Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute) Affiliated to Savitribai Phule Pune University, Pune

Approved by AICTE, Accredited 'A' Grade by NAAC

DEPARTMENT OF INFORMATION TECHNOLOGY

(NBA Accredited - UG Programme)

IT TECHNICAL MAGAZINE

MARCH 2024

VISION OF DEPARTMENT

To develop world class IT professionals through quality education.

MISSION OF DEPARTMENT

To create Academic Excellence in the field of Information Technology through Education, Industry Interaction, Training and Innovation to improve quality of life of people. We are committed to develop industry competent technocrats with life-long learning capabilities and moral values.

PROGRAM EDUCATIONCAL OBJECTIVES (PEOs)

PEO 1:

Graduates of IT program should possess knowledge of fundamental concepts in mathematics, science, engineering and technology as well as skills in the field of Information Technology for providing solution to complex engineering problem of any domain by analyzing, designing and implementing.

PEO 2:

Graduates of IT program should possess better communication, presentation, time management and teamwork skills leading to responsible and competent research, entrepreneurship and professionals, will be able to address challenges in the field of Information Technology at global level.

PEO 3:

Graduates of IT program should have commitment to ethical practices, societal contributions through communities and life-long learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Engineering Graduates will be able to:

PSO 1:

Attain the ability to provide software solutions by applying knowledge of Data Structures & Algorithms, Databases, Web Technology, System Software, Soft Computing and Cloud Computing.

PSO 2:

Apply the knowledge of Computer Hardware & Networking, Cyber Security, Artificial Intelligence and Internet of Things to effectively integrate IT based solutions.

PSO 3:

Apply the knowledge of best practices and standards of Software Engineering for Project Management.

FROM HOD's DESK

The Department of Information Technology is committed to delivering outcome-based education in alignment with the vision and mission of the institution and the Program Educational Objectives (PEOs) and Program Specific Outcomes (PSOs) of the program. The curriculum and academic activities are structured to ensure that graduates acquire strong foundational knowledge, professional competencies, and ethical values required to address contemporary and emerging challenges in the field of Information Technology.

The projects undertaken by students form an integral component of the teaching–learning process and provide a platform for the effective application of theoretical concepts to real-world engineering problems. These projects demonstrate students' ability to analyze complex problems, design viable solutions, and implement them using appropriate methodologies, tools, and technologies in areas such as software development, data structures and algorithms, databases, networking, artificial intelligence, cybersecurity, cloud computing, and system software. Emphasis is also placed on developing professional skills including teamwork, communication, project management, ethical responsibility, and life-long learning, thereby preparing graduates for higher studies, research, entrepreneurship, and successful professional careers at the national and global levels.

I commend the sincere efforts of the students and faculty members involved in the successful completion of these projects. I am confident that the work presented herein reflects the attainment of the stated program outcomes and will contribute meaningfully to the academic and professional growth of the students.

Dr. Madhuri Jawale,
Professor and Head

FROM EDITOR'S DESK

The compilation of student projects presented in this volume reflects the academic rigor, outcome-based approach, and quality standards upheld by the Department of Information Technology. These projects are a culmination of systematic learning, continuous assessment, and effective mentoring, aligned with the Program Educational Objectives (PEOs) and Program Specific Outcomes (PSOs) of the program.

Each project demonstrates the students' ability to apply engineering principles, computational techniques, and contemporary tools to analyze and solve complex real-world problems. Emphasis has been placed on adherence to software engineering best practices, ethical considerations, and structured documentation, in accordance with NBA and institutional guidelines.

This compilation also highlights the development of professional competencies such as analytical thinking, innovation, teamwork, communication, and project management, which are essential for successful careers in industry, research, and higher education. The editorial process ensured uniformity, technical correctness, and academic integrity across all submissions.

I extend my appreciation to the students for their dedicated efforts and to the faculty members for their guidance and meticulous review. It is hoped that this compilation will serve as a valuable academic resource and inspire future learners to pursue excellence in the field of Information Technology.

Editor

Mr. U.B. SANGULE
Editor, Department of IT

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Generative AI Solution for Lane Departure, Pedestrian Detection, and Path Planning of Autonomous Vehicles

Problem Landscape

Road transportation systems worldwide continue to face significant safety challenges due to human errors such as distraction, fatigue, delayed reaction time, and poor judgment in complex driving scenarios. Lane departure accidents account for a substantial portion of highway crashes, often resulting from driver inattention or misinterpretation of road markings. Similarly, pedestrian-related accidents remain a critical concern in urban environments, where unpredictable pedestrian movement and dense traffic conditions increase the risk of collisions.

Traditional Advanced Driver Assistance Systems (ADAS) rely primarily on rule-based algorithms and classical computer vision techniques. While these systems perform adequately in controlled conditions, they often struggle in real-world environments involving poor lighting, adverse weather, occlusions, irregular lane markings, and dynamic obstacles. Furthermore, conventional path planning algorithms are limited in their ability to anticipate future scenarios, leading to suboptimal navigation decisions.

With the rapid advancement of Artificial Intelligence, particularly Generative AI and deep learning, there is a growing opportunity to develop intelligent autonomous driving systems capable of learning complex patterns, predicting multiple future outcomes, and adapting to dynamic environments. This project addresses the limitations of conventional systems by proposing a Generative AI–driven solution that enhances lane departure detection, pedestrian recognition, and intelligent path planning for autonomous vehicles.

OBJECTIVES

The primary objective of this project is to design and implement an intelligent autonomous driving assistance system that improves vehicle safety and decision-making through advanced AI techniques. The specific objectives of the project are as follows:

· To develop a robust lane detection mechanism that accurately identifies lane boundaries under varying road and lighting conditions.

· To implement an efficient pedestrian detection system capable of recognizing pedestrians in real time, even in crowded or partially occluded environments.

· To design an intelligent path planning module that dynamically generates safe and optimal driving paths based on real-time traffic conditions.

· To integrate Generative AI models to simulate multiple driving scenarios and select the safest navigation strategy.

· To reduce dependency on rigid rule-based systems by enabling adaptive, data-driven decision-making.

· To enhance overall road safety and support the future development of fully autonomous vehicles.

METHOD USED

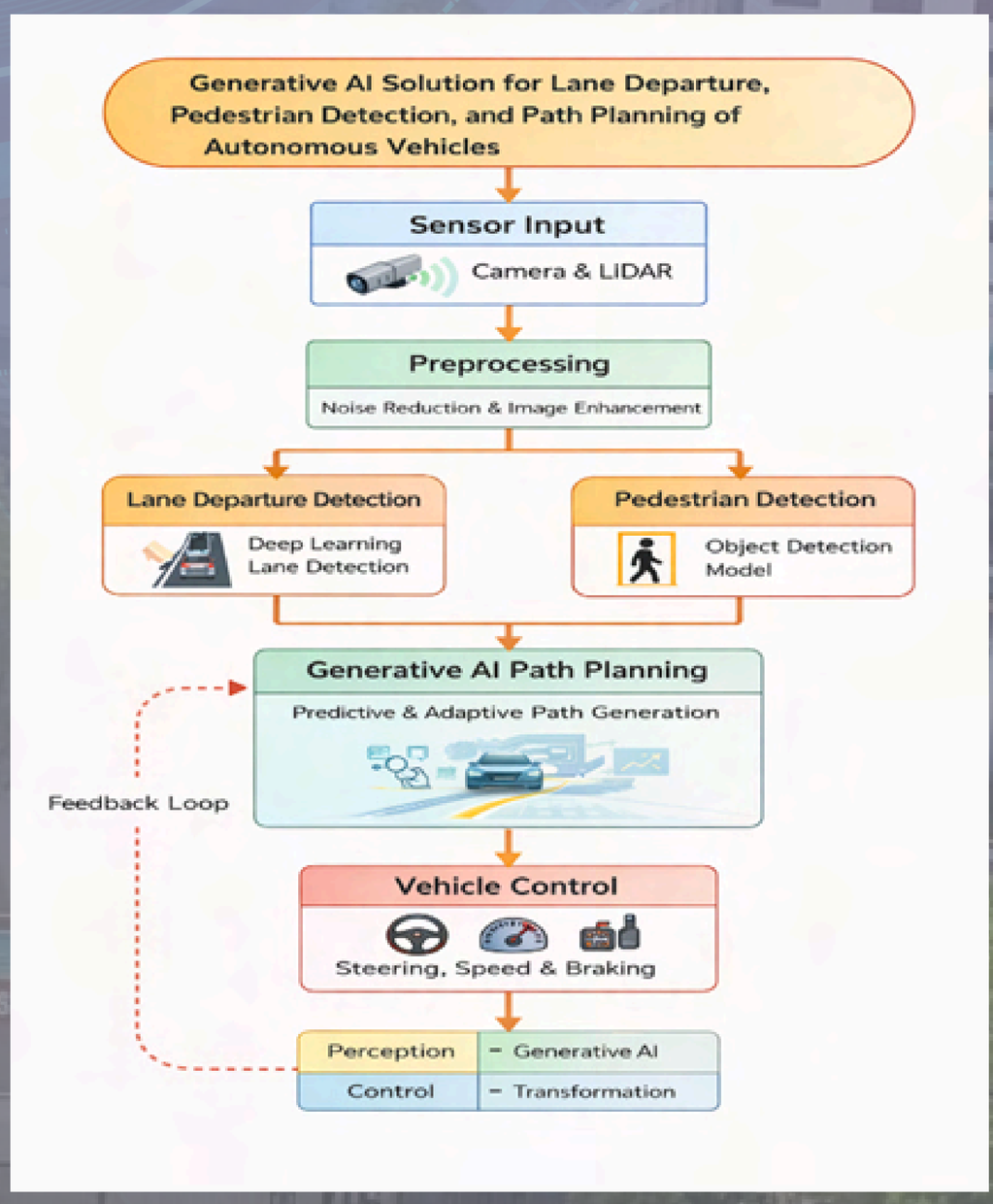
The proposed system follows a modular architecture consisting of perception, prediction, and planning stages. The perception module uses camera sensors to capture real-time video data of the driving environment. This visual data is preprocessed using image enhancement and noise reduction techniques to improve detection accuracy.

For lane detection, deep learning–based semantic segmentation models are employed to identify lane markings accurately. These models analyze pixel-level information to distinguish lanes from road surfaces, even when markings are faded or partially visible. Pedestrian detection is achieved using convolutional neural network (CNN)–based object detection models that can identify pedestrians at different scales and orientations.

The core novelty of the system lies in the use of Generative AI for path planning. Generative models, such as Generative Adversarial Networks (GANs) or transformer-based architectures, are utilized to generate multiple feasible driving trajectories based on current and predicted environmental conditions. These trajectories are evaluated using safety constraints, obstacle proximity, and vehicle dynamics to select the optimal path.

The selected path is then passed to the control module, which ensures smooth vehicle steering and speed regulation. Continuous feedback from sensors allows the system to update its decisions in real time, ensuring adaptive and reliable performance.

PROPOSED MODEL



Technical Innovation

The key technical innovation of this project is the integration of Generative AI into the autonomous driving pipeline. Unlike traditional systems that rely on predefined rules or single-path planning algorithms, the proposed approach enables the system to generate and evaluate multiple potential driving scenarios simultaneously.

By leveraging Generative AI, the system can anticipate future road conditions, pedestrian movement, and lane changes, allowing for proactive decision-making rather than reactive responses. This capability significantly improves robustness in unpredictable traffic environments.

Another important innovation is the seamless integration of perception and planning modules. The project combines advanced computer vision techniques with generative modeling to create a unified framework capable of understanding complex driving scenes and responding intelligently. This hybrid approach enhances system adaptability and scalability, making it suitable for real-world deployment.

PERFORMANCE

The performance of the proposed system is evaluated using multiple metrics, including detection accuracy, response time, and path safety. Experimental results demonstrate that the lane detection module achieves high accuracy under diverse road conditions, including curved roads and low-visibility scenarios.

The pedestrian detection system shows improved precision and recall compared to traditional object detection approaches, significantly reducing false positives and missed detections. The Generative AI–based path planning module successfully generates smooth and collision-free trajectories, ensuring safe navigation in dynamic environments.

Overall, the system exhibits faster decision-making and greater adaptability compared to rule-based systems. The results indicate that the proposed solution enhances both safety and reliability, making it suitable for advanced autonomous driving applications.

Real-World Application

The proposed system has wide-ranging real-world applications in the automotive and transportation sectors. It can be integrated into autonomous vehicles and semi-autonomous driving systems to improve road safety and driving efficiency. The solution is also highly relevant for Advanced Driver Assistance Systems (ADAS), where it can assist drivers in lane keeping, pedestrian avoidance, and safe navigation.

In addition to personal vehicles, the system can be deployed in smart transportation infrastructures, autonomous public transport, and logistics vehicles operating in complex urban environments. The use of Generative AI enables continuous learning and adaptation, making the system future-ready for evolving traffic conditions and regulatory requirements.

This project contributes significantly to the development of intelligent transportation systems and supports the long-term vision of safer, more efficient, and fully autonomous mobility.

Guide: Dr. M. A. Jawale

Project Group Members:

1) Aditya Sakure

2) Bachhav Kiran Raju

3) Chinmay Bitne

4) Chopade Vaibhav Pandurang

5) Dhawade Vaishnavi Vinayak

Prescriptive Analysis for Predicting Accidents Based on Weather Conditions to Avoid Accidents in India

Problem Landscape

Road accidents remain one of the most serious public safety challenges in India, causing significant loss of human life and economic damage every year. A major contributing factor to these accidents is adverse weather conditions such as heavy rainfall, fog, dust storms, extreme heat, and reduced visibility. These environmental conditions negatively impact driver perception, vehicle control, and road surface quality, thereby increasing accident probability.

Traditional traffic management systems in India mainly rely on reactive approaches, where safety measures are implemented only after accidents occur. Existing accident prediction models focus primarily on historical data analysis without providing actionable decision support to drivers or traffic authorities. Moreover, the diversity of Indian road conditions, varying traffic density, and unpredictable weather patterns make accident prediction highly complex.

With the rapid growth of data analytics and artificial intelligence, prescriptive analysis offers an advanced solution by not only predicting accident risks but also recommending preventive measures. This project proposes a prescriptive analytics framework that integrates weather data, accident records, and traffic parameters to forecast accident-prone situations and suggest safety recommendations. The system aims to enhance road safety by enabling proactive accident prevention strategies across Indian transportation networks.

OBJECTIVES

The primary objective of this project is to develop an intelligent prescriptive analytics system that predicts road accident risks based on weather conditions and provides preventive recommendations. The specific objectives include:

- To collect and analyze historical accident data along with weather condition records across different regions of India.
- To identify key environmental factors influencing accident occurrence such as rainfall intensity, temperature, humidity, fog density, and wind speed.
- To develop predictive models capable of forecasting accident probability under different weather scenarios.
- To implement prescriptive analytics techniques that suggest preventive safety actions for drivers and traffic authorities.
- To design a real-time monitoring dashboard for accident risk visualization.
- To improve road safety awareness and reduce accident rates through intelligent decision support systems.

