



**IETE Sponsored
2025 National Conference
on
Innovations in Science,
Engineering and Technology.
24 June 2025, (Tuesday)**



PROCEEDINGS

Organized by

**CSMSS Chh. Shahu College of Engineering
Kanchanwadi, Paithan Road,
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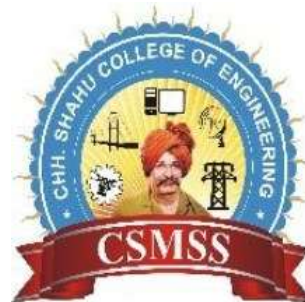


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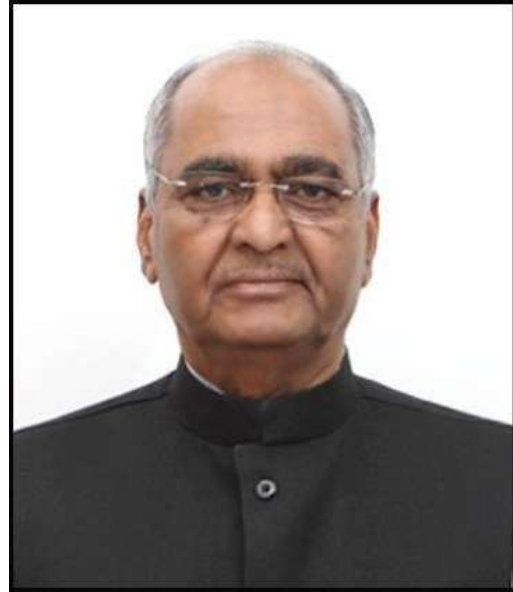
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FORWARDINGS:



**Hon. Shri. Ranjeet Mulay,
President, CSMSS**



**Hon. Shri. Padmakarrao Mulay
Secretary, CSMSS**

It gives us immense pride and pleasure to extend our warmest greetings to all the distinguished guests, keynote speakers, researchers, faculty members, and student participants attending the 2025 National Conference on Innovations in Science, Engineering and Technology (NCISET 2025) organized by the CSMSS Chh. Shahu College of Engineering Chhatrapati Sambhajinagar.

In today's rapidly evolving world, science and engineering are the driving forces behind innovation, progress, and sustainable development. Academic platforms such as this conference play a pivotal role in bringing together bright minds, fostering collaboration, and promoting a culture of research and inquiry. They provide an invaluable opportunity for knowledge exchange and cross-disciplinary dialogue that helps address some of the most pressing global challenges.

We are especially proud of our faculty and students for their dedicated efforts in organizing this event and curating a platform that encourages quality research and innovation. We also appreciate the enthusiastic participation of delegates from various institutions, which is a testament to the academic community's commitment to continuous growth.

We congratulate the organizers and extend our best wishes for the grand success of the conference. We are confident that the deliberations and discussions will yield valuable insights and inspire new directions for future research and development.

May this conference be a fruitful and enriching experience for all.

FORWARDINGS:



Hon. Dr. S. G. Deshmukh,
Administrative Officer, CSMSS.



Dr. G. B. Dongre
Principal, CSMSS CSCOE

It is with immense pleasure and a deep sense of pride that we extend my warmest greetings to all participants, speakers, researchers, academicians, and delegates attending the 2025 National Conference on Innovations in Science, Engineering and Technology (NCISET 2025), organized by CSMSS Chh. Shahu College of Engineering Chhatrapati Sambhajnagar.

In an age characterized by rapid scientific discovery and technological innovation, the role of interdisciplinary research in engineering and the sciences has become more crucial than ever before. This conference offers a dynamic platform to explore emerging trends, share breakthrough ideas, and foster collaboration between academia, industry, and research institutions. It reflects the spirit of inquiry and knowledge dissemination that lies at the heart of higher education and scientific advancement.

We applaud the organizing committee, faculty coordinators, and student volunteers for their tireless efforts in bringing together such a rich confluence of minds. Their dedication has ensured that the conference meets high academic standards while also providing an engaging and intellectually stimulating experience for all attendees.

We are confident that the outcomes of this conference will not only contribute to the scholarly community but also inspire innovative solutions to real-world problems. We encourage all participants to engage actively in discussions, forge new collaborations, and explore the opportunities that this gathering presents.

On behalf of the entire campus community, we welcome you to this academic celebration and wish the conference grand success.

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About the CSMSS CSCOE:

CSMSS Chh. Shahu College of Engineering (CSMSS CSCOE) Kanchanwadi, Chhatrapati Sambhajnagar, established in 2013 by Chhatrapati Shahu Maharaj Shikshan Santha (CSMSS). CSMSS CSCOE is approved by All India Council for Technical Education (AICTE), New Delhi and affiliated to Dr. Babasaheb Ambedkar Technological University (DBATU) Lonere, Raigad, Maharashtra.

Institute offers eight undergraduate programs: Civil Engineering, Computer Science & Engineering, Electronics & Computer Engineering, Electrical Engineering, Mechanical Engineering, Artificial Intelligence & Data science, Electronics Engineering (VLSI Design and Technology), and Electronics and Communication Engineering (Advanced Communication Technology) with total intake of 840 for undergraduate programs and six Post graduate programs: Computer Science & Engineering, Electronics & Telecommunication Engineering, Automation and Robotics, Civil Engineering (CASE), Electronics Engineering (VLSI Design and Technology) and Electronics and Communication Engineering (Advanced Communication Technology) with intake 12 students to each program.

CSMSS CSCOE is adhering to National Education Policy-2020 with institute vision and mission to provide the quality technical education to develop good human resources. Awareness in the faculty members is initiated on requirements of NEP like choice-based curriculum, multiple entry and exit of students, technological improvements in teaching and learning, innovative and critical thinking. In NEP the course structure for academic programs may be redesigned and include multidisciplinary and interdisciplinary courses as electives, open electives.

The Institute has well-furnished infrastructure, separate hostels for girls and boys. Academic blocks consist of classrooms, state-of-the-art laboratories, computer centres, staff rooms and seminar halls, etc. Each department has its own computing facilities with LAN, Wi-Fi, and required software. The library operates with software for automation. It has air-conditioned reading hall, a stockpile of 2934 titles, 21272 volumes, access to 21295 e-Books, 12186 e-Journals.

An auditorium of capacity of 550 people, canteen, hospital, medical and general stores, post office, Bank ATM, on the premises. Students are provided with facilities of indoor games with fully equipped gym, outdoor sports with playgrounds and equipment. Round the clock Security Guards and CCTV surveillance is available.

The institute's strengths lie in its support systems, including a student counselling system, training and placement cell, departmental students associations, an active NSS unit, a Wi-Fi-enabled campus, and various centres of excellence.

Our institute's motto covers students' welfare, academic growth, placement opportunities, and overall personality development.

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PREFACE

The 2025 National Conference on Innovations in Science, Engineering, and Technology (NCISET 2025) stands as a prestigious platform dedicated to fostering innovation, research excellence, and interdisciplinary collaboration. It brings together a vibrant community of researchers, academicians, professionals, and students from diverse fields to share their insights, present pioneering research, and explore practical advancements addressing contemporary challenges in science, engineering, technology, and management.

NCISET 2025 aspires to serve as a catalyst for intellectual exchange and collaborative innovation—an environment where ideas converge, knowledge expands, and meaningful solutions emerge. The conference underscores the importance of critical thinking, creative problem-solving, and ethical research dissemination, while promoting synergy between academia and industry.

In today's rapidly evolving technological era, innovation and research are the driving forces of sustainable development. Through its sessions, deliberations, and discussions, NCISET 2025 seeks to contribute to national growth and global progress by advancing the frontiers of science and technology.

We express our deepest gratitude to all those whose dedication and hard work have made this conference possible - the Organizing Committee, Technical Review Committee, Scientific Program Committee, Publicity and Publication Teams, Session Chairs, Keynote Speakers, Track Coordinators, and all the faculty and student volunteers who worked tirelessly behind the scenes. Their collective effort, commitment, and professionalism have been instrumental in shaping NCISET 2025 into a meaningful and successful academic event.

We also extend heartfelt thanks to all the authors, reviewers, and participants for their valuable contributions and active engagement, which enrich the academic discourse and uphold the spirit of innovation that this conference embodies.

May the discussions and outcomes of NCISET 2025 inspire continued research, collaboration, and discovery in the pursuit of excellence.

Dr. Yogesh H. Bhosale

CONVENER

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Keynote Address

Adulteration Detection in Pharmaceutical Materials Using Hyperspectral Remote Sensing Data

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Abstract— Hyperspectral remote sensing is a growing field that combines knowledge from different areas like spectroscopy, imaging, and data analysis. It works by capturing images in many narrow and continuous bands of light. This helps to detect small differences in how materials absorb light, which can reveal important details about their physical and chemical makeup. Hyperspectral remote sensing is a useful technology for identifying and detecting different materials accurately. Hyperspectral remote sensing have numerous applications in various filed likes Agriculture and Crop Monitoring, Mineral Exploration and Geology, Environmental Monitoring, Forestry, Water Quality Assessment, Soil Mapping and Analysis, Military and Defense, and so on. It can be used for Quality Control and Assurance, Drug Development and Formulation, Counterfeit Detection (Fake Medicines), Raw Material Analysis. Counterfeit medicines or Falsified medicines is one of the critical problem all over the world. According to the World Health Organization (WHO) the worldwide revenue of falsified medicines is around 200 billion dollars (USD). In pharmaceutical the counterfeiting of medicines can be type of underdoes, overdose or having wrong Active Pharmaceutical Ingredients (API) or the API is not present. Due to counterfeiting of medicines sometimes it causes to people to lose their health as well as money. Such a falsified medicines can not only cause serious illness but death also. To identify this type of counterfeit or fake

medicines is challenging task. In pharmaceutical domain, now a days Spectroscopic technique is most famous, effective and widely used in pharmaceutical industry due to its numerous advantages. It is fast and non-destructive and accurate technique preferably use for analysing, finding counterfeit/fake, substandard medicines qualitatively and quantitatively analysing the pharmaceutical materials. We used ASDFieldSpec4 Spectroradiometer NIR range for collection of Hyperspectral data. We applied various Machine Learning and Deep Learning techniques for classification. Finally we have implemented a GUI model for the detection of adulteration level from 0% - 100% of given Paracetamol sample.

Keywords— ASDFieldSpec4 Spectroradiometer, ENVI, Paracetamol, Near Infrared (NIR), Hyperspectral Data.

Introduction

The pharmaceutical industry is expanding rapidly all over the world. The Indian pharmaceutical industry is one of the largest and most developed industry. The problem of quality assessment of pharmaceutical solid dosage form is important all over the world. Falsified or counterfeit drugs are one of the major problems in the world today [1]. The World Health Organization (WHO) estimates that the global market for counterfeit medications generates about \$200 billion annually (USD). In the pharmaceutical industry, counterfeit medications can take the form of under or overdosing, having the incorrect Active

Pharmaceutical Ingredients (API), or not having any API at all. Sometimes people lose both money and their health due to the counterfeiting of drugs [2]. Such fake medications have the potential to not only cause significant disease but also death. Ensuring quality of medicine is becoming more important and challenging, this generates the need for more fast and smart technique to identify the fake medicines. Pharmaceutical solid dosage forms for oral use are the most common pharmaceutical formulation types worldwide. They are complex multicomponent System that may be available in many diverse structures such as powders, granule, compressed tablet, chewable tablet and capsules [3]. To study the pharmaceutical solid dosage forms is important aspect in current era. The various methods like Near Infrared Chemical Imaging (NIR-CI), High and Ultra Performance Liquid Chromatography (HPLC), NIR Spectroscopic Technique, Hyperspectral Imaging and so on, are available to analyze the pharmaceutical solid dosage forms, Identification of the contents from solid dosage forms, determined the structure of chemical compounds used in the formulation of pharmaceutical product [4]. India has faced challenges in regulating its pharmaceutical industry, and this has created opportunities for counterfeit drugs to enter the market. The World Health Organization (WHO) has estimated that around 20% of drugs sold in India could be counterfeit or substandard.

Hyperspectral Remote Sensing

Imaging and non-imaging spectroscopy included in Hyperspectral Remote Sensing. In recent developments in remote sensing and in Geographic Information System (GIS) has focused the process for evolving of Hyperspectral sensors, which is comparatively new technology that being used by the researcher currently for recognition and identification of material, crop species discrimination, soil analysis, man-made materials and terrestrial vegetation applications, Dairy Products domains [5, 6]. For over 100 years Hyperspectral Remote Sensing is used for analysis of various objects and their biological as well as chemical compositions. Hyperspectral Sensors provide physical and chemical properties of object in non-destructive way. Spectroscopy is the mechanism is used to detect specific absorption features due to particular bonding in solid, liquid and gaseous objects. Hyperspectral sensors covers very wide range of electromagnetic spectrum

including visible, Near Infrared (NIR) and Short Wave Infrared (SWIR) regions [7,8]. Figure 1 shows the electromagnetic spectrum in which all types of electromagnetic radiations are available. The Spectroscopic devices are worked on Near Infrared range which is specifically use for material analysis. It helps to find out the contents are available in it with the help of spectrogram or Spectral signature given by the Spectroradiometer in particular wavelength.

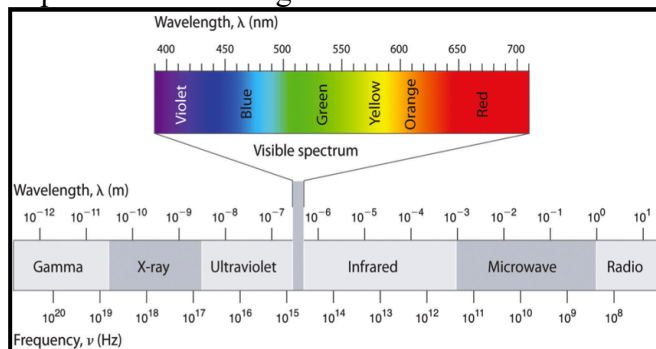


Fig. 1 Electromagnetic Spectrum for Remote Sensing

NIR Spectroscopic Application in Pharmaceutical Domain.

Near-infrared (NIR) spectroscopy is a valuable analytical technique widely used in the pharmaceutical industry for various applications. It is a non-destructive and rapid method that provides information about the chemical composition of pharmaceutical products [9, 10]. Here are some important NIR spectroscopic applications in the pharmaceutical domain:

Blend Uniformity Testing: In the manufacturing of solid dosage forms (tablets, capsules), ensuring the uniform distribution of active pharmaceutical ingredients (APIs) and excipients is critical. NIR spectroscopy can be used to assess blend uniformity without the need for destructive sampling. It helps in real-time monitoring of the mixing process and reduces the risk of content non-uniformity [11, 12].

Counterfeit Drug Detection: NIR spectroscopy can be employed to detect counterfeit drugs by comparing the spectra of authentic products to those of suspected counterfeits. Variations in the spectra can reveal differences in chemical composition.

Process Analytical Technology (PAT): NIR spectroscopy is a key component of PAT initiatives in pharmaceutical manufacturing. It enables real-time monitoring of critical process parameters, facilitating process optimization and ensuring product quality [13].

Rapid Method Development: NIR spectroscopy offers a rapid method development process, allowing pharmaceutical companies to develop and validate analytical methods more quickly than traditional techniques [14].

Overall, NIR spectroscopy has become an indispensable tool in the pharmaceutical industry for ensuring product quality, optimizing manufacturing processes, and complying with regulatory requirements. Its non-destructive nature, speed, and versatility make it a valuable asset for pharmaceutical companies seeking to improve efficiency and product quality.

Techniques for analyzing pharmaceutical solid dosage forms

There are various techniques available for analysis of pharmaceutical solid dosage forms. Non-invasive technique is nothing but the nondestructive method, in that the samples do not touched by the device. Invasive technique can touch the sample and added some solvents, chemicals to determine the quality of sample and analyse that sample [15]. For non-invasive technique the various spectrosopes are used like ASD FieldSpec4, Raman Spectroscopy etc. [16] The techniques like, UV/VIS spectroscopic technique, Capillary electrophoresis, Vibrational spectrosopes, Near Infrared Spectroscopic technique, Near Infrared Chemical Imaging (NIR-CI) technique, Chromatographic technique (Thin layer chromatography, Gas chromatography, High and ultra-performance, liquid chromatography), HPLC technique, Hyper spectral Imaging technique etc [17].

SPECTROSCOPIC TECHNIQUE

Spectroscopy refers to a large amount of different kinds of techniques that employ radiation in order to obtain data on the structure and properties of matter, which is used for solving a wide variety of analytical problems [18]. Spectroscopy technique can provide information about pharmaceutical solid dosage forms like tablet, powder etc. It can be used to determine the content from material, determine its impurities and comparing related substances, determine of molecular structure etc. The spectroscopy can be used in Agriculture area. Spectroscopy can be used in soil to find various content from it like salt, moisture, carbon etc. [19] To use this technique various Infrared spectroscopic methods are

available like, FTIR, ATR, DRIFT, NIR, Raman Spectroscopy etc. The Figure 2 shows the schematic view of Near Infrared Spectroscopy that is ASDFieldSpec4 Spectroradiometer. We used this device for our further research.

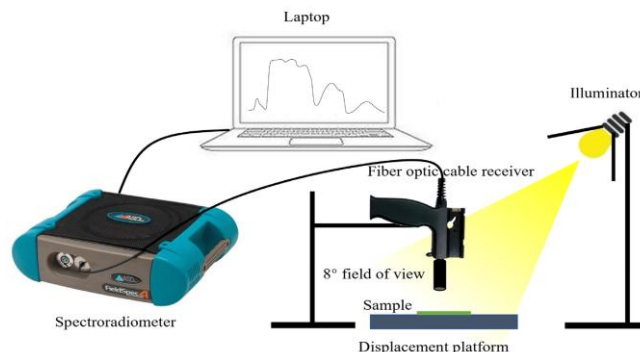


Fig. 2 Spectroscopic Technique

ManfeiXu, Luwei Zhou et al. and its co-workers used Near Infrared Chemical Imaging technique for quantitative analysis of pharmaceutical tablet formulation. They were used Near Infrared (NIR) spectroscopy with chemical imaging. A four ingredient pharmaceutical formulation was used to produce the NIR-CI data set. A NIR lining mapping instrumentation was applied to analyze the samples. For data processing and analysis purpose the hyper-view software and spectrum image software were used. The other data analysis was performed by home-made routines programmed in MATLAB 2009 software. The results of the model were R² Val 0.981%, RMSEG 0.631%, RMSEV 0.484% and RMSEP 0.631 %, indication that this model is reliable [20].

Xiaojing Chen, Di Wu et al.22 and its co-workers developed a method to differentiate species of panax, including American panaxquinquefoliuml, Chinese panaxquinquefolium and Chinese panax ginseng. The panax samples were provided by school by pharmacy of Wenzhou medical college china. The spectra measurement was taken using a handheld spectroradiometer, FieldSpec Pro FR (325 - 1,075 nm. Genetic algorithm and least square support vector machine (LS-SVM) methodology is used for data analysis. The author got the 99.90% accuracy;it's showed that VIS-SWNIR spectroscopy technique is reliable [21].

Rohit Gupta, Deshmukh R. R. et al. and its coworkers developed a method for finding Spectral indices of Pharmaceutical Excipients and Paracetamol drug using preprocessing techniques like Savitzky golay filter and 2nd derivatives. For development of Spectral library the ENVI 5.5

remote sensing and GIS software was used. The common excipients like microcrystalline cellulose, Talc, Maze starch and pure paracetamol was got it as gift sample for research purpose. The ASD FiledSpec4 Spectroradiometer that having 350-2500nm device was used for collecting spectral signatures of samples in a control environment laboratory. The author successfully created Spectral library with said method and found the absorption bands related to excipients and for paracetamol drug [22].

Rohit Gupta, Deshmukh R. R. et al. used Near Infrared Sensor in the form of ASD FieldSpec4 Spectroradiometer having 350-2500 nanometer broad spectral range. Spectral database in the form of spectral signature of pharmaceutical samples was collected by NIR sensors. The chemometrics and Savitzky golay filter with First and Second derivative preprocessing techniques was used for sample preparation and preprocessing. For analysis of pharmaceutical data the PLSR Regression model is proposed and for validation of results the cross validation having 10 fold technique is used. As per the result given by authors the model given good results and high accuracy as 99% [23].

Rohit S. Gupta, Ratnadeep R. Deshmukh, et al. analyzes the different types of manufacturers Paracetamol tablets, excipients used for making tablets in pharmaceutical area. The Hyperspectral non imaging data was developed using ASDFieldSpec4 Spectroradiometer, Chemometric and Statistical techniques, Preprocessing techniques like Savitzky golay filter combine with Second derivative, Standard normal variate techniques was used for noise removal and smoothing of spectral data. Hyperspectral dataset developed by ASDFieldSpec4 Spectroradiometer and Machine Learning and Deep Learning techniques was used to developed model that can predict the Paracetamol contents from tablets. For this the Partial least square regression, Support Vector Machine, Random Forest, Decision tree, K-Nearest Neighbor machine learning algorithms was used. The model showed good prediction accuracy by using all the algorithm used in this model, out of which the PLSR algorithm and Random Forest was given higher accuracy on original dataset and with PCA feature extraction algorithm compare to all other algorithms. The accuracy given by PLSR is 98% and by Random Forest is 99% [24].

In Remote Sensing and GIS domain the Spectroscopic techniques plays a vital role not only

in specific area but can be useful in various domains. In food analysis it can be helpful for finding adulteration in it like honey adulteration, dairy products adulteration and so on.

Mokhtar A. Al-Awadhi; Ratnadeep R. Deshmukh Developed a method for detecting adulteration in coconut milk, utilizing infrared spectroscopy. The machine learning three phases was applied like preprocessing, feature extraction, and classification. In the first phase involves removing irrelevant data from coconut milk spectral signals. In the second phase, the Linear Discriminant Analysis (LDA) algorithm was applied for extracting the most discriminating features. In the third phase, the KNearest Neighbor (KNN) model was used to classify coconut milk samples into authentic or adulterated. Finally the author evaluate the performance of the proposed model using a public dataset comprising Fourier Transform Infrared (FTIR) spectral information of pure and contaminated coconut milk samples. The proposed method successfully detects adulteration with a cross-validation accuracy of 93.33% [25].

HYPER SPECTRAL IMAGING TECHNIQUE

Hyperspectral imaging techniques have widely demonstrate their usefulness in different area of interest in pharmaceutical research during the last decade. Hyperspectral imaging is imaging of a target at a large number of discrete wavelength. In its simplest form, a Hyperspectral image forms a “data cube” in which two dimensional represent spectral wavelength. Hyperspectral imaging is like a spectral imaging; it collects and processes information from across the electromagnetic spectrum. Hyperspectral imaging is also known as remote sensing technique; it is use for both imaging and nonimaging data. The objective of Hyperspectral imaging is to obtain the spectrum for each pixel in the image of scene with purpose of finding objects, identifying materials and detecting processes [26]. Hyperspectral imaging can be used in pharmaceutical field for identifying counterfeit medicines.

CHROMATOGRAPHIC TECHNIQUE

Chromatography is the technique that is use in laboratory for separation of mixture. The mixture is dissolved in a fluid called the mobile phase, which carries it through a structure holding another material called the stationary phase. Chromatography can be preparative and analytical.

