was to find: what methods should be adopted so that the cost is minimum or the total profit is maximum?

Simplex method solves such type of problem. While making use of the techniques of Linear programming, a mathematical model is formulated. The model is actually a simplified representation of the problems in which only the most important features are considered for reasons of simplicity. Then an optimal or most favourable solution is found. Linear Programming is the mathematical tool used in solving problems to business, industry, commerce, military operations, etc. Here the problem before us is usually to maximize the profit or minimize the cost keeping in mind the restrictions imposed upon us by the limitations of various resources.

In addition, building a two-dimensional space plot and displacing the objective function line along the feasible region to find the optimum extreme point is time consuming and not the most effective approach. The application of other optimization algorithms in multiple computer programs (e.g. GAMS, AMPL) reduces significantly the time spent solving an optimization problem while obtaining additional valuable information (e.g. sensitivity analysis).

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PARTIAL REPLACEMENT OF CEMENT WITH MARBLE DUST AND BRICK POWDER

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Abstract

The waste generated from the industries cause environmental problems. Hence the reuse of waste material can emphasize. Brick and marble dust considered as the waste material which not only occupy land but also create environmental problems like air pollution, soil pollution etc. This is a serious problem and can be reduced using brick powder and marble dust as an admixture in concrete. People dump such admixture without knowing its value. It is definitely very useful as admixture in concrete to give better strength at no cost. Our study shows the use of brick powder and marble dust as an admixture in concrete which is dumped by people. we have designed M_{25} grade of concrete. We have casted ordinary concrete and then concrete replacing 5% and 10% of brick powder and marble dust. After 7, 14and 28 days of curing, their compressive strength of bar graph and line graph. Workability of the concrete also been compared after adding the admixture of brick powder and marble dust. It is found that the workability increased by the addition of brick powder up to 10%. It is also observed that the workability of marble dust up to 5% of marble dust.

Keywords- *Marble dust, Brick dust, Compressive strength, Flexural strength and Workability*

1. Introduction

The purpose of this study is to investigate whether or not it is possible to successfully replace cement in concrete with either waste brick powder (WBP) or marble powder using either of these alternative materials. In comparison to the concrete that served as the reference, the levels of replacement were maintained at 5% and 10%. Slump, density, compressive, flexural, and splitting tensile strengths were evaluated throughout the testing process. The term "mineral admixture" refers to any material other than cement, aggregate, and water that is added either during or after the batching mixing process in order to achieve the desired properties, most notably an increase in strength. They are the finely ground solid material, such as brick dust, marble dust, and other similar examples. This type of cementing material is referred to as

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supplementary cementing material. They have the ability to improve the workability of freshly laid concrete as well as the finish ability of that concrete. Construction has been recognized as an essential component in the contemporary society, which is undergoing rapid transformation. The introduction of new and advanced building materials is directly correlated with the construction industry's innovation. The most important category of building materials is cementations material, which has been utilized in the industry for a number of years.

2. Scope

Construction has been recognized as an essential component in the contemporary society, which is undergoing rapid transformation. The introduction of new and advanced building materials is directly correlated with the construction industry's innovation. The most important category of building materials is cementations material, which has been utilized in the construction industry for a number of years. Lime, lime mixed with natural pozzolan and gypsum, and gypsum alone were the building materials of choice in ancient times, whereas cement is the material of choice in today's construction industry. In many countries, there is a shortage of cement despite the fact that demand is higher; consequently, the search for an alternative binder or material that can replace cement has become an area of interest in the field of technology. From an ecological point of view, one must also consider to manufacture binders that have a lower overall energy footprint and produce fewer emissions of greenhouse gases. to incorporate industrial byproducts and recycled materials into both the cementitious binder and the concrete itself as much as possible. to produce the structure in such a way that it would function more effectively over time, i.e., one that is more resilient and has a higher level of strength. Some weight of cement was used to replace the waste material and by-products that are produced in industry and have no use for human beings such as marble dust, brick powder, and other similar materials. The findings demonstrated that the strength was improved, and if it is implemented, then our structure will be more cost-effective. Additionally, it will help our environment by lowering the amount of waste that is produced in our surroundings.

2.1 Objective and Aim

The aim of experiment is to find the maximum content of brick dust and marble dust replacement of cement in concrete. The percentage of brick dust and marble dust replacement of cement in concrete are 0%, 5%, 10%, 20% and 30%. M20, M25, M30 grades concrete cubes

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of (150*150*150mm) size were casted for conducting compressive strength test. From the experimental studies 10% of Partial replacement of cement with the combination of brick and marble dust so we improved the hardened concrete properties.TO increase compressive strength. To reduce the water demand. To decrease the permeability. To reduce the heat of hydration. To improve durability, the use of mineral admixture results in costs and energy saving as they are waste material. The use of minerals like marble dust, brick powder etc. Reduce air pollution which can be eco-friendly to your environment.

3. Materials

3.1 Cement

Cement is general sense are adhesive and cohesive material which are capable of binding together particles of solid matter into a compact durable mass for our project work BDW and MDW based on Pozzolana Portland Cement (PPC) was used. The percentage of brick dust mixed in cement was 30+-3.