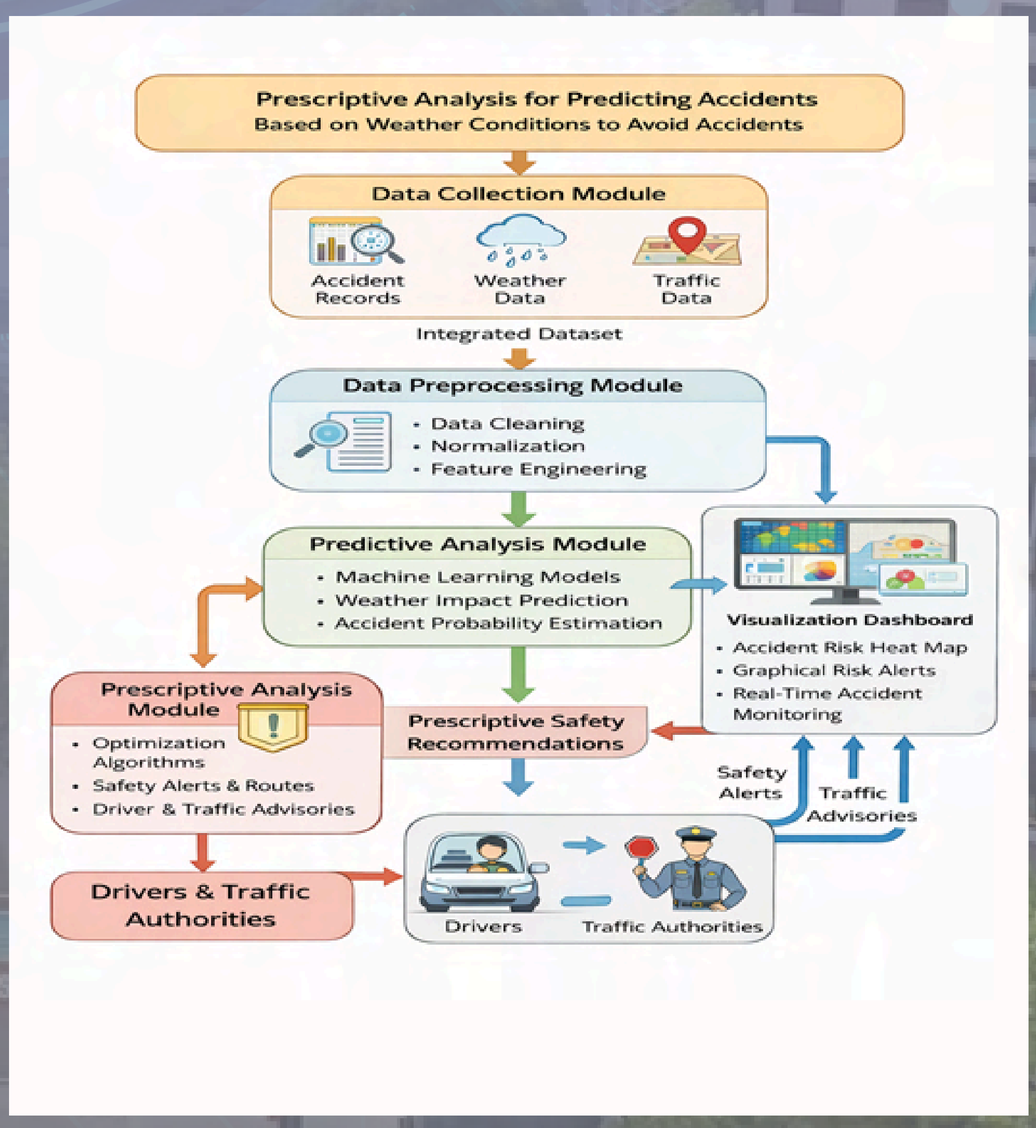
METHOD USED

The proposed system follows a data-driven analytical framework consisting of data acquisition, preprocessing, predictive modelling, and prescriptive recommendation modules. Initially, accident datasets are collected from government traffic databases, road safety organizations, and meteorological department records. Weather data parameters including temperature, precipitation, humidity, wind speed, and visibility are integrated with accident occurrence data to create a comprehensive dataset.

Data preprocessing techniques such as data cleaning, normalization, and missing value handling are applied to ensure dataset reliability. Feature engineering techniques are used to extract significant attributes that influence accident occurrence. Machine learning algorithms such as Random Forest, Decision Trees, and Logistic Regression are implemented to predict accident probability based on weather conditions.

The prescriptive analysis module evaluates predictive results and generates safety recommendations using optimization and rule-based decision models. The system suggests measures such as speed reduction alerts, alternate route suggestions, driver warnings, and traffic control advisories. A visualization dashboard is developed to display accident risk levels across different regions using graphical representations and risk heat maps.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in the integration of predictive analytics with prescriptive decision-making techniques for road safety. Unlike traditional accident analysis systems that only forecast accident occurrence, the proposed system provides practical preventive recommendations to minimize accident risks.

Another innovative aspect is the use of multi-source data integration combining meteorological data with traffic accident datasets. The project also introduces real-time visualization techniques that help traffic authorities monitor accident risk dynamically. The system enables adaptive decision-making by continuously updating predictions based on changing weather conditions.

PERFORMANCE

The performance of the proposed system is evaluated using accuracy, precision, recall, and prediction reliability metrics. Experimental results demonstrate that the predictive models successfully identify accident-prone weather conditions with high accuracy. The system effectively recognizes patterns linking rainfall intensity, fog density, and reduced visibility with increased accident risk.

The prescriptive recommendation module significantly enhances decision support by providing actionable safety measures. The visualization dashboard improves monitoring efficiency and enables timely intervention by traffic authorities. Overall system performance shows improved accident prediction capability and enhanced road safety decision-making.

Real-World Application

The proposed system has significant applications in intelligent transportation systems and smart city traffic management. It can be integrated with navigation applications to provide weather-based driving alerts and route safety suggestions. Traffic management authorities can utilize the system to implement precautionary measures during adverse weather conditions.

The solution can also be deployed in highway safety monitoring systems, public transportation planning, and emergency response management. By providing proactive accident prevention strategies, the project contributes to reducing road accident rates and improving transportation safety infrastructure in India.

Guide: Dr. M. A. Jawale

Project Group Members:

1) LUNGADE KIRAN SANJAY

2) RAHANE ARATI BHAGWAT

3) RAHANE PRIYANKA BHARAT.

4) RAHANE SHITAL ANNA

5) VAISHNAVI SANJAY AHER

Cost Effective IoT Solution for Bus Pass System

Problem Landscape

Public transportation systems play a crucial role in urban and rural mobility across India. Bus services are widely used by students, employees, and daily commuters. However, the existing bus pass management system in many regions is still manual or semi-digital, which creates operational inefficiencies and user inconvenience. Traditional bus pass systems require physical pass verification by conductors, leading to longer boarding times, increased chances of fraud, and difficulties in maintaining passenger records.

Another major issue is the lack of real-time monitoring and data tracking. Transport authorities face challenges in verifying pass authenticity, managing renewal processes, and analysing passenger usage patterns. Manual record maintenance also increases administrative workload and operational costs. Moreover, passengers often experience delays due to manual verification and ticketing processes, especially during peak hours.

With the advancement of Internet of Things (IoT) technology, smart transportation solutions can automate bus pass verification and enhance passenger convenience. IoT enables seamless communication between devices, allowing real-time monitoring, automated authentication, and digital record management. This project proposes a cost-effective IoT-based bus pass system that reduces operational expenses while improving passenger experience and transportation efficiency.

OBJECTIVES

The primary objective of this project is to design and implement an affordable IoT-based smart bus pass system that automates passenger verification and monitoring. The specific objectives include:

- To develop an automated bus pass authentication system using IoT devices.
- To reduce manual verification efforts and minimize boarding delays.
- To design a centralized database for storing passenger pass information.
- To enable real-time passenger monitoring and usage tracking.
- To provide an easy renewal and management system for bus passes.
- To develop a cost-effective and scalable transportation management solution.

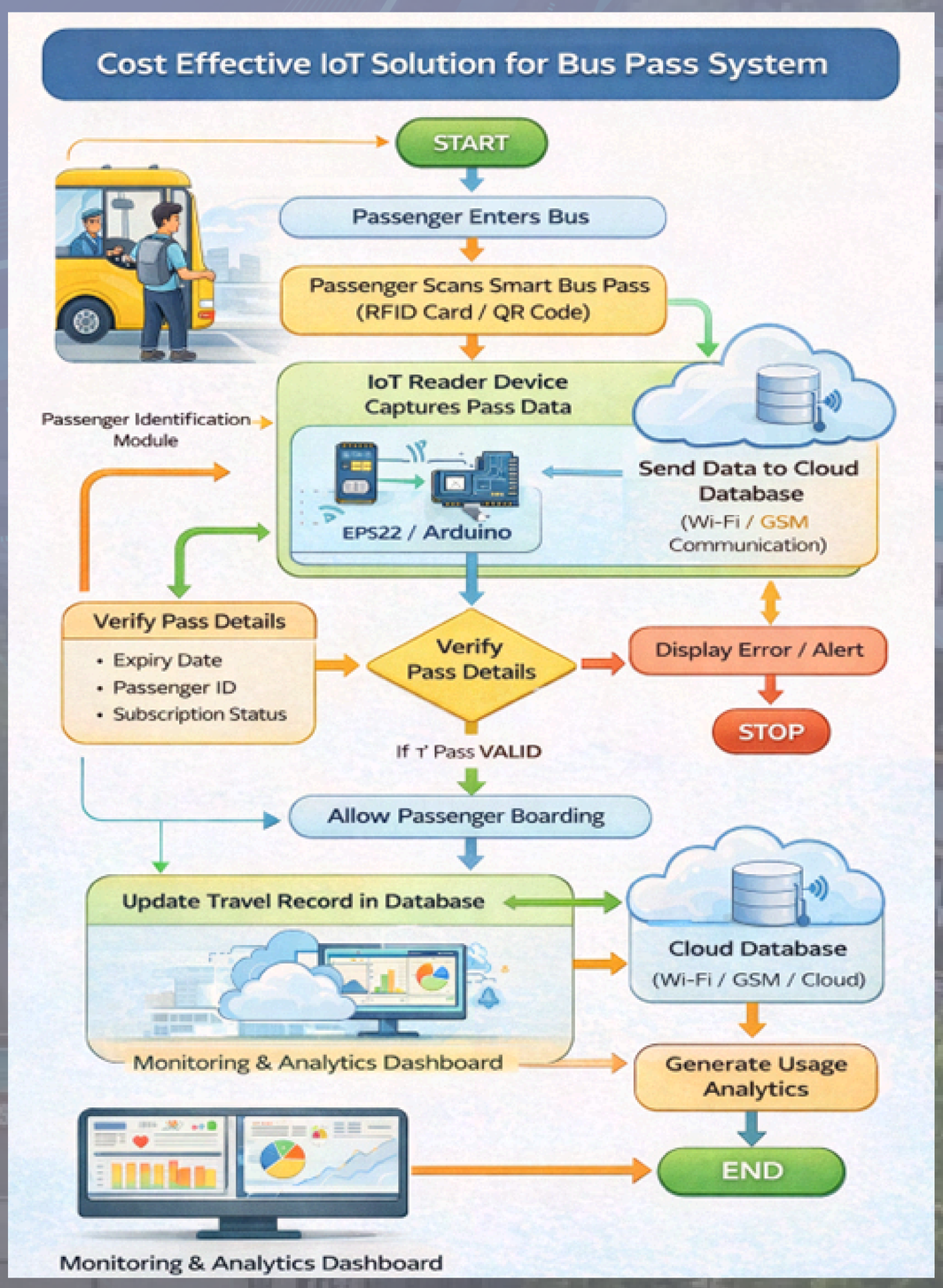
METHOD USED

The proposed system integrates IoT hardware devices with cloud-based data management and software applications. Each passenger is provided with a smart identification mechanism such as RFID cards or QR-based digital passes. The bus is equipped with an IoT reader device connected to a microcontroller that scans passenger passes during boarding.

When a passenger enters the bus, the RFID or QR scanner reads the pass information and sends the data to the cloud database via wireless communication modules such as Wi-Fi or GSM. The system verifies pass validity by checking expiration dates, passenger identity, and subscription status. If the pass is valid, access is granted automatically, and the boarding event is recorded in the database.

The system also includes a web-based or mobile dashboard that allows transport authorities to monitor passenger usage, manage pass issuance, and track bus occupancy levels. Data analytics techniques are used to generate reports related to passenger travel frequency and route demand analysis.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in developing a low-cost IoT-based smart transportation solution suitable for public bus systems in developing regions. Unlike traditional electronic ticketing systems that require expensive infrastructure, the proposed solution uses affordable microcontrollers and RFID or QR technology to minimize implementation cost.

Another innovative feature is the integration of cloud-based data management with real-time passenger monitoring. The system supports automated pass renewal notifications and usage analytics, enabling efficient transportation planning. The modular design allows easy scalability and integration with existing transport infrastructure.

PERFORMANCE

The performance of the proposed system is evaluated based on authentication speed, system reliability, and cost efficiency. Experimental testing demonstrates that the IoT-based authentication process significantly reduces passenger boarding time compared to manual verification methods. The system provides accurate pass validation and maintains real-time travel records with minimal data latency.

The system also reduces administrative workload by automating pass issuance and renewal processes. The cloud-based database ensures secure storage and efficient data retrieval. Overall, the solution achieves improved operational efficiency while maintaining low implementation cost.

Real-World Application

The proposed system can be deployed in public bus transportation networks, school and college transport systems, and private fleet management services. It can also be integrated with smart city transportation infrastructure to enable automated ticketing and passenger monitoring.

Transport authorities can utilize the system to analyze passenger travel behavior, optimize route planning, and improve service quality. The IoT-based approach enhances transportation transparency and contributes to the development of smart and sustainable mobility solutions.

Guide: Dr N S Patankar

Project Group Members:

1) ADHAV VIRAJ VIKRAM

2) BHOR SHREYAS GANPAT

3) SHINDE PIYUSH CHANDRAKANT

4) DHAGE YASH PRAMOD

5) HON AKANKSHA DWARKANATH

Automatic Question Paper Generation and Analysis

Problem Landscape

Educational institutions face significant challenges in preparing balanced and high-quality question papers that effectively evaluate student knowledge and learning outcomes. Traditional question paper preparation methods involve manual effort by faculty members, which is time-consuming, prone to human bias, and may lead to repetition or improper distribution of difficulty levels. Maintaining uniformity across examinations and ensuring syllabus coverage becomes difficult, especially when multiple faculty members contribute to paper setting.

Another major issue is the lack of analytical feedback after examinations. Institutions often struggle to evaluate the effectiveness of question papers in measuring student performance and identifying learning gaps. Manual evaluation methods do not provide insights into question difficulty levels, student success rates, or topic-wise performance trends.

With advancements in Artificial Intelligence and data analytics, automated question paper generation systems can improve examination quality and reduce faculty workload. This project proposes an intelligent system that automatically generates question papers based on syllabus coverage, difficulty levels, and predefined academic guidelines. Additionally, the system performs post-examination analysis to evaluate student performance and question effectiveness, thereby improving academic assessment quality.

OBJECTIVES

The primary objective of this project is to develop an automated system that generates balanced question papers and performs performance analysis using data-driven techniques. The specific objectives include:

To create a centralized question bank categorized by subject, topic, and difficulty level.

To develop algorithms for automatic generation of question papers based on syllabus distribution.

To ensure uniform coverage of course outcomes and learning objectives.

To implement difficulty balancing mechanisms for fair assessment.

To analyze student examination performance using statistical and analytical methods.

To generate performance reports and feedback for academic improvement.