The use of preparative chromatography is to separate the components of a mixture for later use, and it thus a form of purification [27, 28]. Analytical chromatography is normally used for smaller amount of material chromatographic technique can be used for pharmaceutical analysis and its formulation. Chromatography can be used for purification, identification and separation of the components of a mixture for quantitative and qualitative analysis. Chromatography types are Column chromatography, Ion-exchange chromatography, Gel-permeation (molecular sieve) chromatography, Affinity chromatography, Paper chromatography, Thin-layer chromatography, Dye-ligand chromatography [29, 30].

counterfeiting in paracetamol medicines

Main objective of this research is to analyse different types of Paracetamol tablets available in the market and find out the fake Paracetamol tablets or counterfeiting in it. We choose Paracetamol tablet because it has many uses and used basically for reliving from fever and also worked as pain killer [31]. The Paracetamol tablets can be useful for adults as well as child. Due its huge uses it has higher demand and supply, so there will be more chances of counterfeiting in it. Paracetamol, also known as acetaminophen in the United States and Canada, is a widely used over-the-counter (OTC) medication with several important applications [32]. Figure 3 shows the molecular formula of Paracetamol API. Here are some of the key reasons for the importance and widespread use of Paracetamol:

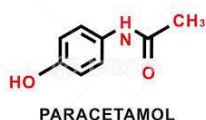


Figure3. Molecular Formula of Paracetamol

Pain Relief: Paracetamol is primarily used as a pain reliever (analgesic). It is effective in reducing mild to moderate pain, such as headaches, toothaches and muscle aches. It's often used for everyday pain management.

Fever Reduction: Paracetamol is also used to lower fever (antipyretic). It can help reduce fever associated with various illnesses, including infections, flu, and colds.

Safe for Most People: Paracetamol is generally considered safe when used as directed. It is well-tolerated by most individuals and has a lower risk of gastrointestinal irritation compared to some other

pain relievers like non-steroidal anti-inflammatory drugs (NSAIDs) [33].

Pediatric Use: Paracetamol is commonly used for children to reduce fever and relieve pain. It comes in various forms, including liquid formulations, making it easier to administer to young children.

OTC Availability: Paracetamol is available over-the-counter without a prescription in many countries, making it easily accessible for self-treatment of minor aches, pains, and fevers.

Combination Products: Paracetamol is often included in combination products with other active ingredients, such as decongestants or antihistamines, to provide relief from multiple symptoms, such as in cold and flu medications.

Research methodology

To achieve our objectives, we proposed a model based on machine learning and deep learning approaches. The details of model will be explained in the following sections. Hyperspectral reflectance of Pharmaceutical samples data was used. The proposed models followed the necessary processing steps, including data collection, sample preparation, preprocessing, classification, and accuracy assessment. For getting good accuracy in results it is necessary that we collect the data in proper way and also we have to process it using recommended methods [34]. The samples were collected from study area and samples were prepared using standard methods. We applied various preprocessing methods like Savitzky golay filter combine with Second derivative, standard normal variate techniques for noise removal and smoothing of spectral data [35, 36, 37]. For Classification and model development we used Support Vector Machine, Random Forest, Decision tree, K-Nearest Neighbor machine learning algorithms was used for development of model.

Study Area and Sample Collection

The study area in this work is Aurangabad, a city in Maharashtra, India. It is located geographically at 75°13'10.75" -75°30'14.87" E longitude and 19°28'43.27"- 20°24'52.19" N latitude. The pharmaceutical samples were collected from various locations in the Aurangabad city. Paracetamol API and Pharmaceutical excipients given by Department of Chemical Technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad and Srinath College of Pharmacy, Bajaj nagar, Waluj, Aurangabad. Paracetamol

tablets from various manufacturers were purchased from local pharmacies from Jubly park, Aurangpura, Padegaon, Waluj, CIDCO, Aurangabad. Geographical location of study area showed in figure 4.1.1.

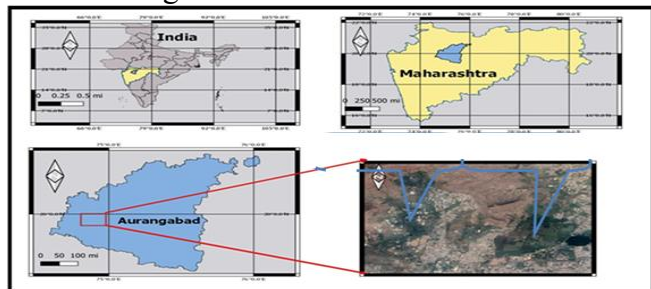


Figure 4. Study area geographical location

Pharmaceutical Samples Collection and Spectral Measurements

In this work, we carried out an extensive survey and found various methods for sample preparation and data collection. We found standard method specifically for pharmaceutical sample preparation and we applied it for our research work [38]. Total 20 types of Paracetamol tablets that having 500mg of Paracetamol prescribed on medicines was purchased from study area from various pharmacies. From 20 tablets each sample given label as Sample 1 to Sample 20. Sample1 (having 20 tablets) were crushed using mortar and pestle and converted to the fine powder. Likewise, all 20 Samples are prepared as fine powder. Weighing machine was used for weighing weight of each sample and it was noted according to the sample number. Every sample was packed in airtight bag and labeled it according to sample number. Figure 5. showed Mortar and Pestle are used to crush the tablets into powder form, Petri dish is used to hold the sample for experiments and Spatula is used to transfer the powder from mortal to petri dish.



Figure 5. Study area geographical location

Instrument and Software Used

ASDFieldSpec4 Spectroradiometer is used for capturing Hyperspectral data of samples. The device have many applications in Remote Sensing domain and it can be used for different types of applications like. Geology and Mining, Defense, Environmental, Material Analysis, Agriculture, etc. From Agriculture and Material Analysis the ASDFieldSpec4 device is using for Soil, Plant, Biomass, Commercial Agriculture, Food analysis, Nutraceuticals and Dietary Supplements, Pharmaceuticals analysis[39, 40, 41]. In this research work, we used this device for Pharmaceuticals applications. The Figure 6 showed the ASDFieldSpec4 Spectroradiometer and Table 1 shows the major specification of ASDFieldSpec4 Spectroradiometer device.



Figure 6. ASDFieldSpec4 Spectroradiometer

TABLE I. SPECIFICATION OF ASDFIELDSP4 DEVICE

Spectroradiometer Name	ASD Field Spec 4 Std. Resolution Spectroradiometer
Spectral Range	350-2500 nanometer
Sampling Interval	1.5 nm @350-1000nm , 2nm @ 1001-2500nm
Spectral Resolution	3 nm @ 700nm , 10nm @ 1400/2100nm
Detectors	VNIR (350-1000 nm), SWIR1 (1001-1800nm), SWIR2 (1801-2500nm)
Input	Direct Mounted Fiber optic (25 degree FOV), optional narrowed FOV fiber optic lens available to change the FOV
Wavelength Accuracy	0.5nm

As the light source, a halogen lamp was fixed on a tripod positioned at 0.5 m from the sample surface at an angle of 45°. Figure 7 shows the laboratory setup of ASD FieldSpec4 at the time of pharmaceutical sample spectral measurement.



Figure 7 The ASD Fieldspec4 setup for sample spectral reflectance measurement

After recording the spectral reflectance, the noisy bands at two regions (350nm–399 nm and 2401nm–2500nm) were removed for each sample because they were identified as internal device noise. We considered the bands' range of 400nm to 2400nm, which means 2001 bands as spectral features for further processing.

In this research work, we used RS3 software for acquisition of Spectral signature of samples. ViewSpec Pro software was used for converting Spectral signature graphs to ASCII/numeric format for analysis of spectral signature and also used to apply statistical process and Chemometrics process like Averaging, Mean, Max, Preprocessing techniques [42]. For developing machine learning model for classification as front end Spider tool was used combine with Python language with essential libraries. We worked on Paracetamol tablets and we purchased it from study area from local pharmacies. We choose paracetamol tablet because of its widely used in pharmaceutical industry. We purchased 20 different types of tablet from various types of manufacturers. While taking spectral signatures of sample, we take 30 utterances for each samples because of higher accuracy and database collection. Table 4.2 shows the all tablets purchased from study area and their manufacturers, size and utterances while taking spectral signature. The ASDFieldSpec4 Spectroradiometer was used for the collection of spectral database.

TABLE 2. The Pharmaceutical Samples and its size for research work

S r. n o	Table t Nam e	Manufacture r	Sam ple Size	Scans
1	Paci mol	Ipca Laboratories Ltd	20	30
2	Parac ip	CIPLA	20	30

3	Parac ip	HSN International	20	30
4	Parac ip	CIPLA	20	30
5	Calpo l	Glaxo SmithKline Pharmaceutic als Ltd	20	30
6	Calpo l 650	Glaxo SmithKline Pharmaceutic als Ltd	20	30
7	Parad en	Den Mark Pharmaceutic als	20	30
8	Parac etamo l IP	Danish Healthcare Ltd	20	30
9	PAR A 500	Advision Laborate Pharmaceutic al Ltd	20	30
1 0	P 500 Table t	Apex Laboratories Pvt Ltd	20	30
1 1	Croci n	Health Encare Pvt.Ltd	20	30
1 2	Corm ax	Roussel Laboratories Pvt Ltd	20	30
1 3	Corm ax	Roussel Laboratories Pvt Ltd	20	30
1 4	Corin al Adva nce	SGS Pharmaceutic als	20	30
1 5	Dolo 650m g	Micro Labs Ltd	20	30
1 6	Dolo	Micro Labs Ltd	20	30
1 7	Dolo par	Micro Labs Ltd	20	30
1 8	T-98 Table t	Mankind Pharma Ltd	20	30
1 9	HEA LTH Y	HEALTHY PARA	20	30

	PAR A			
2 0	Xolo	A M Healthcare	20	30

The total scans represents the total number of spectral reflectance records for each species where each sample was recorded 10-15 times.

In the pharmaceutical industry while making tablets the API is not only the requirements, with API the excipients are also required. For binding tablets and making into proper shape the common excipients are played a major role [43, 44]. The table 4.3 showed the common excipients used in this research work. Same like Paracetamol tablets the excipients and Paracetamol API are acquired as a gift samples from various locations from study area.

TABLE 3. The Pharmaceutical common Excipients and its size for research work

Sr.no	Excipients Name	Gramm	Scans
1	Magnesium Stearate	50	30
2	MCC	50	30
3	Calcium Carbonate	50	30
4	Starch Maize	50	30
5	Lactose	50	30
6	Sucrose	50	30
7	Calcium Sulphate	50	30
8	Talc Powder	50	30
9	Glucose	50	30
10	Mannitol	50	30
11	Sorbitol	50	30
12	Dextrin	50	30
13	HPMC	50	30
14	Kaolin	50	30
15	Sodium Lauryl Sulphate	50	30
16	Gum Acacia Powder	50	30
17	Sodium Chloride	50	30
18	Calcium Phosphate	50	30
19	Gum Tagacanth	50	30
20	Dicalcium Phosphate	50	30

The total 20 types of pharmaceutical excipients are used in this research out of this the common

excipients are Magnesium Stearate, Microcrystalline Cellulose, Starch Maize, Lactose, Sucrose and Talc Powder. For preparing plain Paracetamol tablets this excipients are commonly used.

To get the higher accuracy we scan each sample 30 times and then we take the averaging of each sample used file as mean of sample. The ViewSpec Pro software was used for showing spectral signature and taking averaging and min of excipient and Paracetamol sample. The figure 8 shows the spectral signature of common excipients and Paracetamol API.

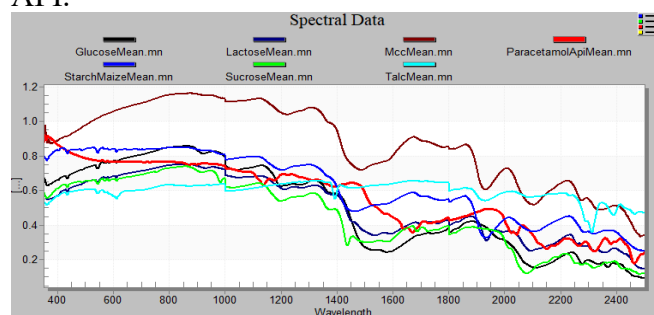


Figure 8 Mean spectral reflectance of Paracetamol API and Common excipients for study

The figure shows that how every sample spectral signature is different from each other. We can see that in red color Paracetamol API is shown and in other colors the pharmaceutical excipients are shown.

Preprocessing of Pharmaceutical Database

Hyperspectral dataset of Common excipients and Paracetamol API was prepared by ASDFieldSpec4 device. The Hyperspectral data need to be preprocessed for removing irrelevant spectral bands, noise and make smoothing for spectral signature curves. It helps to achieve better accuracy in the result. According to the previous study and their efficient results the Savitzky golay filter combined with second derivatives and Standard normal variate (SNV) is widely used as preprocessing technique for NIR dataset. So in this research we applied Savitzky golay filter combine with second derivative and SNV as a preprocessing technique for dataset [45, 46]. The Splice correction and smoothing was done after applying preprocessing techniques. Same process were applied for all the common excipients, Pure Paracetamol and Paracetamol tablets purchased from study area. In the first stage we take all 30 scans or utterances for each sample and showed it by using ViewSpec pro spectral signature

preprocessing software [47]. In the Second stage, we take all samples scanned Mean file and consider that mean file as a final sample for further processing and used this dataset for giving input to the machine learning models. Figure 9 shows after applied preprocessing techniques on Pure Paracetamol Mean Spectral data and Paracetamol tablet Mean Spectral data.

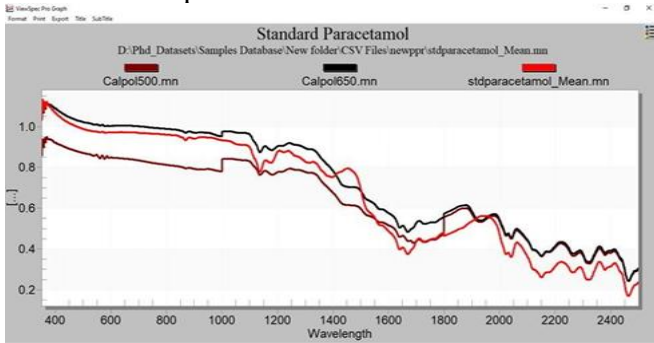


Figure 9 After Smoothing

Third stage, after observing the Mean spectra of sample we processed it to 1st and 2nd derivative as a preprocessing technique for splice correction and to clearly visualize the Absorbance and reflectance bands in it, Figure 10 shows after applied 1st and 2nd derivative, this same process is applied for all the Spectral database.

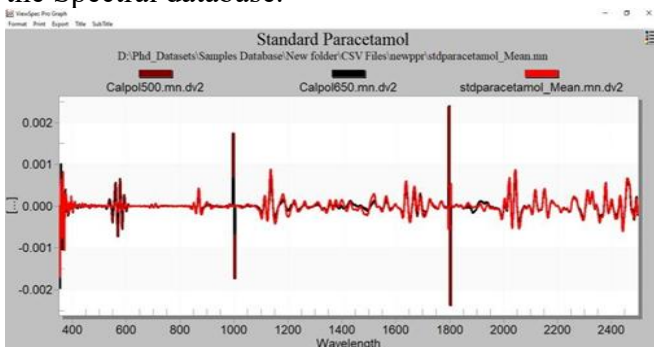


Figure 10 1st and 2nd derivative preprocessing technique

Classification with Machine Learning

The objective of the experiment is to develop the machine learning model that can detect the adulteration level (0%, 25%, 50%, 75%) of given sample [48,49]. As shown in Table 2, from Sample Preparation and Data Collection section samples were prepared and did the following steps from 1-4.

1. Original Medicine Powder
2. Original Medicine Powder is removed ~25% of weight and Mixed with ~25% of Calcium Carbonate

3. Original Medicine Powder is removed ~50% of weight and Mixed with ~50% of Calcium Carbonate

4. Original Medicine Powder is removed ~75% of weight and Mixed with ~75% of Calcium Carbonate

Finally, the dataset was prepared as shown in below table 4.

Table 4. Dataset Classes Label

Class Label	Values
1	Original Medicine Powder
2	25% Adulterated (Low)
3	50% Adulterated (Medium)
4	75% Adulterated (High)

After preparation of dataset, the model was developed having five classifiers with feature extraction techniques using Linear Discriminant Analysis (LDA) and Principal Component Analysis (PCA). Random Forest (RF), K Nearest Neighbor (KNN) and Decision Tree classification algorithms given higher accuracy on original dataset and using PCA feature extraction technique compare to other classifiers [50]. As compare to LDA Feature extraction technique, PCA performed well for all classifiers. Support Vector Machine (SVM) is a linear model for classification and regression problems, here it gives 94% accuracy compare to SVM with Radial Basis Function (RBF) kernel, and it gives 83% accuracy. Table 4.7 shows the performance of various classifiers on original dataset and using LDA and PCA Feature extractor techniques. The below table 5 and Figure 11 shows results of various machine learning algorithm applied in this experiments on original dataset and after applying LDA and PCA feature extraction on original dataset in tabular and graphical format. In this experiment the Random forest machine learning algorithm given higher accuracy on original dataset as well as with PCA feature extractor.

Table 5. Machine learning model results

Machine Learning Algorithms	Machine Learning Model Accuracy		
	Original Data	LDA	PCA

KNN	0.9869	0.9256	0.9872
SVM Linear	0.9428	0.9250	0.8981
SVM RBF	0.8362	0.9263	0.9716
DT	0.9855	0.9181	0.9827
RF	0.9962	0.9241	0.9975

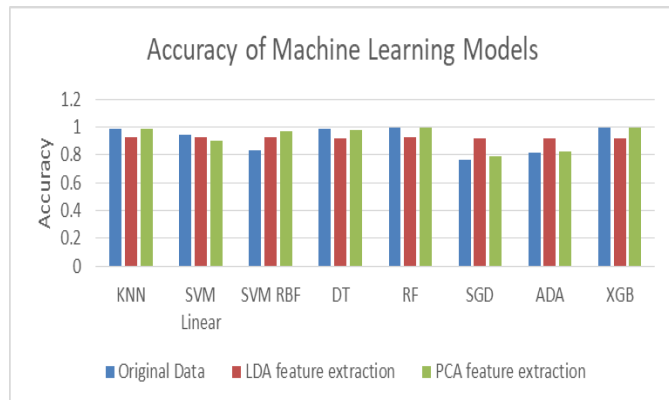


Figure 11 Accuracy graph of machine learning model

We designed and implemented a GUI application for predicting the adulteration level in Pharmaceutical solid dosage forms by using python 3.7. The application started by training the model with a selected classifier using a training dataset and then loading the test data and predicting the adulteration level in the samples. The Pure Paracetamol was taken and created 11 classes from 0 to 100 as label for identification of adulteration level in a sample as shown in Table 6. The weighing machine was used for calculating accurate weight of samples. Spatula and Borosilicate Petri dish was used for holding the sample and mixing accurate amount of calcium carbonate as excipient in pure Paracetamol. After applying said process dataset was developed by using ASDFieldSpec4 NIR Spectroradiometer and giving class labels to the samples. The dataset was distributed in total 11 labels from Pure (0%, 10%, 20%) label up to 100% (adulteration percentage). Finally, the prepared Hyperspectral dataset having 440 features in the form of Spectral signature. This dataset was used to train the proposed model with various machine learning techniques. After this the model is able to identify the adulteration percentage in Paracetamol tablet from 0-100% [51].

Table 6. Adulteration process and label

Label	Pure Paracetamol (gm)	Calcium Carbonate as adulterant(gm)
0	12	0
10	10.8	12.2
20	9.6	2.4
30	8.4	3.6
40	7.2	4.8
50	6	6
60	4.8	7.2
70	3.6	8.4
80	2.4	9.6
90	1.2	10.8
100	0	12

The proposed model developed in Python language. Python is a high-level, general-purpose programming language widely used in Machine learning and Artificial Intelligence area. Python is also use for data analysis. Spyder is an open-source cross-platform integrated development environment (IDE) is used in the process for development of model [52].



Figure 12 Sample and Algorithm selection
Various types of Machine Learning and Deep Learning libraries was used for the proposed system. For this SVM, KNN, SVM with RBF kernel, Decision Tree and Random Forest algorithm was used for testing the adulteration level in the sample. The PCA and LDA was used for feature extraction process and Savitzky golay filter with Second derivative and Standard Normal Variant technique was used for preprocessing the Hyperspectral data.

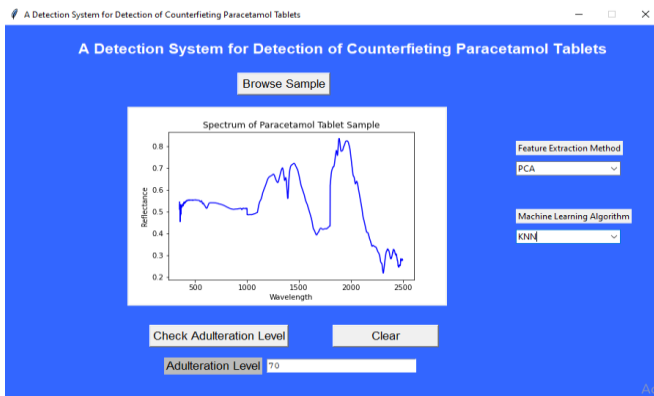


Figure 13 Model result

The process of checking adulteration level in the sample is easy, the screen shots of the developed system is shown in figure 12 and figure 13 First click on browse sample button, then select sample as input to the model, select Feature extraction technique either PCA or LDA, Select machine learning algorithm which you want to use for your sample, Click adulteration level button. As shown in figure 4.14, it will show you the adulteration level and the Spectral signature of sample.

Conclusion

This study aimed to identify the counterfeiting in pharmaceutical solid dosage forms, analyze the content available in medicine and detect adulteration level in Paracetamol tablet from Aurangabad city, Maharashtra, India. The findings obtained in this study have proved that by optimizing ML methods and utilizing Preprocessing and Feature extraction techniques, it is possible to significantly improve the work in pharmaceutical domain for quality assessment, identification of fake medicines, and adulteration detection in Paracetamol tablets. The main conclusions are as follows:

- Remote sensing techniques such as NIR Spectroscopic devices such as ASDFieldSpec4 used in this study can be used effectively to explore and understand the Pharmaceutical solid dosage forms.
- One of the significant challenges in pharmaceutical domain is to identify the contents are mixed in it, and verify its quantity. Medicine content can be effectively identified using Hyperspectral data. This information can be useful for identification of counterfeiting or fake medicines.
- Whatever feature extraction technique used, PCA at proper scales is an encouraging tool to enhance the performance of model.

d) Preprocessing of Hyperspectral data by using Savitzky-Golay filter with first derivatives shows significant difference in result accuracy. Hence, testing with other smoothing filters may show remarkable differences.

e) This study developed various machine learning models with the help of Supervised and Unsupervised algorithms. The highest results were obtained by the models of Random Forest with Feature extraction techniques and without feature extraction technique. According to our findings, the optimal models Random Forest with PCA Feature extraction technique and KNN are superior to the traditional classifiers such as SVM and simple neural network.

f) The advantage of optimal models highlights the importance of well-designed network architecture in Hyperspectral reflectance data classification.

g) The study recommends that among the numerous ML methods of Hyperspectral non-imaging data classification the Random Forest, KNN and Decision Tree are good algorithms.

h) Our findings demonstrated that ML algorithms could effectively analyze the Pharmaceutical solid dosage forms and helps to identify the adulteration level in the sample. Also the study can helpful for finding counterfeiting in Paracetamol tablet and helps to identify the fake medicines available in the market. RF and KNN models could obtain a better result than SVM regarding their suitability for processing large Hyperspectral data.

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Track 01: AI & DS, Paper No: 01

Blood Group Prediction Using Fingerprint

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Abstract— Fingerprints are unique biometric features that remain consistent over an individual's lifetime. Beyond their well-established role in personal identification, fingerprints also contain distinctive ridge patterns and minutiae that may correlate with certain physiological characteristics, including blood groups. In this study, a non-invasive method for blood group prediction is proposed by analyzing fingerprint images using deep learning techniques. A Convolutional Neural Network (CNN) specifically, VGG16 architecture with transfer learning was employed to extract discriminative features from fingerprint patterns. Future research could investigate more diverse and broader datasets and advanced deep learning models. This approach offers a rapid, scalable, and accessible alternative to traditional blood group determination methods, particularly valuable in emergency and resource-limited healthcare settings.