3.2 Aggregate

Aggregate are the important to give body to concrete reduce shrinkage and effect economy. Aggregate are use for providing bulk to the concrete .

3.3 Coarse Aggregate

The aggregate which are retained on 4.75mm IS sieve is term as coarse aggregate. Provide to strength of concrete. The aggregate used in project consists both angular and rounded grains. Passing through 16mm and retained 12.5 mm IS sieves was use**.**

3.4 Fine Aggregate

The aggregate which passes through 4.75 mm. fine aggregate assist in producing workability and uniform admixture. The sand passing through 4.75 sieves was used.

3.5 Marble Dust

Marble dust are collected from the dressing unit of college. Collected by 600-micron sieves Rakesh D Gupta.

3.6 Brick Powder

Brick powder was collected fromcollege compound and then it was sieved by 600 microns by M Kamal Uddin.

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4. Methodology

The experimental study's goal was to learn about the properties of concrete made from waste brick powder. Workability, density, compressive strength, flexural strength, and split tensile strength are all parameters that predict the functionality and quality of concrete. ASTM standard methods and techniques for concrete manufacturing and testing. The properties of fresh and hardened concrete were determined. The concrete specimens were subjected to the following tests. Slump, Density, Compressive Strength, Split Tensile Strength, and Flexural Strength are all factors to consider.

Table 1: slump table

SERIAL NO	CONCRETE	W/C RATIO	SLUMP (MM)
1	Ordinary	0.45	2
2	5%B.P..	0.45.	25.
3	10%B.P..	0.45..	25.
4	5%M.P..	0.45.	30.
5	10%M.P..	0.45.	27.

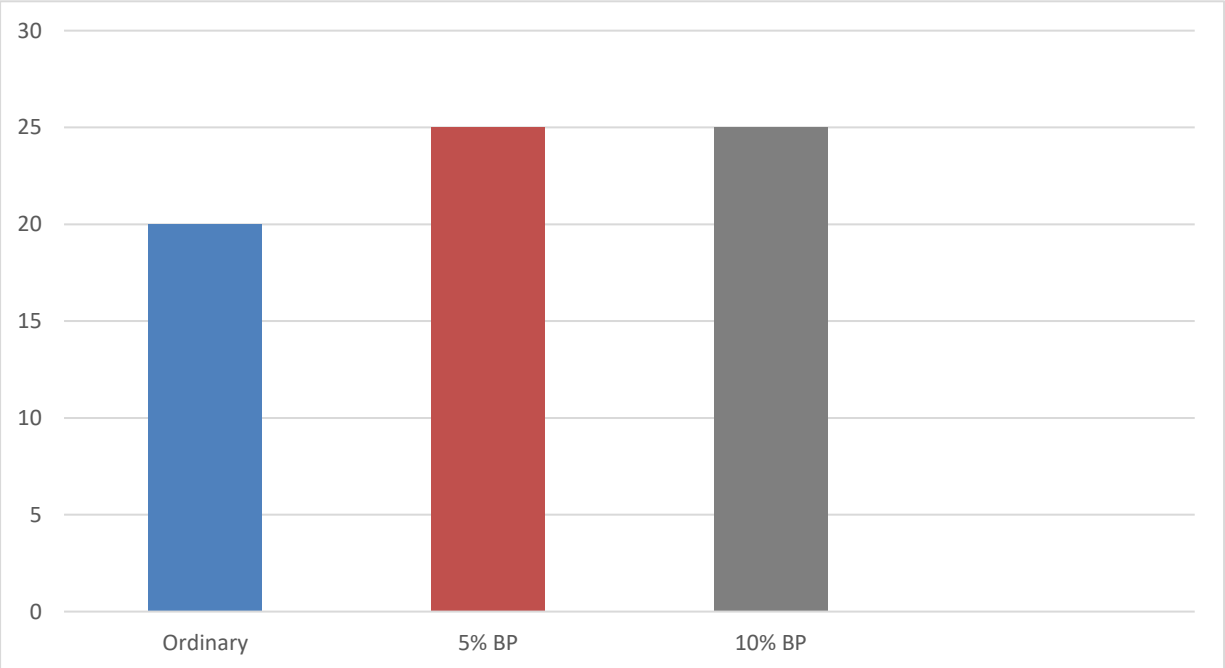

Fig 1: Comparison between workability of ordinary, 5% B.P. and 10% B.P.

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The slump of ordinary concrete was 20 mm. On replacing 5% and 10% of brick powder the slump value increased to 25 mm. It concludes that with the addition of brick powder in concrete the water required will be less as compared to that of ordinary concrete.