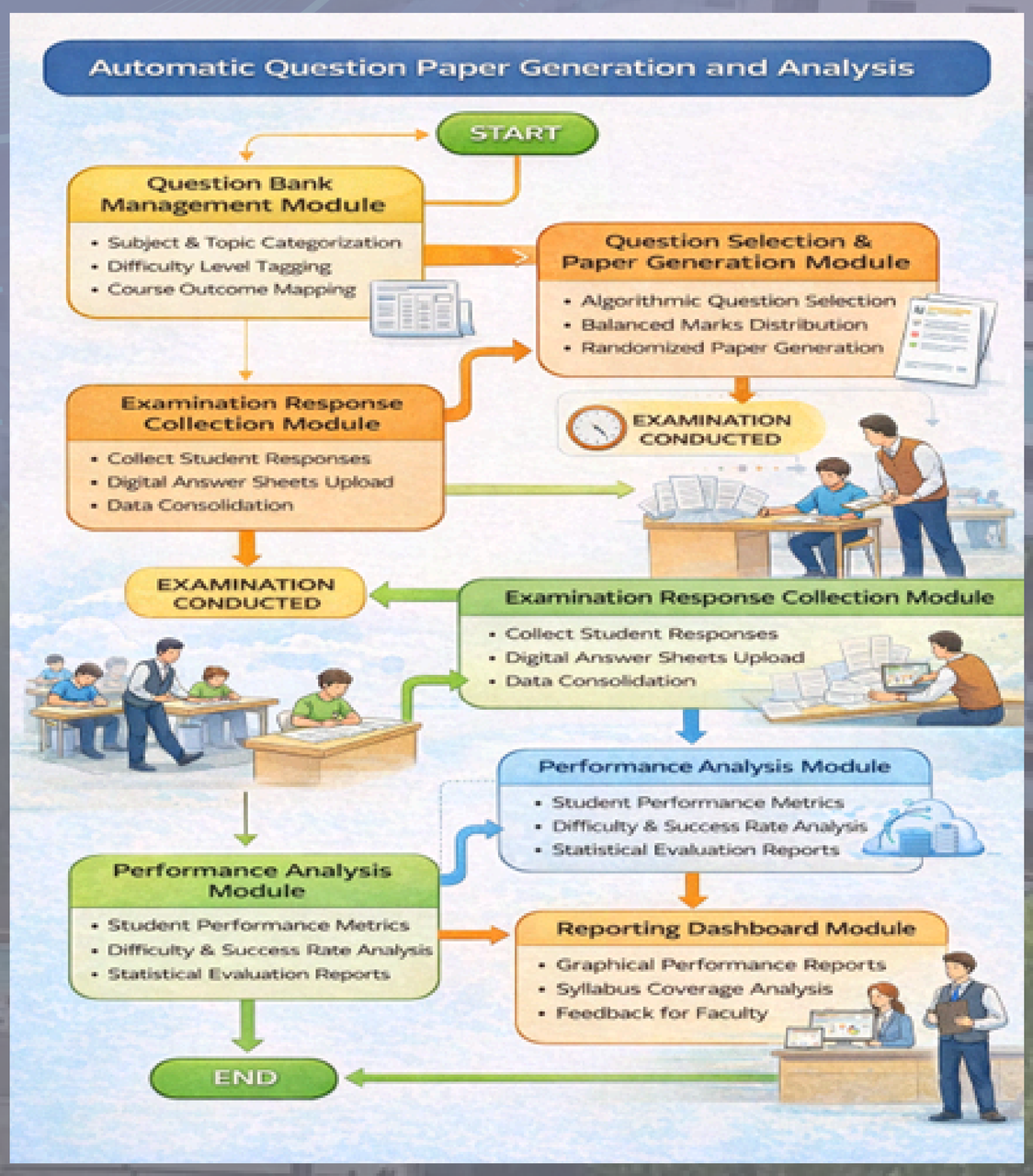
METHOD USED

The proposed system follows a structured workflow consisting of question bank management, question paper generation, and performance analysis modules. Initially, a comprehensive question bank is created where questions are stored along with metadata such as topic classification, marks distribution, difficulty level, and course outcome mapping.

The question paper generation module uses rule-based and algorithmic selection techniques to generate question papers. The system selects questions based on predefined constraints such as marks distribution, syllabus coverage, and difficulty balancing. Randomization techniques are applied to avoid question repetition and enhance examination security.

After examination completion, student response data is collected and analyzed using statistical analysis and machine learning techniques. Performance metrics such as pass percentage, average marks, topic-wise performance, and difficulty index are calculated. The system generates graphical reports and analytical insights to assist faculty in improving teaching strategies and assessment quality.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in integrating automated question generation with performance analytics in a single system. Unlike traditional systems that focus only on question paper creation, the proposed solution provides comprehensive examination analysis and academic decision support.

Another innovative aspect is the use of intelligent question selection algorithms that ensure balanced syllabus coverage and difficulty distribution. The system also introduces dynamic reporting techniques that help faculty members identify weak learning areas and improve curriculum design. The automation reduces human error and enhances examination transparency.

PERFORMANCE

The performance of the proposed system is evaluated based on paper generation accuracy, syllabus coverage efficiency, and analysis reliability. Experimental results demonstrate that the automated system generates well-balanced question papers with minimal repetition. The system successfully maintains predefined difficulty levels and course outcome mapping.

The performance analysis module provides accurate statistical insights into student performance patterns. Faculty members can easily identify high-performing and low-performing topics using graphical dashboards. The system significantly reduces manual workload and improves academic assessment quality.

Real-World Application

The proposed system can be deployed in schools, colleges, universities, and competitive examination organizations. It can be integrated with online learning platforms and examination management systems to automate assessment processes. Educational institutions can utilize the system to maintain standardized evaluation practices and improve academic planning.

The solution also supports outcome-based education frameworks by providing course outcome analysis and performance evaluation reports. By automating examination processes, the system contributes to efficient and transparent academic management.

Guide: Ms KD Patil

Project Group Members:

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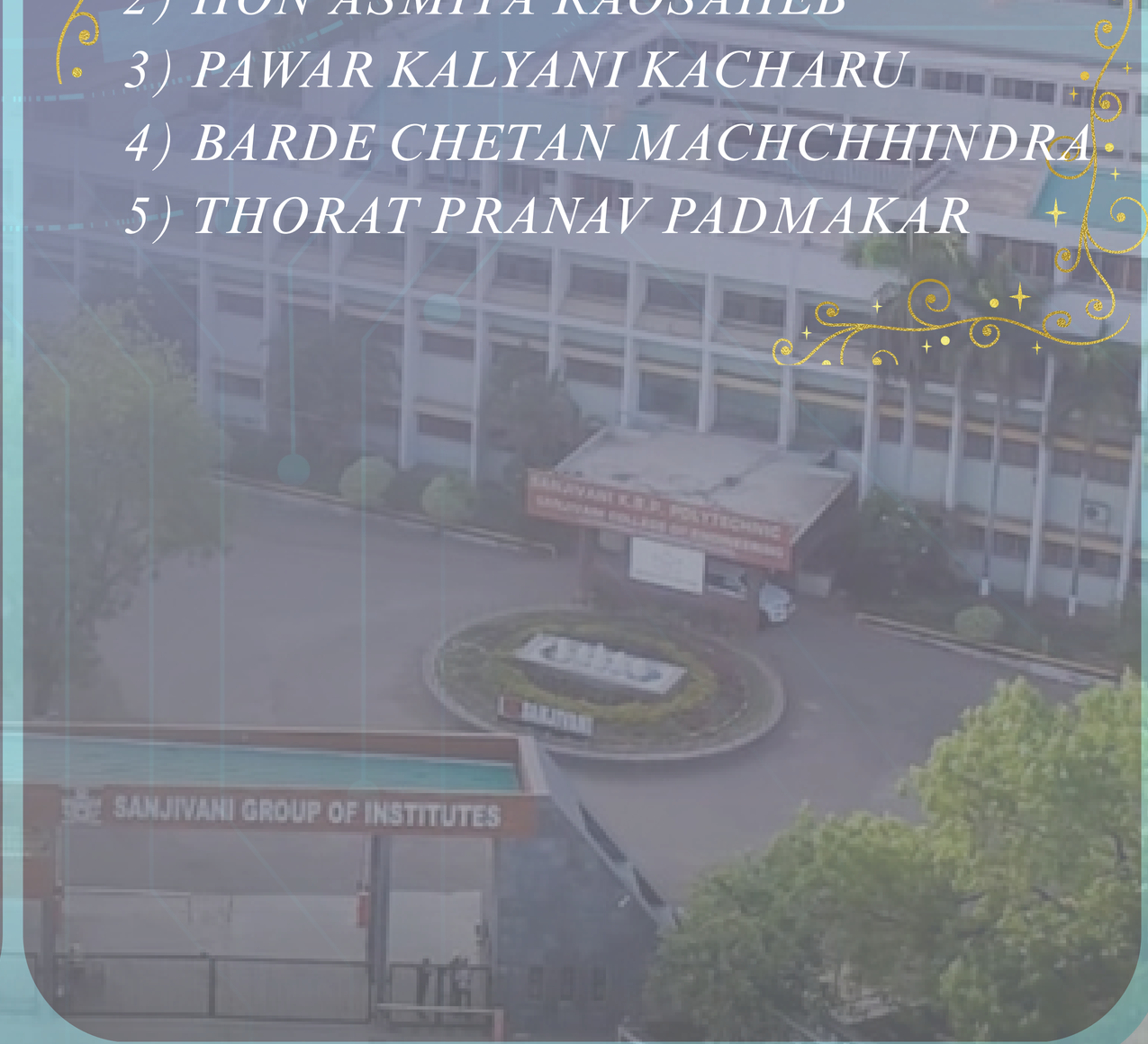
2) HON ASMITA RAOSAHEB

3) PAWAR KALYANI KACHARU

4) BARDE CHETAN MACHCHHINDRA

5) THORAT PRANAV PADMAKAR



An IoT-Based Smart Electrical Automotive Battery Management Network

Problem Landscape

The rapid growth of electric vehicles (EVs) and hybrid automotive systems has increased the demand for efficient battery management technologies. Automotive batteries are critical components that determine vehicle performance, safety, and lifespan. However, traditional battery monitoring systems often lack real-time monitoring capabilities and fail to provide predictive insights about battery health and performance degradation.

Electric vehicle batteries operate under varying environmental and operational conditions such as temperature fluctuations, charging cycles, load variations, and aging effects. Improper monitoring can lead to battery overheating, reduced efficiency, unexpected failures, and safety hazards. Existing battery management systems mainly provide basic voltage and temperature monitoring without intelligent data analysis or remote monitoring capabilities.

With the integration of Internet of Things (IoT) technology, battery systems can be monitored in real-time using connected sensors and cloud-based analytics. IoT enables continuous tracking of battery parameters, predictive fault detection, and optimized battery usage. This project proposes an IoT-based smart battery management network that improves battery safety, enhances performance monitoring, and increases the operational lifespan of automotive batteries.

OBJECTIVES

The primary objective of this project is to design and implement an intelligent IoT-based battery management network for electric automotive systems. The specific objectives include:

- To monitor battery parameters such as voltage, current, temperature, and charge levels in real-time.
- To develop a wireless communication network for transmitting battery data to cloud platforms.
- To implement predictive analytics for early fault detection and battery health monitoring.
- To design a centralized dashboard for real-time battery status visualization.
- To improve battery efficiency, safety, and lifespan using intelligent monitoring techniques.
- To create a scalable and cost-effective battery monitoring solution for electric vehicles.

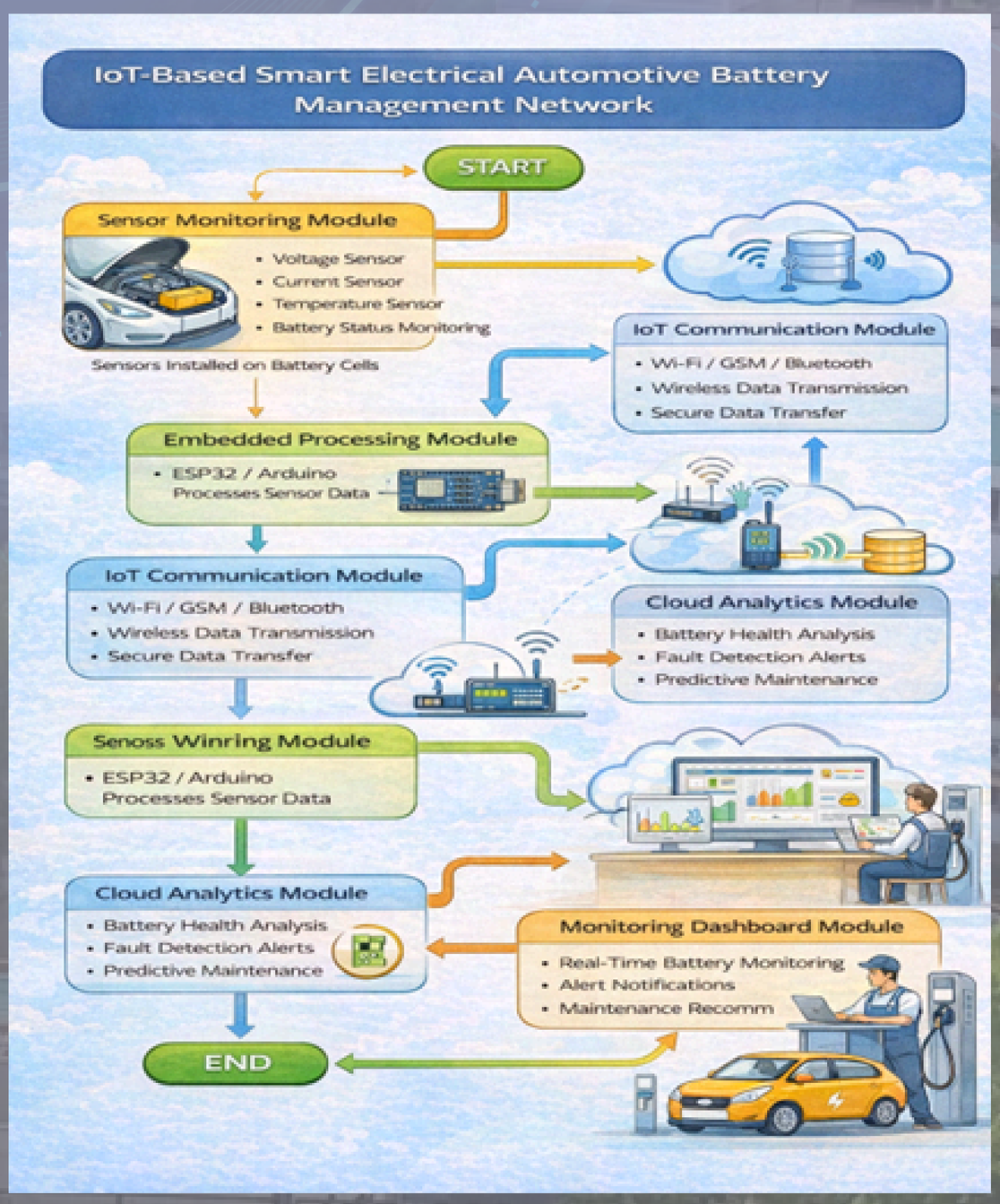
METHOD USED

The proposed system integrates IoT sensor networks, embedded microcontroller units, and cloud-based data analytics platforms. Multiple sensors are deployed across battery modules to measure electrical and thermal parameters including voltage, current, temperature, and state of charge. These sensors continuously collect battery performance data during vehicle operation.

The sensor data is processed using embedded microcontrollers such as ESP32 or Arduino-based controllers. The microcontroller converts analog sensor signals into digital data and transmits the information through wireless communication technologies such as Wi-Fi, Bluetooth, or GSM networks.

The transmitted data is stored and processed in a cloud-based platform where advanced analytics algorithms evaluate battery health and detect potential faults. Machine learning models can be implemented to predict battery degradation trends and recommend preventive maintenance strategies. A user interface dashboard is developed to display battery performance metrics, warning alerts, and maintenance recommendations.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in developing a distributed IoT-based battery monitoring network that provides real-time data acquisition and predictive analytics. Unlike traditional battery monitoring systems, the proposed system enables remote monitoring and early fault detection through cloud-based analytics.

Another innovative aspect is the integration of machine learning techniques for battery health prediction and performance optimization. The system supports multi-cell battery monitoring, enabling precise analysis of individual battery modules. The modular architecture allows easy integration with electric vehicle control systems and smart transportation infrastructure.

PERFORMANCE

The performance of the proposed system is evaluated based on monitoring accuracy, data transmission reliability, and predictive fault detection efficiency. Experimental results demonstrate that the IoT sensor network accurately monitors battery parameters under varying operating conditions. The wireless communication module ensures reliable real-time data transmission with minimal latency.

The predictive analytics module successfully identifies battery degradation patterns and provides early warning alerts. The system enhances battery safety by preventing overheating and overcharging conditions. Overall performance results indicate improved battery reliability and operational efficiency compared to conventional monitoring systems.

Real-World Application

The proposed system can be deployed in electric vehicles, hybrid vehicles, battery-powered industrial equipment, and renewable energy storage systems. It can be integrated into smart electric transportation networks to monitor battery health remotely and optimize vehicle performance.

Automotive manufacturers can utilize the system to improve battery warranty management and preventive maintenance planning. The solution also supports smart charging infrastructure and contributes to the development of sustainable electric mobility solutions.

Guide: Dr N S Patankar

Project Group Members:

1) BOBADE UMESH KRISHNA

2) KAMANDAR SHUBHAM BAPPASAHEB

3) KOLASE RAHUL SUNIL

Intelligent System for School Bus Using Smart Mining, Tracking and API's

Problem Landscape

Student transportation safety has become a major concern for educational institutions and parents. Traditional school bus transportation systems often lack real-time monitoring, efficient route optimization, and emergency response mechanisms. Parents usually have limited visibility regarding bus location, student boarding status, and travel delays. This creates anxiety and reduces transportation reliability.