Track 01: AI & DS, Paper No: 02

Deep Learning with Data Augmentation for Eye Disease Detection: An Experimental Study

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Abstract— Accurate detection of eye diseases such as cataract, diabetic retinopathy, and glaucoma from retinal images is critical for early diagnosis and treatment. Deep learning models, particularly convolutional neural networks (CNNs), have shown remarkable success in medical image classification tasks. However, their performance can be limited by the availability and variability of training data. This study investigates the impact of data augmentation techniques on CNN performance for eye disease detection. Two models were trained and evaluated: one without augmentation (Model A) and another incorporating random flips, rotations, zooms, and contrast adjustments (Model B). Results revealed that while Model A achieved an overall accuracy of 82.3% and high per-class F1-scores, Model B exhibited a substantial performance drop to 49.5% accuracy. These findings suggest that the aggressive augmentation strategies applied may have introduced excessive variability, hindering model learning. Future work should focus on optimizing augmentation parameters and training strategies to balance variability and data realism. This study highlights the importance of carefully designed data augmentation in improving deep learning-based eye disease detection systems.

Track 01: AI & DS, Paper No: 04

Comparative Analysis of Machine Learning Techniques for DoS Attack Detection in Vehicular Networks

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Abstract— Vehicular Ad-Hoc Networks (VANETs) are an essential component of intelligent transportation systems (ITS) enables vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication for improving road safety, traffic efficiency, and driving experience. Due to decentralized architecture, they are prone to various cybersecurity threats, particularly Denial-of-Service (DoS) attacks, which can disrupt communication and compromise safety-critical applications. This study presents a comparative evaluation of several machine learning algorithms for detecting DoS attacks in vehicular networks. The performance of Logistic Regression, Decision Trees, K-Nearest Neighbors, Naive Bayes, Gradient Boosting, Random Forest, and Support Vector Machines are analyzed on a simulated VANET dataset. Key performance metrics including accuracy, precision, recall, F1 score and cross-validation scores were used to assess model efficacy. Results indicate that tree-based ensemble models such as Decision Tree, Gradient Boosting, and Random Forest achieve perfect detection performance, significantly outperforming others. These findings underscore the potential of machine learning in enhancing security and reliability in future vehicular communication systems.

Track 01: AI & DS, Paper No: 05

Explainable AI for Medical Diagnosis Using SHAP and LIME.

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Abstract: - In today's healthcare systems, building trust in AI-powered diagnosis tools is crucial. That's where Explainable AI (XAI) comes in—it helps doctors understand how machine learning models make decisions. In this project, we used two popular explainability methods, SHAP and LIME, to interpret the results of Random Forest and XGBoost models applied to two medical datasets: UCI Breast Cancer and Pima Diabetes. The models achieved around 95.2% accuracy for breast cancer detection and 78.4% for diabetes prediction. By using SHAP and LIME, we could see which features played major roles in the predictions—for example, clump thickness was important for breast cancer, while glucose levels stood out for diabetes. Overall, adding explainability made the models more transparent and helpful for medical professionals trying to make informed decisions.

Track 01: AI & DS, Paper No: 7

Data Analytics

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Abstract: In this paper, we explain the concept, Data analytics is the process of collecting, transforming, and organizing data in order to draw conclusions, make predictions, and drive informed decision making. Data analytics is a broad term that includes everything from simply analyzing data to theorizing ways of collecting data and creating the frameworks needed to store it. Data is everywhere, and people use data every day, whether they realize it or not. Daily tasks such as measuring coffee beans to make your morning cup, checking the weather report before deciding what to wear, or tracking your steps throughout the day with a fitness tracker can all be forms of analyzing and using data. Big data analytics is a specialized form of data analytics that deals with extremely large, complex, and diverse datasets that traditional methods cannot handle efficiently. The Big Data analytics is a fast-growing, influential practice and a key enabler for the social business. aims to analyze some of the different analytics methods and tools which can be applied to big data, as well as the opportunities provided by the application of big data analytics in various decision domains.

Track 01: AI & DS, Paper No: 08

Modern AI Tools To Study Human Body Behaviour

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Abstract—The subject of this research is the AI-enabled multimodal analysis of human behavior, a new domain that utilizes artificial intelligence, machine learning, and data fusion. These techniques result in high-level insights into human actions and intents by fusing text, images, and sound data. The paper therefore, elaborates on the entire methodology, covering a comprehensive literature review, methodology, results, discussions, and conclusions, which will shed light on possible applications of AI-enabled multimodal analysis. The literature section reviews existing knowledge in this domain quite exhaustively, which forms the basis on which we build our method. The authors construct a thorough methodology by unifying natural language processing, computer vision, and audio analysis. Thereafter, they clearly outline all steps of data collection, preprocessing, feature extraction, and model training. They present striking results showing the power of AI-enabled multimodal analysis in interpreting complex behavior patterns. These conclusions span sentiment analysis of text, emotion recognition via facial expressions, and insights derived from audio signals. The discussion expands to embrace wide-reaching implications across fields, mentioning ethical aspects: from psychology to marketing. There are a wide range of use cases; however, both responsible AI deployment and protection of privacy are paramount. To summarize, AI-enabled multimodal analysis has the potential for transformation. It transcends boundaries across disciplines and provides meaningful power for understanding human behavior. It is

the hope of this research that one day, these methodologies will be standard tools that will clarify and demystify navigating the intricacies of human actions and intentions.

Track 01: AI & DS, Paper No: 11

Role of Artificial Intelligence in Student Management System

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Abstract: The integration of Artificial Intelligence (AI) into educational institutions has significantly transformed Student Management Systems (SMS), enhancing administrative efficiency, learning personalization, and decision-making processes. This paper presents a comprehensive study on the role of AI in SMS, exploring underlying model architectures, their practical applications, and the ethical implications associated with AI deployment in academic settings. By examining AI technologies such as large language models, computer vision systems, and predictive analytics tools, the paper highlights how AI supports automated admissions, attendance tracking, academic performance monitoring, and behavioral analysis. While these advancements provide numerous benefits, including scalability, real-time insights, and inclusivity, they also introduce challenges related to data privacy, algorithmic bias, and equitable access. The study concludes with a discussion on responsible AI adoption, emphasizing the need for transparency, ethical frameworks, and inclusive design in AI-powered student management solutions.

Track 01: AI & DS, Paper No: 13

Spam Mail Classifier using Naïve Bayes Algorithm

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Abstract - This paper presents a robust and efficient spam mail classifier model developed by using the Naive Bayes algorithm. This is where E-mail spam/ham detection comes into play, playing a significant role in classifying the emails into spam or ham respectively, thus saving users lot of time to fetch their E-mails. This study addresses the challenge of accurately distinguishing legitimate emails (ham) from unsolicited ones (spam) by leveraging the probabilistic framework of Naive Bayes, which is particularly well-suited for text classification due to its simplicity and computational efficiency. This research paper aims to apply the Machine Learning algorithm viz Multinomial Naïve Bayes Classifier to classify E-mails into spam or ham. This work can further be extended to other methods of vectorizing viz the Bag-of Words (BOW) & Term-Frequency-Inverse Document Frequency (TF-IDF) for the said models.

Track 01: AI & DS, Paper No: 14

Sports League Data Analysis : Using Python and ML Models

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Abstract: The Indian Premier League (IPL) is one of the most popular cricket tournaments globally, generating a massive volume of data every season. This project focuses on analyzing historical IPL datasets to extract meaningful insights and patterns related to team performance, player statistics, match outcomes, and strategic decision-making. The analysis involves data preprocessing, exploratory data analysis (EDA), visualization, and the application of statistical and machine learning techniques. Key objectives include identifying the most successful teams and players, understanding the impact of toss decisions, venue influence, and analyzing winning factors. Visualization tools like Matplotlib, Seaborn, and Plotly are used to present trends and comparative analyses in an intuitive manner. The insights derived can benefit team strategists, fans, and analysts by highlighting performance metrics and trends over time. The project demonstrates the power of data science in sports analytics, promoting data-driven decisions in cricket strategy and management.

Track 01: AI & DS, Paper No: 16

A Comparative Study of GIN and GraphSAGE GNN Models for Graph Classifications with Explainable Artificial Intelligence

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Abstract—Graph-based neural networks have gained significant popularity recently due to their capability to automatically and efficiently extract essential features from graphs. Previously, the most common method to handle complex graph-like structures was to compute task-agnostic features using kernel functions. However, these kernels are often computationally expensive and inflexible, making GNNs more appealing. This work attracts broad academic attention, and numerous ready-to-use GNN algorithms have been developed to handle graph classification efficiently. However, experiments are rarely repeatable and often lack strict guidelines. This study provides a general overview of several popular models, focusing on re-evaluating two well-known models: Graph Isomorphism Network (GIN) and GraphSAGE. We conducted over 20 tests using widely used benchmarks on a localized hardware setup with a consistent framework, requiring significant time and computing resources. Our goal is to deliver trustworthy and reproducible findings, enabling GNN practitioners to compare their model architectures with these benchmarks.

Track 01: AI & DS, Paper No: 17

Enhancing Cultural Heritage Tourism in India through Augmented Reality

Abstract: Cultural heritage sites serve as vital touchpoints for preserving and understanding the historical, artistic, and cultural identity of civilizations. Yet, traditional interpretation methods—such as printed plaques, guidebooks, and limited guided tours—often fail to provide immersive, interactive, and multilingual experiences for today’s tech-savvy and diverse audience. To bridge this gap, this paper presents the design and development of an Augmented Reality (AR) Heritage Experience Enhancer: a mobile-based application that transforms heritage site visits into interactive learning journeys.

Track 01: AI & DS, Paper No: 19

Indian Sign Language Recognition System for Real-Time Text and Speech Translation Using Deep Learning and Computer Vision

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Abstract — The communication gap between the hearing-impaired and the general population remains a significant barrier in inclusive interaction. This paper presents a real-time Indian Sign Language (ISL) recognition system that translates hand gestures into both text and speech, and vice versa, using computer vision and machine learning techniques. The system captures 21 hand landmarks using MediaPipe, from which custom geometric features such as angles and distances between key points are computed. A Random Forest classifier is then trained to recognize motions using these engineered features. Speech synthesis and recognition modules support two-way communication. Implemented as a web application using Flask, HTML, CSS, and JavaScript, the system achieves high accuracy across 35 ISL classes and promotes accessibility for India’s speech- and hearing-impaired communities.

Track 01: AI & DS, Paper No: 20

An AI-Driven Surveillance System for Real-time Anomaly Detection and with High Accuracy and Rapid Response

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Abstract— The growing complexity of urban environments has intensified the demand for advanced security mechanisms, particularly as traditional surveillance systems struggle with slow response times and limited threat detection capabilities. This paper introduces an intelligent surveillance solution powered by Artificial Intelligence (AI), aimed at improving urban security through live video processing, sophisticated anomaly detection, and rapid response mechanisms. The proposed system utilizes deep learning models—including Convolutional Neural Networks (CNNs), Long Short-Term Memory (LSTM) architectures, and cutting-edge object detection techniques such as YOLO—to ensure continuous surveillance, precise threat identification, and optimal deployment of emergency resources. It features a hybrid architecture that combines edge computing for low-latency performance with cloud-based analytics to manage large-scale data effectively. Evaluation results reveal notable gains in both accuracy (up to 98.3%) and response efficiency over traditional surveillance setups. Additionally, this study discusses essential aspects of cybersecurity and ethical considerations in AI deployment, such as secure data handling and responsible use. The findings highlight the transformative role of AI-based surveillance systems in promoting safer and more responsive urban ecosystems and outline potential avenues for future research and development.

Track 01: AI & DS, Paper No: 22

Language Translator

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Abstract— Language barriers significantly hinder global communication, education, and accessibility to information. This paper addresses these challenges by implementing an English-to-Marathi language translation system using a Sequence-to-Sequence (Seq2Seq) architecture with Long Short-Term Memory (LSTM) networks. The model comprises an encoder-decoder framework that effectively captures both short-term and long-term dependencies within sequential data. It processes input sequences in the source language and generates accurate translations in the target language. The research includes a comprehensive literature survey on neural machine translation techniques, model development using TensorFlow and Keras, and evaluation of performance based on applications. The proposed system demonstrates promising results for language translation.

Track 01: AI & DS, Paper No: 24

Smart Waste Segregation System

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Abstract—The increasing volume of municipal solid waste, especially in urban areas, has created a critical need for efficient and hygienic waste management solutions. Traditional manual segregation methods are labor-intensive, time-consuming, and prone to human error. This research paper presents the design and development of a Smart Waste Segregation System that leverages deep learning and embedded systems to automate the categorization and physical segregation of waste into wet and dry types. The system integrates a pre-trained VGG16 convolutional neural network for image-based classification, trained on a Kaggle dataset and deployed via a Streamlit web interface. The hardware infrastructure includes a Raspberry Pi for local processing, camera module for image capture, and various sensors such as IR, moisture, and ultrasonic sensors to monitor the waste flow and bin status. A servo motor-driven conveyor belt controlled by an Arduino board is used for physical waste segregation, guided by real-time classification results sent through HC-05 Bluetooth communication. Additionally, an ESP8266 Wi-Fi module is employed to send bin status notifications to mobile devices. The funnel mechanism with an IR sensor ensures the conveyor operates only when waste is present, optimizing energy efficiency. Experimental results demonstrate a classification accuracy of over 93%, validating the system's effectiveness and potential for real-world application in smart cities and institutional waste management.

Track 01: AI & DS, Paper No: 25

Scheme-Connect: An AI-Powered Government Scheme Eligibility Analyzer

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Artificial Intelligence & Data Science

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Abstract—Government welfare schemes in India aim to support the underprivileged yet lack of awareness and complex eligibility criteria limit their impact. We present Scheme-Connect, an AI-powered platform designed to assess an individual's eligibility for various central and state schemes using demographic, socio-economic, and geographic data. The system combines rule-based logic with machine learning and natural language processing to intelligently match users with relevant benefits. Multilingual support, smart filtering, and offline access enhance accessibility. The platform demonstrates improved efficiency and usability compared to traditional manual methods, thus improving social scheme delivery.

Track 01: AI & DS, Paper No: 26

Doctor AI – Medicine Recommendation System

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Abstract— This paper proposes an integrated, robust, and scalable machine learning-based medicine recommendation system tailored for use in medical emergencies. The system combines symptom-based classification, personalized historical data from drug reviews to provide accurate, safe, and effective medication suggestions. Ensemble ML methods improve over traditional models, and simulation results confirm its reliability and efficiency. Online recommender systems are being used increasingly often for hospitals, medical professionals, and drugs. Today, the great majority of consumers look online before asking their doctors for prescription suggestions for a range of health conditions. The medical suggestion system can be valuable when pandemics, floods, or cyclones hit. In the age of Machine Learning (ML), recommender systems give more accurate, precise, and reliable clinical predictions while using less resources.

Track 01: AI & DS, Paper No: 27

Resume Screening and Job Role Prediction using Machine Learning

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Artificial Intelligence & Data Science

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Abstract— In today's competitive job market, recruiters are inundated with a vast number of resumes for a limited number of roles, making the selection process time-consuming and error-prone. This paper proposes an end-to-end resume screening and job role recommendation system using machine learning. The system extracts and classifies candidate resumes into suitable job categories and recommends job roles using the Random Forest algorithm combined with TF-IDF for feature extraction. The application accepts .pdf and .txt resumes, performs text pre-processing, resume parsing, and category prediction in real time. Developed using Python and Flask, the system aims to streamline the recruitment process for educational institutes and small to mid-sized organizations.

Track 01: AI & DS, Paper No: 28

Smart Helmet Detection and Safety Approval System for Two-Wheeler Riders Using Deep Learning

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Artificial Intelligence & Data Science

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Abstract— Road safety is a serious concern, especially for two wheeler riders like motorbike and scooter users. Wearing a helmet can save lives, but many riders still ignore this rule. This project presents a real-time AI-based system that automatically checks if both the driver and the passenger on a two-wheeler are wearing helmets or not. The system uses a deep learning object detection model (YOLOv8) to detect and classify objects in live video or images. Our model is trained on seven specific classes: driver_with_helmet, driver_without_helmet, passenger_with_helmet, passenger_without_helmet, driver, passenger, and bike. After detecting these objects, the system applies smart logic to decide if the ride is “approved” or “not approved.” If the driver is wearing a helmet, the ride is marked approved, even if the passenger is not. If only the passenger is wearing a helmet, or no one is wearing one, the ride is marked not approved. This rule helps ensure that at least the driver, who is in control of the vehicle, follows safety laws. The system works in real-time using a camera and can be used in traffic surveillance, smart city monitoring, or law enforcement systems. By using this solution, manual checking can be reduced, and helmet rule enforcement becomes faster, more accurate, and fully automatic. This project supports safer roads and helps encourage helmet usage among two-wheeler riders.

Track 01: AI & DS, Paper No: 29

Improving Image Super-Resolution with Deep Learning

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Artificial Intelligence & Data Science
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Abstract— This paper presents a deep learning-based approach for Image Super-Resolution (ISR) using Enhanced Super-Resolution Generative Adversarial Network (ESRGAN). The goal is to enhance the resolution and quality of low-resolution images, which is critical in fields such as medical imaging, surveillance, and satellite analysis. The ESRGAN model leverages a generative adversarial network (GAN) architecture with a residual-in-residual dense block (RRDB) to produce photo-realistic high-resolution images. The system is implemented using Python, PyTorch, and OpenCV. The proposed model is trained on the DIV2K dataset and demonstrates significant improvements in Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index (SSIM) compared to traditional interpolation techniques. Results indicate that ESRGAN effectively restores fine textures and sharp edges while preserving visual realism. This research outlines the system design, training pipeline, and deployment strategy, emphasizing the role of GANs in perceptual quality enhancement for ISR tasks.

Track 01: AI & DS, Paper No: 30

CropGuard : GSM-Enabled Pest and Disease Monitoring system for smallholder farms.

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Abstract : Smallholder farmers often face heavy losses due to pests and crop diseases, mainly because early signs go unnoticed and support is hard to access in rural areas. CropGuard is a GSM-based monitoring system designed to solve this issue with simplicity and affordability in mind. It uses basic sensors to detect early signs of pest or disease presence in the field and sends real-time alerts via SMS in the local language no internet required. The system helps farmers take quick action, reducing damage and improving crop yield. With its user-friendly design and low-cost setup, CropGuard offers a practical solution for smarter, more responsive farming in underserved agricultural communities.

Track 01: AI & DS, Paper No: 33

A Voice-Driven AI Assistant for Enhancing Elderly Well-Being

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Abstract— The global increase in the aging population, elderly individuals face growing challenges such as social isolation, cognitive decline, and a lack of continuous care. This paper proposes an intelligent, voice-enabled AI Companion system designed to support the elderly in their daily lives. The system leverages Natural Language Processing (NLP), voice interaction, and smart reminders to assist with medication schedules, health check-ins, and appointment notifications. Additionally, it fosters emotional well-being through storytelling, entertainment, and video call integration with family members. Built using modern technologies like React, Flutter, Node.js, Python, Firebase, and Dialog flow GPT-3, the AI Companion provides a responsive and intuitive interface for elderly users. The system also incorporates an emergency alert mechanism to ensure timely assistance. This solution addresses the critical issue of elderly loneliness and health negligence, aiming to enhance the quality of life for seniors living independently. Preliminary evaluations indicate its potential to serve as a scalable, low-cost alternative to human companionship and continuous monitoring.

Track 01: AI & DS, Paper No: 34

PyCodeML

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Abstract—This electronic document presents PyCodeML, a Python-based AutoML framework developed to streamline the process of algorithm selection and model training for classification and regression tasks. By integrating enhanced Exploratory Data Analysis (EDA) and a genetic algorithm-based optimization strategy, the tool intelligently recommends the most suitable machine learning model for a given dataset. Our system automates model evaluation and performance comparison, reducing the need for manual intervention and domain expertise. Designed with usability and accuracy in mind, PyCodeML empowers developers, researchers, and students to efficiently build robust models with minimal coding effort.

Track 01: AI & DS, Paper No: 35

Automated Wind Turbine Inspection and Structural Damage Detection Using YOLOv5s

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Abstract—An automated damage detection method based on deep learning for wind turbine blades uses the YOLOv5 framework, which is object detection that is quite fast and relatively accurate for detecting objects and localization instances of damage in images. Source data has been a curated collection dataset of wind turbine images with annotated regions of damage; thus, a model was trained from Roboflow. This uses transfer learning in which the model is started with pre-trained YOLOv5s weights and further fine-tunes it over the specific dataset. It also fits well into the nature of the dataset including the number of classes of damage. The training process, therefore, is optimizing the model parameters to achieve the minimization of differences between predicted bounding boxes and the available ground-truth annotations. Standard metrics for object detection are used in the evaluation of the model: precision, recall, mean Average Precision (mAP), and F1-score. Qualitative assessment is also carried through as a visual check on the predictions that the model would produce on unseen images, validating its use in real conditions. It contributes to developing an automated and efficient system concerning structural health monitoring of wind turbines and enables maintenance at the appropriate time, thus decreasing down times.

Track 01: AI & DS, Paper No: 36

AI-Based Human Health Monitoring and Insights Using an Android Application

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Abstract: The proliferation of smartphones and wearable devices has ushered in a new era of healthcare, enabling continuous monitoring of physiological parameters and delivering personalized health insights. This paper introduces HealthMonitorAI, an innovative Android application designed to track and analyze human health metrics, including heart rate, sleep patterns, physical activity, stress levels, and calorie expenditure, using integrated smartphone sensors and wearable devices. By leveraging advanced machine learning techniques, specifically a Random Forest model optimized for mobile environments, HealthMonitorAI provides actionable AI-driven insights to promote proactive health management. The proposed system employs a three-step data processing pipeline: (1) Data collection from sensors and wearables, (2) Feature extraction and dimensionality reduction, and (3) AI-based risk prediction and recommendation generation. Through a systematic feature reduction technique, the system focuses on 15 significant health parameters, reducing computational overhead while maintaining high accuracy. Experimental results demonstrate that HealthMonitorAI achieves a prediction accuracy of 92.8% in identifying health risks, with reduced processing time and battery consumption. This approach provides a scalable, secure, and user-friendly solution for real-time health monitoring, with potential applications in preventive healthcare and the management of chronic diseases.

Track 01: AI & DS, Paper No: 37

Fake News Detection Using Machine Learning: A Comparative Study

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Abstract— The rapid spread of misinformation through digital platforms has posed a serious challenge to information integrity. This paper presents a comparative study of various machine learning models for fake news detection. Leveraging Natural Language Processing (NLP) techniques like TF-IDF and n-grams, we analyze the performance of classifiers such as Naïve Bayes, Support Vector Machine (SVM), Logistic Regression, and Random Forest. Experimental results using real-world datasets show that SVM with TF-IDF achieves the highest accuracy. We also highlight the significance of preprocessing steps such as stop-word removal and text normalization. This study emphasizes the importance of machine learning in automating fake news detection and provides insights for further research in this domain.

Track 01: AI & DS, Paper No: 38

Sewage Treatment Using Artificial Intelligence (AI): A Review of Current Applications and Future Prospects

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Abstract: Rapid urbanization and industrialization have led to significant increases in sewage production worldwide. Traditional sewage treatment methods, while effective, often struggle with high operational costs, changes in inflow characteristics, and inefficient resource use. In response, Artificial Intelligence (AI) has emerged as a promising technology to optimize, automate, and improve various parts of sewage treatment processes. This review provides an overview of AI applications in sewage treatment, including predictive modeling, real-time process optimization, anomaly detection, and integration with IoT technologies. It also discusses key research contributions, current challenges, and potential future directions for AI in sewage treatment.

Track 01: AI & DS, Paper No: 39

Cognicare: A Caregiving Support Application for Dementia Patients

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Abstract— Dementia is a degenerative neurological condition that severely impacts memory, routine task management, and personal safety, placing a significant burden on caregivers. In India, over 8.8 million people suffer from dementia, yet existing solutions often lack real-time coordination, personalization, and emotional support. To address this challenge, we propose Cognicare, an AI-enabled mobile platform that facilitates seamless coordination between patients and caregivers. The solution includes task scheduling, emergency contact management, full-screen reminders, and a custom-developed AI chatbot for emotional support. A GPS tracking feature enhances safety by enabling real-time location monitoring of patients, while the caregiver-only web interface ensures centralized oversight. The system leverages Firebase for secure, real-time data synchronization across devices. By integrating emotional support, safety monitoring, and routine management into a single platform, Cognicare provides a holistic solution aimed at enhancing the quality of life for dementia patients and reducing the stress experienced by their caregivers.