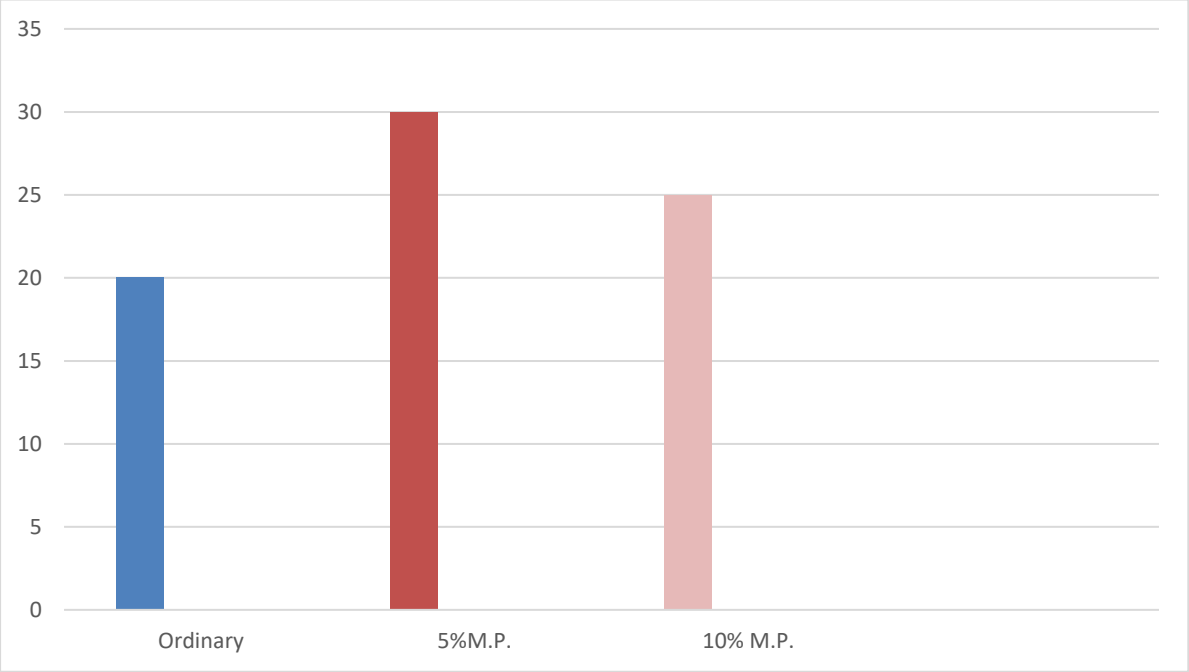

Fig.2 Compressive Strength of Concrete Observation for Ordinary Concrete

TABLE2: Compressive Strength of Ordinary Cube

SERIAL NO	NO. OF DAYS	COMPRESSIVE STRENGTHOF ORDINARY CUBE
1	7	16.88
2	14	20.88
3	28	26.81

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TABLE 3: Overall Comparison of Compressive Strength of Concrete

SERIAL NO	NO OF DAYS	COMPRESSIVE STRENGTH OF ORDINARY CUBE N/mm^2	Compressive strength of cube with replacement of 5%brick powder N/mm^2	Compressive strength of cube with replacement of 10%brick powder N/mm^2	Compressive strength of cube with replacement of 5%marble powder N/mm^2	Compressive strength of cube with replacement of 10%marble powder N/mm^2
1	7	16.88	18.88	17.77	19.55	14.88
2	14	20.88	27.55	25.33	22.88	19.77
3	28	26.81	33.33	28.44	30.51	27.85

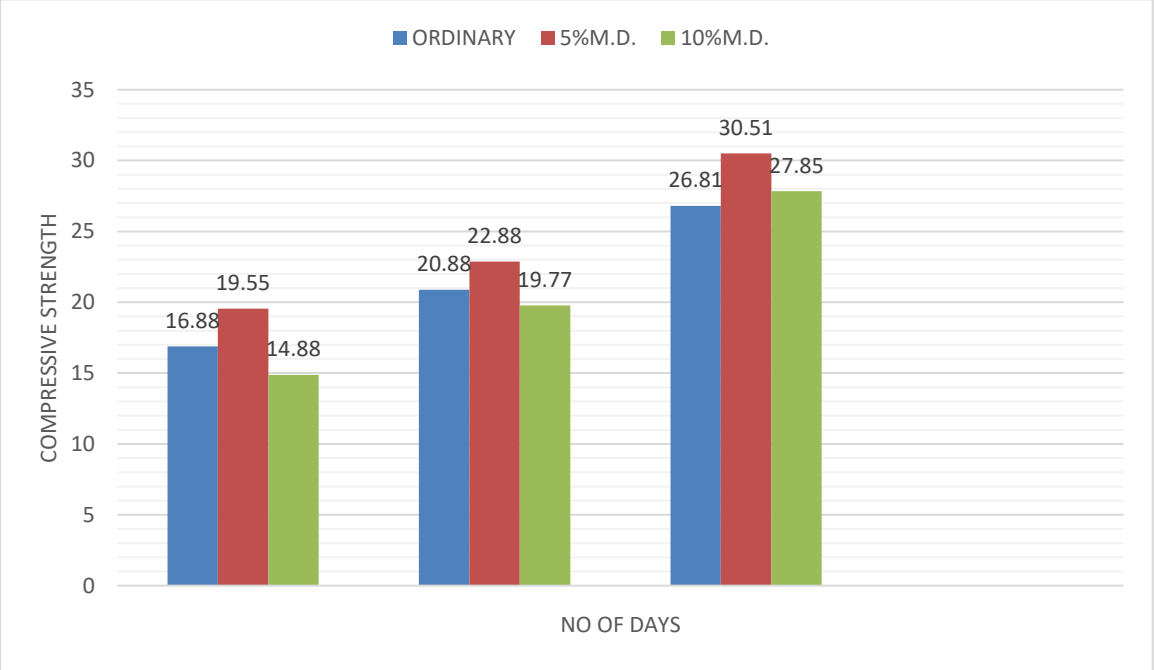

Fig 3(a): Comparison of Compressive Strength of Concrete using 5% marble dust and 10% marble dust (Bar Graph)