Existing school transportation systems rely heavily on manual monitoring and communication methods, which are prone to human errors, miscommunication, and inefficiencies in route management. Moreover, school buses frequently experience issues such as traffic congestion, unexpected route changes, fuel inefficiency, and lack of automated attendance monitoring for students.

With the advancement of Smart Mining, Internet of Things (IoT), and Application Programming Interfaces (APIs), transportation systems can be transformed into intelligent, data-driven platforms. Smart data mining techniques allow analysis of transportation patterns, while tracking systems enable real-time location monitoring. APIs allow integration of multiple services such as mapping, notifications, and emergency alerts into a unified system.

This project proposes an intelligent school bus management system that enhances student safety, improves transportation efficiency, and provides real-time communication between schools, drivers, and parents using smart mining techniques and integrated tracking technologies.

OBJECTIVES

The primary objective of this project is to develop an intelligent school bus monitoring and management system using smart data mining, GPS tracking, and API-based integration. The specific objectives include:

- To design a real-time school bus tracking system using GPS technology.
- To implement automated student attendance monitoring using smart identification techniques.
- To analyze transportation data using smart mining techniques for route optimization.
- To develop notification systems for parents and school authorities using API integration.
- To enhance student safety by implementing emergency alert and monitoring systems.
- To provide a centralized dashboard for monitoring bus operations and student transportation activities.

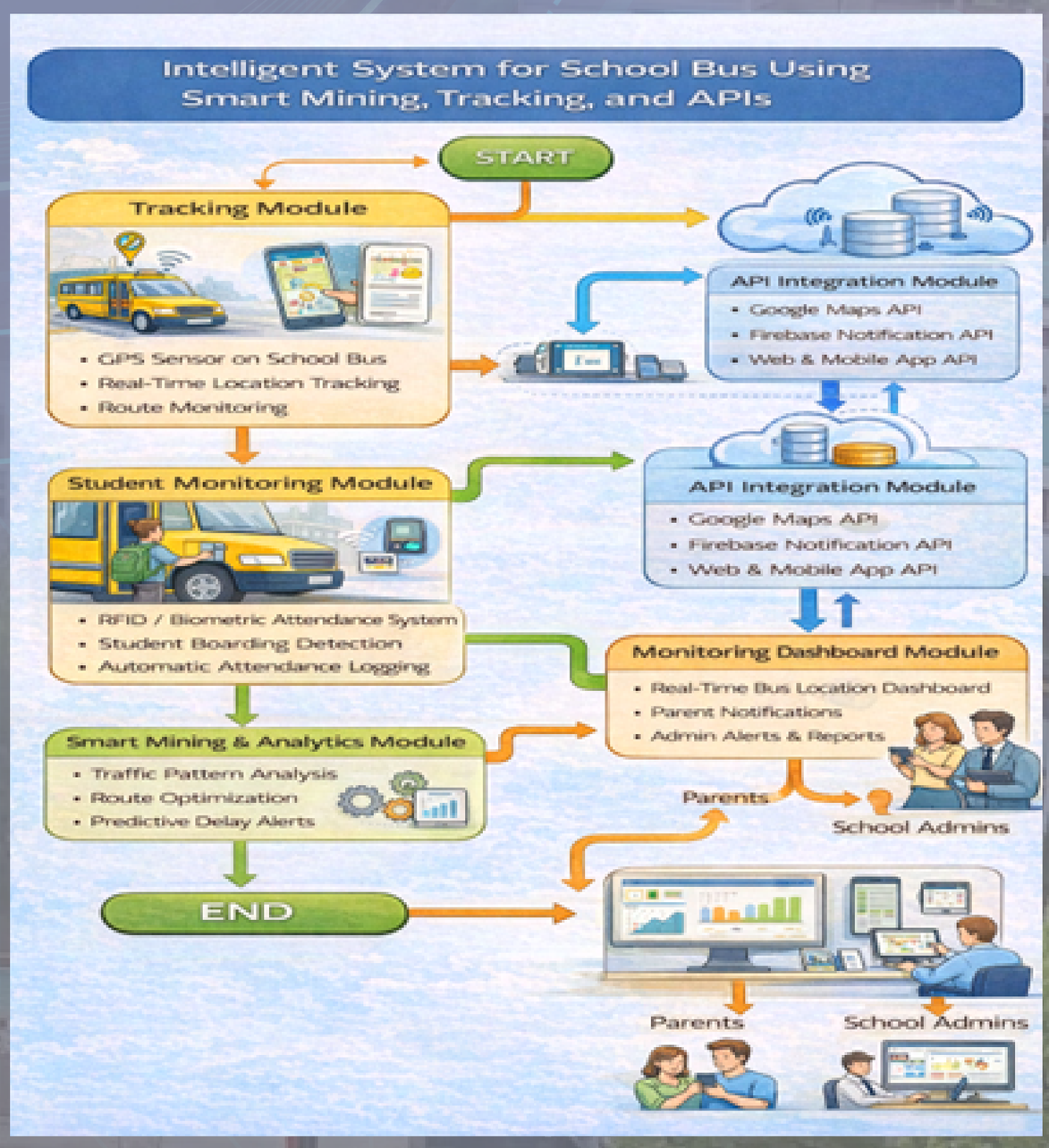
METHOD USED

The proposed system integrates GPS tracking devices, RFID or smart card–based student identification, cloud-based data storage, and API-based communication services. GPS modules installed in school buses continuously capture location coordinates and transmit them to a centralized cloud server using wireless communication technologies.

RFID or biometric identification systems are installed inside buses to record student boarding and exit activities. Each student carries an RFID card or is identified using biometric authentication, allowing automatic attendance tracking. This data is transmitted to the cloud database and linked with parent and school monitoring applications.

Smart data mining algorithms analyse historical transportation data to identify traffic patterns, optimize bus routes, and improve fuel efficiency. APIs such as Google Maps API are used to display real-time bus location and route information on mobile applications and web dashboards. Notification APIs are integrated to send real-time alerts regarding bus arrival, delays, or emergency situations.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in combining smart data mining techniques with real-time GPS tracking and API-based service integration. Unlike traditional school bus systems, the proposed system provides automated student attendance monitoring and intelligent route optimization.

The system introduces predictive analytics that can forecast traffic congestion and transportation delays using historical data patterns. Another innovative aspect is the seamless integration of mobile applications and web-based dashboards that allow parents and school authorities to monitor transportation activities remotely. The modular system design supports scalability and easy integration with existing school transportation infrastructure.

PERFORMANCE

The performance of the system is evaluated based on tracking accuracy, student attendance detection reliability, route optimization efficiency, and notification response time. Experimental results show that GPS tracking provides accurate real-time location updates, enabling effective transportation monitoring.

The RFID-based attendance monitoring system demonstrates high reliability with minimal detection errors. Smart mining algorithms successfully analyse transportation data and optimize route planning, reducing travel time and fuel consumption. The notification system ensures timely alerts, improving communication between parents and school management.

Overall, the system improves transportation safety, reduces operational costs, and enhances monitoring efficiency compared to conventional school bus management systems.

Real-World Application

The proposed system can be implemented in school transportation management systems to enhance student safety and improve transportation efficiency. Educational institutions can use this system to monitor bus routes, student attendance, and driver performance.

The solution can also be extended to public transportation systems, corporate employee transportation services, and smart city transportation networks. The integration of data mining and tracking technologies supports the development of intelligent transportation management systems for safer and more efficient mobility solutions.

Guide: Ms M Kurhe

Project Group Members:

1) KUSALKAR ABHISHEK LAXMAN

2) SADGIR SACHIN BHASKAR

3) SHELKE SANKET CHANDRABHAN

4) SHETE VAIBHAV DAGADU

5) WAGH ISHWAR SANTOSH

Detection of Cardiovascular Diseases in ECG Images Using Machine Learning and Deep Learning Methods

Problem Landscape

Cardiovascular diseases (CVDs) are among the leading causes of mortality worldwide, including in India. Early diagnosis and monitoring of heart-related disorders are essential for reducing mortality rates and improving patient outcomes. Electrocardiography (ECG) is one of the most widely used diagnostic tools for detecting heart abnormalities. ECG signals provide detailed information about heart rhythm, electrical activity, and cardiac health.
Traditional ECG analysis relies heavily on manual interpretation by medical professionals, which requires specialized expertise and is time-consuming. Human interpretation may also lead to diagnostic errors due to fatigue, subjective judgment, and variations in ECG patterns. Moreover, large volumes of ECG data generated in hospitals and diagnostic centers make manual analysis inefficient and prone to delays.

With advancements in Machine Learning (ML) and Deep Learning (DL), automated ECG image analysis systems can assist medical professionals in early detection of cardiovascular diseases. These techniques can identify complex patterns in ECG images and classify heart abnormalities with high accuracy. This project proposes an intelligent diagnostic system that utilizes machine learning and deep learning algorithms to detect cardiovascular diseases from ECG images, thereby improving diagnostic efficiency and healthcare support.

OBJECTIVES

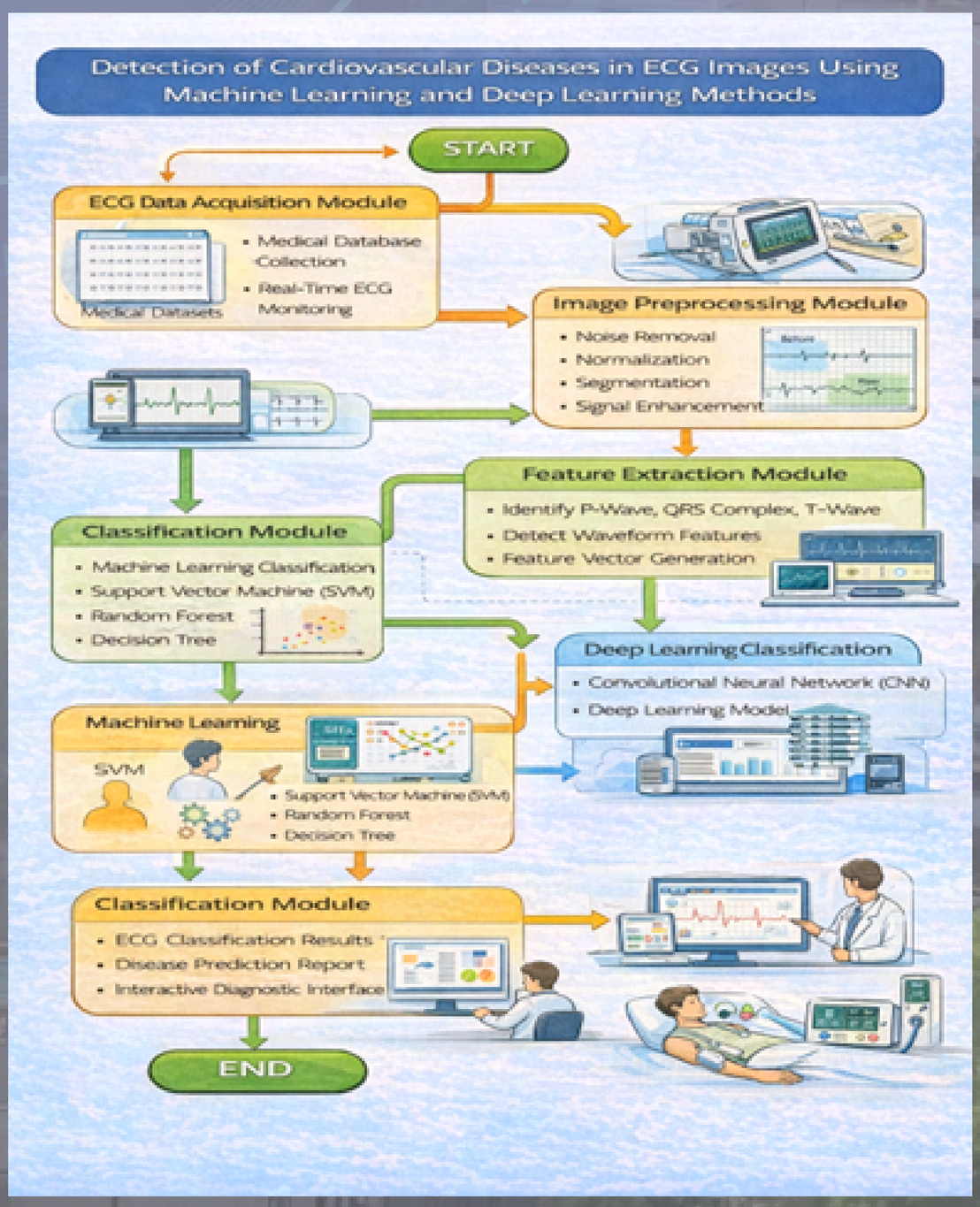
The primary objective of this project is to develop an automated ECG image analysis system capable of detecting cardiovascular diseases using machine learning and deep learning techniques. The specific objectives include:

- To collect and preprocess ECG image datasets for disease detection.
- To extract significant features from ECG signals and images using machine learning techniques.
- To implement deep learning models for automatic ECG pattern recognition.
- To classify cardiovascular abnormalities such as arrhythmia, myocardial infarction, and heart block.
- To design a graphical interface for ECG image analysis and diagnosis visualization.
- To improve early detection accuracy and support clinical decision-making.

METHOD USED

The proposed system follows a structured workflow consisting of ECG image acquisition, preprocessing, feature extraction, model training, and disease classification. Initially, ECG image datasets are collected from publicly available medical datasets or hospital records. Image preprocessing techniques such as noise removal, normalization, segmentation, and signal enhancement are applied to improve data quality.
Feature extraction methods are applied to identify important ECG waveform characteristics such as P-wave, QRS complex, and T-wave patterns. Machine learning algorithms such as Support Vector Machine (SVM), Decision Tree, and Random Forest are implemented for preliminary classification of ECG abnormalities.
Deep learning models such as Convolutional Neural Networks (CNNs) are employed for automatic feature learning and accurate disease detection. The trained models analyze ECG images and classify cardiovascular diseases based on learned patterns. The system generates diagnostic results and visualization outputs for medical interpretation.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in integrating machine learning and deep learning techniques for automated ECG image-based cardiovascular disease detection. Unlike traditional manual ECG analysis, the proposed system provides fast and accurate diagnostic support using intelligent algorithms.

Another innovative aspect is the use of convolutional neural networks for automatic feature extraction, reducing dependency on manual feature engineering. The system supports multi-class disease classification and can adapt to different ECG signal variations. The integration of visualization tools enhances interpretability and clinical usability.

PERFORMANCE

The performance of the proposed system is evaluated based on classification accuracy, sensitivity, specificity, and processing efficiency. Experimental results demonstrate that deep learning models achieve higher accuracy compared to traditional machine learning algorithms in detecting cardiovascular diseases.

The system effectively identifies abnormal ECG patterns and provides reliable disease classification results. The automated diagnosis process reduces analysis time and improves clinical efficiency. The model also shows strong generalization capability when tested on different ECG datasets.

Real-World Application

The proposed system can be deployed in hospitals, diagnostic laboratories, telemedicine platforms, and wearable health monitoring systems. It can assist cardiologists in early disease detection and remote patient monitoring. The solution supports healthcare automation and reduces diagnostic workload for medical professionals.

The system can also be integrated with smart healthcare infrastructure and mobile health applications to provide real-time cardiac monitoring and early warning alerts. By enabling early diagnosis, the project contributes to improved cardiovascular healthcare management and patient safety.

Guide: Dr D S Jadhav

Project Group Members:

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2) BHOSALE NAMRATA PRAMOD

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4) DARODE RADHIKA SANTOSH

5) ROKADE LAXMI MALHARI

Group Photo Facial Recognition Attendance System

Problem Landscape

Attendance management is an essential administrative task in educational institutions, corporate environments, and event management systems. Traditional attendance recording methods such as manual roll calls, biometric scanning, and RFID-based systems often consume time and require individual verification. These methods can lead to attendance manipulation, proxy marking, and administrative inefficiencies, especially in large classrooms or meetings involving multiple participants.

