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

FEB 2023

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

It gives me immense pride to present this edition of the IT Technical Magazine, which reflects the innovation, dedication, and technical excellence demonstrated by our students during this academic year. The projects showcased in this volume represent the strong alignment of our department with emerging technologies such as Artificial Intelligence, Machine Learning, Industry 4.0, Digital Twin systems, Healthcare Analytics, Smart Agriculture, and Intelligent Transportation Systems.

From AI-driven healthcare solutions like Alzheimer's and Chronic Kidney Disease prediction to intelligent systems such as Distracted Driver Detection and Fake Social Media Account Identification, our students have addressed real-world challenges with analytical thinking and practical implementation. The development of Digital Twin models for Industry 4.0 and smart IoT-enabled agricultural systems highlights our commitment to bridging the gap between academic learning and industrial application.

These projects reflect not only technical proficiency but also a strong understanding of societal impact and sustainable innovation. I sincerely appreciate the hard work of our students, faculty mentors, and editorial team in bringing this publication to life. I am confident that our department will continue to nurture future-ready technologists who contribute meaningfully to the evolving digital world.

Let us continue striving for excellence in research, innovation, and ethical technological development.

Dr. Madhuri Jawale,
Professor and Head

FROM EDITOR'S DESK

Dear Readers,

Welcome to this vibrant edition of the IT Technical Magazine, where innovation meets imagination. This year's collection of projects showcases the dynamic capabilities of our students in domains such as Artificial Intelligence, Deep Learning, IoT, Cloud Computing, Blockchain, Smart Manufacturing, and Cybersecurity.

The diversity of topics—from Digital Twin technology in Industry 4.0 to intelligent systems for distracted driver detection and predictive healthcare—demonstrates our students' ability to apply theoretical concepts to solve complex real-world problems. The integration of AI and data analytics across various domains highlights the department's forward-thinking approach and adaptability to global technological trends.

This edition is more than just a documentation of projects; it is a reflection of curiosity, research orientation, collaboration, and creative problem-solving. Each contribution symbolizes countless hours of experimentation, debugging, learning, and refinement.

I extend my heartfelt gratitude to our respected HOD, faculty mentors, and student contributors for their continuous support and enthusiasm. I hope this magazine inspires readers to explore new technological horizons and pursue innovation with confidence.

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

Contents

Time-Bound Access and Monetization of Products Using Blockchain

Problem Landscape

In the modern digital economy, businesses increasingly rely on subscription-based models, pay-per-use systems, and time-limited access to digital and physical products. However, traditional centralized systems for managing access control and monetization often suffer from security vulnerabilities, lack of transparency, fraud risks, and dependency on intermediaries.

For digital products such as software licenses, online courses, e-books, streaming services, and even IoT-enabled physical devices, enforcing time-bound access securely remains a major challenge. Unauthorized sharing, license duplication, data tampering, and delayed payments reduce revenue and weaken trust between providers and consumers.

Blockchain technology, with its decentralized, tamper-proof, and transparent architecture, provides a secure framework for managing access rights and monetization. Smart contracts enable automated enforcement of time-bound conditions without reliance on centralized authorities. The proposed system leverages blockchain technology to create a secure and automated time-based access and payment ecosystem.

OBJECTIVES

The primary objective of this project is to develop a blockchain-based system for secure, time-bound access control and monetization of products. The specific objectives include:

- To design a decentralized access control mechanism.
- To implement smart contracts for automated time-based access validation.
- To enable secure and transparent payment transactions.
- To prevent unauthorized duplication or misuse of digital assets.
- To automate subscription and pay-per-use models.
- To enhance trust and transparency in digital commerce systems.

METHOD USED

The proposed system integrates blockchain infrastructure, smart contract programming, user authentication mechanisms, and payment gateway integration.