FieldAlert: GSM-Driven Farming Intelligence

Varad R. Kulkarni, Harshal A. Patil, Samiksha S. Bhosale, Gitanjali N. Wagh, Sujal R. Kurkute, Gauri G. Dongre

Abstract- In modern agriculture, the need for timely decision-making and efficient resource management has led to the adoption of smart technologies. However, many existing solutions depend heavily on internet connectivity and complex infrastructures, making them inaccessible to farmers in remote and rural areas. To bridge this gap, FieldAlert offers a cost-effective, GSM-based smart farming system that delivers critical agricultural updates through mobile text messages. This paper presents two primary tasks enabled by the system: (1) Remote Farm Management via GSM Module Integration, which allows farmers to monitor and control irrigation devices using SMS commands; and (2) GSM-Based Soil Moisture Alert System, which continuously monitors soil moisture levels and sends alerts when irrigation is needed. The proposed system employs an Arduino microcontroller, SIM800L GSM module, and capacitive soil moisture sensor to ensure reliable performance without the need for internet access. Through real-world field testing, FieldAlert demonstrated a reduction in water usage, minimized manual labor, and improved crop yield. By delivering real-time, actionable information directly to farmers' mobile phones, FieldAlert empowers them to make data-driven decisions and improve productivity. This solution holds significant potential for scalable deployment in developing regions, promoting sustainable agriculture through accessible technology.

Track 02: CSE, Paper No: 01

A Smart Attendance Monitoring and Management System

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Abstract—In the digital age, traditional attendance systems in educational institutes face challenges such as proxy attendance, lack of transparency, manual errors, and delayed communication with parents. This paper presents Attend Ease, a smart, secure, and automated attendance monitoring and management system that integrates biometric authentication and dynamic QR code scanning to ensure real-time, proxy-free attendance tracking. The smart attendance management system distinguishes between user roles, granting teachers and administrators exclusive control to mark or modify attendance, while students are restricted to view-only dashboards. A built-in attendance calculator helps students plan to meet minimum requirements. The system also sends automated WhatsApp alerts to parents when a student is absent and includes a feedback and complaint module. By integrating secure, user-focused features, the System enhances transparency, accountability, and efficiency in academic institutions.

Track 02: CSE, Paper No: 02

“Image Compressor”

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Abstract: This paper presents a new lossless image compression method based on the learning of pixel values and contexts through multilayer perceptrons (MLPs). The prediction errors and contexts obtained by MLPs are forwarded to adaptive arithmetic encoders, like the conventional lossless compression schemes. The MLP-based prediction has long been attempted for lossless compression, and recently convolutional neural networks (CNNs) are also adopted for the lossy/lossless coding. While the existing MLP-based lossless compression schemes focused only on accurate pixel prediction, we jointly predict the pixel values and contexts. We also adopt and design channel-wise progressive learning, residual learning, and duplex network in this MLP-based framework, which leads to improved coding gain compared to the conventional methods.

Track 02: CSE, Paper No: 03

Smart Health Prediction System Using Android App

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Abstract—The Smart Health Prediction System using Android is a mobile application developed to help users get preliminary health assessments based on the symptoms they experience. The application allows users to input their symptoms through a simple and user-friendly interface. Based on this input, the system uses a predefined database and basic matching algorithms to predict possible diseases and suggest precautions or basic treatments. In addition to disease prediction, the system also provides a feature to search for nearby doctors based on specialization, location, and availability, making it easier for users to find appropriate medical help. The app includes modules for patient registration, profile management, and secure communication between patients and doctors. An admin panel is also provided to manage doctors, patient records, and system data. The backend is developed using PHP and MySQL to store and manage all related information efficiently. Although the system is not intended to replace professional medical advice, it acts as an early assessment tool and provides a convenient way for users to understand their health status and connect with doctors when needed.

Track 02: CSE, Paper No: 04

Off-Chain Storage Solutions for Healthcare Data

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Abstract— Blockchain technology has gained popularity in healthcare systems because to its potential to improve data security, privacy, and interoperability. However, the inherent limitations of blockchain, such as scalability and storage constraints, have led to the exploration of off-chain storage solutions. The Interplanetary File System (IPFS) and hybrid blockchain models are the main topics of this paper's thorough analysis of off-chain storage solutions for healthcare data management. We analyze the strengths and limitations of existing approaches, propose a novel framework for secure and scalable off-chain storage, and discuss future research directions. According to our research, off-chain solutions have the ability to solve important issues with healthcare data management while maintaining privacy laws.

Track 02: CSE, Paper No: 05

“Web Application For Exploration of all NGO’s and Charity Platform”

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Abstract: The NGO & Charity Platform is a web-based application designed to centralize and showcase various non-governmental organizations (NGOs) and charitable initiatives across India. The platform categorizes NGOs into key areas such as Education, Health, Women Empowerment, Animal Welfare, and Environment, making it easier for users to explore and support causes they care about. Each NGO listing provides detailed information including mission, services, contact details, and location. The site aims to bridge the gap between donors, volunteers, and social organizations by offering a user-friendly interface and clear categorization. Backend integration using Node.js, Express, and MongoDB enables dynamic content management and scalable data storage. The project promotes transparency, awareness, and accessibility, encouraging active public participation in social development. With intuitive navigation and structured data, the platform aspires to become a one-stop destination for all charitable engagement needs.

Track 02: CSE, Paper No: 07

Design and Development of an Automated Portfolio Generation Dashboard with Integrated Admin Management Panel

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Abstract—In today’s digital-first landscape, professionals across disciplines require dynamic platforms to effectively present their expertise, achievements, and projects. This research introduces the design and implementation of an Automated Portfolio Generation Dashboard integrated with a dedicated Admin Page for system oversight and analytics. The platform enables users to create personalized, interactive portfolios that showcase skills, experiences, and projects in real-time. The proposed solution is developed using modern web technologies to ensure responsiveness, scalability, and ease of use. The result is a centralized, user-friendly environment that supports both individual branding and administrative control, contributing significantly to digital portfolio management systems.

Track 02: CSE, Paper No: 08

BLEattend: Student Attendance System using BLE Technology

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Abstract— This BLEattend technology used to design automated and secure classroom attendance, BLEattend, is Bluetooth Low Energy (BLE)-based attendance system. Using encrypted UUIDs created from every student's PRN and device time helps to prevent proxy attendance and eliminate handmade mistakes. While teachers scan and check the signals in real time, students broadcast their identity using BLE. Built using Firebase Fire store and Android (Java), the system guarantees cloud-based data synchronizing and safe authentication. Enhanced security comes from time-based encryption and device binding. For contemporary classroom attendance management, BLEattend presents a contactless, scalable, quick fix.

Track 02: CSE, Paper No: 09

Machine Learning-Based Prediction of Educational Performance.

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SYCET

Abstract: Predicting student performance has become essential due to the vast amount of data stored in educational databases. This challenge is addressed through Educational Data Mining (EDM), which focuses on extracting meaningful patterns from educational data to better understand students and their learning environments. Educational institutions often seek early insights into student success or failure to plan appropriate interventions. In this project, two predictive models were developed: one for predicting students' assessment scores and another for forecasting overall academic performance. These models help identify key factors that affect learning outcomes, especially in Machine Learning courses. The results demonstrate that both models provide accurate and practical predictions. Additionally, an early warning system was designed to monitor and predict student performance in online learning environments using learning portfolio data.

Track 02: Cse, Paper No: 10

A Contactless Gesture Controlled Framework: Virtual Human Computer Interaction

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Abstract— This paper discusses the integration of multiple frameworks including Computer Vision, Google’s machine learning multi-model pipeline called MediaPipe Hands, Python library PyAutoGUI and programmatic logic to build an advanced human computer interaction framework with a contactless gesture-based virtual interface. This approach enables the contactless control system peripherals such as keyboard and mouse, within a virtual environment by eliminating the need for physical hardware to interact with the system or devices, this makes it a suitable alternative and solution in scenarios with limited peripherals or where hygienic and sterile are essential. Furthermore, the proposed system demonstrates the implementation of multi-frameworks as an application which uses the user’s hands to interact with the system by detecting the hand landmarks and enables the actions and functionalities of the keyboard and mouse using logical operations to simulate user interactions. The framework extends to a real-world use case, such as a secure, gesture-based Smart virtual door lock control system demonstrating the practicality and accessibility of the solution as a hardware-free alternative with secure authentication system.

Track 02: CSE, Paper No: 11

Smart College Chatbot: Simplifying Student Support with AI

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Abstract—This paper presents the design, development, and evaluation of an AI-powered college chatbot aimed at automating student support and enhancing information retrieval within academic institutions. The proposed system leverages a hybrid approach: a local FAQ retrieval engine using fuzzy matching for known queries, and integration with OpenAI’s GPT-3.5-turbo for generative responses to complex or novel queries. Developed with Python Flask, RapidFuzz, and a structured JSON FAQ knowledge base, the chatbot demonstrates high reliability, rapid response times, and significant potential to reduce staff workload while improving student access to timely and accurate information. We discuss system architecture, key implementation strategies, use cases, evaluation metrics, and practical challenges, and propose directions for future work, establishing a scalable model for intelligent conversational agents in education. **Index Terms—**AI chatbot, educational technology, FAQ re-trieval, fuzzy matching, OpenAI GPT, student support, hy-brid chatbot, campus information system, information retrieval, Python Flask, RapidFuzz.

Track 02: CSE, Paper No: 12

Quality And Gamified Education Through Pyquiz

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Abstract— In the rapidly evolving digital landscape, foundational programming literacy is paramount for fostering critical thinking and problem-solving skills. This paper presents PYQUIZ, an interactive, gamified educational tool developed in Python. Addressing the UN Sustainable Development Goal for Quality Education, PYQUIZ aims to enhance learning engagement and comprehension of fundamental Python programming concepts for novice learners. The system incorporates features such as adaptive difficulty levels (Easy, Medium, Hard), a timed response mechanism (15 seconds per question for 10 questions per session), instant feedback, and score tracking. Users are prompted for their name, and feedback on 'correct' or 'wrong' answers is provided immediately. Its modular architecture, encompassing a dynamic question bank and rule-based game logic, ensures a user-friendly interface. This work highlights the efficacy of interactive learning platforms in making complex technical subjects accessible and enjoyable, thereby contributing to improved educational outcomes, digital inclusivity, and critical logic development for students.

Track 02: CSE, Paper No: 13

Modern AI Tools to Study Human Body Behavior

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Abstract—The subject of this research is the AI-enabled multimodal analysis of human behavior, a new domain that utilizes artificial intelligence, machine learning, and data fusion. These techniques result in high-level Abstract— Pregnancy is a really important time for women, and it's vital to spot any possible problems early on to keep both the mother and baby healthy. This project is all about creating a smart computer model that can predict whether a pregnancy might be high-risk or low-risk. The model looks at different health factors like the mother's age, blood pressure, sugar levels, body mass index (BMI), past pregnancies, and lifestyle. It uses machine learning, which involves teaching computers to recognize patterns in data. Algorithms like Decision Trees, Random Forests, or Logistic Regression are trained using health records to find subtle signs that might indicate a risky pregnancy – things that doctors might not easily spot on their own. The goal is to help doctors make better, faster decisions based on data, which can lead to healthier outcomes for both the mother and the baby. The project also considers important issues like protecting patient privacy and how to fit this new system into existing healthcare setups. Overall, this is a move towards using technology to make pregnancy care more proactive and effective.

Track 02: CSE, Paper No: 14

SMART HEALTH PREDICTION SYSTEM USING ANDROID APP

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Abstract—The **Smart Health Prediction System using Android** is a mobile application developed to help users get preliminary health assessments based on the symptoms they experience. The application allows users to input their symptoms through a simple and user-friendly interface. Based on this input, the system uses a predefined database and basic matching algorithms to predict possible diseases and suggest precautions or basic treatments. In addition to disease prediction, the system also provides a feature to search for nearby doctors based on specialization, location, and availability, making it easier for users to find appropriate medical help. The app includes modules for patient registration, profile management, and secure communication between patients and doctors. An admin panel is also provided to manage doctors, patient records, and system data. The backend is developed using PHP and MySQL to store and manage all related information efficiently. Although the system is not intended to replace professional medical advice, it acts as an early assessment tool and provides a convenient way for users to understand their health status and connect with doctors when needed.

Track 02: CSE, Paper No: 15

Water Guardians: A water conservation game

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Abstract— This paper presents “Water Guardians,” a mobile-based educational game designed to address the critical issue of water scarcity by engaging children in learning about groundwater management and sustainable water practices through gamification. The game addresses key concepts of groundwater conservation by placing players in realistic scenarios where they must make strategic decisions about water use, pollution prevention, and resource allocation. Through interactive challenges that reflect real-world environmental issues, such as environmental conditions, planting, and contamination, players experience the impact of their choices on the virtual ecosystem, fostering both cognitive and behavioral engagement. By combining game mechanics such as rewards, points, and level progression with educational content, “Water Guardians” not only enhances problem-solving skills but also encourages long-term, water-conscious habits that can be applied in everyday life. The technological stack incorporates tools like Unity, Blender to create an immersive learning experience.

Track 02: CSE, Paper No: 17

AI-Powered Conversational Agents: A Literature Review and Integrated Framework Proposal

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Abstract—This research paper presents a comprehensive review of recent advancements in AI-driven conversational agents. The focus lies on transformer-based architectures, such as those implemented in BlenderBot and HuggingFace models, which have significantly enhanced contextual understanding and response generation. We analyze ten scholarly articles from sources like ArXiv, ResearchGate, Springer, and ScienceDirect, encompassing topics including personalization, empathy, and domain adaptation. Notably, the TaxBot system demonstrates the practical application of AI chatbots in handling complex taxation queries in India. The review also explores hybrid models that combine rule-based logic with neural networks to improve interpretability and performance. Deployment challenges in industrial and legal settings are examined, highlighting real-world integration constraints. Additionally, the study considers the role of multimodal systems, such as DALL·E and CLIP, in expanding chatbot capabilities across text and vision modalities. A comparative analysis and system architecture diagram are included to illustrate key differences among models.

Track 02: CSE, Paper No: 18

LEO DESKTOP VOICE ASSISTANT

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Abstract: This paper presents the design and development of Leo, a desktop-based personal voice assistant inspired by existing virtual assistants such as Cortana and Siri. Leo offers a user-friendly interface that enables users to perform various daily tasks using both voice commands and keyboard input. Built using Python and leveraging Speech Recognition APIs, Leo can engage in general conversation, conduct web searches, fetch multimedia content, retrieve real-time weather data, provide word meanings, give health advice based on symptoms, and set reminders. The assistant utilizes basic machine learning techniques to understand and respond to user queries effectively. With voice-controlled systems becoming increasingly pervasive across domains—such as smartphones, vehicles, healthcare, and education—Leo aims to offer a lightweight, customizable alternative tailored for desktop environments. Leo leverages Speech Recognition APIs to convert spoken language into text, which is then processed using rule-based logic and basic Natural Language Processing (NLP) to determine user intent. It can engage in basic conversations, execute internet searches, retrieve multimedia content, define words, check live weather updates, respond to health-related symptom queries, and manage user schedules through reminder functionality. The assistant integrates multiple third-party libraries and APIs to achieve real-time performance with minimal latency. The development of Leo illustrates the practicality of building a customizable voice assistant tailored specifically for desktop systems. It provides a strong foundation for further advancements in conversational AI, context-aware

computing, and user-centric automation, particularly in environments where commercial assistants may not be feasible or customizable.

Track 02: CSE, Paper No: 19

**Autonomous Vehicles: Integration of Drive-by-Wire Technologies in Next -
Generation Mobility of ATV**

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Abstract - Autonomous vehicles (AVs) use advanced sensors and electronic systems to drive without human input. This paper focuses on drive-by-wire technologies, which replace traditional mechanical controls with electronic systems for steering, braking, and acceleration. The integration of LiDAR, GPS, and AI enables AVs to perceive and navigate their environment. A simulation model was developed to test performance and control accuracy. Results show promising potential, but challenges like safety, reliability, and regulation must still be addressed for real-world deployment.

Track 02: CSE, Paper No: 20

**MenuMap: A Real-Time Restaurant Locator and Menu Discovery App for Urban
Users**

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Abstract: As urbanization accelerates and the demand for quick, affordable dining solutions grows, location-based applications have emerged as essential tools for everyday users. This paper presents a comprehensive study of MenuMap, a real-time restaurant locator and menu discovery app developed to enhance food access and decision-making for urban populations. Built using Flutter, Firebase, and Google Maps APIs, MenuMap enables users to locate nearby restaurants, view community-uploaded menus, apply filters (e.g., veg/non-veg, rating, distance), and receive timely notifications. We explore the app's architecture, features, and real-time data handling strategies, and evaluate its role in improving food transparency, affordability, and user convenience. The paper also examines challenges such as geolocation accuracy, content moderation, and digital inclusivity. In addition, we reflect on ethical aspects like privacy, open data use, and accessibility. Through this study, we aim to inform developers, urban planners, and food service stakeholders about how mobile geolocation platforms like MenuMap can contribute to smarter, more inclusive urban food ecosystems.

Track 02: CSE, Paper No: 21

STUDENT LEAVE TRACKER SYSTEM

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Abstract— This paper presents a Student Leave Tracker System designed to digitize and streamline the leave management process within academic institutions. The system employs a role-based access control mechanism, distinguishing between students, faculty, and administrators to ensure appropriate authorization levels. Developed using PHP and MySQL, the web-based application facilitates real-time submission, tracking, and approval of leave requests. Key features include automated attendance verification, categorization of leave types (medical, emergency, academic), and an integrated notification system to enhance communication among stakeholders. The dashboard provides comprehensive analytics, enabling administrators to monitor leave patterns and enforce institutional policies effectively. By transitioning from manual to digital processes, the system aims to improve transparency, reduce processing time, and support data-driven decision-making in educational systems.

Track 02: CSE, Paper No: 23

Online Doctor Appointment Booking System

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Abstract: The Online Doctor Appointment Booking System is a web-based application designed to streamline and digitalize the process of scheduling medical appointments. The system offers three types of user logins: Admin, Doctor, and Patient, each with distinct functionalities to ensure efficient management of healthcare services. The admin has control over core system functionalities, including adding new doctors, managing their specializations, and scheduling their available sessions. This ensures that patients always have access to updated and accurate doctor information and appointment availability. The Doctor can log in to view their scheduled sessions, monitor upcoming appointments, and has the authority to cancel individual appointments if needed. This provides flexibility and control over their professional commitments. The Patient can register, log in, and search for doctors based on specialization. They can view the availability of doctors and book appointments accordingly. The system ensures real-time booking and prevents double-booking of sessions. This project has been developed using HTML, CSS, JavaScript, and Bootstrap for the frontend, and MySQL as the backend database. The application is hosted and managed locally using XAMPP. The proposed system improves the efficiency of doctor

appointment scheduling, reduces administrative overhead, and enhances patient satisfaction through an accessible and user-friendly platform.

Track 02: CSE, Paper No: 24

Automated Plant Disease Detection

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Abstract—Plant diseases pose a serious threat to agricultural productivity and global food security. Traditional manual methods of disease detection are often time-consuming, error-prone, and inaccessible to many farmers. This paper presents an automated plant disease detection system using deep learning techniques, specifically Convolutional Neural Networks (CNNs) and transfer learning models such as ResNet and MobileNet. Trained on labeled leaf images of healthy and infected plants, the proposed system achieves high accuracy in classifying various plant diseases. It offers a scalable and efficient solution for real-time disease diagnosis in agricultural applications.

Track 02: CSE, Paper No: 25

Scheme-Connect: An AI-Powered Government Scheme Eligibility Analyzer

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Abstract—Government welfare schemes in India aim to support the underprivileged yet lack of awareness and complex eligibility criteria limit their impact. We present Scheme-Connect, an AI-powered platform designed to assess an individual's eligibility for various central and state schemes using demographic, socio-economic, and geographic data. The system combines rule-based logic with machine learning and natural language processing to intelligently match users with relevant benefits. Multilingual support, smart filtering, and offline access enhance accessibility. The platform demonstrates improved efficiency and usability compared to traditional manual methods, thus improving social scheme delivery.

Track 02: CSE, Paper No: 26

Development of DocNest: A MERN stack Web Based Application for Doctor Appointment Scheduling

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Abstract— The Doctor Appointment Booking System (DABS) is a web-based solution developed using the MERN stack (MongoDB, Express.js, React.js, Node.js). It enables users to view doctors based on specialization, book appointments, and receive confirmations. The system addresses inefficiencies in traditional appointment scheduling by offering real-time slot availability, seamless user experience, and secure data handling. This paper provides an in-depth discussion of the design, development, architecture, functionalities, implementation challenges, and potential enhancements. The system is scalable, modular, and emphasizes a responsive design suitable for different devices and users.

Track 02: CSE, Paper No: 27

MeshRescue: A Decentralized Emergency Communication System Using Offline Mesh Networking

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Abstract— Emergency communication infrastructure often fails during natural disasters, terrorist attacks, and large-scale crises due to power outages, tower damage, or network congestion. This paper presents Mesh Rescue, a novel decentralized emergency communication system that operates independently of existing network infrastructure using offline mesh networking technology. The system leverages Bluetooth Low Energy (BLE) and Wi-Fi Direct protocols to enable smartphones to communicate directly in a peer-to-peer manner. When an SOS alert is triggered, MeshRescue collects critical information including GPS location, number of people requiring assistance, and emergency messages, then forwards this data through multi-hop relaying until it reaches rescue centers or devices with internet connectivity. Implemented using Python and Kivy framework, the system demonstrates high reliability, scalability, and resilience during network outages. Performance evaluation shows successful message delivery rates of 92% in simulated disaster scenarios with network densities of 10-50 devices per square kilometer. The proposed system addresses critical communication gaps during emergencies and significantly improves response times compared to conventional systems.

Track 02: CSE, Paper No: 28

A Real-Time Ride-Hailing Platform with Geolocation, Dynamic Pricing, and Secure Payment Integration

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Abstract— This project, "NexTrip," is a comprehensive ride-hailing platform designed to connect users and captains (drivers) seamlessly. The system leverages modern web technologies, including React for the frontend and Node.js with Express for the backend, to deliver a robust and user-friendly experience. NexTrip enables users to book rides, track their journeys in real-time using Google Maps integration, and make secure payments via Razorpay. Captains can manage ride requests, update their location dynamically, and complete rides efficiently. The platform incorporates advanced features such as real-time communication using Socket.IO, geolocation-based captain discovery, and dynamic fare calculation based on distance and time. It also ensures secure authentication and authorization using JWT tokens and implements token blacklisting for enhanced security. Feedback and rating mechanisms allow users to evaluate their ride experience, fostering trust and quality assurance. NexTrip's modular architecture, including separate services for user management, ride handling, payment processing, and map services, ensures scalability and maintainability. By combining cutting-edge technologies and a user-centric design, NexTrip aims to redefine the ride-hailing experience, making it more accessible, efficient, and reliable. make it little in less lines.

Track 02: CSE, Paper No: 29

Development of Lecture and Task Reminder Android Application for Teachers

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Abstract — Smart Lecture Reminder for teachers is an Android-based application designed to help teachers manage their daily lecture schedule efficiently. This app allows users to register, select lecture dates using a calendarview, and set a lecture time using TimePikar with AM/PM format. Once a lecture is determined, the app uses an alarm and media mediaplayer to provide voice or bajra alerts from time to time before each lecture, which helps teachers to stay organized. The app stores lecture data using a Firebase or SQLite, ensuring data protection and easy recovery. With its user-friendly interface, the app is suitable for use in schools, colleges, and coaching classes. Its purpose is to reduce the possibility of remembered or delayed lectures, promote better time management, and support digital teaching equipment in education. Overall, the project shows how mobile technology can be applied to solve real-world problems in the educational environment.