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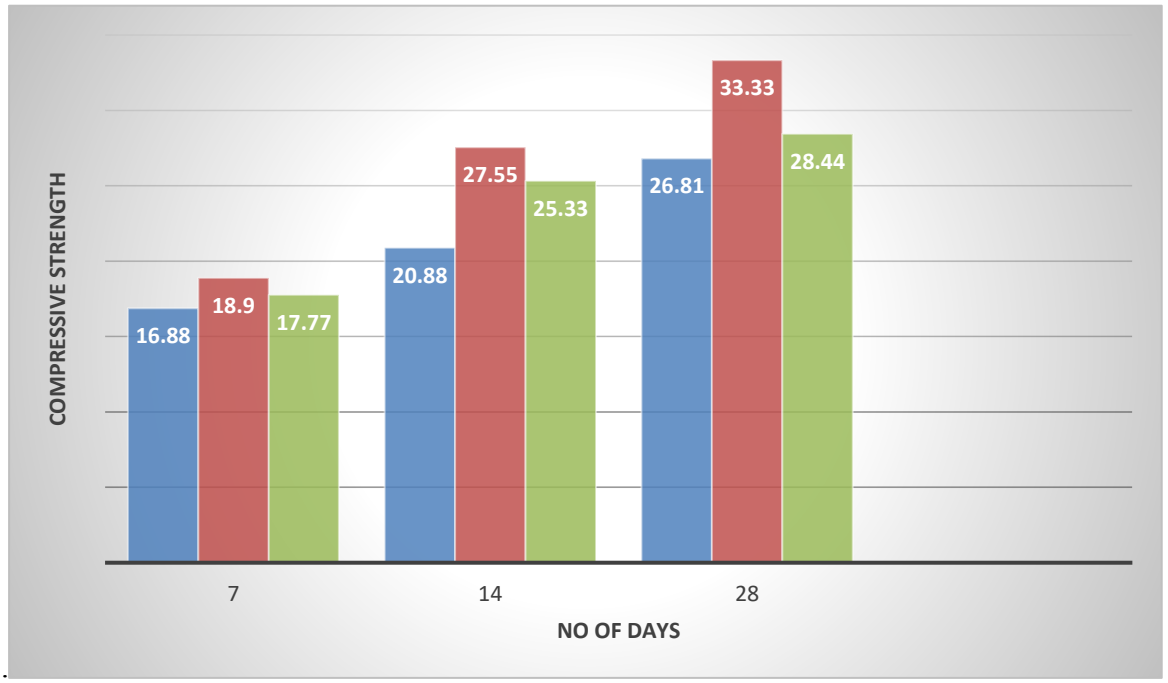

FIG 3(b): Comparison of compressive strength of concrete using 5& 10% B.P. (Bar Graph)

5. Conclusion

- Brick powder and marble which is waste material produced from brick factory and cutting unit of marble can be used as mineral admixture in concrete
- This admixture can be replaced by some percentage of cement which tends to increase the compressive strength of concrete
- On replacing 5 and 10% of cement with brick powder and marble dust,the compressive strength of concrete was increased
- The compressive strength was maximum for 5% of brick powder in 28 days
- The compressive strength of 10% of marble dust was less as 7 and 14 days as compared to that of ordinary concrete but on curing for 28 days strength increased.
- 5% of marble dust also gave good result but the strength was less when compared with 5% brick powder
- Both brick powder and marble dust can be used in concrete to generate economical structure.
- It also reduces the environmental pollution as the environmental waste is reduced.

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AN OVERVIEW ON PRECAST CONCRETE

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Abstract
The greater part of the development exercises in India happen by ordinary cast in situ strategy for development. Yet at the same time there is a colossal interest for lodging in India. So the development action needs to occur in an a lot quicker way. This can't be accomplished by traditional technique for development. It very well may be done conceivable with precast cement of development. In addition there are more points of interest of precast solid when contrasted and traditional one. Most Indian building uses cast-in-place methods. India's housing demand is still high. Construction must move quickly. Conventional building can't do this. Precast concrete makes it possible. Precast concrete has greater benefits than traditional. This study reviews numerous literatures. This study reviews numerous literatures. Also mentioned are precast construction's pros and downsides. Precast concrete has various advantages over cast-in-place. Off-site manufacture of structural elements allows for more control over the materials used and the quality of the handicraft, enhanced health and safety (resulting from casting taking place on the ground rather than at a height), and increased productivity (reusing standard forms). Many national standards of practise devote portions to design and detailing because of their performance. Modern design practise doesn't always follow experimental study findings.