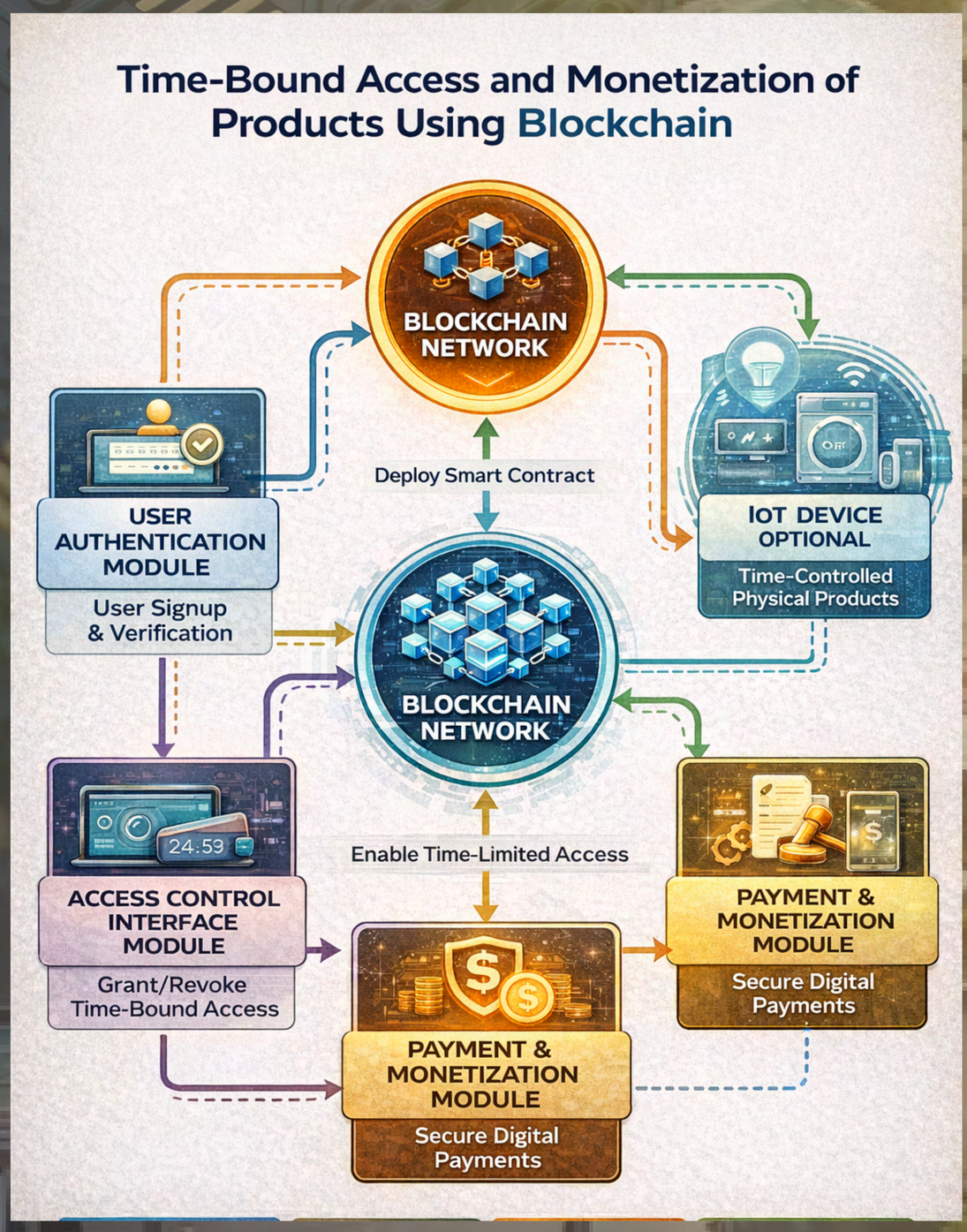
A blockchain network (such as Ethereum) is used to deploy smart contracts that define access conditions. When a user purchases access to a product, a smart contract records the transaction and assigns time-limited usage rights.

The smart contract automatically verifies whether access conditions are valid before granting product usage. Once the time duration expires, access is revoked automatically without manual intervention.

For monetization, cryptocurrency or token-based payments are processed securely on the blockchain. All transactions are recorded in an immutable ledger, ensuring transparency and traceability.

Optional integration with IoT devices allows time-based control of physical products such as rented equipment or smart appliances.

PROPOSED MODEL



Technical Innovation

The innovative aspect of this project lies in applying blockchain-based smart contracts to automate time-bound access control. Unlike centralized licensing systems, this approach eliminates dependency on third-party intermediaries.