Track 02: CSE, Paper No: 33

A Voice-Driven AI Assistant for Enhancing Elderly Well-Being

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Abstract— The global increase in the aging population, elderly individuals face growing challenges such as social isolation, cognitive decline, and a lack of continuous care. This paper proposes an intelligent, voice-enabled AI Companion system designed to support the elderly in their daily lives. The system leverages Natural Language Processing (NLP), voice interaction, and smart reminders to assist with medication schedules, health check-ins, and appointment notifications. Additionally, it fosters emotional well-being through storytelling, entertainment, and video call integration with family members. Built using modern technologies like React, Flutter, Node.js, Python, Firebase, and Dialog flow GPT-3, the AI Companion provides a responsive and intuitive interface for elderly users. The system also incorporates an emergency alert mechanism to ensure timely assistance. This solution addresses the critical issue of elderly loneliness and health negligence, aiming to enhance the quality of life for seniors living independently. Preliminary evaluations indicate its potential to serve as a scalable, low-cost alternative to human companionship and continuous monitoring.

Track 03: Civil, Paper No: 1

Assessment of Soil Stabilization Properties Using Reused Printer Toner Ink: A Sustainable Perspective

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Abstract - Improving the load-bearing strength of weak soils is a critical aspect of construction, and soil stabilization serves as a key method in achieving this goal. This research investigates the innovative use of waste printer toner ink as a stabilizing additive to enhance soil properties, particularly Unconfined Compressive Strength (UCS) and bearing capacity. Toner waste, often improperly discarded, presents environmental concerns; however, its sticky nature may contribute to better soil binding. In this study, soil samples were prepared with toner ink additives at varying percentages 0%, 0.5%, 1%, 1.5%, 2%, 2.5%, and 3% and evaluated using UCS tests, Standard Proctor Compaction, and California Bearing Ratio (CBR) tests. The experimental results were compared with those of untreated soil. The inclusion of toner ink was found to enhance cohesion, compaction behavior, UCS, and CBR values, thereby increasing the soil's load-bearing performance. The toner ink aids in bonding soil particles together, lowering permeability and improving compaction. However, higher concentrations beyond the optimum level were observed to reduce strength due to increased brittleness and reduced workability. This investigation presents a sustainable solution for soil improvement using industrial waste, contributing both to environmental protection and geotechnical enhancement. The results point to the effectiveness of toner ink as a viable alternative soil stabilizer, with further studies recommended to assess long-term performance and ecological implications.

Track 03: Civil, Paper No: 2

A Review on Comparative Study of High-Rise Buildings with Different Geometric Shape.

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Abstract - This study investigates the literature study for comparative performance of high-rise buildings with different geometric shapes under wind loads in cyclonic regions. The research aims to identify desirable building shapes that enhance structural stability and minimize wind-induced displacements and story drifts. A comprehensive literature review reveals the significance of building geometry in wind load resistance, with circular and elliptical shapes exhibiting superior performance compared to rectangular or irregular forms.

Aerodynamic modifications such as chamfers, setbacks, and tapering are found to further mitigate vortex shedding and lateral deflections. The study highlights the importance of integrating terrain effects, updated building codes, and multi-hazard considerations for a holistic design approach. Advances in computational fluid dynamics and structural simulations provide valuable insights, but experimental validations remain crucial for confirming model predictions. Optimizing building geometry not only improves structural safety but also enhances occupant comfort and urban environmental conditions. The review identifies research gaps, including the need for integrated multi-hazard studies, experimental validations, investigations of terrain and microclimate effects, exploration of adaptive building shapes, and cost-effectiveness analyses. Future research should focus on developing robust design guidelines, updating building codes, and emphasizing holistic approaches that balance aesthetics, structural resilience, and sustainability in high-rise building design for cyclonic regions.

Track 03: Civil, Paper No:3

Blast Resisting Structure: A Review

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Abstract - As per the National Crime Records Bureau (NCRB) report, fire-related accidents have risen to the fifth rank, climbing three positions compared to the previous year. These incidents have led to significant loss of life and property. Explosive accidents generate effects such as impacts on primary and secondary structural components and pressures from reflective and blast waves, often resulting in the collapse of entire structures. To mitigate the damage caused by fire accidents, it is essential to strengthen structural members, protect structures, design components to resist blast loads, and develop blast-resistant buildings. This paper reviews the impact of blast loads on various structural elements and examines numerical methods to analyze blast load behavior. It also explores the behavior of different types of concrete under blast conditions. Based on the findings, it is concluded that to prevent structural collapse from explosions, members must be designed to withstand blast waves. Additionally, utilizing lightweight, adaptive materials and incorporating less rigid fibers into concrete can enhance its blast performance by reducing energy transfer.

Track 03: Civil, Paper No:4

Bridging the Gap: The Indore Model for Enhancing Irrigation Potential Utilization in Maharashtra

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Abstract - Maharashtra, an agriculturally significant state in India, faces a persistent challenge in fully utilizing its created irrigation potential, particularly in minor irrigation projects. This underutilization is often attributed to inefficiencies in traditional open canal irrigation networks and, at times, issues with newer piped irrigation systems. To overcome these issues, the paper advocates for the widespread adoption of the "Indore Model" for piped distribution networks. This model offers inherent hydraulic stability, ensuring equitable and precise water distribution to individual farm holdings, significantly reducing water losses, and minimizing land acquisition requirements. The Indore Model also facilitates enhanced crop diversification and optimized conjunctive water use. Furthermore, the paper emphasizes the crucial role of Water User Associations (WUAs) in promoting farmer participation, improving management, and resolving disputes. It also explores the integration of solar-powered pumping systems to address energy constraints and stresses the importance of robust maintenance strategies and supportive government policies, including financial incentives, to accelerate the transition to more efficient and sustainable irrigation practices. The widespread implementation of the Indore Model, combined with strong WUAs and appropriate technological and policy support, is crucial for maximizing irrigation potential and boosting agricultural productivity in Maharashtra.

Track 03: Civil, Paper No:5

Intelligent Infrastructure for Clean Cities: A Review on Automated Street Cleaning and Drainage Management Systems

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Abstract - Manual cleaning of roads and drainage is time consuming and unhygienic, often exposing workers to hazardous waste and diseases. This paper represents automatic cleaning system and drainage by screening method. The system uses a mechanical arm's to automatic cleaning and remove the waste by water jet, reducing human effort and enhancing efficiency. It can be applied in small scale and medium-sized urban localities to maintain cleanliness. Keeping cities clean and managing drainage systems are essential for public health and quality of life. However, traditional methods often rely on manual labour, which can be slow, costly, and inconsistent especially in growing urban areas. This review paper explores how modern technologies, particularly automated machines and intelligent systems, are being used to improve street cleaning and drainage maintenance. We examine recent developments such as self-driving street sweepers, and machines that can operate in difficult-to-reach areas like narrow drains. These systems are designed to work more efficiently, reduce human effort, and maintain cleanliness more consistently. The paper also looks at how these technologies are being used in different parts of the world, compares their effectiveness, and discusses their benefits and challenges. Key issues include high setup costs, limited

awareness, and the need for proper planning and support from city authorities. Finally, the review suggests future improvements such as using environmentally friendly machines, improving design for better access, and creating more adaptable cleaning systems. Overall, intelligent infrastructure offers a promising solution for making roads cleaner and more sustainable.

Track 03: Civil, Paper No:6

AI-Driven Construction Project Scheduling: A Research Overview

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Abstract -Construction project scheduling is critical to ensuring timely project completion, cost efficiency, and resource optimization. Traditional scheduling methods, such as the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), often struggle with the dynamic and uncertain nature of construction projects. Artificial Intelligence (AI) offers trans-formative potential by enabling data-driven, adaptive, and predictive scheduling. This research explores the role of AI in construction project scheduling, its methodologies, applications, challenges, and future directions, emphasizing its impact on improving project outcomes.

Track 03: Civil, Paper No:7

Comparative Analysis of GFRP, CFRP&STEEL As a Reinforcement

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Abstract -Steel, Glass Fiber Reinforced Polymer (GFRP), and Carbon Fiber Reinforced Polymer (CFRP) are three key reinforcement materials used in concrete structures, each with distinct advantages and limitations. Steel is the most used due to its high strength, ductility, and compatibility with traditional construction methods. However, it is prone to corrosion in moist or chemically aggressive environments, leading to increased maintenance and reduced service life. GFRP, on the other hand, offers excellent corrosion resistance, is lightweight, and non-conductive, making it ideal for marine and chemically exposed settings. Its

drawbacks include lower stiffness and a brittle failure mode, which limit its use in seismic or high-load applications. CFRP stands out for its superior tensile strength, durability, and resistance to environmental degradation, making it ideal for high - performance uses such as retrofitting and seismic reinforcement. Despite its advantages, CFRP is costly and requires specialized installation. In conclusion, steel is best for general use, GFRP for corrosion-prone areas, and CFRP for critical structural applications. Hybrid systems combining these materials may provide more efficient and durable solutions for future infrastructure.

Track 03: Civil, Paper No:8

“Seismic Analysis of Soft Story Structures with Stiffness Irregularities and Basement Integration”

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Abstract -The demand for open floor space in multistorey buildings for uses such as parking, lobbies, or commercial purposes has led to the widespread incorporation of soft storeys. These levels often lack infill walls and exhibit significantly reduced lateral stiffness, making them vulnerable during seismic events. This study investigates the seismic behaviour of a reinforced concrete (RC) frame structure with basement shear walls and stiffness irregularities at select storey levels. A G+10 RC frame with shear walls at the basement and increased storey heights at the 3rd, 6th, and 9th levels is analysed using the Response Spectrum Method in ETABS 2019. The analysis compares seismic parameters—storey displacement, drift, shear, and stiffness— across all seismic zones in India. Findings reveal that structures in higher seismic zones (IV & V) experience notable performance reductions, with storey failures observed in multiple parameters. However, the presence of basement shear walls improves the stability and stiffness of adjacent lower storeys. **Keywords:** ETABS, Irregularity, Soft storey, Seismic, Stiffness.

Track 03: Civil, Paper No:10

Natural Fibre Reinforced Composites: Sustainable Material For Civil Engineering Applications.

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Abstract - There is growing concern for the environment, and this has pushed natural fibre-reinforced composites (NFRCs) into the limelight as plausible eco-friendly alternatives to conventional synthetic composites in civil engineering. These NFRCs are sourced from renewable plants like jute, flax, hemp, sisal and coir which offer a number of benefits: they are biodegradable; their carbon footprints are minimized; they are economically feasible; and their mechanical performance remains competitive. These composites have been used in polymeric or cementitious matrices for various purposes including structural applications such as concrete reinforcement and non-structural uses such as lightweight cladding or insulation systems. In this regard, the review provides an extensive overview on NFRCs by discussing essential properties including strength, durability, thermal behaviour prevalent fabrication methods: compression molding, hand lay-up and pultrusion among others as well as their role in sustainable construction. Some key limitations that hinder wider implementation such as moisture sensitivity, interfacial bonding issues and long term performance maintenance will be critically discussed herein. The review thus points out some emerging solutions like advanced fibre treatments, hybrid composite designs, sustainable bio-resins etc., that seem to hold promise in tackling these challenges. It also emphasizes the strong sustainability profile of NFRCs.

Track 03: Civil, Paper No:11

Earthquake-resistant building framework: An Experimental Study on building frameworks

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Abstract - The effect of earthquake can be prevented minimized by taking certain preventive measures as per standard scientific guidelines. In Earthquake prone areas, these measures may prevent the loss of lives and material. This is the need of hour to educate the masses to adhere to the standard measures during the process of construction in earthquake prone areas. Organization of different workshops and revision of curriculum in engineering courses from the viewpoint of frequent earthquakes in different parts of the country may be of great help to minimize the damage.

Track 03: Civil, Paper No:12

Optimization of water distribution and Loss Detection through Smart metering in Chh. Sambhajinagar

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Abstract - Urban water scarcity and distribution inefficiencies pose critical challenges in rapidly growing cities, especially in developing countries like India. This research, titled **Optimization of Water Distribution and Loss Detection through Smart Metering in Chhatrapati Sambhaji Nagar City**, introduces a smart, data-driven solution to tackle these issues. The project analyzes real-time water supply and consumption patterns across urban zones and categorizes them by water loss severity using a color-coded model red (high), yellow (medium), and green (low). Based on 2023 data and historical trends from the past five years, the city recorded an average non-revenue water (NRW) loss of 17.22%. The deployment of IoT-enabled smart water meters shows a promising reduction of water losses by up to 40%, driven by 30% savings through early leakage detection and an additional 10% via user behavioral changes influenced by real-time feedback. The model integrates GIS-based visualization, statistical analyses, and intuitive graphs to highlight inefficiencies and suggest zone-specific corrective actions. It also enhances operational performance, billing accuracy, and consumer awareness. Comparative references such as Veolia's water loss reduction (20–40%) in France and Thames Water's 12–15% consumption savings in the UK validate the model's global relevance. This scalable framework not only improves water distribution and infrastructure resilience but also contributes to sustainable urban management. The study recommends future integration of advanced analytics and mobile applications for expanded functionality and deeper community engagement, offering a replicable blueprint for smart water governance in cities worldwide.

Track 03: Civil, Paper No:13

Raising Safety: A Sustainable Approach to House Lifting

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Abstract - House lifting using the hydraulic jack method is an advanced and effective technique. It is used to elevate structures to prevent flood damage, foundation failure, or to add an additional floor or basement. This method involves placement of hydraulic jacks beneath the foundation, which are then operated in a synchronized manner to uniformly lift the entire building. The method minimizes structural damage and maintains the integrity of the house during elevation. It is particularly beneficial in flood-prone areas where elevating the structure can significantly reduce future risk. The study focuses on the planning, technical process, equipment used, safety considerations, and cost-effectiveness of the hydraulic jack method. This paper also highlights case studies demonstrating the successful implementation

of this method in residential projects, emphasizing its growing relevance in modern civil engineering practices.

Track 03: Civil, Paper No:14

Eco-Friendly Materials in Pervious Concrete: An Experimental Study on the Use of Banana Stem Fibers and Sugarcane Husk

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Abstract -This study explores the incorporation of eco-friendly agricultural waste materials banana stem fibers and sugarcane husk into pervious concrete to enhance its sustainability and mechanical performance. Pervious concrete is a permeable material that mitigates urban flooding by allowing water infiltration, thus promoting groundwater recharge. However, it traditionally suffers from low tensile strength and durability. By integrating natural fibers and agricultural byproducts, this research aims to improve strength, permeability, and environmental benefits. Experimental tests on compressive strength, permeability, and water absorption were conducted on concrete samples with added banana fibers and sugarcane husk at 4% aggregate weight. Results indicated a slight reduction in compressive strength due to increased porosity but demonstrated optimized permeability and adequate durability, with an 8% water absorption rate. The eco-friendly additives contribute to reducing reliance on conventional materials and lowering carbon emissions, aligning with sustainable construction goals. Economic analysis showed pervious pavement blocks to be cost-effective compared to standard blocks. This research supports the potential of agricultural waste in green infrastructure, encouraging further large-scale applications and long-term durability studies. Future work should focus on optimizing mix designs, life-cycle assessments, and establishing industry standards for sustainable pervious concrete.

Track 03: Civil, Paper No:15

Performance Assessment of Crumb Rubber Substitution for Bitumen and Recycled Fillers on Asphalt Performance

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Abstract: This study analyzes the impacts of replacing bitumen with crumb rubber at various percentages: 5%, 10%, 15%, 20% and 25%, as well as adding glass powder and limestone powder as mineral filler for asphalt mixtures. The goal is to increase the pavement life while

responsibly managing the generated waste by incorporating recycled materials. Crumb rubber obtained from used tires was incorporated into the bitumen to modify the binder. In addition, glass powder and limestone powder, functioning as traditional mineral fillers, were used in part with constituents to form new binders. To evaluate the mechanical and durability properties of the modified asphalt mixes, a number of the laboratory tests were carried out, such as: Marshall Stability, Flow Value, Moisture Susceptibility, rutting resistance, and shear strength. The engineered asphalt mixtures showed the most optimal results in value of stability and tensile strength at 10-15% crumb rubber usage but workability began to diminish at 20-25% and caused trade-off performance problems. Glass powder used with limestone filler also resulted in greater shear and moisture resistance. The study illustrates that asphalt containing these fillers where crumb rubber is added under reasonable boundaries is better performing and more sustainable towards the environment.

Track 03: Civil, Paper No:16

Analysis Of High-Rise Building By Comparing Footing with Base Isolation And Without Base Isolation Using Etabs

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Abstract: This study investigates the seismic performance of a G+40 reinforced concrete (RCC) high-rise building with varying aspect ratios using ETABS 2016. Models were developed for five different aspect ratios ranging from 0.25 to 2.0, comparing conventional footing-supported structures with base-isolated buildings incorporating Lead Rubber Bearings (LRBs). The seismic analysis was conducted under Zone V seismic conditions with medium soil classification, applying gravity loads and lateral loads per relevant Indian standards (IS 875 and IS 1893). Both static and dynamic analysis methods, including Equivalent Static Analysis, Response Spectrum Analysis, Time History Analysis, and nonlinear analysis, were employed to capture realistic building behavior under earthquake excitations. Results reveal that base isolation significantly reduces base shear forces, lateral displacements, and inter storey drifts, particularly in tall and slender buildings with higher aspect ratios. The Lead Rubber Bearings effectively decouple the superstructure from ground motion, increasing natural periods and dissipating seismic energy, thereby enhancing structural safety and occupant protection. Conversely, footing-supported buildings experience higher seismic demands, necessitating heavier structural components. The study underscores the importance of aspect ratio in seismic design and demonstrates that base isolation offers a viable and cost-effective solution for improving earthquake resilience in high-rise buildings. These findings provide valuable insights for engineers and researchers aiming to optimize seismic performance and promote sustainable construction practices in seismic-prone regions.

Track 03: Civil, Paper No:17

Smart Cities: Opportunities and Strategic Suggestions for Developing Chhatrapati Sambhajnagar (Aurangabad) as a Smart City

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Abstract: The rapid pace of urbanization across India has intensified existing infrastructural and governance challenges, particularly in mid-tier cities. The Smart Cities Mission (SCM), initiated by the Government of India, seeks to address these issues through the integration of digital infrastructure, sustainable practices, and citizen-centric services. This paper critically examines the concept and framework of smart cities while evaluating the current development status of Chhatrapati Sambhajnagar (Aurangabad) under the Smart Cities Mission. The study outlines significant achievements in areas such as waste management, road infrastructure, and heritage conservation. Additionally, it identifies persistent urban challenges, including traffic congestion, underdeveloped renewable energy systems, and limited public digital services. This paper proposes strategic and actionable recommendations focusing on integrating advanced infrastructure, enhancing citizen services, implementing renewable energy systems, and promoting sustainable development practices. The suggestions aim to support the holistic transformation of Chhatrapati Sambhajnagar (Aurangabad) into a model smart city that ensures balanced growth, environmental resilience, and social inclusivity.

Track 03: Civil, Paper No:18

Dark Matter: The Invisible Fabric of the Universe

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Abstract—Dark matter is one of the biggest puzzles in space science today. Even though we can't see it with telescopes because it doesn't give off or interact with light it still has a huge effect on how galaxies move and how the universe has grown over time. This paper looks at the clues we have that dark matter is real, the main theories about what it might be made of, and the experiments scientists are doing right now to try and detect it. Figuring out what dark matter is will help us better understand how the universe really works. "Dark matter seems to be made of a completely new kind of particle something that doesn't fit into the types we already know from the Standard Model of particle physics. This means discovering dark matter could open the door to entirely new physics." It's as if something invisible is pulling

on them something with mass but no light. Similarly, entire galaxies tend to clump together in patterns that suggest there's a hidden force at work. These puzzling motions and groupings point to the presence of dark matter, acting like a cosmic scaffolding that holds the universe together.

Track 03: Civil, Paper No:19

Sustainable Concrete: Integrating Bio-Based Additives for Environmental Adaptation

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Abstract: Concrete, though indispensable in modern infrastructure, remains one of the highest contributors to global carbon emissions. Its limited adaptability to harsh environmental conditions—especially thermal and chemical stress—raises urgent concerns for durability and sustainability. This paper investigates the role of bio-based additives as green alternatives to synthetic chemical admixtures traditionally used in concrete. Specifically, four types of concrete formulations were developed using alginate, agar, soy-based resins, and a hybrid of alginate and soy. These mixes were evaluated through a comprehensive testing framework including mechanical strength, workability, water resistance, freeze-thaw durability, and thermal adaptability. The results indicate a significant improvement in both structural and environmental performance across all formulations, with the hybrid mix outperforming others in combined criteria. The use of natural polymers not only contributes to the longevity of concrete structures but also aligns with global sustainable development goals (SDGs) by reducing resource depletion and ecological impact.

Track 03: Civil, Paper No:20

Fiber Reinforced Concrete Using Human Hair – A Sustainable Approach

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Abstract: Concrete remains one of the most consumed construction materials globally due to its compressive strength and versatility. However, its inherent brittleness and poor tensile properties limit its performance under tensile and flexural loads. Fibre-Reinforced Concrete (FRC) has emerged as an effective approach to improve these mechanical deficiencies. Among various fibres, human hair is increasingly gaining attention due to its availability,

non-biodegradability, and excellent tensile characteristics. This study investigates the incorporation of human hair into standard M20 concrete at varying percentages (0%, 0.5%, 1%, and 1.5% by weight of cement). Tests were conducted to evaluate the effect of these fibres on compressive, split tensile, and flexural strength at 3, 7, and 28 days. The results indicated that the addition of 1.5% hair fibres significantly enhances mechanical performance, especially in tensile and flexural strength, while offering a sustainable solution for hair waste disposal. The study contributes to the growing field of sustainable materials in construction.

Track 03: Civil, Paper No:21

Research Review on Optimizing Mass Concrete Foundations for Low-Frequency Rotary Machines and the role of Rubberized Concrete and Geometric Modifications.

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Abstract: This paper presents a comprehensive review of the optimization strategies for mass concrete foundations designed for low-frequency rotary machines, with a particular focus on rubberized concrete and geometric modifications. While mass concrete foundations are effective in providing the necessary stiffness and damping to absorb dynamic loads, their traditional designs often lack adaptability to modern environmental and performance demands. Through critical analysis of existing literature and identification of key research gaps, this review explores how advanced materials like rubberized concrete and innovative geometric configurations can enhance vibration isolation and structural integrity. Recommendations are proposed for future research directions, including the integration of finite element modelling and experimental validation to develop performance-based design guidelines.

Track 04: Electrical Engg., Paper No: 01

WeedSpray – One solution for weeding and spraying

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Abstract: Weed management is a critical aspect of agricultural productivity, often requiring significant labor and resources. This paper presents the design, development, and evaluation of an innovative electric weeder that operates without the use of spraying pumps. The proposed system utilizes a battery-powered motor to drive a mechanical weeding tool, effectively removing unwanted vegetation while minimizing soil disturbance. The electric weeder is designed for ease of use, efficiency, and sustainability, making it suitable for small to medium-sized farms. The research focuses on the performance evaluation of the electric weeder in various crop settings, assessing its effectiveness in weed control compared to traditional methods. Key parameters such as weeding efficiency, energy consumption, and user ergonomics are analyzed. Results indicate that the electric weeder significantly reduces the time and effort required for weed management while providing an environmentally friendly alternative to chemical herbicides. This study highlights the potential of electric weeders in modern agriculture, emphasizing their role in promoting sustainable farming practices. The findings contribute to the ongoing development of innovative agricultural technologies aimed at enhancing productivity and reducing the ecological footprint of farming operations.

Track 04: Electrical Engg., Paper No: 02

Power Generation Using Speed Breaker

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Abstract: In the modern world, power has become necessary to mortal actuality. Energy is responsible for significant shifts in every country's economy. Conventional sources give for ultimate of the energy generated in the modern world. But the population is adding every day, and the conventional energy sources are running out. These conventional energy sources also contribute to pollution and global warming. Consequently, the development of sustainable, eco-friendly, and clean unconventional sources for power generation is demanded. In this work, we propose a renewable non-conventional energy source based on speed breakers. By exercising the jerking pressure that is wasted when a bus passes a speed limit on the side of the road, we hope to buck up the expressways. By employing the speed swell as a power generating unit, we may harness the energy produced by moving motorcars and induce electricity. Through the use of a rack and pinion mechanism, the kinetic energy of moving vehicles can be converted into mechanical energy. This mechanical energy can

also be converted into electrical energy using a creator, which will be employed to illuminate the road lights. Thus, we can save a lot of energy by employing this fashion, which will help us meet our future needs.