Existing automated attendance systems usually rely on single-person facial recognition or biometric verification, which still requires individuals to stand in front of a scanner one by one. This approach becomes inefficient for group scenarios such as classrooms, seminars, and organizational meetings. Additionally, maintaining accurate attendance records while minimizing human intervention remains a major challenge.

With advancements in computer vision and artificial intelligence, group facial recognition technology enables simultaneous identification of multiple individuals from a single photograph. Deep learning models can detect and recognize multiple faces in a group image and automatically record attendance. This project proposes an intelligent attendance system that captures group photos and uses facial recognition algorithms to identify individuals and mark attendance automatically, improving efficiency and accuracy.

OBJECTIVES

The primary objective of this project is to design and implement an automated attendance system using group photo facial recognition techniques. The specific objectives include:

- To capture group images for attendance recording.
- To implement face detection and recognition algorithms for multiple individuals simultaneously.
- To develop a centralized database for storing registered facial data.
- To automate attendance marking and record maintenance.
- To reduce attendance manipulation and proxy marking.
- To develop a user-friendly interface for attendance monitoring and reporting.

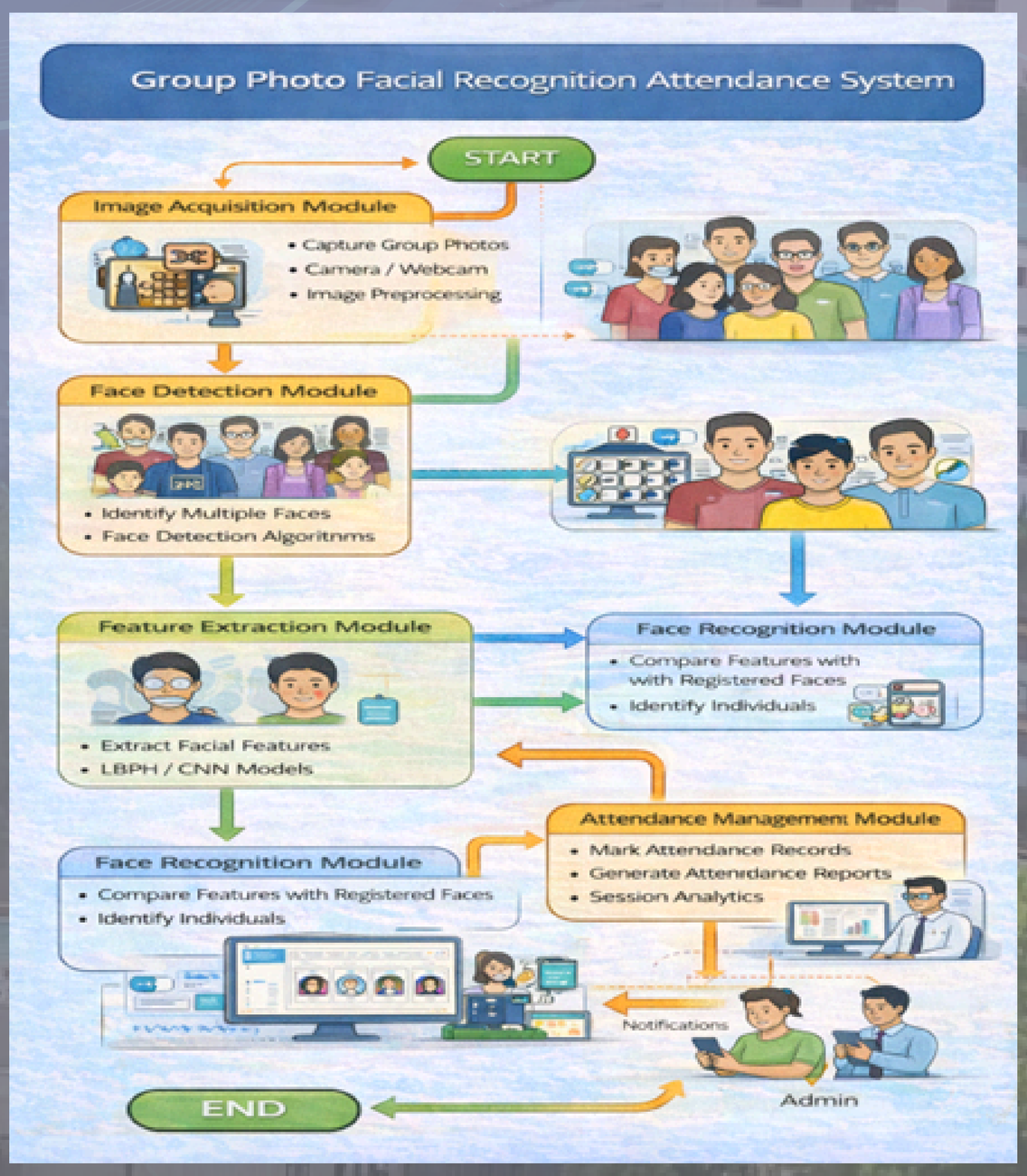
METHOD USED

The proposed system integrates image acquisition, facial feature extraction, face recognition, and attendance recording modules. Initially, a facial dataset is created by capturing and storing images of registered individuals. The dataset is pre-processed using image normalization, face alignment, and augmentation techniques to improve recognition accuracy.

During attendance marking, a group photograph is captured using a camera system. Face detection algorithms such as Haar Cascade or deep learning–based detectors identify multiple faces in the image. Facial features are extracted using feature extraction models such as Local Binary Pattern Histogram (LBPH) or deep learning–based convolutional neural networks.

The extracted facial features are compared with stored database records using recognition algorithms. Once individuals are identified, attendance is automatically marked and stored in the attendance database. The system generates attendance reports and visualization dashboards for administrative monitoring.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in implementing group-based facial recognition for automated attendance marking. Unlike traditional biometric or single-face recognition systems, the proposed system can identify multiple individuals simultaneously from a single photograph.

Another innovative aspect is the integration of deep learning-based recognition algorithms that improve identification accuracy even in varying lighting conditions and facial orientations. The system reduces administrative workload and improves attendance transparency. The scalable architecture allows integration with classroom management systems and organizational attendance platforms.

PERFORMANCE

The performance of the proposed system is evaluated based on recognition accuracy, detection speed, and attendance recording reliability. Experimental results demonstrate that deep learning-based facial recognition models achieve high identification accuracy even in crowded group scenarios.

The system efficiently detects multiple faces and marks attendance within seconds. The automated attendance recording reduces human errors and ensures reliable record maintenance. The system also supports real-time attendance monitoring and report generation, improving administrative efficiency.

Real-World Application

The proposed system can be implemented in educational institutions, corporate offices, training programs, and event management systems. Schools and colleges can utilize the system for automated classroom attendance, reducing manual verification efforts.

Corporate organizations can use the system for meeting attendance monitoring and workforce management. The system can also be integrated into smart classroom infrastructure and online learning environments to improve attendance tracking and performance analysis.

Guide: Mr. R R Nikam

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1) GHODEKAR ATHARVA VINOD

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Enhancing Educational Decision-Making through Result Analysis and Visualization with Power BI

Problem Landscape

Educational institutions continuously strive to improve academic performance, curriculum effectiveness, and student learning outcomes. However, many institutions still rely on traditional result analysis methods that involve manual data compilation and spreadsheet-based evaluations. These methods are time-consuming, error-prone, and do not provide deep analytical insights required for data-driven academic decision-making.

Manual result analysis often fails to identify student performance trends, subject difficulty levels, and learning gaps across different academic programs. Faculty members and administrators find it difficult to monitor academic progress and evaluate teaching effectiveness without comprehensive data visualization tools. Additionally, large volumes of academic data generated across multiple semesters and departments create challenges in data interpretation and reporting.

With the advancement of Business Intelligence (BI) tools, institutions can transform raw academic data into meaningful insights through interactive dashboards and visual analytics. Microsoft Power BI provides advanced data visualization, real-time reporting, and performance analytics capabilities. This project proposes a data-driven academic performance analysis system that uses Power BI to visualize student results, identify performance trends, and support educational decision-making processes.

OBJECTIVES

The primary objective of this project is to develop an academic result analysis and visualization system using Power BI for improved educational decision-making. The specific objectives include:

- To collect and organize student academic result datasets from institutional databases.
- To perform data preprocessing and transformation for accurate analysis.
- To develop interactive dashboards for visualizing academic performance trends.
- To analyse subject-wise, semester-wise, and student-wise performance metrics.
- To identify learning gaps and subject difficulty patterns using analytical reports.
- To support academic planning and curriculum improvement through data visualization.

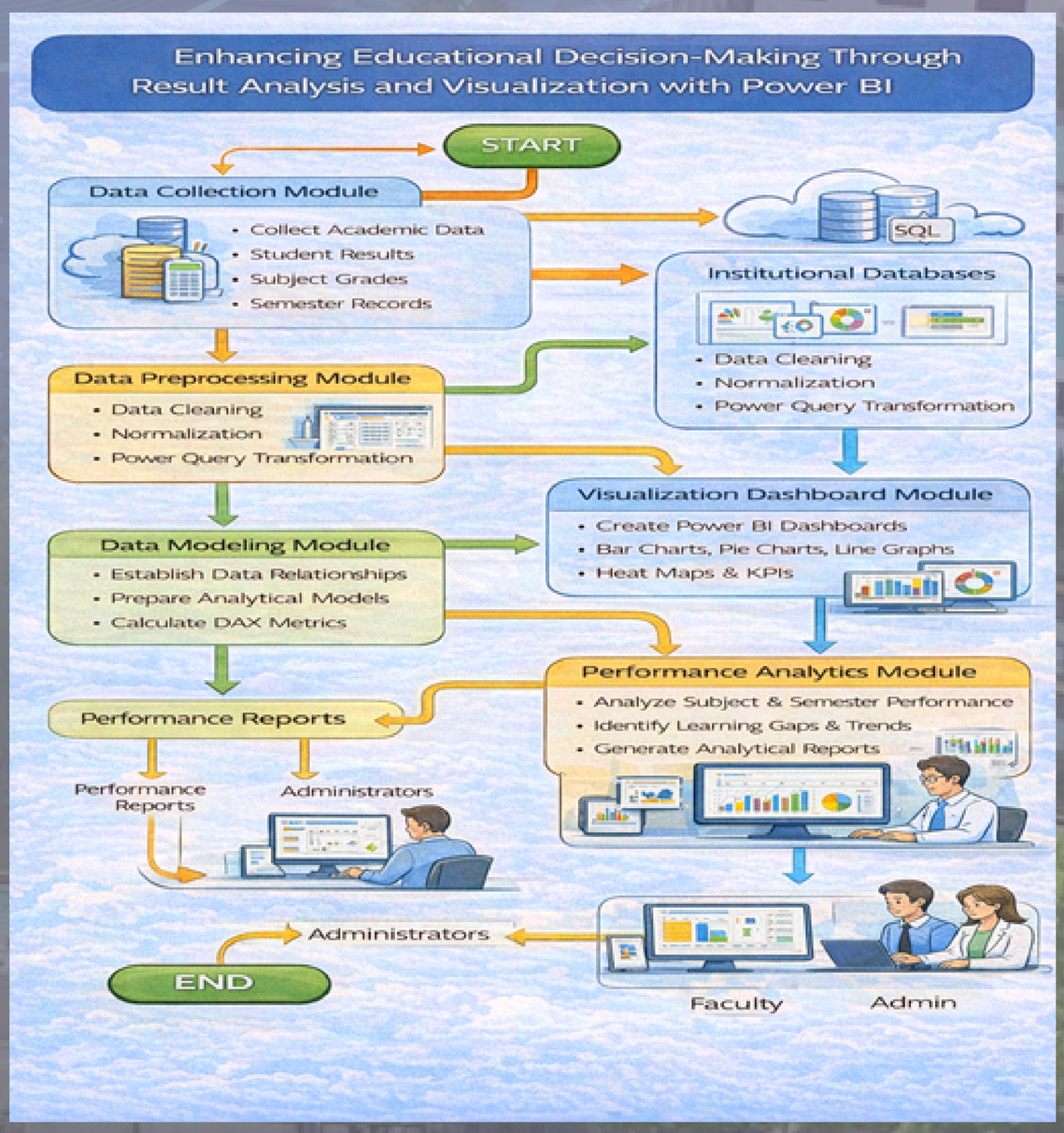
METHOD USED

The proposed system follows a structured workflow consisting of data collection, data preprocessing, data modelling, dashboard development, and performance analytics. Academic result datasets are collected from institutional records, including student marks, subject grades, semester results, and attendance records.

Data preprocessing techniques such as data cleaning, normalization, and missing value handling are performed using Power Query in Power BI. Data modelling techniques are used to establish relationships between multiple datasets such as student information, subject details, and performance metrics.

Power BI dashboards are designed using visual components such as bar charts, pie charts, line graphs, heat maps, and performance indicators. Analytical calculations such as pass percentage, average marks, subject performance comparison, and trend analysis are implemented using DAX (Data Analysis Expressions). The dashboards provide real-time academic insights that assist administrators and faculty members in monitoring student performance and making data-driven decisions.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in integrating Business Intelligence and educational analytics to support academic decision-making. Unlike traditional spreadsheet-based result analysis, the proposed system provides real-time interactive dashboards and visual analytics.

Another innovative aspect is the implementation of advanced DAX calculations for performance prediction and trend analysis. The system allows multi-level academic performance monitoring, enabling institutions to evaluate student outcomes, teaching effectiveness, and curriculum performance. The dashboard-based reporting improves data accessibility and decision-making efficiency.

PERFORMANCE

The performance of the proposed system is evaluated based on data processing efficiency, visualization clarity, and analytical accuracy. Experimental results demonstrate that Power BI dashboards provide faster and more accurate academic performance analysis compared to manual result evaluation methods.

The system effectively identifies performance trends, subject difficulty levels, and student learning gaps. Interactive visualization features allow faculty members to explore academic data dynamically and generate customized reports. The automated analytics system reduces administrative workload and improves decision-making accuracy.

Real-World Application

The proposed system can be deployed in schools, colleges, universities, and educational training institutes for academic performance monitoring. Institutions can utilize the dashboards to track student progress, evaluate teaching effectiveness, and plan curriculum improvements.

The system can also support accreditation processes such as NAAC and NBA by providing performance analytics and outcome-based education reports. The integration of data visualization techniques enhances institutional transparency and supports data-driven academic governance.

Guide: Mr. C D Bawankar

Project Group Members:

1) KOLSE PRAJAKTA SAMBHAJI

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3) PAWAR MITUSHA JAYANT

4) SOLANKI SAVI HEMANT

Early Detection of Breast Cancer Using Machine Learning

Problem Landscape

Breast cancer is one of the most common and life-threatening diseases affecting women worldwide. Early detection plays a crucial role in increasing survival rates and improving treatment effectiveness. Traditional breast cancer detection methods, such as manual examination, mammography, and biopsy, require specialized medical expertise and may sometimes fail to detect cancer at early stages due to subtle abnormalities or human diagnostic limitations.

Manual screening processes are often time-consuming and may lead to delayed diagnosis, especially in regions with limited medical infrastructure. Additionally, large volumes of medical imaging data generated through screening procedures create challenges in accurate and efficient analysis. Variations in tumor size, shape, and texture further complicate early detection using traditional methods.

Machine Learning techniques provide advanced analytical capabilities that enable automated detection of breast cancer by analyzing medical imaging data and patient diagnostic records. By identifying complex patterns in mammogram images and clinical datasets, machine learning models can assist healthcare professionals in early diagnosis. This project proposes an intelligent machine learning-based system for early breast cancer detection, improving diagnostic accuracy and supporting medical decision-making.

OBJECTIVES

The primary objective of this project is to develop an automated breast cancer detection system using machine learning techniques. The specific objectives include:

- To collect and preprocess breast cancer medical datasets and imaging records.
- To extract significant tumor-related features from medical images and clinical data.
- To implement machine learning algorithms for classification of cancerous and non-cancerous cases.
- To improve early-stage cancer detection accuracy using predictive modelling techniques.
- To design a diagnostic interface for visualization of prediction results.
- To support healthcare professionals in early diagnosis and treatment planning.