The system ensures:

- Tamper-proof access records
- Automated expiration of access rights
- Transparent payment tracking
- Decentralized verification

Smart contracts execute automatically when predefined conditions are met, reducing administrative overhead and enhancing security. The architecture supports tokenized monetization models and digital asset ownership verification.

PERFORMANCE

The system performance is evaluated using:

- Transaction Validation Time
- Smart Contract Execution Speed
- Access Verification Latency
- Security Integrity
- Scalability Performance

Testing demonstrates reliable smart contract execution and secure transaction processing. The decentralized architecture ensures high data integrity and reduces fraud risks.

Real-World Application

The proposed system can be deployed in:

- Online course platforms
- Digital content distribution services
- Software licensing systems
- Rental-based IoT product services
- Subscription-based SaaS platforms
- Digital rights management (DRM) systems

Businesses can automate licensing, subscriptions, and revenue models securely. The system supports transparent digital commerce ecosystems and reduces operational risks.

Guide: ***Prof. C D Bawankar***

Project Group Members:

1) Sanjana Satish Amale

2) Nandini Kumar Gujarathi

3) Shital Kailas Kale

4) Mayuri Mahendra Shirode

Elevator(Digital Twin)

Problem Landscape

Elevators are critical vertical transportation systems in residential buildings, commercial complexes, hospitals, and smart infrastructure. As urbanization increases, efficient elevator performance becomes essential for safety, energy optimization, and passenger convenience.

Traditional elevator maintenance relies on scheduled servicing or reactive repairs after failure. Such approaches often result in unexpected breakdowns, passenger inconvenience, increased downtime, and high maintenance costs. Additionally, monitoring real-time operational performance in high-rise buildings is complex and inefficient without centralized analytics.

Digital Twin technology offers a transformative solution by creating a real-time virtual replica of a physical elevator system. By integrating IoT sensors and simulation models, a digital twin continuously mirrors the elevator's operational behavior, enabling predictive maintenance, performance optimization, and safety analysis.

The proposed project aims to design a Digital Twin-based Elevator Monitoring System that improves reliability, safety, and operational efficiency.

OBJECTIVES

The primary objective of this project is to develop a Digital Twin framework for real-time monitoring and optimization of elevator systems. The specific objectives include:

- To create a virtual replica (digital twin) of a physical elevator system.
- To collect real-time sensor data from elevator components.
- To monitor performance parameters such as speed, load, vibration, and door cycles.
- To detect anomalies and predict potential failures.
- To optimize elevator scheduling and energy efficiency.
- To enhance passenger safety and reduce downtime.

METHOD USED

The proposed system integrates IoT sensors, data acquisition systems, cloud-based simulation platforms, and predictive analytics models.