Track 04: Electrical Engg., Paper No: 03

Automatic Street Light Control By Using LDR Sensor

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Abstract—The Street Light Control System is a smart and automatic way to manage streetlights. It turns the ON when it gets dark, like at night or on cloudy days, and turns them OFF during the day using sensors like Light Dependent Resistors (LDRs). Some advanced systems also use motion sensors, so lights only turn ON when someone is nearby. This helps save electricity, makes the lights last longer, and improves safety on the streets. It's a low-cost, eco-friendly solution that's better than the old manual method of switching street lights. An automatic street light control system uses sensors to check how bright or dark it is outside, and sometimes also detecting movement. If it gets dark or someone passes by, the lights turn on automatically. When it's bright again or no one is around, the lights turn off. This helps save electricity, makes roads safer at night, and can even work together with things like security cameras in smart cities. This system helps save energy, reduces electricity bills, and makes street lighting more efficient and reliable. This kind of smart system helps reduce power consumption, improves safety, and requires less human effort to manage the street lights. The main goal is to save energy, keep streets safely lit when needed, and reduce harm to the environment caused by unnecessary lighting.

Track 04: Electrical Engg., Paper No: 04

DC-DC Traction Converter

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Abstract—DC–DC traction converters are pivotal in modern electric vehicle (EV) architectures, facilitating efficient energy conversion between high-voltage battery systems and low-voltage auxiliary circuits. These converters ensure the proper functioning of essential systems such as lighting, infotainment, and control electronics by stepping down high voltages (e.g., 400–800V) to lower levels (e.g., 12–48V). The integration of advanced semiconductor materials, such as silicon carbide (SiC) and gallium nitride (GaN), has significantly enhanced converter performance, offering higher efficiency, reduced switching

losses, and improved thermal management. Additionally, the adoption of bidirectional power flow capabilities enables features like regenerative braking, contributing to overall energy efficiency. However, the design and implementation of DC–DC converters in EVs present several challenges, including thermal management, electromagnetic interference, efficiency under variable loads, size and weight constraints, and safety considerations. This paper provides a comprehensive review of these challenges and explores contemporary solutions, including advanced cooling techniques, electromagnetic shielding, adaptive control algorithms, and modular converter architectures. Furthermore, the paper discusses emerging trends in converter technology, such as the application of artificial intelligence in control systems and the development of multi-port converter topologies. Through a detailed analysis of current research and technological advancements, this paper aims to provide valuable insights into the role of DC–DC traction converters in the evolution of electric mobility.

Track 04: Electrical Engg., Paper No: 05

Analysis On Recycling of Photovoltaic Solar

Aachal H. Kori, Neha S. Patil, Janhavi. J. Sonwane, Riya R . Kshirsagar, Prof. S.R.Bakal

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Abstract- Solar panels are assisting us move in the direction of purifier energy, however there may be a growing hassle: many vintage panels at the moment are accomplishing the stop of their lifestyles and want to be thrown away or recycled. This study seems at how we will recycle sun panels in a manner that's top for the environment and not too expensive. It talks about ways to recover useful materials like silicon, silver, and aluminum from vintage panels, and additionally how to effectively cope with dangerous materials like lead or cadmium that a few panels comprise. The examine compares distinctive recycling technique like breaking, heating, or the usage of chemicals—to see which of them work exceptional. It also seems at what guidelines and legal guidelines different nations have for recycling sun panels, and why we want higher international requirements. Finally, the paper shows new thoughts to make solar panel recycling simpler and greater powerful, so we will protect our environment and reuse precious substances.

Track 04: Electrical Engg., Paper No: 06

Automatic Solar Panel Cleaning System

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Abstract—Energy is one of the major issues that the world is facing in India, the supply of energy has been one of the major problems for both urban and rural households. About 60%

to 70% of the energy demand of the country is met by fuelwood and agriculture residues. Solar energy is a renewable source of energy, which has a great potential and it is radiated by the sun. Renewable energy is important to replace the using of electric energy generated by petroleum. Solar power has become a source of renewable energy and solar energy application should be enhanced. The solar PV modules are generally employed in dusty environments which are the case tropical countries like India. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun. It reduces the power generation capacity of the module. The power output reduces as much as by 50% if the module is not cleaned for a month. The cleaning system has been designed cleans the module by controlling the Arduino programming. To remove the dust in the PV modules to improving the power efficiency.

Track 04: Electrical Engg., Paper No: 07

Electrical Motors in Electric Vehicle: Classifications, Applications, and Future Trends

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Abstract: Electric vehicles (EVs) are one of the world's favored options for clean and green transport. The electric motor is at the heart of their operation, which converts electrical power from the battery to mechanical energy. While alternating current (AC) motors are the favoured choice in modern electric vehicle (EV) designs, direct current (DC) motors are still important—particularly in cost-effective, low-speed, and auxiliary applications. This paper gives a comprehensive overview of the different types of electric motors used in electric vehicles, i.e., Brushed DC (BDC), Brushless DC (BLDC), Permanent Magnet DC (PMD), and Series DC motors. Each of the types is discussed in terms of working principles, characteristics, advantages, disadvantages, and typical applications in EV systems. The paper also presents recent trends in DC motor control, gives a standard system integration block diagram, and proposes future directions for their application in electric mobility.

Track 04: Electrical Engg., Paper No: 08

"Smart Battery Management System"

Dhiraj Jadhav, Sharad Shinde

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Abstract: Electric vehicles (EVs) have become increasingly popular in India and are seen as an important response to reduce air pollution. These vehicles use rechargeable batteries, and

to ensure that these batteries are efficient, safe, and long-lasting, a battery management system (BMS) is important. The article offers a smart battery management (BM) machine designed for use with lithium-ion battery banks, usually located in electric cars (EVs) and other electronic devices. The device can display, measure, and diagnose the general performance and location of the battery. It is designed by means of a combination of hardware and software administration. The system acts as an ESP8266 microcontroller in the middle, as the primary controller and processor. BMS also contains ACS712-30A strength sensor, which is a voltage sensor to provide a degree up to 30 EPS, DS18B20 sensor for temperature tracking, and music at battery voltage level. Since the voltage sensor has a limited penetration space, a voltage converter is used to reduce the battery voltage to a safe level. The collected items are sent to the cloud platform for surveillance and analysis in real time. This smart BMS improves battery performance, increases battery survival, and ensures the safety of operating electric cars.

Track 04: Electrical Engg., Paper No: 09

Emerging Trends and Prospects in Sodium-Ion Battery Electrode Materials: A Review

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Abstract— Sodium-ion batteries (SIBs) are gaining recognition as a sustainable and lower-cost alternative to lithium-ion systems, particularly for large-scale energy storage applications. This review focuses on electrode materials—the anode and cathode—highlighting key advancements from 2023 to 2025. Hard carbon continues to lead as anode material, with notable improvements achieved via biomass precursors, heteroatom doping, and advanced synthesis methods, resulting in enhanced capacity and cycle stability [4], [5]. Two-dimensional materials such as MXenes and metal borides are gaining traction thanks to their high conductivity and accelerated Na⁺ diffusion [6]. On the cathode side, research has advanced layered transition-metal oxides, polyanionic compounds (e.g., Na₂V₃(PO₄)₃), and Prussian blue analogs, each showing improved structural stability and higher operating voltages [7]–[9]. Innovations in fabrication—like high-loading electrode production and AI-guided material design—are pushing energy densities toward ~230 Wh/kg and boosting rate performance [10], [11]. Nonetheless, challenges such as limited volumetric energy density, electrolyte compatibility, and practical cycle life remain. We discuss these issues and outline future research directions, including solid-state architectures, organic electrodes, interface optimization, and machine-learning-driven materials discovery. This review aims to provide a comprehensive overview.

Track 04: Electrical Engg., Paper No: 10

A Review on Use of FACTS Devices for Improving Stability in Microgrids

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Abstract: Microgrids are rapidly important to integrate renewable energy sources and ensure reliable power supply in local regions. However, their operations are challenged by issues of stability due to variable generations, load ups and downs. Flexible AC transmission systems (facts) devices provide advanced solutions to increase microgrid stability by dynamic controlling power flows and voltage. This paper examines the application of equipment of facts, such as static version Compacers (SVC), Static Synchronous Compacers (Statcom), and Unified Power Flow Controller (UPFC), transient in microgrids, to improve voltage and frequency stability. Through simulation-based analysis, studies suggest that fact equipment enhanced microgrid flexibility against disturbances, ensuring reliable operation. Conclusions highlight the ability of facts technique to support scalability and strength of modern microgrid systems. Identified research intervals include energy storage, cyber security and coordination of facts with field tests.

Track 04: Electrical Engg., Paper No: 11

Electric Vehicle (EV) Bus Charging Demand Forecasting: A Comprehensive Review of Time-Series and Hybrid Models

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Abstract—Accurate forecasting of electric vehicle (EV) bus charging demand is critical for optimizing grid stability, infrastructure planning, and operational efficiency in urban transit systems. This paper provides a comprehensive review of time-series models (ARMA, ARIMA, SARIMA) and hybrid machine learning frameworks for predicting EV charging demand. We evaluate model performance using key metrics (MAE, RMSE, MAPE) and highlight advancements in hybrid methodologies that integrate exogenous variables like weather and traffic. The review demonstrates SARIMA's superiority in seasonal scenarios and hybrid models' dominance in non-linear, real-time predictions. Key challenges including data scarcity, scalability, and privacy-preserving techniques are analyzed. The paper concludes with recommendations for future research, emphasizing adaptive, scalable models aligned with smart grid integration.

Track 04: Electrical Engg., Paper No: 12

Underwater Windmill

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Abstract— The need of energy is increasing day by day due to increase in domestic and industrial work demand. The energy should be produced from renewable energy sources rather than non-renewable sources. Now countries are developing energy mainly from renewable sources. Among them mostly are not quick and fast processes. But tidal energy can give rapid production of electricity using underwater windmill. In this research paper, review on production of energy through underwater windmill, its types, technology, challenges, literature work has been studied. The challenges can be overcome in this technology by change in design, material and environment.

Track 04: Electrical Engg., Paper No: 13

Power Generation Using Speed breaker

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Abstract— In the modern world, power has become indispensable to human existence. Energy is responsible for significant shifts in every country's economy. Conventional sources provide for most of the energy generated in the modern world. But the population is increasing every day, and the conventional energy sources are running out. These conventional energy sources also contribute to pollution and global warming. Consequently, the development of sustainable, eco-friendly, and clean nonconventional sources for power generation is required. In this work, we propose a renewable unconventional energy source based on speed breakers. By utilizing the jerking pressure that is wasted when a car passes a speed limit on the side of the road, we hope to brighten the streets. By employing the speed breaker as a power generating unit, we may harness the energy produced by moving cars and generate electricity. Through the use of a rack and pinion mechanism, the kinetic energy of moving vehicles may be transformed into mechanical energy. This mechanical energy can then be transformed into electrical energy using a generator, which will be utilized to illuminate the street lights. Thus, we can save a lot of energy by employing this technique, which will help us meet our future needs.

Track 04: Electrical Engg., Paper No: 14

Electric Vehicle Battery Health Estimation System Using AI

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Abstract— Electric vehicles (EVs) are becoming increasingly important in the shift toward cleaner transportation. A key component of EV performance and safety is the battery system, which requires constant monitoring to ensure its reliability and efficiency. Estimating battery health, particularly the State of Health (SOH), is essential for preventing failures and planning maintenance. Traditional methods often struggle with accuracy under varying real-world conditions. This paper explores the use of Artificial Intelligence (AI) techniques for estimating battery health in EVs. Machine learning and deep learning algorithms are applied to analyze battery usage data and predict health degradation patterns. The Suggested system improves prediction health accuracy and supports real-time monitoring, making it a promising approach for next-generation Battery Management Systems (BMS). The study also discusses the system's structure, data handling, model evaluation, and future research opportunities.

Track 04: Electrical Engg., Paper No: 15

Smart Wireless Power Transfer for EVs

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Abstract—In this paper, we focus on providing an innovative method for a wireless charging system for electric cars, which validates the evolved principle through the utility of a battery charger for electric cars. Charging an electric automobile's battery using a charger and wires is inconvenient, doubtlessly dangerous, and steeply priced. Current gasoline and petrol engine automobiles contribute to air and noise pollutants, as well as greenhouse gas emissions. This paper introduces a Wi-fi battery charging device for electric motors using the inductive coupling method. A using circuit is wired between the transmitter and receiver coils, where a MOSFET is applied for switching operations. The transmitter coil circuit is activated while the car is present and deactivated when it's miles away.

Track 04: Electrical Engg., Paper No: 16

"Smart Battery Management System"

Dhiraj Jadhav, Sharad Shinde

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Abstract: Electric vehicles (EVs) have become increasingly popular in India and are seen as an important response to reduce air pollution. These vehicles use rechargeable batteries, and to ensure that these batteries are efficient, safe, and long-lasting, a battery management system (BMS) is important. The article offers a smart battery management(BM) machine designed for use with lithium-ion battery banks, usually located in electric cars (EVs) and other electronic devices. The device can display, measure, and diagnose the general performance and location of the battery. It is designed by means of a combination of hardware and software administration. The system acts as an ESP8266 microcontroller in the middle, as the primary controller and processor. BMS also contains ACS712-30A strength sensor, which is a voltage sensor to provide a degree up to 30 EPS,DS18B20 sensor for temperature tracking, and music at battery voltage level. Since the voltage sensor has a limited penetration space, a voltage converter is used to reduce the battery voltage to a safe level. The collected items are sent to the cloud platform for surveillance and analysis in real time. This smart BMS improves battery performance, increases battery survival, and ensures the safety of operating electric cars.

Track 04: Electrical Engg., Paper No: 17

**Comparative Analysis of Electric and Petrol Scooters with CO2 Emission Reduction:
A Case Study of Ather 450X and Honda Activa 125**

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Abstract— Increasing concern for environmental stability and the need for cost-effective urban mobility solutions has intensified changes in electric vehicles (EVS) from traditional petrol-operated vehicles. This research paper presents a comparative analysis of two popular two-wheelers in the Indian market: Ather 450X Electric Scooter and Honda Activa 125 Petrol Scooter. The study evaluates major parameters such as technical specifications, performance, energy efficiency, running and maintenance costs and environmental impacts. The findings indicate that the Ather 450X provides low operating costs and zero tail Pipe emissions, Honda Activa 125 limited EVs in the infrastructure areas better range and convenience. Paper conclusion is that Ather 450X is a more suitable option for Daily City

Commuting, while Honda Activa 125 remains a practical option for long distance and regions where charging features are rare.

Track 04: Electrical Engg., Paper No: 19

Smart Solar Drying for Indian Crops: Design and Feasibility of an Arduino-Based Temperature-Controlled System

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Abstract: This paper reviews solar drying technology for agricultural produce, focusing on its benefits in extending shelf life and preserving nutrition, especially in regions like Chhatrapati Sambhaji Nagar, Maharashtra. It highlights solar drying as a sustainable and cost-effective alternative to conventional methods, particularly for small farmers. The study evaluates current drying technologies, recent advancements, and areas for further research. A case study on a low-cost, temperature-controlled solar dryer is presented. Key topics include drying principles, pre-treatment methods, temperature control, types of solar dryers, and innovations like hybrid systems, thermal storage, and IoT integration. **Keywords:** Agricultural products, renewable energy, smart farming, solar dryer, review.

Track 05: Mechanical Engg., Paper No: 02

A Review on Multifaceted biomaterials used for hip joint prosthesis and its mechanical properties

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Abstract— Hip joint replacement (Total Hip Arthroplasty) involves replacing the damaged joint with artificial components made from biomaterials selected for their Durability Biocompatibility, Strength, and Wear resistance. These biomaterials can include metals (titanium, stainless steel), ceramics, or polymers chosen for their ability to withstand the body's environment and promote long-term functionality. This surgical procedure aims to alleviate pain, restore mobility, and improve quality of life for patients with severe hip damage or arthritis. This research paper focuses on study of chronology of biomaterial used for hip joint prosthesis and its tribological properties.

Track 05: Mechanical Engg., Paper No: 03

Application of Design of Experiments and Taguchi Methods to Study Heat Transfer Properties from a Flat Plate

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Abstract— A detailed experimental and statistical stied had been carried out of the steady air jet impingement. The Reynolds number range was chosen as $6500 \leq Re \leq 15000$, with the air jet outlet-to-target surface spacing set at $2 \leq Y/D \leq 6$. Understanding the impact of the parameters on torridity transfer across the target surface is crucial for optimizing the process. The Design of experiments (DoE) approach is more beneficial as it enables both comparative parameter analysis and the improvement of experimental procedures and computational modelling. This research applies a DoE utilizing the signal-to-noise ratio method and full factorial method alongside an Analysis of Variance (ANOVA) to perform an experimental investigation into air jets striking a surface. This study outlines the procedure to be adhered to prior to conducting experiments on jet impingement over a smooth flat plate covering the experimental setup configuration to the formulation of the experiment matrix.

Track 05: Mechanical Engg., Paper No: 04

A Comprehensive Review of Heat Transfer Augmentation Strategies

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Abstract— The combined use of two or more heat transfer augmentation methods plays a very significant role in enhancing the performance of thermal systems which are used in different industrial sector such as oil refineries, thermal power plants, automobiles, medicinal, petrochemical and other industries which are integrated to process industries like sugarcane, dairy and food industries where the heat exchange is one of the important processes. As a result, it is essential to improve heat transfer in heat exchange equipment while minimizing costs and conserving electricity. Heat transfer augmentation methods are broadly classified into three categories: passive, active, and compound techniques. During this review work, a comprehensive literature evaluation of combinational passive heat transfer augmentation methods is performed. The method adopted is the concurrent use of the latest trend and technique used while designing of innovative types of heat exchangers which includes the effects of different volume concentration of nanofluids along with altered coil geometries like cylindrical, helical and spiral and simultaneous uses of inserts like spring, twisted tape, swirl type and making corrugation on tubes for augmentation of heat transfer.

Track 05: Mechanical Engg., Paper No: 05

Performance And Emission Characteristics Of Ci Engine Having Lemon Peel Biodiesel Blend Fuel

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Abstract- The constant increase in energy use, and the environmental consequences of increased diesel fuel use, are both concerning. The most efficient strategy to minimize diesel usage and reduce greenhouse gas by biodiesel. These fuels have more life span and contribute significantly to greenhouse gas emissions. Because lemon peel oil is easily accessible, could be very useful alternative source of fuel. Lemon peel oil has also proven as a sustainable and ecologically preferred alternative fuel source. LPO has significant diversity in performance and emission parameters. Lemon peel oil mixes have been introduced to decrease carbon monoxide, hydrocarbon and smoke emissions. LPO blends outperform diesel fuel in name of BTE. The chemical and physical properties of the recovered LPO were investigated, and they were found to be very convenience for usage as a diesel fuel mix. The oil from the lemon peel is removed and mixed with diesel. The mixture is prepared to get B5 (950 ml Diesel + 30 ml LPO+15 ml DEE+5 ml ET), B10 (900 ml Diesel + 70 ml LPO+20 ml DEE+10 ml ET) and B15 (850 ml Diesel + 100 ml LPO + 35 ml DEE + 15 ml ET) mixtures. This research uses a VCR type CI engine to assess performance and emissions using the three fuel alternatives stated above. The tests were done using the new blend under various engine operating conditions, and the B10 mixture's BTE is 0.6 percent to 2 percent higher when compared with diesel fuel.

Track 05: Mechanical Engg., Paper No: 06

A Vision for a Sustainable Future of Textiles in Automotive Sector

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Abstract— The textile manufacturing sector has emerged as a significant contributor to the economies of numerous countries, thanks to advancements in technology and product quality improvements. Since its inception during British colonial rule, the textile industry has been vital to India's development. This sector has greatly aided India's economic progress and has also played a role in reducing poverty among the populace. The automotive industry has turned into one of the biggest markets for textiles, with their usage rising considerably over the years, as they offer excellent protection for vehicle parts and overall durability. Nowadays, various manufacturers create different kinds of textiles, including cotton, silk, wool, and synthetic fibers, which automobile companies utilize in car production. Textiles play a significant role in enhancing vehicle quality in various aspects. They improve passenger comfort by offering thermal insulation against cold temperatures or heat generated by sunlight or hot air vents during the summer months. The effectiveness of cushions is determined by their density, thickness, and the type of materials used. Textiles can also be utilized to embellish interior features such as seats or door panels; they serve as a desirable element for buyers who value skilled craftsmanship in automobile manufacturing. They are extensively employed in creating car seats, door panels, headrests, and seat covers utilizing a range of textile fibers including cotton, rayon, polyester, or wool. Upholstery comprises various types of fabrics with distinct designs and patterns. It is also used to fabricate covers for the backrests and armrests of cars or trucks. To cater to consumers seeking enhanced comfort while driving, automobile manufacturers frequently incorporate fabrics made from natural fibers like cotton or linen. These materials are considerably softer than those made from synthetic fibers such as polyester or nylon, yet they are easier to clean than natural fibers, as they are soft and absorbent when exposed to water or detergent solutions. As technological advancements continue to progress rapidly, the demand for mobility is increasingly paramount. Textiles can be applied in automobiles in two primary ways—interior and exterior applications. The former typically aims to provide comfort, while the latter focuses on safety in adverse weather conditions. Both applications can be effectively combined as well. This paper discusses how technical textiles are transforming the automotive sector with lightweight, sustainable, and innovative materials, and examines key advancements that are shaping the future of automotive applications.

Track 05: Mechanical Engg., Paper No: 08

Some Investigations on Turning of SAF 2205 Duplex Stainless Steel using Coated Carbide Inserts

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Abstract—This study investigates the turning performance of SAF 2205 duplex stainless steel using various coated carbide inserts under dry machining conditions. Cutting forces was analyzed using experimental trials with TiAlN, TiAlSiN (Sputter), and TiAlSiN (CA-PVD) coatings. The experiments revealed that coating type and cutting parameters significantly influence tool performance and surface quality. TiAlN-coated inserts demonstrated superior machining behavior in terms of cutting force reduction and surface finish.

Track 05: Mechanical Engg., Paper No: 09

Design and Development of Automated Multi- Vegetable Transplanter

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Abstract- India ranks second in vegetable production in the world. The production of tomato, Chilli, Brinjal in Maharashtra is increasing day by day. Manual Transplanting of vegetables is always a time consuming and Labourites activity which is cost intensive. At present semi-automatic transplanting is done which accounts for manual interruption labour and time. A machine of two row tractor mounted automatic vegetable transplanter was conceptually designed and developed the function behaviour of the machine was examined with Computer aided design and the various units of machine have been finalized the machine consist of tray feeder and pickup and hopper with digger and furrow closer. The machine has a set row-to-row spacing of 600 mm, and it may alter the plant-to-plant spacing when the machine's forward speed changes. The pace was customized to achieve the required 450 mm plant-to-plant spacing. A machine of a two-row tractor-mounted semi-automatic vegetable seedling transplanter (SVT) was conceptualized and developed for small agricultural holdings. The machine has set row to row spacing. The developed machine is fully automatic and can effectively handle the sample without damage and would thus help in mechanizing transplanting of vegetable seedlings.