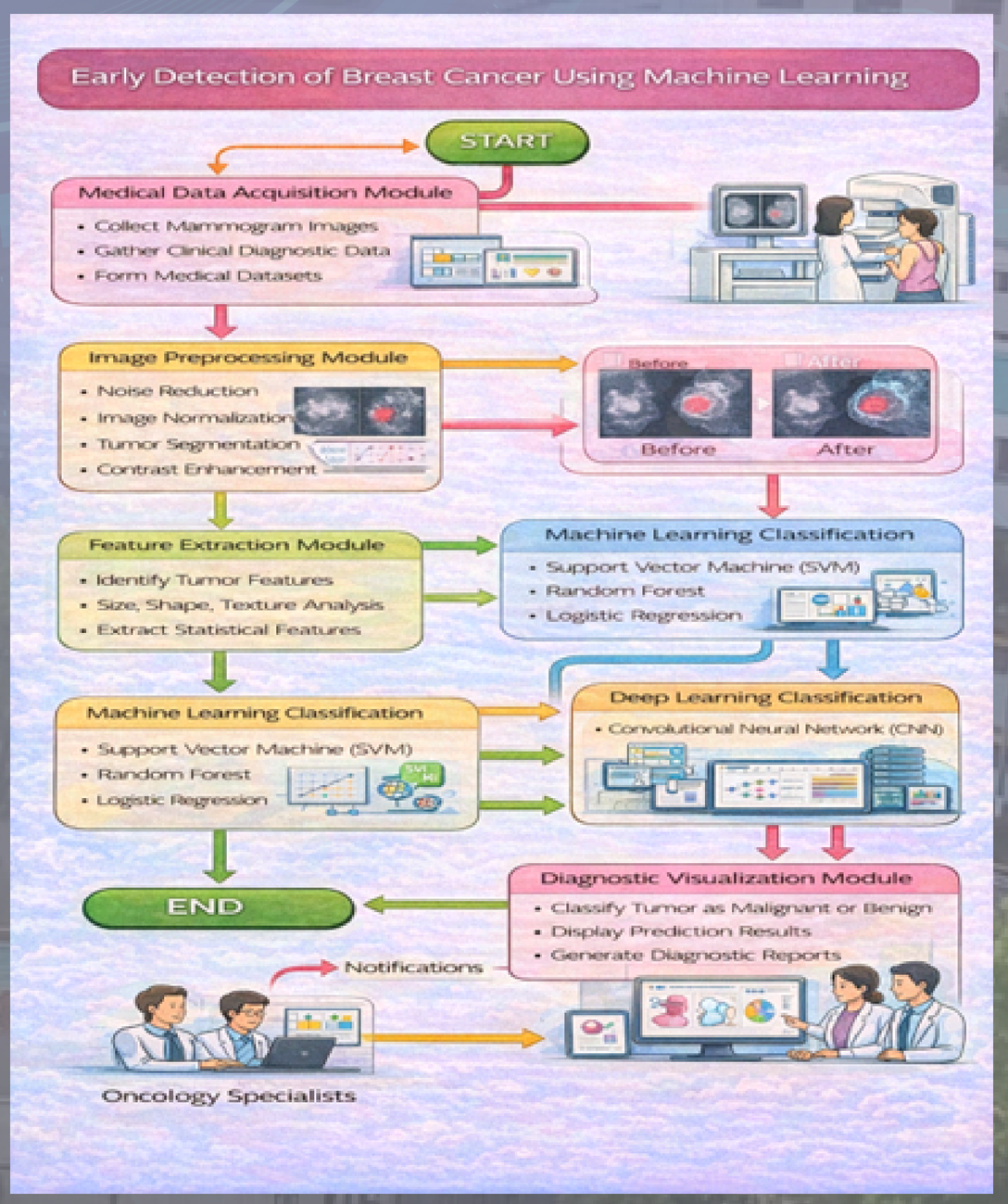
METHOD USED

The proposed system follows a structured workflow consisting of data acquisition, preprocessing, feature extraction, model training, and classification modules. Breast cancer datasets are collected from publicly available medical repositories such as Wisconsin Breast Cancer Dataset or mammography image datasets.

Image preprocessing techniques such as noise removal, image normalization, segmentation, and contrast enhancement are applied to improve data quality. Feature extraction methods are used to identify tumor characteristics such as size, shape, texture, and boundary irregularities.

Machine learning algorithms such as Support Vector Machine (SVM), Logistic Regression, Decision Tree, and Random Forest are implemented for classification of breast cancer cases. Deep learning models such as Convolutional Neural Networks (CNNs) can also be used for automated feature extraction and image classification. The trained models analyze input data and classify cases into malignant or benign categories, providing prediction results through a diagnostic interface.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in integrating machine learning algorithms with medical imaging techniques for automated breast cancer detection. Unlike traditional manual screening methods, the proposed system provides fast and accurate diagnostic support using intelligent data-driven analysis.

Another innovative aspect is the use of deep learning models that automatically extract tumor features from medical images, reducing reliance on manual feature engineering. The system supports multi-class classification and adapts to variations in tumor characteristics. The visualization interface improves interpretability and enhances clinical usability.

PERFORMANCE

The performance of the proposed system is evaluated based on classification accuracy, sensitivity, specificity, and computational efficiency. Experimental results demonstrate that machine learning models effectively classify breast cancer cases with high diagnostic accuracy.

Deep learning models show improved performance in detecting complex tumor patterns and minimizing false detection rates. The automated detection process reduces diagnostic time and enhances clinical workflow efficiency. The system also demonstrates strong generalization capability when tested with multiple medical datasets.

Real-World Application

The proposed system can be deployed in hospitals, diagnostic laboratories, telemedicine platforms, and healthcare research centers. It can assist radiologists and oncologists in early cancer detection and patient monitoring. The system supports automated screening programs and reduces diagnostic workload for healthcare professionals.

The solution can also be integrated with wearable medical monitoring devices and remote healthcare platforms for continuous patient monitoring. By enabling early diagnosis, the project contributes to improved cancer treatment outcomes and healthcare management.

Guide: Dr Y S Deshmukh

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2) HON SHRUTIK LAXMAN

3) SARAF TUSHAR RAMDAS

4) TAMBE ABHISHEK SUNIL

WAGH TEJAS ANIL

Smart Waste Detection and Segmentation Using Ultralytics YOLO v8

Problem Landscape

Rapid urbanization and population growth have significantly increased waste generation worldwide. Inefficient waste management systems lead to environmental pollution, public health risks, and improper recycling processes. Traditional waste segregation methods rely heavily on manual sorting, which is time-consuming, labor-intensive, and prone to human error. Improper waste segregation reduces recycling efficiency and increases landfill waste accumulation.

Many municipalities and waste management authorities struggle to implement automated waste segregation systems due to limitations in object detection accuracy and real-time processing capability. Conventional image processing techniques often fail to identify waste categories under complex environmental conditions such as varying lighting, occlusion, and cluttered waste environments.

With advancements in artificial intelligence and deep learning, computer vision techniques enable automated waste detection and segmentation. Ultralytics YOLO v8 is a state-of-the-art object detection and segmentation model capable of real-time waste classification with high accuracy. This project proposes an intelligent waste detection system using YOLO v8 to automatically identify and segment different types of waste materials, improving recycling efficiency and smart waste management practices.

OBJECTIVES

The primary objective of this project is to develop an intelligent waste detection and segmentation system using Ultralytics YOLO v8 deep learning models. The specific objectives include:

• To collect and prepare waste image datasets for training and testing.

• To implement YOLO v8 object detection and segmentation models for waste classification.

• To identify and categorize waste materials such as plastic, metal, paper, and organic waste.

• To improve automated waste segregation efficiency using real-time detection.

• To develop visualization tools for waste detection monitoring.

• To support smart city waste management systems and recycling automation.

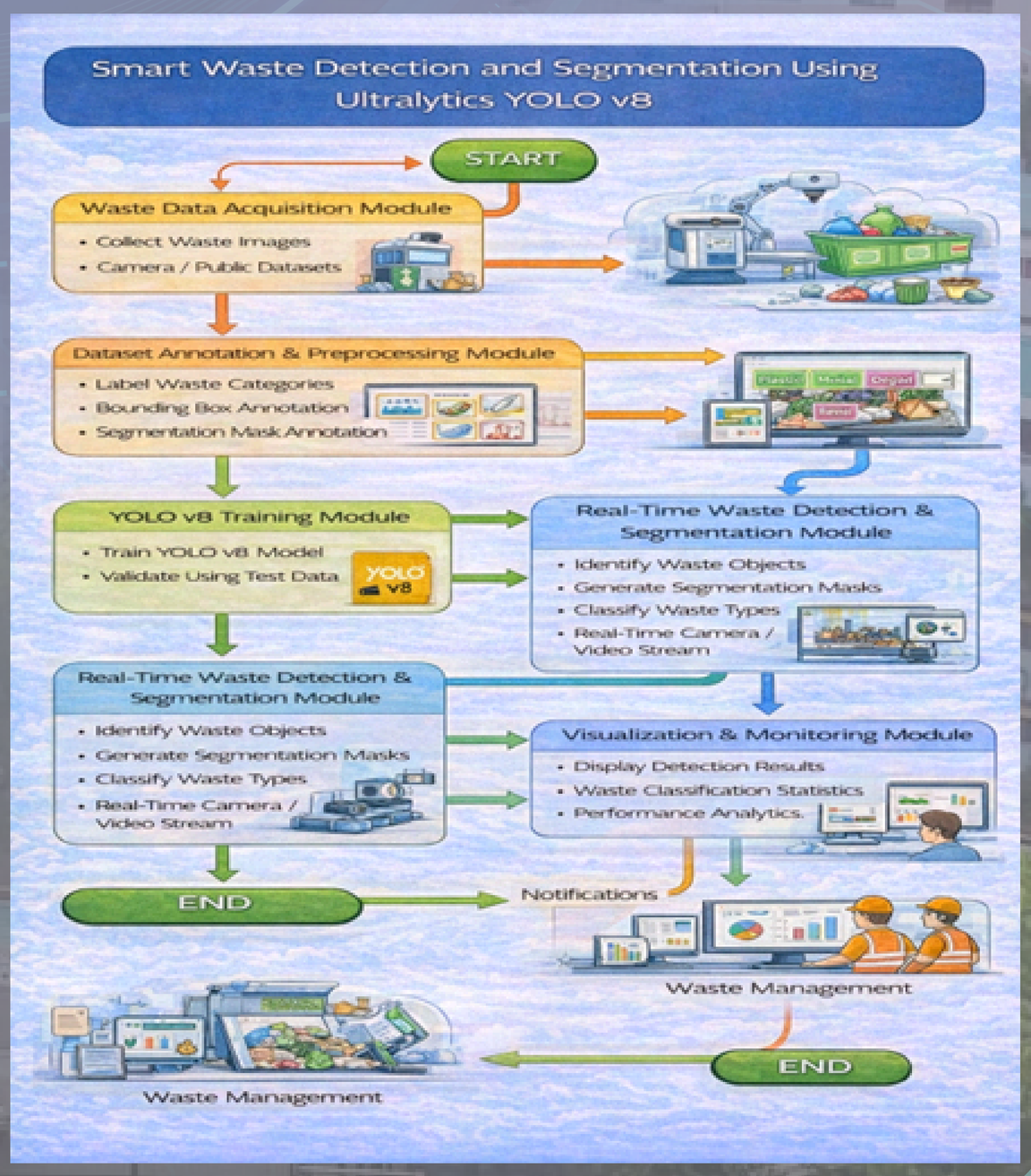
METHOD USED

The proposed system follows a deep learning-based computer vision workflow consisting of dataset preparation, model training, real-time detection, and segmentation modules. Waste image datasets are collected from public datasets and real-world waste collection environments. The dataset is annotated using bounding boxes and segmentation masks to identify different waste categories.

Image preprocessing techniques such as resizing, normalization, and augmentation are applied to improve dataset quality and model performance. The Ultralytics YOLO v8 model is trained using annotated waste datasets to detect and segment waste objects. The trained model processes input images or real-time camera feeds to identify waste materials and classify them into predefined categories.

The segmentation module generates pixel-level segmentation masks to accurately separate waste objects from the background. Visualization tools are implemented to display detection results, segmentation outputs, and waste classification reports. The system can be integrated with automated waste sorting mechanisms to improve recycling efficiency.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in utilizing Ultralytics YOLO v8 segmentation models for real-time waste detection and classification. Unlike traditional waste classification systems, the proposed system provides pixel-level segmentation accuracy, enabling precise identification of waste materials.

Another innovative aspect is the integration of deep learning-based detection with automated waste sorting applications. The system supports multi-class waste detection under complex environmental conditions. The scalable architecture allows integration with robotic waste sorting systems and smart city waste management infrastructure.

PERFORMANCE

The performance of the proposed system is evaluated based on detection accuracy, segmentation precision, processing speed, and real-time classification efficiency. Experimental results demonstrate that YOLO v8 models achieve high detection accuracy and fast processing speed suitable for real-time waste management applications.

The segmentation module provides precise waste object boundaries, improving sorting accuracy. The system effectively detects multiple waste categories simultaneously and maintains consistent performance under varying lighting and environmental conditions. Overall, the system enhances waste classification reliability and recycling efficiency.

Real-World Application

The proposed system can be deployed in smart waste collection centers, recycling plants, and automated waste sorting facilities. Municipal waste management authorities can use the system to improve segregation efficiency and reduce manual sorting efforts.

The system can also be integrated into robotic waste sorting systems and smart dustbin infrastructure for automated waste classification. The project supports sustainable waste management practices and contributes to environmental protection initiatives.

Guide: Dr M B Gawali

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3) JAPE DIPJYOT DILIP

4) MORE KISHOR ARJUN

NAGARE TEJAS DILIP

Preventive Maintenance of Automobile

Problem Landscape

Automobiles are essential for modern transportation, but vehicle breakdowns and unexpected mechanical failures remain major challenges affecting safety, operational efficiency, and maintenance costs. Traditional automobile maintenance approaches mainly follow reactive maintenance strategies, where repairs are performed only after system failure occurs. This leads to increased repair expenses, vehicle downtime, and potential safety hazards.

Mechanical components such as engines, brakes, batteries, and transmission systems experience gradual wear and tear during operation. Lack of continuous monitoring and early fault detection often results in severe mechanical failures that could have been prevented through timely maintenance. In addition, vehicle owners and fleet management organizations face difficulties in tracking maintenance schedules, component performance, and service history.

With advancements in IoT, sensor technology, and predictive analytics, preventive maintenance systems can monitor vehicle health in real time and predict component failures before they occur. This project proposes an intelligent preventive maintenance system that continuously monitors automobile performance parameters and provides early maintenance alerts, improving vehicle reliability and operational efficiency.

OBJECTIVES

The primary objective of this project is to develop an intelligent preventive maintenance system for automobiles using sensor monitoring and predictive analytics techniques. The specific objectives include:

- To monitor critical automobile parameters such as engine temperature, oil level, battery health, and brake performance.
- To develop real-time vehicle health monitoring using IoT sensor networks.
- To implement predictive analytics for early detection of mechanical faults.
- To design maintenance alert systems for vehicle owners and service providers.
- To reduce vehicle breakdowns and maintenance costs through preventive maintenance planning.
- To improve vehicle safety and operational reliability.