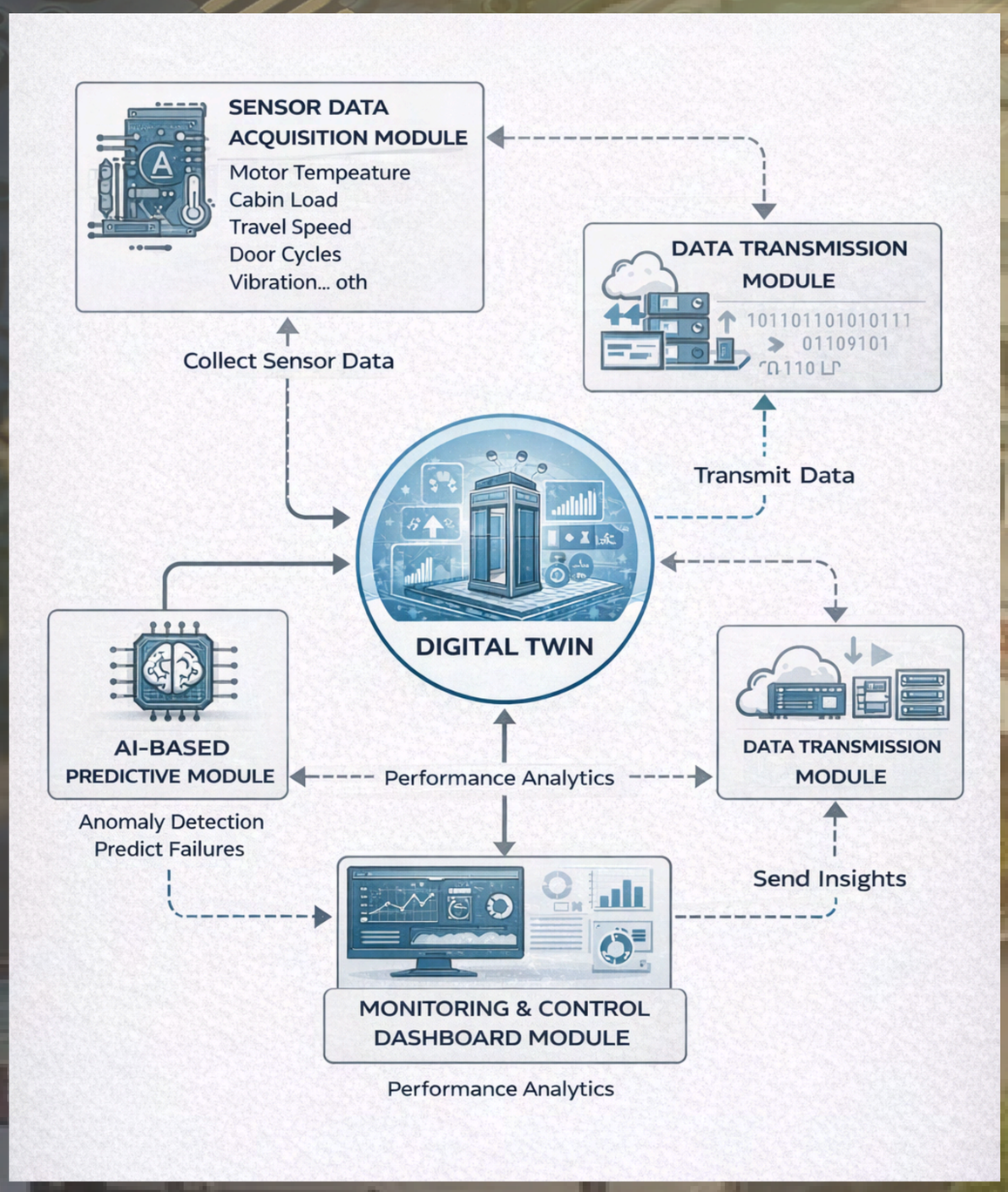
Sensors installed in the elevator measure parameters such as:

- Motor temperature
- Cabin load
- Door open/close cycles
- Vibration levels
- Travel speed
- Energy consumption

These sensor readings are transmitted to a cloud-based digital twin model that simulates real-time elevator behavior. Machine learning algorithms analyze operational patterns to detect anomalies and predict component wear.

The digital twin visualizes system performance using dashboards and 3D simulation models. Maintenance alerts are generated automatically when abnormal conditions are detected.

PROPOSED MODEL



Technical Innovation

The innovative aspect of this project lies in applying Digital Twin technology to vertical transportation systems. Unlike conventional monitoring systems, the digital twin continuously synchronizes physical and virtual systems.

Real-time simulation allows:

- Performance optimization
- Load balancing
- Energy efficiency analysis
- Predictive maintenance scheduling

Integration with AI enhances anomaly detection accuracy. The system supports Industry 4.0 and smart building automation frameworks.

PERFORMANCE

The system performance is evaluated using:

- Downtime Reduction Percentage
- Failure Prediction Accuracy
- Energy Optimization Rate
- System Latency
- Maintenance Cost Reduction

Experimental results demonstrate improved maintenance efficiency and reduced unplanned breakdowns. The digital twin model effectively identifies abnormal operational patterns before failure occurs.

Real-World Application

The proposed system can be deployed in:

- High-rise residential buildings
- Commercial complexes
- Hospitals
- Airports and metro stations
- Smart city infrastructure

Building management systems can integrate digital twin models for centralized elevator control and monitoring. The system enhances operational reliability and passenger safety.