Keywords: *Precast concrete, structural elements*

1. Introduction

Construction of tilt-up buildings, highways, bridges, and high-rises are all examples of applications that call for the use of precast concrete, which is also used in interior applications. When precast concrete is manufactured in a setting that is temperature and humidity controlled (which is commonly referred to as a precast plant), the precast concrete has the opportunity to properly cure while also being closely monitored by staff of the plant. When compared to casting concrete on-site, using a precast concrete technology has a number of potential

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advantages. The fabrication of precast concrete can take place on the ground, which significantly increases the safety of the casting process. When opposed to a construction site, a precast plant allows for a greater degree of quality control over both the materials used and the workmanship. Because the moulds that are used in a precast plant can be reused anywhere from hundreds to thousands of times before they need to be changed, the cost per unit of formwork is typically lower in a precast plant than it is in an onsite casting operation.

Strength and durability are both increased when concrete is reinforced with steel. Concrete, when used by itself, possesses strong compressive strength but lacks tension and shear strength. As a result, it is susceptible to breaking when sustaining loads for extended periods of time. Steel's high tension and shear strengths can help compensate for concrete's lack of these types of strength. Because steel responds similarly to shifting environmental conditions as concrete does, this implies that it will contract and expand with concrete, mitigating the risk of cracking. The most often used kind of reinforcing for concrete is called rebar. Typically, it is fabricated from steel, and it has ribbing on the surface so that it may connect with concrete as it dries. The flexibility of rebar allows it to be bent or constructed into any shape necessary to support the weight of a concrete construction. The most often used material for rebar is carbon steel. On the other hand, corrosion can be stopped by using stainless steel, galvanised steel, and epoxy coatings. These days, precast concrete is employed extensively in a wide variety of construction projects, including both residential and commercial buildings. Because of the characteristics of the precast concrete, this is the case. It is very easy to handle, has superior thermal properties, and long-term durability, among other advantages. Additionally, because of the stringent manufacturing standards, The quality of the concrete that was prefabricated has seen significant advancement. Nevertheless, there is a lack of awareness as well as information regarding precast concrete in our country. This has to be altered, and additional research needs to be conducted in reference to precast. In addition to this, careful attention needs to be paid to the specifics of the precast members' connections. This journal covers a wide range of literary works, and it also publishes the findings of a wide range of research projects. The construction industry has a significant impact on overall economic expansion by virtue of the myriad ripple effects that it has on the various other subsectors of the economy. The concept of precast construction refers to structures in which the majority of their structural components are

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standardized and produced in plants or yards in a location that is either closer to or further from the construction site. These components are then transported to the location where they will be assembled at the construction site. The use of standardized precast parts makes mass production easier, which enables a greater number of buildings to be constructed in a shorter amount of time. Setting up a casting yard, producing and stacking precast pieces, transporting and erecting precast structures are all required steps in the precast construction method. Precast The construction is efficient in terms of time, labor requirements, superior quality, improved performance and finish, optimal material needs, less waste, reduced usage of shuttering, desired shape, and improved finish, among other benefits. The constant search for advancement is something that must be done in the construction sector if it is to keep up with the rapidly expanding infrastructure and the rising demand for high-quality buildings. This will eventually result in the industrialization of the construction business, which can be accomplished through the use of precast concrete construction. After the concrete has approximately cured in an environment that is regulated, the component is transported to the construction site where it is then put in situ. In recent years, the international precast concrete sector has been able to achieve a growth rate that is considered to be satisfactory. This is due to the fact that precast concrete offers structural elements of a high quality, an efficient building process, as well as savings in both time and the entire cost of investment.

There is a need for research to be carried out within the realm of precast buildings and procedures. In the following sections, a literature review of numerous relevant works will be presented with the overarching goal of raising awareness about the benefits of precast and encouraging younger generations to make greater use of it.

2. Literature Review

Sadeghi and Singh (2022) researched that the construction industry is beginning to pay more attention to geothermal energy piles as a means of heating and cooling buildings that is both economical and kind to the environment. In ground source heat pump systems, also known as geothermal heat pumps, energy heaps serve as the principal unit, exchanging heat with the ground below. Driven piles, also known as displacement piles, are distinguished from cast-in-place piles, also known as non-displacement piles, in terms of their construction method. The purpose of this study is to provide a thorough understanding of the issues that are involved in

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the building of driven precast concrete energy pile foundations as well as to discuss the various methods of design and construction for these foundations. In addition, both precast and cast-in-place energy pile foundations are evaluated and contrasted against one another. According to the findings of this study, precast concrete-driven energy pile foundations are a viable and cost-effective alternative to cast-in-place energy piles. In addition to higher levels of quality control and quality assurance throughout the building process, driven concrete energy piles also have an installation technique that is simpler, quicker, and more dependable. The technological, economic, and environmental benefits and drawbacks of such piles, along with a number of additional potential benefits and drawbacks, are dissected in greater detail. However, there is a shortage of norms, design standards, and expertise for employing such foundations as energy piles despite the fact that driven precast concrete foundations have a big market all over the world.