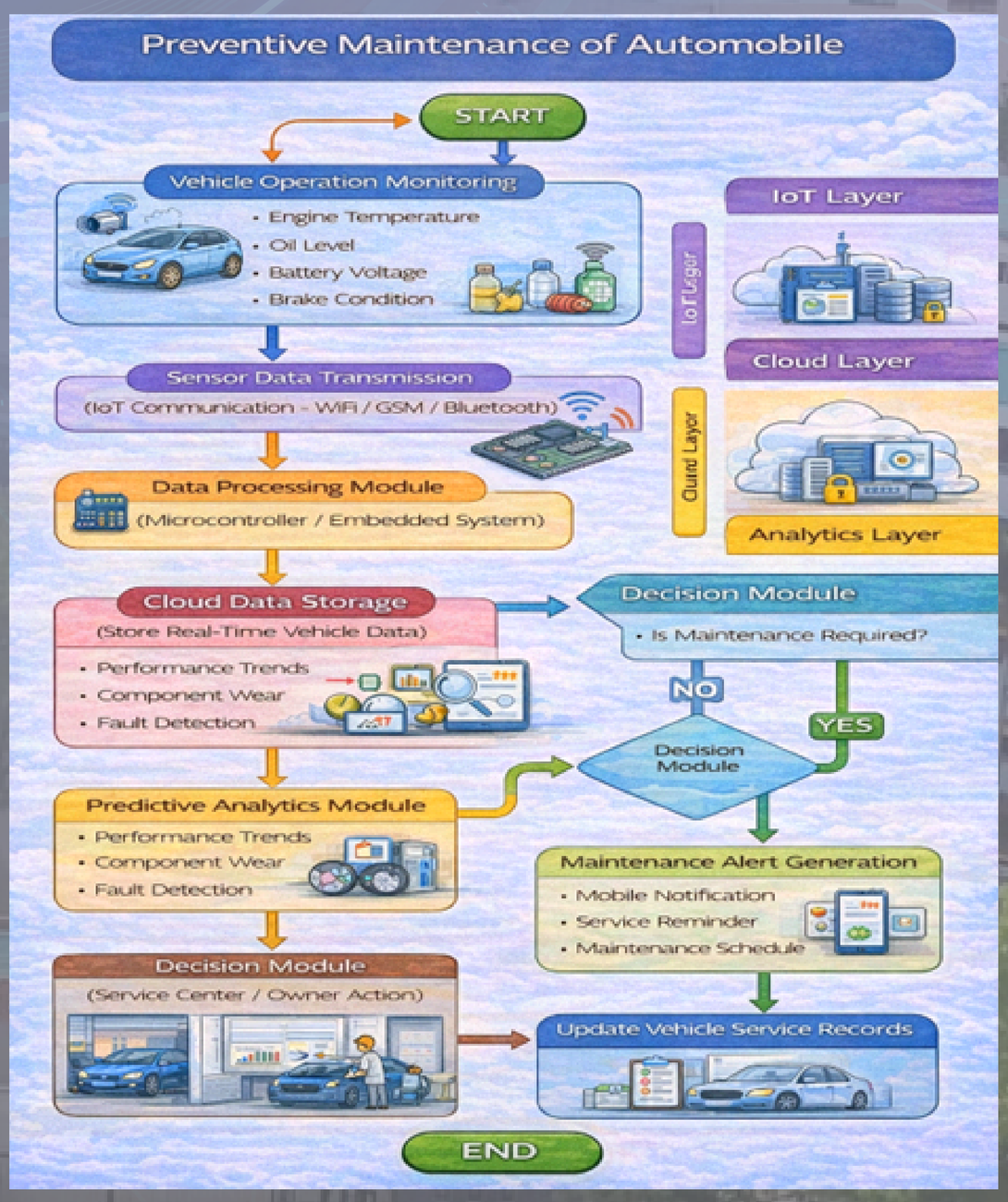
METHOD USED

The proposed system integrates IoT-based sensor monitoring, embedded processing units, cloud-based analytics, and maintenance alert modules. Sensors are installed in automobiles to continuously monitor performance parameters such as engine temperature, vibration levels, oil quality, battery voltage, and brake wear condition.

Sensor data is processed using embedded microcontrollers such as Arduino or ESP32 controllers. The processed data is transmitted to cloud-based platforms through wireless communication technologies such as GSM, Bluetooth, or Wi-Fi. Data analytics algorithms analyse vehicle performance trends and detect abnormal patterns indicating potential component failures.

Predictive maintenance models evaluate historical and real-time vehicle data to forecast maintenance requirements. A mobile or web-based dashboard is developed to display vehicle health reports, maintenance schedules, and warning alerts. The system sends notifications to vehicle owners and service centers for timely maintenance actions.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in implementing predictive maintenance techniques using IoT-based real-time automobile monitoring. Unlike traditional reactive maintenance systems, the proposed system predicts component failures before breakdown occurs.

Another innovative aspect is the integration of multi-sensor monitoring with cloud-based analytics and automated maintenance alert systems. The system supports remote vehicle health monitoring and maintenance scheduling. The modular architecture enables integration with fleet management systems and smart automotive monitoring platforms.

PERFORMANCE

The performance of the proposed system is evaluated based on monitoring accuracy, fault detection efficiency, data transmission reliability, and maintenance prediction accuracy. Experimental results demonstrate that IoT sensors accurately monitor automobile parameters under different operating conditions.

Predictive analytics models successfully identify abnormal vehicle performance trends and provide early maintenance alerts. The system reduces unexpected vehicle breakdowns and improves maintenance scheduling efficiency. Overall, the preventive maintenance system enhances vehicle reliability and reduces operational costs.

Real-World Application

The proposed system can be deployed in personal vehicles, commercial fleet management systems, logistics transportation networks, and automotive service centers. Fleet operators can use the system to monitor vehicle health, reduce downtime, and improve maintenance planning.

Automobile manufacturers can integrate the system into smart vehicle monitoring platforms for warranty management and predictive service support. The system also supports smart transportation infrastructure and contributes to safer and more efficient vehicle maintenance practices.

Guide: Mr A A Barbind

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2) JAGDHANE RAHUL KAILAS

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4) SHINDE TANMAY DNYANESHWAR

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Traffic Sign Board Recognition and Voice Alert System

Problem Landscape

Road accidents remain a major public safety concern worldwide, particularly in developing countries where traffic rule violations and lack of driver awareness contribute significantly to accident rates. Traffic sign boards provide essential information regarding speed limits, road conditions, warnings, and regulatory instructions. However, drivers often fail to notice or correctly interpret traffic signs due to distractions, poor visibility, fatigue, or unfamiliar road conditions.

Traditional driver assistance systems primarily rely on manual sign recognition, which depends heavily on driver attention and environmental visibility. This becomes especially challenging during nighttime driving, adverse weather conditions, or high-speed highway travel. The absence of automated traffic sign recognition systems increases the risk of traffic violations and accidents.

With advancements in computer vision, artificial intelligence, and speech synthesis technologies, intelligent traffic sign recognition systems can automatically detect and interpret road signs in real time. This project proposes a smart traffic sign recognition and voice alert system that detects road signs using image processing and deep learning techniques and provides audio alerts to drivers, enhancing road safety and driver awareness.

OBJECTIVES

The primary objective of this project is to develop an intelligent traffic sign recognition system that provides real-time voice alerts to drivers. The specific objectives include:

- To detect traffic sign boards using computer vision techniques.
- To classify traffic signs using machine learning and deep learning algorithms.
- To develop real-time image processing systems using camera input.
- To generate voice alerts corresponding to detected traffic signs.
- To improve driver awareness and reduce traffic rule violations.
- To enhance road safety through automated driver assistance technology.

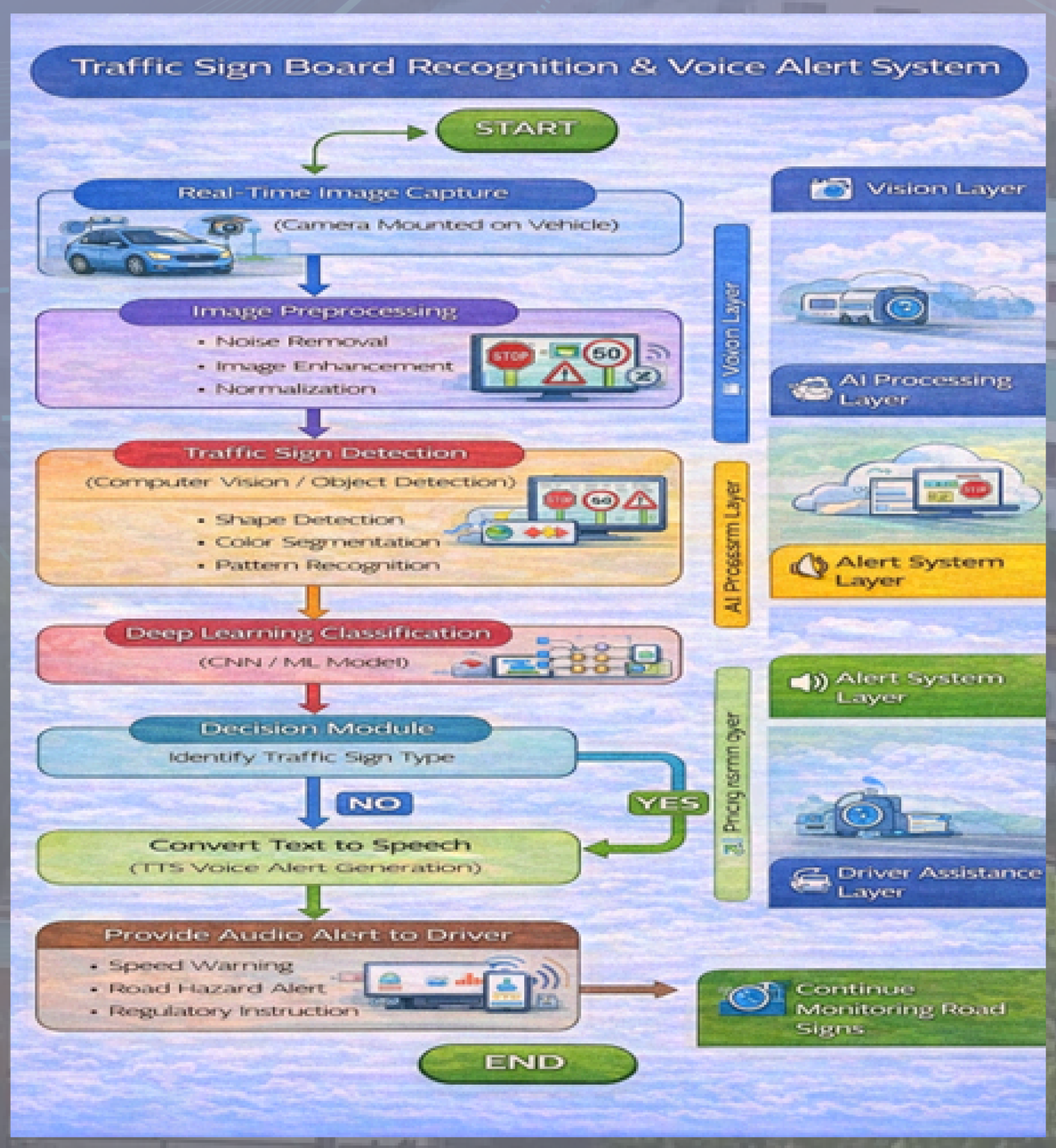
METHOD USED

The proposed system integrates image acquisition, image preprocessing, traffic sign detection, classification, and voice alert modules. A camera system installed in the vehicle captures real-time road images. Image preprocessing techniques such as noise removal, image normalization, and contrast enhancement are applied to improve detection accuracy.

Traffic sign detection algorithms identify sign board regions using computer vision techniques such as colour segmentation and shape detection. Deep learning models such as Convolutional Neural Networks (CNNs) are trained using traffic sign datasets to classify detected signs accurately.

Once the traffic sign is recognized, the system converts the classification output into voice alerts using text-to-speech (TTS) technology. The voice alert informs drivers about speed limits, warning signs, and regulatory instructions. The system continuously monitors road signs and provides real-time driver assistance.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in combining computer vision-based traffic sign recognition with real-time voice alert systems. Unlike traditional driver assistance systems, the proposed solution provides automated visual and auditory driving guidance.

Another innovative aspect is the integration of deep learning models for accurate traffic sign classification under varying environmental conditions. The system supports multi-class sign recognition and real-time alert generation. The modular architecture allows integration with advanced driver assistance systems (ADAS) and autonomous vehicle technologies.

PERFORMANCE

The performance of the proposed system is evaluated based on detection accuracy, classification precision, processing speed, and voice alert response time. Experimental results demonstrate that deep learning-based models achieve high traffic sign recognition accuracy under different lighting and weather conditions.

The system efficiently processes real-time video input and generates voice alerts with minimal delay. The automated sign recognition system reduces driver distraction and improves traffic rule compliance. Overall, the system enhances road safety and driver assistance efficiency.

Real-World Application

The proposed system can be implemented in smart vehicles, driver assistance systems, and autonomous vehicle platforms. It can assist drivers in recognizing traffic signs in unfamiliar routes and adverse driving conditions.

Transportation authorities can integrate the system into intelligent transportation systems to improve traffic management and accident prevention. The solution also supports driver training programs and smart road safety monitoring infrastructure.

Guide: Dr R D Chintamani

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4) *SUSHIL KUMAR SHARMA*
5) *WALTE ARATI VIJAY*

Non-Traceable VPN Browser

Problem Landscape

With the increasing dependence on internet-based services, user privacy and online security have become major concerns worldwide. Internet users are constantly exposed to cyber threats such as data tracking, identity theft, surveillance, and unauthorized data collection. Most traditional web browsers store browsing history, cookies, and user metadata, which can be accessed by third-party trackers, advertisers, and cyber attackers.

Although Virtual Private Networks (VPNs) are widely used to enhance online privacy, conventional VPN solutions still face limitations such as IP address leakage, DNS tracking, browser fingerprinting, and centralized data logging. These vulnerabilities reduce the effectiveness of user anonymity and allow cyber entities to trace user activities.

With advancements in cybersecurity technologies, there is a growing need for secure browsing platforms that combine VPN functionality with advanced privacy protection mechanisms. This project proposes a Non-Traceable VPN Browser that integrates multi-layer encryption, anonymous routing, anti-tracking mechanisms, and secure browsing architecture to ensure complete user privacy and safe internet access.

OBJECTIVES

The primary objective of this project is to develop a secure and anonymous web browser integrated with VPN-based encryption and anti-tracking mechanisms. The specific objectives include:

• To design a browser that prevents user identity tracking and data leakage.

• To integrate VPN-based secure communication with multi-layer encryption techniques.

• To implement anonymous routing mechanisms for secure internet browsing.

• To prevent browser fingerprinting and tracking by third-party applications.

• To provide secure data transmission through encrypted communication channels.

• To develop a user-friendly interface for safe and anonymous browsing.

METHOD USED

The proposed system integrates VPN tunneling, encrypted communication protocols, anonymous routing algorithms, and anti-tracking browser features. The browser establishes secure VPN connections using encryption protocols such as OpenVPN or WireGuard. User internet traffic is routed through encrypted VPN tunnels, masking the original IP address and protecting user data from interception.

Anonymous routing mechanisms such as multi-hop VPN routing or onion routing techniques are implemented to enhance user anonymity. These routing methods transmit user data through multiple encrypted network layers, making tracking extremely difficult.

The browser integrates anti-tracking modules that block cookies, third-party trackers, and fingerprinting scripts. Secure browsing features such as HTTPS enforcement, encrypted DNS resolution, and malware protection are implemented. The system also provides real-time monitoring of network security and user privacy status.

PROPOSED MODEL

Technical Innovation

The major innovation of this project lies in combining advanced VPN encryption with anonymous multi-hop routing and anti-fingerprinting browser architecture. Unlike traditional VPN browsers, the proposed system integrates multiple layers of privacy protection to ensure complete user anonymity.

Another innovative aspect is the implementation of encrypted DNS resolution and automated tracking prevention mechanisms. The system dynamically detects potential privacy threats and blocks malicious tracking activities. The modular design allows integration with advanced cybersecurity frameworks and secure communication networks.

PERFORMANCE

The performance of the proposed system is evaluated based on encryption efficiency, browsing speed, anonymity protection, and tracking prevention accuracy. Experimental results demonstrate that the VPN browser effectively masks user IP addresses and prevents data interception.

Multi-hop routing techniques significantly enhance user anonymity while maintaining stable browsing performance. The anti-tracking module successfully blocks third-party tracking scripts and prevents browser fingerprinting attempts. Overall, the system provides improved privacy protection compared to conventional web browsers and VPN services.

Real-World Application

The proposed system can be deployed for secure personal browsing, corporate data protection, and cybersecurity applications. Journalists, researchers, and organizations handling sensitive data can use the system to ensure secure communication and anonymous internet access.

The browser can also be integrated into government cybersecurity frameworks, online privacy platforms, and secure enterprise communication systems. The solution supports digital privacy initiatives and contributes to protecting user data from cyber surveillance and tracking threats.