Track 05: Mechanical Engg., Paper No: 10

Recent developments in hydrogen vehicles

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Abstract— Hydrogen fuel cell vehicles have the potential to address both the environmental and oil dependency problems in transportation, but the construction of an infrastructure is a major issue that remains to be solved. This chapter reviews the challenges raised by the investment in infrastructure after the previous “hype” about hydrogen. The paper analyzes the main obstacles posed by the establishment of a network of refueling stations and examines the strategies that have been followed by countries to deal with these barriers; in particular, in California, Japan, and Germany .where experience has shown how important cooperation is between actors (e.g., automakers, fuel suppliers, technology providers), as well as the support from public authorities to the installation of the early infrastructures. This analysis unveils not only the characteristics of the “revival” of an innovation after the disappointment, but also the strategies that have been followed to again gain visibility and come back to create the car of the future. Vehicles powered by hydrogen have become a viable substitute in the global shift to environmentally friendly and low-emission modes of transportation. Driven by the need to decarbonize the mobility sector, recent trends show notable breakthroughs in hydrogen fuel cell technology, storage systems, and fueling infrastructure. Vehicle performance, range, and cost-effectiveness are being improved by advancements in lightweight materials, high-efficiency fuel cells, and hybrid integration. Concurrently, the establishment of hydrogen supply chains and the expansion of hydrogen refueling stations are being accelerated by government and private sector investment and regulatory assistance. Large automakers are diversifying their hydrogen car lines, concentrating on long-distance transportation and business fleets where battery-electric options are limited. Notwithstanding these developments, issues with fuel delivery, production scalability, and economic feasibility still exist. With an emphasis on their potential contribution to the attainment of global climate goals and a diverse clean energy environment, this analysis explores the most recent technological, commercial, and regulatory advancements influencing the future of hydrogen-fueled cars.

Track 05: Mechanical Engg., Paper No: 11

Experimental study on the Effect of Serpentine Tubes on Heat Exchanger Performance

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Abstract- In fundamental engineering systems, heat exchangers are employed in many different industrial, automobile applications and refrigeration systems. This study uses an oval-shaped shell and tube HE with serpentine tubes that have a constant pitch in the longitudinal flow dimension to experimentally assess the fluid heat transfer rate performance. The serpentine tube has the following measurements: 1200 mm in length, 2 mm in thickness, and 8 mm in diameter. For better performance, copper is the material utilized in serpentine tubes. The experiment's findings demonstrate that, for a given Reynolds

number (Re), Nusselt number, heat transfer coefficient, and HE system performance, fluid flowing through serpentine tubes continuously performs better than fluid flowing through straight tubes. Moreover, it is discovered that fluid traveling through serpentine oval-shaped tubes has a somewhat higher friction factor (f) and, thus, a lower pressure drop than fluid. The serpentine tube configuration's longer flow channel allows for a longer fluid-to-fluid contact time, which improves heat transfer efficiency.

Track 05: Mechanical Engg., Paper No: 12

Comparison of Industrial Robots vs. CNC Machines for Incremental Sheet Metal Forming

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Abstract—Incremental Sheet Metal Forming (ISF) is a cost- effective and versatile process for producing complex and asymmetrical sheet metal components, without the need for traditional dies. This paper compares two primary machine platforms used for ISF: conventional Computer Numerical Control (CNC) machines and industrial robots. CNC machines offer superior geometric accuracy and repeatability due to their high structural stiffness and precise position control. However, their limited workspace and lower flexibility pose a challenge for complex geometries. In contrast, robot assisted forming provides unique flexibility and cost-effectiveness due to its wider range of motion, larger workspaces, and reduced tooling costs. Nevertheless, challenges in achieving accuracy arise from the inherent lower stiffness of robots, tool deflection, and material spring-back. This paper systematically evaluates both machine types on key performance indicators, including achievable geometric accuracy, process flexibility, cost-effectiveness for various production volumes, and suitability for different part complexities and sizes. Drawing upon existing literature, this comparison highlights that while CNC machines remain the benchmark for accuracy in ISF, advancements in force- controlled path planning, stiffness compensation, and digital twin technologies are continually enhancing the capabilities of industrial robots. The aim is to bridge the accuracy gap, allowing robot assisted forming to fully leverage its significant advantages in adaptability and economic viability, thereby expanding its applicability across various industries.

Track 05: Mechanical Engg., Paper No: 14

Performance Analysis of Different Types of Cutting Lubricants Used For Machining Operations

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Abstract— The good machining operation is way for improves in the production of manufacturing industries. The high temperature generated in the region of the tool cutting edge has a controlling influence on the wear rate of the cutting tool and on the friction between the chip and the tool during machining process. This research article explores about the use of different types of lubrication in the machining operation like drill. The different lubrication performance is analysed for drilling operation. It is observed from the experimental analysis the used of the MQL lubrication improves the drilling machining operation and improves tool life. The heat is dissipated uniformly through the surface of work piece. The experiments result for different lubrication are recorded, and for validating the experimental results the computational analysis are used. For the computational analysis the ANSYS software is used. Finally, the comparison is made for different working lubrication for concluding the results.

Track 05: Mechanical Engg., Paper No: 15

Battery Pack Air Cooling System

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Abstract— Overheating in battery-powered systems, especially in electric vehicles and portable electronics, poses a serious risk to performance and safety. This work introduces a cost-effective hardware solution that actively manages battery temperature using an Arduino UNO. The system monitors ambient temperature with a DHT11 sensor and adjusts fan speed through PWM based on predefined thresholds. When critical heat levels are reached, it triggers a visual or audible alert. A 16x2 LCD provides real-time feedback to the user. Built with affordable components, the system is modular, energy-efficient, and easy to integrate into existing setups. Test results confirm reliable temperature response and enhanced battery safety, making this design suitable for small-scale electric and backup power applications.

Track 05: Mechanical Engg., Paper No: 16

Design and Development of Throttle by Wire

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Abstract— Throttle-by-Wire (TBW) is a key technology in autonomous vehicles that replaces mechanical throttle controls with electronic systems. It uses sensors, actuators, and electronic control units (ECUs) to manage engine power based on driver input or autonomous algorithms. This paper discusses the design and function of TbW in autonomous vehicles, highlighting its role in enabling smooth acceleration, improved energy efficiency, and faster response times. Safety mechanisms like fault detection and system redundancy are also reviewed. Simulations and case studies show that TBW is a reliable and essential component for the future of intelligent, self-driving mobility.

Track 05: Mechanical Engg., Paper No: 17

Design and Development of Brake-By-Wire

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Abstract- Brake-by-Wire is an electronic braking system that replaces traditional mechanical parts with sensors and actuators. It offers faster response, better control, and supports modern features like autonomous driving and regenerative braking. Brake-by-Wire (BBW) is a modern braking system that replaces traditional mechanical and hydraulic linkages with electronic controls to initiate braking force. Initially developed for aviation and motorsports applications in the late 20th century, BBW has evolved significantly with advances in sensor technology, control algorithms, and fail-safe systems. The early adoption in high-performance and electric vehicles (such as Formula One cars and premium EVs) demonstrated its advantages—reduced weight, faster response times, and enhanced integration with vehicle stability systems. Our present activity involves the development and design of a prototype Brake-by-Wire system with particular focus on actuator response, control precision, and system reliability. We plan to apply a dual-redundant control approach for safe operation in the event of possible failure. Further, the project extends consideration for integration with regenerative braking control logic to enhance efficiency in electric vehicle usage. The work contributes to emerging research on intelligent, all- electronic braking systems towards the mobility future.

Track 05: Mechanical Engg., Paper No: 18

Design and Development Steer-By-Wire System

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Miss. Sakshi Thange, Mr. Hariom Jadhav, Miss. Janhavi Sakhare

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Abstract—The rapid advancement of autonomous vehicle technology has driven the evolution of traditional steering systems towards fully electronic control mechanisms. Steer-by-Wire (SbW) is a cutting-edge steering technology that replaces conventional mechanical and hydraulic linkages with electronic sensors, actuators, and control units. This project focuses on the design and implementation of a Steer-by-Wire system tailored for autonomous vehicles, aiming to enhance precision, flexibility, and safety. The proposed SbW system eliminates the physical connection between the steering wheel and the road wheels, relying instead on high-precision sensors to detect steering inputs and electric actuators to control wheel angles. A central microcontroller unit processes real-time data, including vehicle speed, wheel position, and environmental conditions, ensuring optimal steering response. Communication protocols like CAN (Controller Area Network) ensure reliable and fast data exchange between components. The system incorporates redundancy and fail-safe mechanisms to ensure reliability, such as dual motor setups, backup power supplies, and emergency return-to-center functions. Integration with advanced driver-assistance systems (ADAS) and navigation modules further enhances the vehicle's autonomous capabilities. This Steer-by-Wire system not only reduces mechanical complexity and weight but also paves the way for innovative vehicle architectures and improved control strategies, making it a crucial component in the development of next-generation autonomous vehicles.

Track 05: Mechanical Engg., Paper No: 21

Influence of Submerged Entry Nozzle (SEN) Port Angle on Meniscus Fluctuation: A Water Model Study

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Abstract— In the present work, an experimental investigation has been carried out to analyse the impact of impingement angle on Submerged Entry Nozzle (SEN) and mould to measure the meniscus fluctuation by varying different liquid flow rates and different Submerged Entry Nozzle (SEN) port angles, i.e., 0° port angles, 15° downward and 15° upward port angles. The terms of maximum surface wave fluctuation and average surface wave fluctuations have been analyzed for the above-mentioned parameters. It was observed that a Submerged Entry Nozzle having 0° port was found to be superior when compared with a 15° downward and 15° upward port nozzle. By conducting an experiment, it was observed that as the water flow rate increased, the maximum wave amplitude was found to be increasing in almost all the cases, which results in more fluctuations near the meniscus. Different mould section sizes were analyzed to provide background information to the steelmaker to analyse the behavior of fluid flow pattern inside the mould. The present

research shows how nozzle angle affects meniscus fluctuation and thus provides useful background information for the steel maker.

Track 05: Mechanical Engg., Paper No: 22

**Advances in Electrical Discharge Machining of Non-Conductive Ceramic Materials:
A Comprehensive Review**

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Abstract—Electrical Discharge Machining (EDM) is a prominent non-traditional machining process widely used for shaping hard and brittle materials through controlled electrical discharges. However, its fundamental reliance on the electrical conductivity of the workpiece restricts its direct application to insulating ceramic materials such as alumina, zirconia, silicon nitride, and silicon carbide materials known for their superior mechanical and thermal properties but poor machinability. Recent research has increasingly focused on adapting EDM for these non-conductive ceramics, recognizing their importance in high-performance applications across aerospace, electronics, and biomedical industries. This literature review synthesizes findings from six recent and comprehensive survey papers that explore the technological advancements, challenges, and future directions in EDM of insulating ceramics. Key areas of focus include the use of assisting electrodes, powder-mixed EDM, conductive coatings, and hybrid methods such as ultrasonic and magnetic-field- assisted EDM. The reviewed studies also discuss the machinability of various ceramics, process performance metrics such as material removal rate and surface integrity, and recurring challenges such as tool wear, thermal cracking, and discharge instability. In addition, the review highlights the growing trend toward automation, AI-driven process optimization, and environmentally sustainable practices. While notable progress has been made in enabling EDM for insulating ceramics, significant barriers remain in achieving industrial scalability, precision, and repeatability. The review concludes that future research should emphasize smart monitoring systems, novel conductive intermediates, and deeper interdisciplinary integration to overcome the inherent limitations of the process and expand its applicability to a broader class of advanced materials.

Track 05: Mechanical Engg., Paper No: 25

**Enhancing Cooling Tower Performance Through Chiller Integration: A Technical
Analysis**

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Abstract— the cooling tower plays a pivotal role in the industrial heat dissipation systems. However, under increasing thermal loads, traditional cooling towers alone often underperform. This research investigates how the integration of chillers significantly enhances cooling tower efficiency, based on real-time operational data across three process lines. Performance metrics such as discharge flow, temperature differential, and heat transfer rate (kW and TR) are analyzed to validate the improvements.

Track 05: Mechanical Engg., Paper No: 26

Hypersonic Wind Tunnel: The Gateway to Understanding Extreme Aerodynamics

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Abstract—In the ever-evolving world of aerospace engineering, the study of hypersonic flight has become a critical focal point. Hypersonic flight refers to speeds that exceed five times the speed of sound, or Mach 5 (about 3,836 miles per hour at sea level). As nations and companies push the boundaries of space exploration, military aviation, and commercial air travel, the demand for hypersonic flight technology is rising. To facilitate the testing and understanding of this high-speed regime, hypersonic wind tunnels have emerged as a crucial tool in the development and validation of aircraft and space vehicles designed to operate at such extreme conditions. This review article explores the role, technology, challenges, and future of hypersonic wind tunnels, shedding light on their importance in advancing aerospace technologies.

Track 06: Electronics Engg., Paper No: 01

IoT based self-configuration & smart Binding control system

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Abstract—The project's primary goal is to use IOT and Zigbee technologies to create a self-configuration and smart binding control system. In this project, we designed a self-configuring system that uses a switch to combine Zigbee and IOT technologies. That is, with the aid of a switch, we may operate the lighting in two modes: IOT and ZigBee technology. Numerous areas make use of Zigbee technology, which offers multi-node networking, low power consumption, and high reliability for communications and sensing. Bluetooth, on the other hand, is utilized for short-range applications. To connect ZigBee with IOT technologies, this study suggests a "Self-Configuration and clever Connection System" and verifies its viability in both theory and reality. Sensor-based lighting control systems are built with smart lighting control and self-configuration. To facilitate reference alignment, the system delivers information on lighting RSSI for controlling devices and configures lighting based on Received Signal Strength Indicator (RSSI) data of reference points. New uses of the Internet of Things have been facilitated by the growing number of smart gadgets in recent years.

Track 06: Electronics Engg., Paper No: 02

A Geofencing-Based Approach for Location Tracking Systems: A Review

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Abstract - Many businesses, particularly those with portable or faraway staff, struggle to monitor and track their employees' whereabouts and call activities. Conventional approaches occasionally rely on handwritten reporting, which is laborious, error-prone, and lacking in real-time visibility. In addition, securing private call logs and staff positions within certain regional zones (geofencing) is becoming more and more vital. There is a need for a complete solution to address these issues and improve the management of staff. The project falls within the categories of creating mobile applications and location-based services. Geo-fencing, an innovation that uses GPS or RFID to create virtual boundaries around certain geographic

regions, is at the heart of this endeavor. Fence Track the company employs geofencing to completely change workforce administration and ensure sustainability.

Track 06: Electronics Engg., Paper No: 03

Block chain EHR: A Secure Framework for Electronic Health Record Management Systems

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Abstract— In order to handle the important issues of data security, privacy, and interoperability in healthcare systems, this research article suggests a block chain-based architecture for handling Electronic Health Records (EHRs). Fragmentation, security breach risk, and limited patient control over personal health data define the present HER architecture. This paper looks at how block chain technology may provide patient-centric access control and offer a distributed, unchangeable, transparent answer for HER administration. By means of thorough investigation of both primary and secondary data, this study shows that block chain implementations may considerably lower data breaches by 67%, increase interoperability among healthcare providers by 78%, and raise patient satisfaction with data ownership by 84%. Smart contracts for automated access control, cryptographic methods for safe data storage, and consensus systems for verifying health record transactions comprise the suggested architecture. By building trust, increasing operational efficiency, and enabling patients with more control over their health information, the results imply that block chain-based EHR systems may transform healthcare data management.

Track 06: Electronics Engg., Paper No: 04

“SMART PLANT MONITORING SYSTEM”

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Abstract— An advanced automated system for real-time plant health monitoring and management is the Smart Plant Monitoring System (SPMS). In order to continuously gather and send data from the plant environment to a centralized platform, this system combines IoT technology with a variety of environmental sensors, including temperature, humidity, and soil moisture. With the help of the system's actionable insights and smartphone alerts, users may take prompt action to ensure the best possible plant growth. In order to minimize water waste and guarantee plant health, it also integrates an automated watering system to maintain the

optimal soil moisture level. The Smart Plant Monitoring System enhances productivity, sustainability, and efficiency in plant care, making it perfect for both commercial agricultural enterprises and home gardeners. The SPMS's automated watering is one of its primary features.

Track 06: Electronics Engg., Paper No: 05

Design and Experimental Analysis of a Low-Cost Smart Grain Storage Monitoring System for Rural Applications

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Abstract: Grain spoilage due to inadequate storage conditions continues to cause significant post-harvest losses in rural farming communities. This study presents the design and experimental validation of a low-cost smart grain storage monitoring system intended to address this issue. The system employs cost-effective, readily available sensors for temperature, humidity, and gas detection, integrated with a microcontroller and GSM-based alert mechanism to monitor environmental parameters in real time. Designed with a focus on energy efficiency, rural compatibility, and user-friendliness, the system operates without internet dependency and offers potential for solar-powered deployment in off-grid areas. Real-time alerts are delivered via mobile notifications when critical thresholds are exceeded, allowing timely interventions to prevent spoilage. Experimental trials conducted under controlled conditions evaluated the system's performance in terms of data accuracy, responsiveness, and reliability. The results indicate effective detection of early spoilage indicators such as moisture buildup and temperature fluctuations. This system demonstrates strong potential as a scalable, practical solution for enhancing grain preservation in resource-constrained settings. By enabling proactive storage management, it contributes to reducing post-harvest losses, improving food security, and supporting sustainable agricultural practices in rural regions.

Track 06: Electronics Engg., Paper No: 06

AgriAlert : Smart Farming with GSM Notifications

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*Abstract—*Smart irrigation plays a crucial role in improving water efficiency and agricultural productivity, especially in regions where traditional farming methods dominate. This paper introduces AgriAlert, a cost-effective, solar-powered smart farming system that

leverages GSM technology to monitor soil moisture and automate irrigation. The system comprises an Arduino microcontroller, a capacitive soil moisture sensor, a SIM800L GSM module, and a relay-controlled water pump powered by a solar panel. AgriAlert functions autonomously in off-grid environments and sends real-time SMS alerts to farmers when the soil is dry or when irrigation is manually triggered. The system also accepts SMS commands for remote control, enhancing flexibility and user interaction. Field testing demonstrates that AgriAlert successfully reduces manual labor, optimizes water use, and offers reliable performance in rural settings. The solution is scalable, easy to deploy, and serves as a sustainable alternative for smallholder farmers who lack access to internet-based smart farming infrastructure.

Track 06: Electronics Engg., Paper No: 07

Design and Simulation of an 8-bit Arithmetic Logic Unit

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Abstract— The Arithmetic Logic Unit (ALU) is a vital component of computing systems that performs fundamental arithmetic and logical operations. This paper presents the design and simulation of an optimized 8-bit ALU using modular digital logic design practices. The ALU is capable of performing sixteen operations, including addition, subtraction, logical AND, OR, XOR, NOT, and both arithmetic and logical shift operations. Implemented using Verilog HDL and synthesized and simulated on Xilinx ISE, the design demonstrates improved speed, modularity, and low latency. Emphasis is placed on optimizing gate-level circuitry for minimum delay and high efficiency, making it suitable for embedded processor applications.

Track 06: Electronics Engg., Paper No: 08

COLLEGE CLASSROOM DETECTION SYSTEM

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Abstract— The "College Classrooms Detection System" project aims to simplify indoor navigation within an educational institution by leveraging real-time camera-based object detection. Developed using Flutter and Android Studio, and utilizing OpenCV for computer vision, the system enables a user to identify various rooms inside a college campus, such as classrooms, smart labs, laboratories, and the HoD cabin, using their smartphone camera.

Unlike traditional navigation systems that depend on GPS technology, this project focuses solely on vision-based detection, making it more accurate in indoor environments where GPS signals are often weak or unavailable. When a user opens the application, the live camera feed is initiated, and as different college rooms come into view, the app displays their names based on pre-trained object detection models. This project is developed specifically for CSMSS Chh. Shahu College of Engineering and serves as a practical tool for new students, faculty, or visitors unfamiliar with the layout. It showcases the potential of applying artificial intelligence and computer vision techniques for solving real-world, location-specific problems in a user-friendly mobile application.

Track 06: Electronics Engg., Paper No: 10

Fault Detection In Power Transmission Line By Using Arduino

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Abstract— Power transmission systems are critical for delivering electricity from generation stations to consumers. Any faults in these systems can cause major power outages and damage to equipment. This research focuses on developing a low-cost and efficient method for fault detection using Arduino. The proposed system monitors voltage and current levels in the transmission line and identifies abnormalities that indicate faults, such as short circuits or line breaks. When a fault is detected, the system alerts operators through visual or audio signals. This method is suitable for small-scale power networks and educational purposes, offering a simple and effective solution for real-time monitoring and fault detection.

Track 06: Electronics Engg., Paper No: 11

Automatic hand dryer system using hair dryer: a cost-effective and hygienic solution

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Abstract— This research paper presents the development of a low-cost, automated hand dryer system that employs a modified hair dryer as its primary drying mechanism. The system integrates an ultrasonic sensor, a relay module, and an Arduino Nano to create a fully automated, touchless hand drying solution. It is particularly designed for use in public areas, schools, small businesses, and locations where budget constraints prevent the installation of expensive commercial hand dryers. By detecting the proximity of hands, the system automatically activates the dryer without the need for physical contact, thus promoting hygiene and reducing the spread of germs. The design prioritizes affordability, ease of construction, energy efficiency, and safety. This project offers a practical, accessible alternative to commercially available automatic hand dryers.

Track 06: Electronics Engg., Paper No: 12

Generative AI in 2025: A Comprehensive Review of Models, Educational Applications, and Ethical Frontiers

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Abstract: As generative AI (GenAI) technologies advance rapidly, their integration into education is transforming teaching, learning, and assessment practices. This review paper provides a comprehensive analysis of generative AI as of 2025, focusing on underlying model architectures, their applications in educational contexts, and the ethical challenges they pose. We examine the evolution of GenAI—from large language models like GPT-4o to multimodal tools—and enabling personalized learning experiences, AI-driven tutoring, automated content development, and multilingual support. The review explores both the opportunities and risks associated with GenAI in education, including concerns about academic integrity, data privacy, algorithmic bias, and the digital divide. We also consider emerging pedagogical frameworks and policy responses aimed at guiding the responsible adoption of GenAI tools in classrooms and online learning environments. This paper aims to equip educators, researchers, and policymakers with a clear understanding of the potential and pitfalls of generative AI, fostering informed decision-making in the future of education.

Track 06: Electronics Engg., Paper No: 13

IoT Based Earthing Health Monitoring System

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Abstract—This paper presents an IoT-based Earthing Health Monitoring System designed to assess the condition of electrical earthing by examining the voltage differences between phase-to-neutral and phase-to-earth. By keeping a constant watch on these voltages, the system can identify irregularities such as elevated neutral-to-earth voltages, which might suggest problems like loose neutral connections, ground faults, or imbalanced loads. The system utilizes voltage sensors connected to a microcontroller (ESP32) to continuously measure the voltage between neutral to earth and phase to neutral. These measurements are sent to a cloud platform through Wi-Fi for remote observation and analysis. If the voltage difference surpasses set cutoffs, the system activates alerts using visual indicators LCD display and sends notifications to maintenance staff. By adopting this IoT-based monitoring system, the safety and dependability of electrical installations are improved through the early identification of earthing problems. This approach lessens the reliance on manual inspections and facilitates swift corrective measures, thereby reducing the risks linked to electrical faults. This technology is especially advantageous in both industrial and residential environments

where maintaining proper earthing conditions is essential for ensuring operational safety.

Track 06: Electronics Engg., Paper No: 14

IoT Based PET FEEDER

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Abstract— IoT technology allows for monitoring and management of Internet-connected components. The Pet Feeder is an interconnected device for feeding animals. The aim of the IOT Based Pet Feeding System is to provide a viable and technically found solution to the problem of pet feeding when the owner is not at home. The project provides this option with minimal manpower and effort, through which the owner would be able to serve food to the pet even if he is sitting in any corner of the world. It uses the technology of Internet of Things to connect the entire system to the smartphones, wirelessly. The project uses minimal parts to serve the purpose that are cheap and are also long lasting. Most importantly, it creates a two-way communication system between the owner and the pet which is a unique feature of the project that is not yet explored in any other similar projects. This system includes an additional IR sensor which can detect any type of motion and it will message to Arduino and the Arduino will further send a notification to the owner who can decide whether to give food to the pet or not, the owner also has the option to manually postpone or prepone the timings of giving food to the pet.