Reichenbach and Kromoser (2021) found that the recent analysis of the building sector reveals both a low level of automation in manufacturing and construction, as well as a very low level of efficiency with regard to the utilisation of building materials. The sector is also struggling with a lack of trained people in mechanical engineering and construction, which has led to an obvious shift toward the use of automated production processes. In light of the fact that concrete is the primary building material utilised on a global scale, the focus of this paper will be on the most recent developments in automated precast concrete construction, with specific attention paid to the automated manufacturing processes and procedures. In the precast sector, numerous new uses of robotics and automated systems have been developed as a direct result of the high level of innovativeness displayed by specific research institutions and firms. There will be a presentation of a classification of the production processes and production methods according to two scales of varying degrees of automation. In addition, the environmental, economic, and social sustainability components of the design, production, and construction of concrete structures will be discussed. This pertains to the use of concrete for building purposes.

Vinutha et al. (2021) conducted a study and found that although it has significant advantages over cast-in-place construction, precast construction is not as widely accepted in India as it is in other parts of the world, despite the fact that it is increasingly widespread everywhere in the

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world. When it comes to giving the building its overall robustness, selecting an appropriate connection method for precast pieces is of the utmost importance. Because the horizontal load is transferred to the vertical load resisting structural elements by the diaphragm action, the precast slab to beam connection is regarded as an essential prefabricated connection. This is the case because it is one of the precast connections. The seismic performance of the precast slab to beam connections is the primary topic of discussion in this paper, which also includes an experimental evaluation of the fundamental design concepts and detailing of the connections. The work that will be done in subsequent studies to refine the slab to beam linkages will be made easier by this outline.

Priya et al. (2018) According to research conducted them the majority of building activities in India are carried out using the standard cast in place method of construction. However, there is still a significant need for residential construction in India. As a result, the activities related to the construction must proceed at a considerably more rapid pace. These days, precast concrete is widely utilised in a variety of construction projects, including those involving residential and commercial buildings. This is due to the many benefits that come along with using precast concrete. It can withstand high temperatures, has excellent thermal properties, is very simple to work with, and so on. Because it is produced in an environment with a high level of control, precast concrete also has a significantly higher quality. On the other hand, our nation suffers from a lack of awareness and understanding regarding precast concrete, which is a disadvantage. This lack of awareness and knowledge is a problem.

Mire et al. (2017) conducted research on that. Since precast members are cast in factories rather than on sites, this causes a shift in the distribution of labor, which ultimately results in a lower overall cast of construction than a conventional system would. The production of construction members in a factory, such as the slab, the column, and the beam, results in increased productivity with increased quality and a reduction in the total amount of time required for construction because all construction members are only connected on the construction site. In principle, the expenditures associated with building with precast technology are going to be more than those associated with building with cast-in-place technology. However, when we take into account the cost of wastage as well as the speed at which building can be completed with high-quality precast concrete, the overall cost of

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construction is cheaper. The most notable advantages of utilizing precast concrete technology are an increase in product quality, a decrease in prices related to labor, a speeding up of construction timeframes, and a reduction in waste amounts.

Cho et al. (2017) Research conducted for thesis examines the similarities and differences between traditional slab systems and half precast concrete slab systems. It is believed that a system known as a half-precast concrete slab system, or HPCSS, displays exceptional structural performance in comparison to typical slab systems. The abbreviation for this system is "HPCSS." On the other side, there is an extreme lack of detailed study that explores the difficulties associated with the construction of an HPCSS. According to the findings, I the construction productivity of an HPCSS is approximately 1.7 times that of a traditional slab system, and (ii) the cost per productivity unit of an HPCSS is higher than that of a traditional slab system. According to the findings of this research, it should be possible to design an effective construction plan for a building site that includes an HPCSS installation, and it also appears likely that the HPCSS will be put to use in the near future. Both of these things are supported by the fact that this research was conducted.

Priya and Kumar (2016) researched that carried the construction industry is transitioning away from the practice of implementing conventional methodology in favor of a number of newly developed innovations in the process of construction and the selection of materials. By utilizing superior construction tools, equipment, and materials, as well as thorough pre-project preparation, the precast method of building has the potential to boost both productivity and the quality of the finished result. Given that there is now no organized entity, this study is absolutely necessary. The conventional way of building and precast construction are compared and contrasted in this study thesis. It was found that the overall cost required for constructing the building using the precast concrete method is reduced by 20% when compared to the cost required for constructing the building using the conventional method. This discovery was made after it was discovered that the overall cost required for constructing the building using the conventional method.