*Guide: **Dr. M B Gawali***

Project Group Members:

1) Naikwade Vaishnavi Vinod

2) Shirole Shital Rajendra

3) Nikam Nikita Kacharu

4) Wable Sayali Sanjay

Missing Person Identification

Problem Landscape

Missing person cases are a major concern globally, involving children, elderly individuals, and vulnerable populations. Law enforcement agencies often face challenges in quickly identifying and locating missing individuals due to lack of centralized data, limited real-time surveillance integration, and manual identification processes.

Traditional identification methods rely on photographs, manual verification, and public reporting, which are time-consuming and prone to human error. In large public gatherings, railway stations, airports, and urban surveillance environments, rapid identification becomes even more complex.

With advancements in Artificial Intelligence (AI), deep learning, and facial recognition technologies, automated identification systems can significantly enhance search efficiency. The proposed Missing Person Identification System leverages computer vision and AI-based facial recognition to detect and match missing individuals in real time using surveillance data.

OBJECTIVES

The primary objective of this project is to develop an AI-based system for identifying missing persons using facial recognition technology. The specific objectives include:

- To create a centralized database of missing individuals.
- To implement facial detection and recognition algorithms.
- To match real-time images with stored database records.
- To generate alerts when a potential match is detected.
- To assist law enforcement agencies in rapid identification.
- To improve accuracy and reduce manual verification time.

METHOD USED

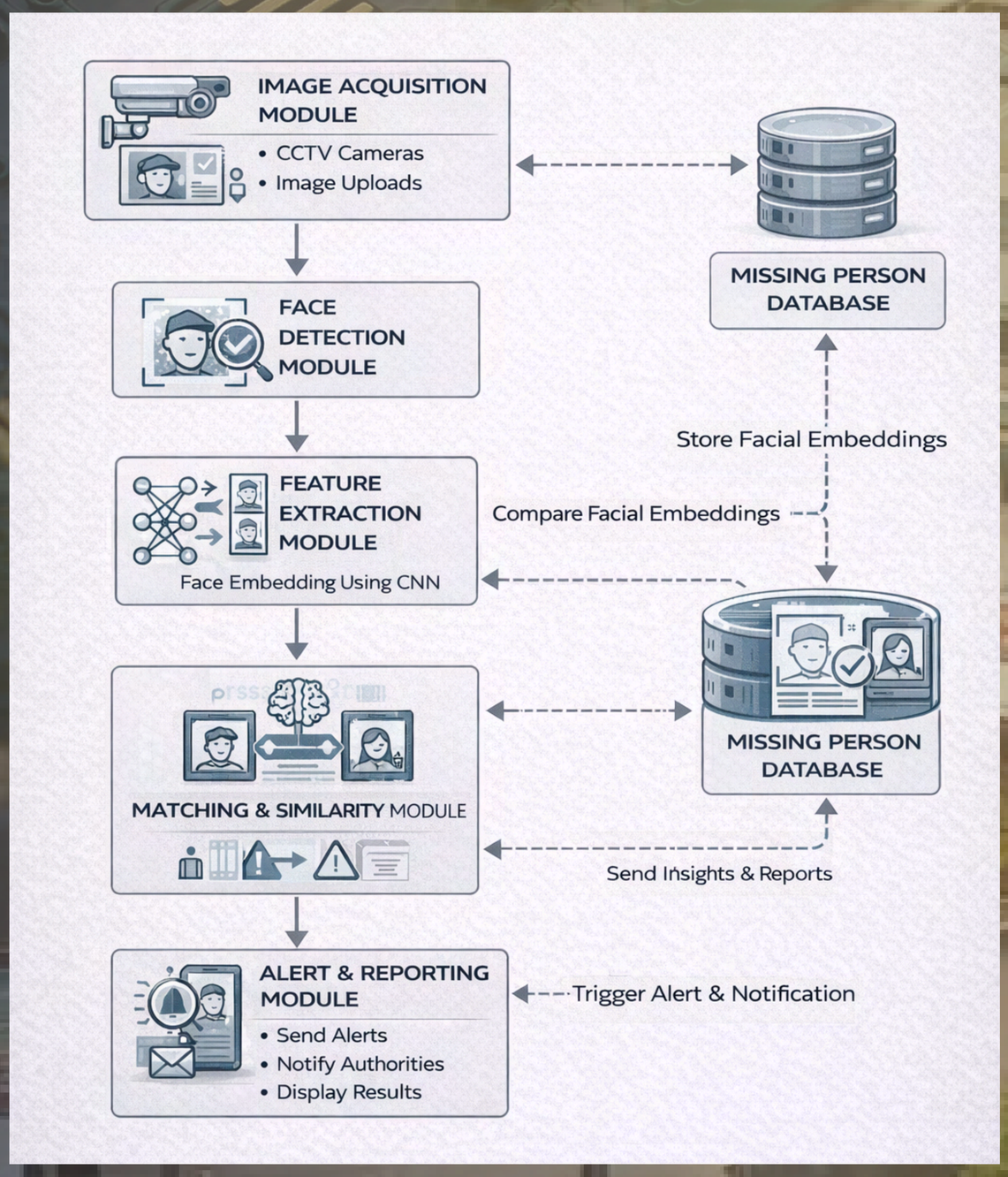
The proposed system integrates image acquisition, facial detection, feature extraction, matching algorithms, and alert notification modules.