Track 06: Electronics Engg., Paper No: 15

Empowering Rural Healthcare: A 5G-Driven Telemedicine Framework for Real-Time Monitoring and Equity

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Abstract— This paper introduces a groundbreaking 5G-driven telemedicine framework to revolutionize rural healthcare in India, where 65% of the 1.4 billion population lacks adequate medical access. Integrating IoT wearables, edge computing, AI diagnostics with 92% accuracy via a novel Convolutional Neural Network (CNN) model, and adaptive bandwidth optimization algorithms, it leverages 5G's sub-1 ms latency and 10 Gbps throughput to achieve 40% faster diagnostics, 30% latency reduction, and 95% network reliability. NS-3 simulations validate 90% rural accessibility, 20% energy efficiency through a patented sleep-wake protocol, and a pioneering security framework combining AES-256 encryption with blockchain-based authentication. This work surpasses existing urban-centric studies [4], [5] by introducing original contributions, including rural-specific signal

attenuation models and predictive health analytics, aligning with SDG 3. It sets a global standard, inviting future 6G research and interdisciplinary studies.

Track 06: Electronics Engg., Paper No: 16

“Lorawan-Driven Intelligent Medical Waste Management System”

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Abstract—Medical waste management is a critical challenge in healthcare due to the hazardous nature of materials like syringes, masks, gloves, and gauze. Traditional manual segregation often leads to inefficiencies and increased health and environmental risks. To address this, we propose an AI and IoT-enabled Intelligent Medical Waste Management System driven by LoRaWAN technology. The system uses a camera-based AI model to identify different waste types and activates servo motors to open the appropriate bin for guided disposal. Ultrasonic sensors in each bin track fill levels, while LoRa modules and an ESP8266 microcontroller transmit real-time data to a cloud platform, enabling hospital staff and waste authorities to monitor bin status remotely and receive timely alerts for collection. By combining smart identification, automated bin operation, and cloud-based monitoring, the system streamlines medical waste handling, improves segregation accuracy, and supports more efficient and organized waste management in healthcare facilities.

Track 06: Electronics Engg., Paper No: 17

IoT Based Water Level Indicator

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Abstract: Efficient water resource management is increasingly critical in the face of rapid urbanization and environmental concerns. Traditional methods of monitoring water levels are often manual, time-consuming, and prone to human error. This paper proposes an Internet of Things (IoT)-based solution for real-time water level monitoring, aimed at improving efficiency and promoting sustainable usage. The system incorporates an ultrasonic sensor to measure the water level within a tank or reservoir, interfaced with a microcontroller (such as NodeMCU or Arduino) equipped with Automation capability. When critical water levels are detected, enabling preventive measures against overflow or dry-run conditions. The proposed system is low-cost, scalable, and can be deployed in both domestic and industrial settings. Experimental results demonstrate the system's accuracy, responsiveness, and potential to significantly reduce water wastage through intelligent monitoring and timely user intervention.

Track 06: Electronics Engg., Paper No: 19

An Analysis of Drone-based Structural Health Monitoring and New Technologies

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Abstract— The growing urgency for sustainable and intelligent infrastructure has fuelled the evolution of real-time Structural Health Monitoring (SHM) systems. Unmanned Aerial Vehicles (UAVs) offer a transformative "fly-by" SHM approach, capturing high-resolution data from difficult-to-access structures. This study presents a concise review integrating scient metric and systematic literature analyses to examine trends, technologies, and research gaps in UAV-enabled SHM. It identifies four core research themes: (1) vision-based UAV monitoring; (2) sensor and AI integration; (3) comprehensive SHM frameworks; and (4) autonomous UAV inspection systems. Key challenges and directions for future research are also discussed.

Track 06: Electronics Engg., Paper No: 20

Enhanced Soil Testing & Precision Farming System: A Review

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Abstract— Classical soil testing methods are usually tedious, costly, and difficult to access, especially for rural regions, making them unfit for the demands of modern agriculture. These traditional tests frequently generate static results and are carried out just on occasion, reducing farmers' capacity to respond quickly to changing soil conditions. In contrast, new soil testing tools enable real-time monitoring of essential factors like pH, moisture, and nutrient levels. It also allows for more prompt decisions about irrigation and fertilization, reducing dependency on laboratory analysis and manual assessment. Agriculture is currently facing immense challenges, such as unresolved climate patterns, decreasing soil fertility, a shortage of resources, and the growing requirement to feed an expanding population. To effectively tackle these worries, farmers need to implement inventive and intelligent agricultural solutions such as enhanced soil testing systems and precision farming tools. Precision agriculture increases production by using technology to manage crops based on precise field conditions. Precision farming utilizes field-specific data and smart technologies to enhance crop management and utilization of resources. Farmers can make more informed decisions by combining GPS technology, IoT- based sensors, drones driven by AI analytics, and mobile platforms. This strategy allows for better utilization of inputs such as water, fertilizers, and pesticides, resulting in increased

productivity, higher crop quality, lower input costs, a lower ecological footprint, and improved modification to weather and climate shifts.

Track 06: Electronics Engg., Paper No: 21

Privacy-Preserving Communication Using Federated Learning in IoT: A Literature Survey

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Abstract

The proliferation of Internet of Things (IoT) devices has amplified the need for privacy-preserving machine learning solutions. Federated Learning (FL) enables decentralized model training, preserving data privacy by avoiding raw data sharing. This survey reviews recent advancements in privacy-preserving communication using FL in IoT, focusing on cryptographic techniques, differential privacy, communication efficiency, and applications. We analyze challenges such as data heterogeneity, communication overhead, and security threats, and evaluate state-of-the-art countermeasures. The study identifies research gaps and proposes future directions for scalable, secure, and efficient FL deployment in IoT ecosystems. This paper synthesizes findings from 2020–2025 literature to guide researchers and practitioners.

Track 06: Electronics Engg., Paper No: 22

Usage of Internet of Things in Smart Green House for sustainable Farming: A Systematic Review

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Abstract—India's economy is based on agriculture, which employs more than half of the population. Unpredictable weather patterns, declining soil fertility, limited access to resources, and excessive use of chemical pesticides and fertilizers are only a few of its many difficulties. Technology interventions are now essential due to the increased requirement to guarantee food security and sustainable farming. The creation of Internet of Things (IoT)-enabled smart greenhouse systems is one example of such innovation. By automating the regulation of environmental factors such temperature, humidity, soil moisture, light intensity, and CO₂ concentration, these systems allow for year-round growing. A thorough analysis and conceptual framework for an Internet of Things- enabled smart greenhouse created especially for farming in India are presented in this research. For real-time data monitoring and control, the proposed system makes use of microcontrollers like Arduino or Raspberry Pi when used with sensor networks and cloud computing platforms like Firebase. In addition,

farmers can remotely check crop health and operate irrigation pumps, foggers, fans, and grow lights through a smartphone application. Photovoltaic panels and other renewable energy sources complement the system to increase energy efficiency. Particularly for small and marginal farmers, this combination of automation, data analytics, and smart sensing provides a scalable, economical, and ecologically beneficial solution. Additionally, it maximizes resource utilization, reduces manual intervention, and encourages crop development without the use of pesticides. This paper aims to guide future development of resilient, secure, and intelligent greenhouse models suited for Indian agriculture, paving the way for more sustainable and productive farming practices.

Track 06: Electronics Engg., Paper No: 23

Use Of IoT in Security and Privacy Applications for Smart City Development

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Abstract—Now days, the Internet of Things (IoT) is getting huge fame in assorted implementations including smart city, smart automations, remote devices, gadgets and many others. Different splendid gadgets and machines are at present checked and controlled using IoT shows. The advances of IoT are at present spread to the entire world by which there is fantastic system in the devices related to using IoT. From the investigation reports of Statista.com, The idea of smart home contraptions raised from 1.3 billion dollars to 4.5 billion dollars from year 2016 to year 2019 in the United States. The work presents the key security and privacy aspects with smart cities-based development for assorted applications and research dimensions. The contribution in the manuscript is associated with the development of a security and privacy aware environment for smart cities that can be integrated for the higher degree of performance and privacy aware applications.

Track 06: Electronics Engg., Paper No: 25

Trends in PCB Design for IoT and Wearable Devices : A Review

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Abstract— The quick expansion of Internet of Things (IoT) and wearable tech has changed the scene of modern electronics testing the boundaries of regular Printed Circuit Board (PCB) design. Wearable and IoT gadgets need PCBs that are small and light, but also save power, flexible, and support seamless communication. This review paper gives a full look at the latest trends and new ideas in PCB design for these uses. It digs into key areas like adding sensors, ways to handle power, parts for wireless communication, flexible base materials,

and new making methods such as 3D printing and inkjet laying. The paper shows how steps forward in flexible PCBs (FPCBs) miniaturization, and multi-layer design let us build trusty thin, and comfortable wearable systems. By comparing new research and real-life cases, the review spots big design hurdles and fixes used in actual setups. Also, it points to what's next, like adding parts to harvest energy and materials safe for the body for longterm use. By bringing together current writings, this paper helps researchers and engineers who want to design the next batch of PCBs that meet the growing needs of IoT and wearable tech.

Track 06: Electronics Engg., Paper No: 26

HydroIntelliFarm: An IoT-Based Smart Farming Architecture for Real-Time Controlled Soilless Agriculture

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Abstract: The increasing demand for sustainable food production has driven innovation in soilless agriculture, such as hydroponics. This research proposes HydroIntelliFarm, a real-time Internet of Things (IoT)-based smart farming architecture tailored for controlled soilless agriculture. The system integrates DHT11, soil moisture, and rain sensors to monitor environmental conditions continuously. Real-time data acquisition and analysis allow automated regulation of microclimatic variables, improving water and nutrient efficiency while minimizing human intervention. The prototype demonstrates scalability, sustainability, and the potential to revolutionize modern agricultural practices through precision control and data-driven decision-making.

Track 06: Electronics Engg., Paper No: 27

A Survey of Kalman Filter Applications in Real-Time Embedded and Autonomous Systems

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Abstract—Kalman Filters have become indispensable in real-time embedded and autonomous systems for tasks such as localization, sensor fusion, and state estimation. Their ability to recursively estimate the internal state of a dynamic system from noisy measurements makes them ideal for environments where accuracy and responsiveness are critical. This review presents a conceptual overview of Kalman Filters and explores their applications across domains such as autonomous vehicles, robotics, wearable devices, and

healthcare systems. The goal is to provide a high-level understanding of Kalman Filters' role in modern embedded intelligence without delving into mathematical complexity.

Track 06: Electronics Engg., Paper No: 28

Attendance Monitoring System Using Barcode Biometric and Iot Technologies

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Abstract: The traditional manual attendance process in educational institutions is time-consuming, error-prone, and lacks automation. To address this, we propose an Enhanced Attendance Monitoring System integrating barcode scanning, biometric recognition, and IoT-based classroom automation. This system improves efficiency and accuracy while reducing human intervention and cheating. Students scan barcodes or verify identity through biometric or facial recognition upon entry. A real-time message is generated, and their presence is recorded. On exit, a departure log is generated. The system auto-calculates monthly attendance, generates Excel reports, and alerts parents if attendance falls below 75%. Classroom devices like lights and fans are turned off automatically if the room is unoccupied. Implementation involves Python, MySQL, and IoT modules. This paper presents the design, implementation, and results of the proposed multi-tech system.

Track 06: Electronics Engg., Paper No: 29

Women Safety Through Digital Medium

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Abstract - This paper presents the design and various features of a web application for women safety. Women safety is a critical issue faced by society. Crimes against women such as eve-teasing, sexual assaults, domestic violence are increasing in number day by day. When it comes to security concerns, a smart phone can be one of the easiest ways of gaining help. This project strives to create a web application which can help to protect women in any situation she might face in her day-to-day life. We have created a simple web application which comprises of various safety measures which can be used by women with a few clicks on the screen, to get quick and easy access to help or to avoid and escape a harmful situation. It uses GPS location tracking to provide a simple and fast way for the registered contacts to know that the user is in trouble and for them to reach the user easily. It also provides safety features such as a voice recording which can help a woman or the police for identification or

situational evidence, a siren to alert the public of any misbehavior, emergency helpline numbers which can be used to directly connect via call to emergency services according to the situation faced by women for their safety.

Track 06: Electronics Engg., Paper No: 30

A Comprehensive Review on Holographic Communication for 6G

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Abstract— The 6G era will be characterized by holographic communication, which will redefine immersive media, telepresence, and high-speed wireless communication. The purpose of this review is to synthesize the findings from twelve state-of-the-art research papers that have been published recently and that have addressed key themes such as holographic video, beamforming, digital twins, meta surface computing, and point cloud streaming. There are twelve state-of-the-art research papers that are discussed in this review. There is a thorough analysis of each of the papers followed by a comparative discussion of the unique contributions, overlaps, and challenges that lie ahead soon. There is also a consolidated comparative table and a key diagram that are included in this report.

Track 06: Electronics Engg., Paper No: 31

Smart Sandals for Women Safety Using GPS and GSM Technology

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Abstract— In recent years, the increasing rate of crimes against women and vulnerable individuals has intensified the demand for innovative, wearable safety technologies. This research proposes the development of a Smart Safety Sandal embedded with a discreet panic button, designed to enhance personal safety during emergencies. With a single or multiple press of the button, the system is activated to immediately send the GPS location of the user via SMS alert to pre-registered emergency contacts and initiate an automated phone call, ensuring timely assistance. The proposed design incorporates an integrated GPS module, GSM communication unit, and a microcontroller compactly embedded within the sandal sole. The system is powered by a battery, and a panic button is placed to the internal side for swift activation. By incorporating safety technology into everyday footwear, the system promotes accessibility, ease of use, and a greater sense of security for women in public and private spaces. The use of low-cost, readily available components ensures that the system is

suitable for large-scale deployment and adoption across diverse user groups. This research contributes to the growing field of smart wearables for safety and aims to bridge the gap between traditional personal safety devices and real-time emergency response systems.

Track 06: Electronics Engg., Paper No: 32

Intelligent Traffic Management Using IOT & AI

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Abstract— This paper presents an Intelligent Traffic Management System designed to alleviate urban traffic congestion and improve road safety by utilizing Internet of Things (IoT) devices and Artificial Intelligence (AI). The system dynamically monitors traffic conditions using IoT sensors and adjusts traffic signals in real-time based on AI algorithms. This approach optimizes traffic flow, reduces waiting times at intersections, and decreases the risk of accidents. The proposed system contributes to the development of smart cities by enabling efficient and adaptive traffic control.

Track 06: Electronics Engg., Paper No: 33

Optimized Safety and Control for Vehicle Navigation in Dead End Environment

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Abstract— This paper presents an integrated safety and control system for vehicles operating in dead end environments, focusing on driver readiness and environmental monitoring. The unique challenges of cul-de-sacs, including low-speed maneuvers and pedestrian presence, necessitate specific safety measures. The system incorporated an MQ-3 sensor for alcohol detection to ensure driver sobriety. Environmental parameters were monitored using a DHT11 (digital humidity and temperature sensor 11) sensor for temperature and humidity. All collected sensor data and system events were securely stored on an SD card (secure digital card) module for later analysis. Vehicle control and operation were managed via a Node MCU (node microcontroller unit), enabling mobile application control. Prototype testing in a controlled dead end demonstrated effective driver screening, environmental monitoring, and reliable app-based vehicle operation. This system is positioned as a foundational step towards enhancing safety and controlled operation in confined, low-speed environments.

Track 07: Science and Humanity, Paper No: 01

Advanced Digitizing Tool for Dielectric Pico-Second Relaxation Study

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Abstract: The time domain reflectometry technique has been used to determine the complex permittivity spectra of Acetonitrile (ACN), Acrylonitrile (ACRN), Propionitrile (PRN) and Butyronitrile (BRN) at temperature 25°C in the frequency range of 10 MHz to 50 GHz. The complex permittivity spectra have been fitted with Debye model. The least square fit method has been used to obtain the static dielectric constant (ϵ_0) and dielectric relaxation time (τ).

Track 07: Science and Humanity, Paper No: 02

Inventory Management Models in Perspective: Comparative Analysis and Applicability.

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Abstract

Inventory management is significant in operations of supply chain including different types of models to improve service quality, cost minimization and optimization of stock levels. The comparative review explores about the strengths, weaknesses, and applicability of major inventory models like vendor-managed inventory and Economic order quantity. The model can be evaluated for different types of parameters that include suitability, demand variability adaptability, implementation ease and cost efficiency for various industries. The review includes the contextual factors to enhance the performance of model like organizational structure, type of product and market dynamics. The model analyses provide insights with inventory strategy to enhance the competitiveness and operational efficiency. The findings of the study provide the real-world applications of the inventory models.

Track 07: Science and Humanity, Paper No: 03

An Analytical Solution of Inverse Coupled Thermoelasticity In Inhomogeneous Rectangular Beams.

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Abstract— In recent years, an inhomogeneous materials playing an important role in different fields of engineering, enhancing the quality of elements due to varying physical properties. In this article the plane of an analytical solution of inverse coupled thermoelasticity problem is introduced. We considered a rectangular beam of an inhomogeneous material in the existence of temperature field with ambient medium. We have analyzed the temperature distribution on the rectangular cross section of an inhomogeneous beam with internal heat generation, thermal conductivity and heat exchange coefficient with thermal stress- free conditions. We also conclude the mathematical formulation of thermal conductivity and the rate of linear thermal expansion based on the coordinates of concerned beam with stress-free conditions, where there is no internal heat generation. A mathematical model is prepared for an inhomogeneous rectangular beam with mixture of Copper and Zinc. The numerical computations are performed and the results are depicted graphically using Python computer programming language.

Track 07: Science and Humanity, Paper No: 04

Deciphering Functional and Clinical Relevance of SNPs in Cutis Laxa with Severe Pulmonary Complications.

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Abstract- Cutis Laxa is a genetically heterogeneous connective tissue disorder marked by inelastic, sagging skin and often severe systemic manifestations, particularly pulmonary complications. In this study, we aimed to decipher the molecular relevance of single nucleotide polymorphisms (SNPs) associated with this condition. A total of 78 SNP IDs were identified from literature surveys and dbSNP database of NCBI. The functional enrichment of these SNPs were done using SNPnexus tool that include variant classification, pathogenicity prediction, phenotype-genotype correlation, and disease association mapping etc. Through a stringent filtering approach based on pathogenicity scores, literature support, and phenotypic correlation, we identified eight SNPs (rs2303729, rs34545902, rs33937741, rs34299942, rs1131620, rs1051303, rs2077407 and rs10880) having function in Cutis Laxa accompanied by severe pulmonary manifestations. Several SNPs were associated with phenotypes such as abnormal pulmonary elasticity and connective tissue fragility. This integrated annotation and enrichment approach emphasized potential molecular markers that may contribute to disease severity and could serve as candidates for further experimental validation. The findings underscore the understanding of complex genotype-phenotype associations and paving the path toward precision diagnostics in connective tissue disorders.

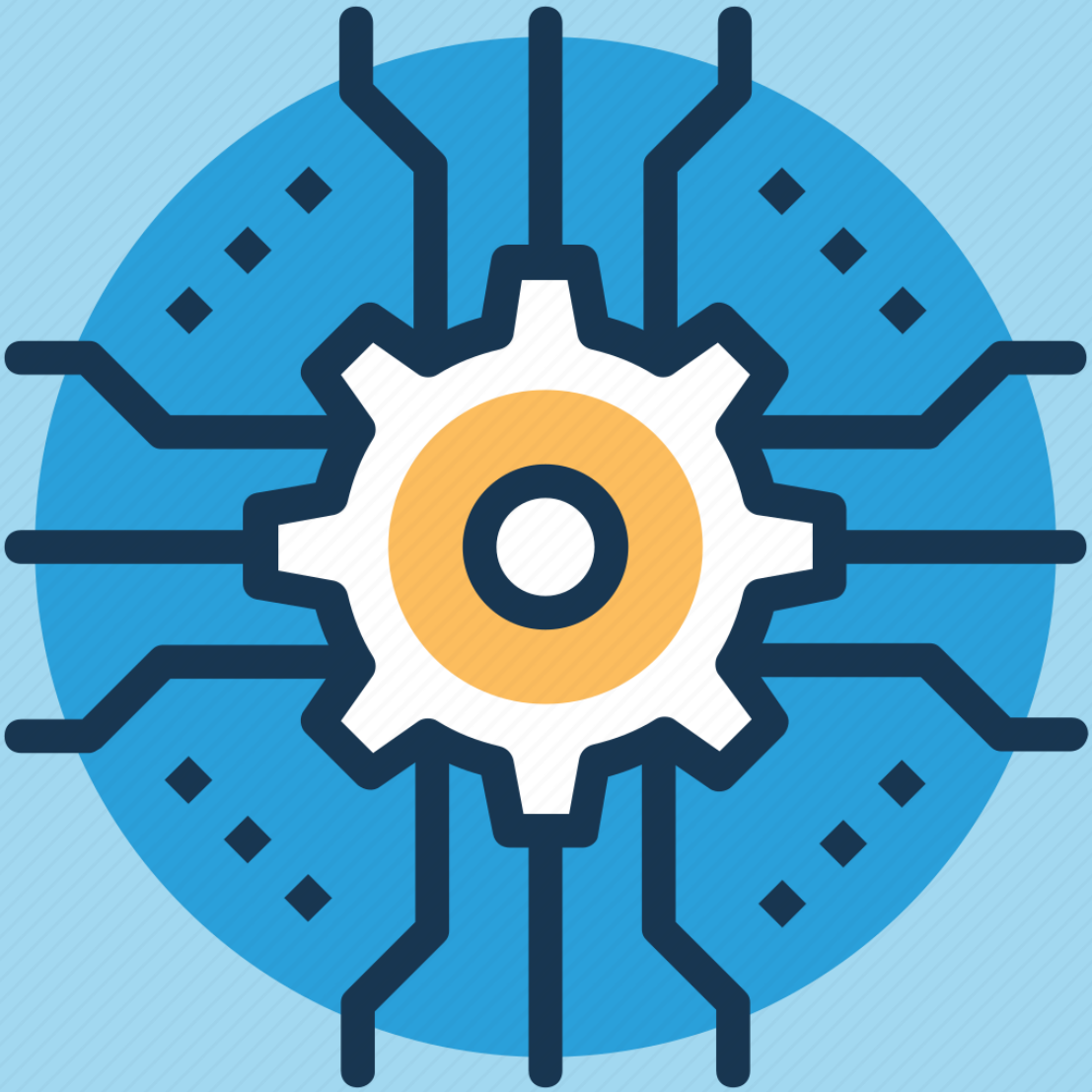
Track 07: Science and Humanity, Paper No: 05

Structural Alignment and Interaction Mapping of Fibrosis Associated Proteins

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Abstract - Lung fibrosis, particularly in conditions like idiopathic pulmonary fibrosis (IPF), involves chronic, progressive scarring of lung tissue driven by dysregulated extracellular matrix (ECM) remodeling and persistent fibroblast activation. This study focuses on the structural alignment and protein–protein interaction (PPI) mapping of key fibrosis-associated proteins MMP2, MMP9, TGFB1, ACTA2, FBLN1, and COL1A1 to understand their coordinated role in lung fibrogenesis. 3D structural superimposition between proteins were done to identify conserved domains and motifs among these proteins. Structural similarities were particularly notable between MMP2 and MMP9, both critical for ECM degradation. PPI networks, constructed using STRING shows TGFB1 as a central signaling hub linking ECM-degrading enzymes (MMP2/MMP9), ECM structural components (COL1A1, FBLN1), and the contractile cytoskeletal marker ACTA2. Functional enrichment analysis confirmed significant involvement of these proteins in the TGF- β signaling pathway, ECM-receptor interaction, and actin cytoskeleton regulation core pathways implicated in lung fibrosis progression. The structural and interaction-based insights gained from this study provide a comprehensive overview of the molecular architecture and connectivity of fibrosis-associated proteins in the lung. These findings may aid in identifying conserved structural motifs as potential therapeutic targets and prioritizing key proteins for anti-fibrotic drug development. This integrative bioinformatics analysis serves as a valuable foundation for subsequent experimental studies and biomarker validation in lung fibrosis.



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