Lanke and Venkateshwarlu (2016) completed a thesis in which they compared the designs, costs, and construction times of precast and RCC buildings. In addition to these factors, the analysis also takes into account a variety of other, less important factors, including the rate of

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construction, the quality control, the environmental conditions, the labour resources, the durability, connection, size, and shape, amongst others. There is a comparison made between the cost and the length of time. One building is selected to serve as a case study, and the design process is repeated for that building using precast construction as well as traditional cast-in-situ construction. The results of this investigation reveal that the cost of constructing a building using prefabricated components is significantly lower, and the amount of time required is also significantly less than that required by conventional methods. It is possible to draw the conclusion from all of this research that the precast concrete system is more cost-effective than the conventional cast in place method. However, there are still some conditions that need to be taken into consideration when using precast, such as the quantity of construction, the distance between the building site and the manufacturing unit, and the type of building.

Dhumal (2015) found that the purpose of the research paper that was carried out by is to investigate the connection of precast members in seismic conditions. The author conducts research into the seismic response of precast structures and how it is caused by the behaviour of the beam to column connection. In regions with a high seismic activity level, a poorly built building that is shaken by an earthquake can cause extensive damage to the entire building. Connection is one of the essential components that can help limit the amount of damage a building sustains. The intricate link between the fabrication steps will shorten the amount of time needed for the building. Understanding the actual connection behaviour of precast concrete is very important, particularly for buildings that are designed and built in areas that are prone to high levels of seismic activity. There are a great number of advantages offered by precast technology, including shorter construction times, improved quality control, construction sites that are cleaner and safer, and many more. Concrete that has been precast is concrete that has been made specifically for the purpose of casting.

Gopinathan and Subramanian (2013) According to the authors, some of the most recent innovations in bridge construction involve the implementation of novel construction techniques that simplify the building process and shorten the amount of time required to complete the overall project. Currently looking into whether or not various connection configurations are suitable for use in regions with moderate to high levels of seismic activity. In areas prone to earthquakes, the load capacity of any connection being considered, the level of ductility it

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possesses, and its ability to be repaired are three significant acceptance criteria.

Ameli et al. (2014) thesis was written by on a two-dimensional, three-bay, five-storey prefabricated frame that was subjected to lateral loading. Welding and bolting were used to reinforce the joints in the beam column junction as well as the joints in the beam to beam connection. These joints were strengthened by using specially designed steel bolts and L-angles. The failure of the frame occurred when it was subjected to lateral cyclic load. The ANSYS model is used to make comparisons with the results. Research was carried out on the efficiency and functionality of beam-column joints and beam-beam joints, and the behaviour of a prefabricated frame was contrasted with that of a monolithic frame. This investigation's focus is on studying Joints in beam column junction as well as Joints in beam to beam connection as its two main areas of inquiry.

3. Components of the Technology Behind Precast Concrete

Tilts and hollow cores are the two different types of structural precast elements that can be differentiated from one another based on the production method that was utilised to manufacture the structural precast elements. The first category, known as tilts, comprises elements such as columns, beams, canopies, wall panels, cladding, balconies, staircases, and landings. The second category, known as the hollow core, is comprised of slabs.

Hollow and solid slabs are the two different types of precast slabs. The precast slab can be divided into these two categories. The hollow component of the slab lies within the zone of zero stresses, which not only improves insulation but also lowers the overall dead load of the structural system.

Figure-1:- Hollow core precast slab

On the other hand, the method of tilting bed with lateral longitudinal reinforcement is utilised in the construction of the solid slab. For the numerous MEP services, common places like restrooms need to have these slabs installed in order to function properly.

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Figure-2:- Solid precast slab

Precast columns are corbelled for simple column-beam connections. Beam systems are characterized by structural position. When floor loading is symmetrical, internal beams are employed; otherwise, exterior beams are used.

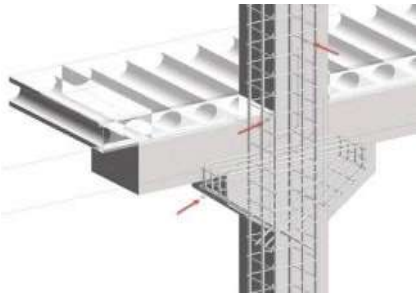

Figure-3:- Precast column with corbel and beams

Precast wall panels offer higher finish surfaces and avoid plaster and touch-ups. These wall panels improve lateral construction stability..

Figure-4: Precast wall panels

Figure-5: Precast Staircase

Precast staircases don't require shuttering or strengthening on-site and have a high-quality finish. It can be thrown as a continuous unit or as independent flights and landings."

Precast systems need connections to transfer load and provide continuity and monolithic behaviour. Horizontal and vertical joints are included. Durability, economy, and uniformity guide the design of these connectors.