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IoT Based Smart Notice Board Using Raspberry Pi

Problem Landscape

Notice boards play an important role in communication within educational institutions, corporate organizations, and public information systems. Traditional notice boards rely on manual updates, which are time-consuming, inefficient, and lack real-time communication capability. Physical notice boards require administrative staff to print and manually display notices, leading to delays in information dissemination and increased paper consumption.

In large institutions, ensuring that notices reach all individuals effectively becomes challenging. Manual notice boards also lack centralized management, remote updating capability, and content scheduling features. Additionally, outdated notices may remain displayed due to improper monitoring, causing communication gaps and confusion among recipients.

With advancements in Internet of Things (IoT) technology, digital notice boards can enable real-time content updates and remote management. IoT-based smart notice boards provide automated content display, wireless communication, and centralized control systems. This project proposes an IoT-based smart notice board using Raspberry Pi that allows authorized users to update notices remotely and display real-time information through digital screens.

OBJECTIVES

The primary objective of this project is to design and implement an IoT-based smart notice board system using Raspberry Pi for efficient communication and real-time information display. The specific objectives include:

- To develop a wireless notice board system capable of remote content updates.
- To integrate Raspberry Pi for digital notice display and system control.
- To enable real-time notice updates using IoT communication technologies.
- To reduce paper consumption and manual administrative workload.
- To provide centralized notice management and scheduling features.
- To enhance communication efficiency in educational and organizational environments.

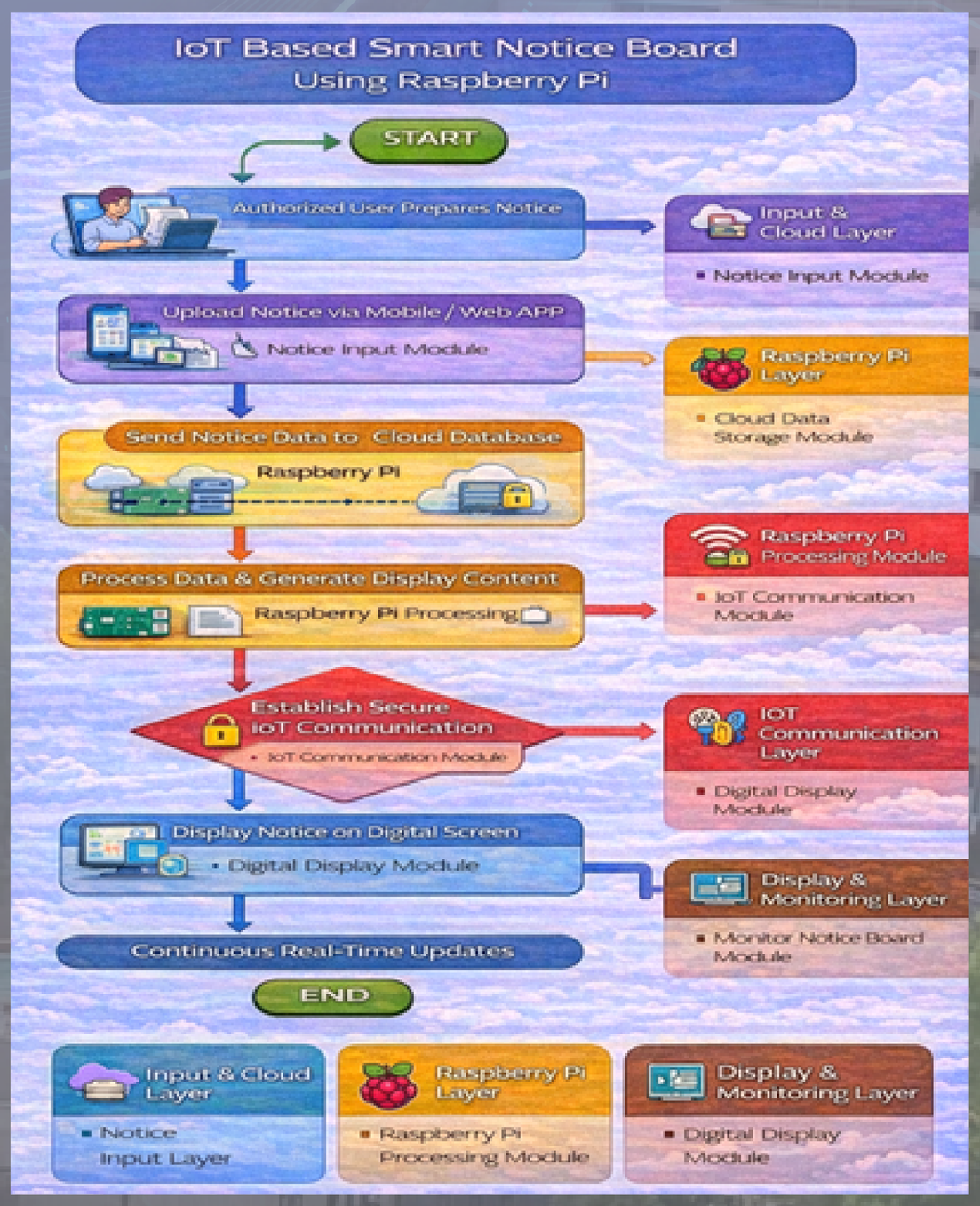
METHOD USED

The proposed system integrates Raspberry Pi microcontroller boards, IoT communication modules, cloud-based data management, and digital display units. Authorized users upload notices through a web or mobile application interface. The notice content is stored in cloud servers or local network databases.

Raspberry Pi connects to the internet using Wi-Fi or Ethernet modules and retrieves notice data from cloud platforms. The system processes notice content and displays it on connected digital screens such as LCD or LED monitors. The system supports text, image, and multimedia content display.

The IoT communication module ensures real-time data synchronization between user applications and display devices. Security mechanisms such as user authentication and encrypted communication protocols are implemented to prevent unauthorized notice updates. The system also supports scheduling features for automatic content display based on predefined time intervals.

PROPOSED MODEL



Technical Innovation

The major innovation of this project lies in implementing IoT-based remote notice management using Raspberry Pi microcontroller platforms. Unlike traditional notice boards, the proposed system enables real-time digital notice updates and automated scheduling capabilities.

Another innovative aspect is the integration of cloud-based content management with wireless display systems. The system supports multimedia notice display, enhancing information presentation quality. The modular architecture allows easy scalability and integration with smart campus infrastructure and digital communication networks.

PERFORMANCE

The performance of the proposed system is evaluated based on data transmission efficiency, display update speed, system reliability, and communication accuracy. Experimental results demonstrate that the IoT-based notice board successfully updates notices in real time with minimal latency.

The Raspberry Pi processing module efficiently handles multimedia content display and communication tasks. The system reduces manual administrative workload and ensures reliable notice communication across institutions. Overall, the system improves communication efficiency and reduces paper-based notice management.

Real-World Application

The proposed system can be implemented in schools, colleges, universities, corporate offices, hospitals, and public information display systems. Educational institutions can use the system to broadcast academic announcements, examination schedules, and event notifications.

Corporate organizations can utilize the system for employee communication and operational updates. The solution can also be integrated into smart city infrastructure for public information dissemination and digital signage applications.

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Predicting Emergency Scenarios Using Digital Twin with the Help of Unreal Engine

Problem Landscape

Emergency situations such as industrial accidents, fire outbreaks, natural disasters, and infrastructure failures pose significant threats to human life and property. Traditional emergency management systems rely on historical data analysis and manual monitoring techniques, which often fail to predict emergencies in real time. Lack of accurate simulation tools makes it difficult for authorities to evaluate disaster scenarios and plan effective response strategies.

Emergency preparedness requires realistic simulation environments capable of predicting hazardous conditions and analyzing system behavior under critical circumstances. Conventional simulation tools often lack real-time data integration and visual representation of emergency scenarios. This limitation reduces decision-making efficiency and delays emergency response planning.

With the advancement of Digital Twin technology and real-time simulation platforms such as Unreal Engine, it is possible to create virtual replicas of physical systems and simulate emergency scenarios dynamically. Digital Twin technology integrates real-time sensor data with virtual models to monitor system performance and predict potential failures. This project proposes an intelligent emergency prediction system using Digital Twin technology and Unreal Engine simulation to enhance disaster preparedness and risk management.

OBJECTIVES

The primary objective of this project is to develop a Digital Twin-based emergency prediction and simulation system using Unreal Engine. The specific objectives include:

- To create virtual digital twin models representing physical infrastructure or environments.
- To integrate real-time sensor data into digital twin simulation environments.
- To simulate emergency scenarios such as fire, structural failure, or environmental hazards.
- To predict emergency situations using real-time monitoring and data analytics.
- To develop visualization dashboards for emergency simulation and risk assessment.
- To improve disaster preparedness and emergency response planning.

METHOD USED

The proposed system integrates Digital Twin modeling, real-time data acquisition, simulation rendering using Unreal Engine, and predictive analytics modules. Initially, digital twin models of physical systems such as buildings, industrial facilities, or smart city infrastructure are created using 3D modeling tools and integrated into Unreal Engine simulation environments.

IoT sensors are deployed in physical environments to collect real-time data such as temperature, structural stress, smoke levels, and environmental conditions. The sensor data is transmitted to cloud-based servers and synchronized with digital twin models. Unreal Engine processes real-time data inputs and simulates emergency scenarios based on system behavior and environmental conditions.

Predictive analytics algorithms analyze simulation results and detect abnormal conditions that indicate potential emergency situations. The system generates visual alerts, simulation outputs, and emergency response recommendations. The platform provides interactive visualization tools that allow decision-makers to evaluate emergency scenarios and plan response strategies effectively.

PROPOSED MODEL

Technical Innovation

The major innovation of this project lies in integrating Digital Twin technology with real-time Unreal Engine simulation for emergency prediction. Unlike traditional disaster simulation systems, the proposed solution provides real-time synchronization between physical environments and virtual simulation models.

Another innovative aspect is the use of advanced 3D visualization and interactive simulation features provided by Unreal Engine. The system enables dynamic scenario analysis and supports predictive emergency planning. The modular architecture allows integration with smart city infrastructure, industrial monitoring systems, and disaster management frameworks.

PERFORMANCE

The performance of the proposed system is evaluated based on simulation accuracy, real-time data synchronization efficiency, prediction reliability, and visualization quality. Experimental results demonstrate that digital twin models accurately simulate physical system behavior under varying environmental conditions.

The Unreal Engine simulation platform provides high-quality visualization and real-time interaction capabilities. Predictive analytics algorithms successfully detect abnormal environmental patterns and generate emergency alerts. Overall, the system improves emergency preparedness and reduces disaster response delays.

Real-World Application

The proposed system can be deployed in industrial safety monitoring systems, smart city disaster management infrastructure, building safety simulation platforms, and environmental hazard prediction systems. Emergency response agencies can use the system to simulate disaster scenarios and plan evacuation strategies.

Industrial organizations can utilize digital twin simulation to monitor equipment safety and predict system failures. The solution supports urban planning, infrastructure safety monitoring, and emergency training simulations. By enabling predictive emergency analysis, the project contributes to improving disaster management and public safety.

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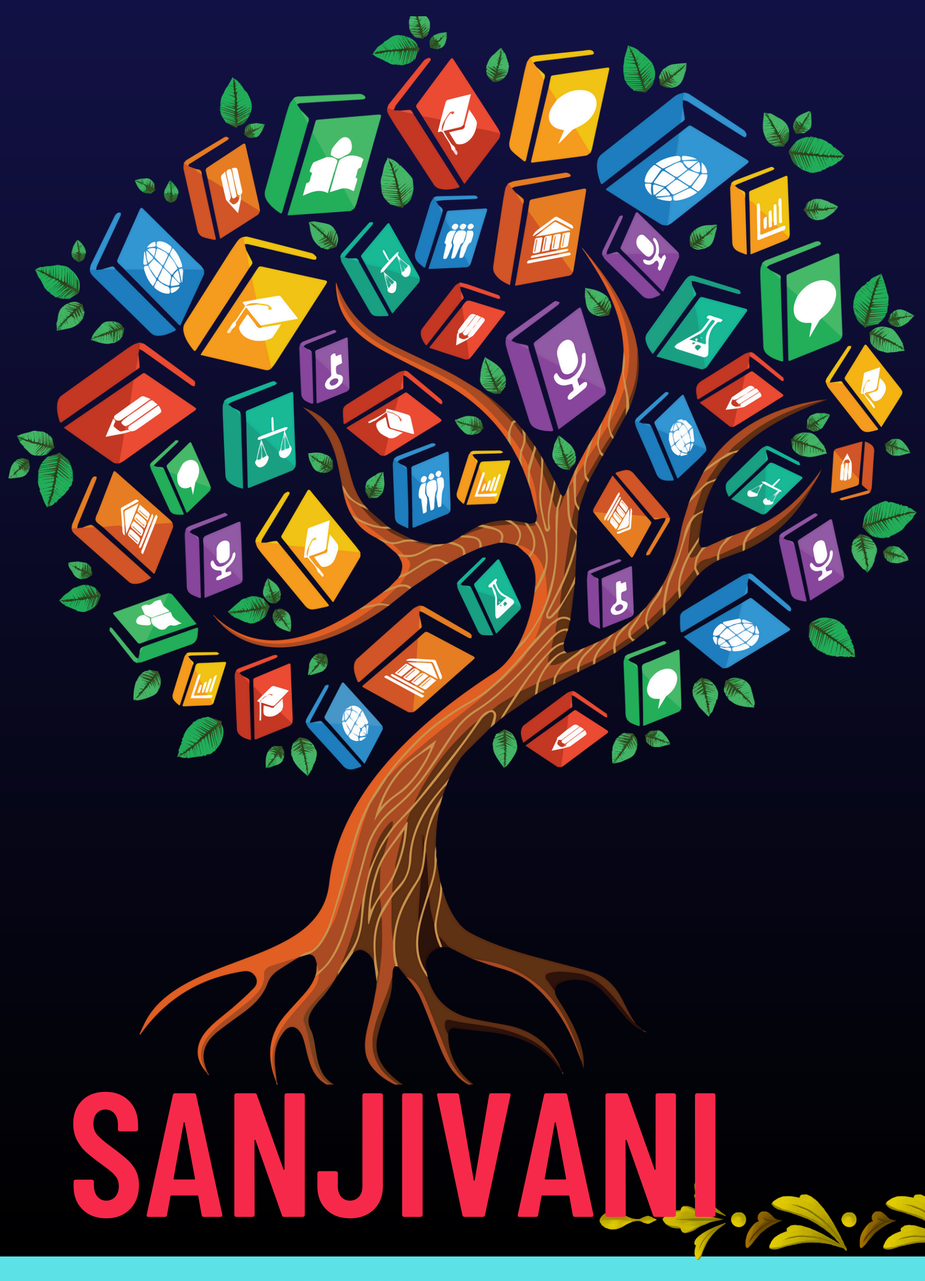

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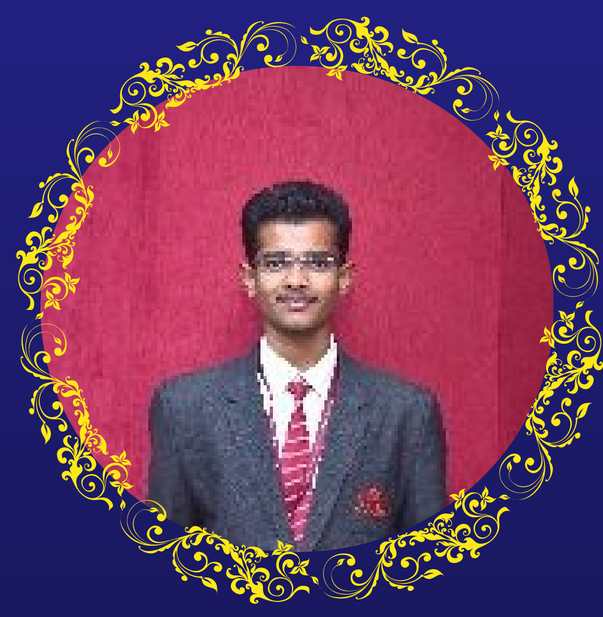

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THANK YOU