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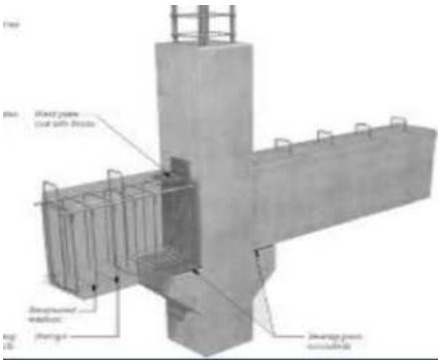

Figure-6: Information on the beam and column connections

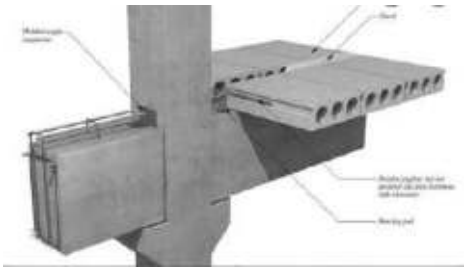

Figure-7: The connection details between the beam and the hollow slab

- Precast concrete construction requires less labour and is lighter and more thermally insulating.
- Construction time can be reduced by 20% compared to conventional methods.
- Precast construction guarantees quality.
- Precast topping slab improves cracking moment.
- Precast concrete is more ductile than monolithic.
- Construction moves faster.
- Precast construction ensures quality.

4. Conclusion

From the examination of numerous literatures, it has been revealed that. Precast is used internationally and has several properties, such as resisting seismic and cyclic loads.

- It's well-made.
- Precast construction increases construction speed and reduces labour.
- Precast installation and connection are uncomplicated.

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- Precast building has several benefits, but India is unresponsive. They choose conventional building because precast is more expensive.
- Our country may lack precast knowledge.

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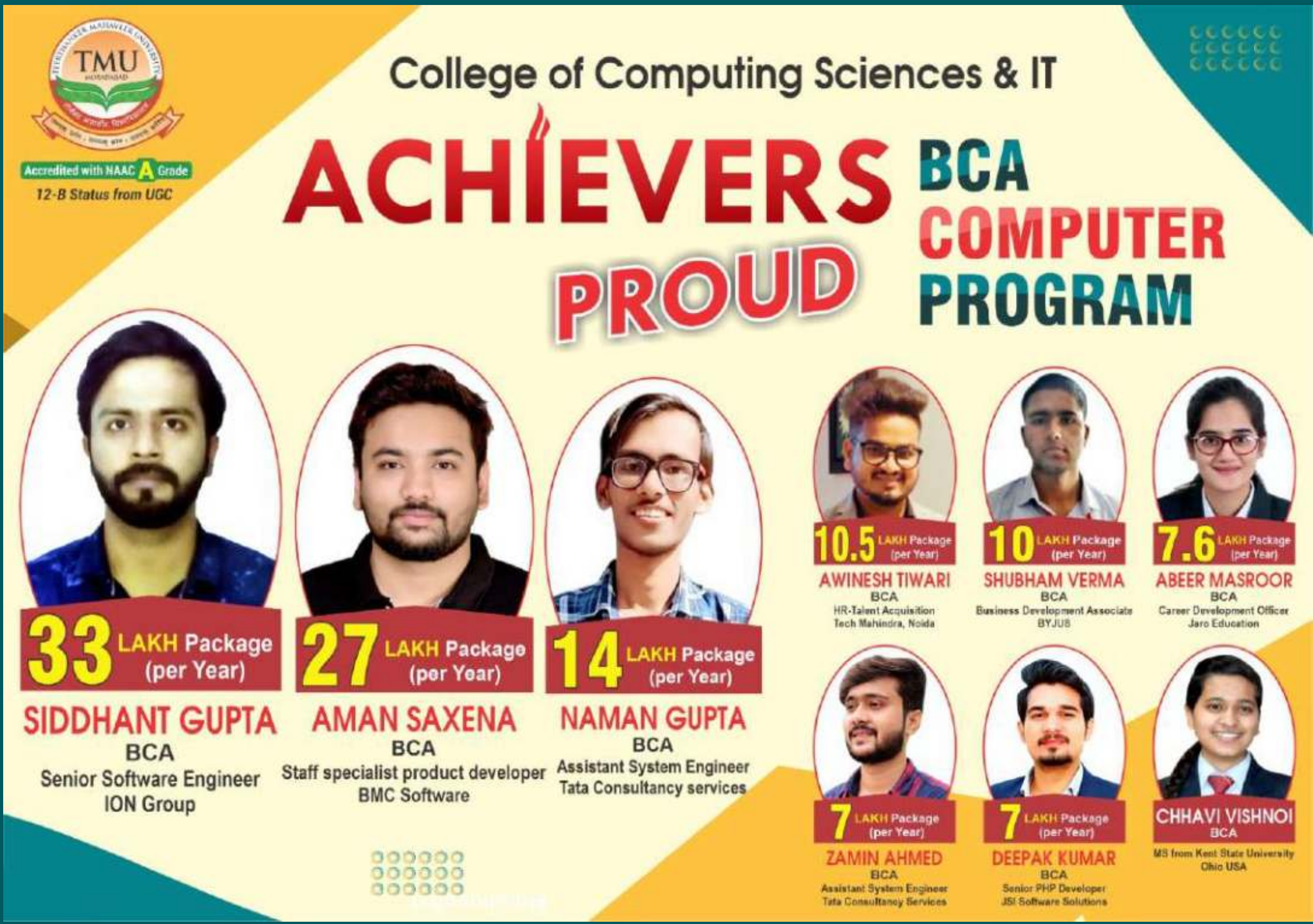
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