Images or video streams are captured from CCTV cameras or uploaded by authorities. Preprocessing techniques such as face detection, cropping, normalization, and alignment are applied.

Deep learning models such as Convolutional Neural Networks (CNNs) or pre-trained face recognition frameworks (e.g., FaceNet, DeepFace) extract unique facial embeddings. These embeddings are compared with stored database vectors using similarity metrics.

If similarity exceeds a predefined threshold, the system generates alerts and notifies authorized personnel. The platform can be deployed on cloud infrastructure for scalable database management.

PROPOSED MODEL



Technical Innovation

The innovative aspect of this project lies in applying AI-driven facial recognition to social security and public safety systems. Unlike manual identification methods, the system performs automated matching with high accuracy and speed. Integration with centralized databases enables multi-location search capability. Edge computing can be implemented for real-time processing in surveillance systems.

The system also supports data encryption and secure access control to maintain privacy and ethical standards.

PERFORMANCE

The system performance is evaluated using:

- Recognition Accuracy
- False Positive Rate
- False Negative Rate
- Matching Speed
- Database Scalability

Experimental results demonstrate high recognition accuracy using deep learning-based face embedding models. The system effectively identifies individuals under varying lighting and pose conditions.

Real-World Application

The proposed system can be deployed in:

- Law enforcement agencies
- Railway stations and airports
- Smart city surveillance systems
- Public event monitoring
- Child safety programs

It enhances public safety infrastructure and accelerates missing person identification processes.

Guide: ***Dr. M A Jawale***

Project Group Members:

1) Omkar Lad

2) Tushar Rokade

3) Kaustubh Gorhe

4) Sayyam Gangwal

Crop Yield Prediction

Problem Landscape

Agriculture remains one of the most vital sectors of the economy, directly influencing food security, farmer income, and national growth. However, crop yield is affected by multiple unpredictable factors such as rainfall patterns, soil fertility, temperature variations, pest attacks, irrigation availability, and fertilizer usage.

Traditional yield prediction methods rely on historical averages or manual estimation, which often lack precision and fail to incorporate real-time environmental variables. Inaccurate yield forecasting can lead to poor market planning, supply-demand imbalance, financial losses for farmers, and inefficient resource allocation.

With advancements in Artificial Intelligence (AI), Machine Learning (ML), and data analytics, predictive models can analyze complex agricultural datasets to forecast crop yield with higher accuracy. The proposed system leverages data-driven approaches to support informed decision-making in precision farming.

OBJECTIVES

The primary objective of this project is to develop a Machine Learning-based system for accurate crop yield prediction. The specific objectives include:

- To collect and preprocess agricultural datasets.
- To analyze climatic, soil, and historical yield data.
- To implement regression-based machine learning models.
- To predict crop yield for a given region and season.
- To assist farmers and policymakers in planning crop production.
- To improve agricultural efficiency through data-driven insights.

METHOD USED

The system integrates data collection, preprocessing, feature engineering, model training, evaluation, and prediction modules.

Data sources include:

- Historical crop yield records
- Rainfall and temperature data
- Soil nutrient levels
- Irrigation patterns
- Fertilizer usage statistics

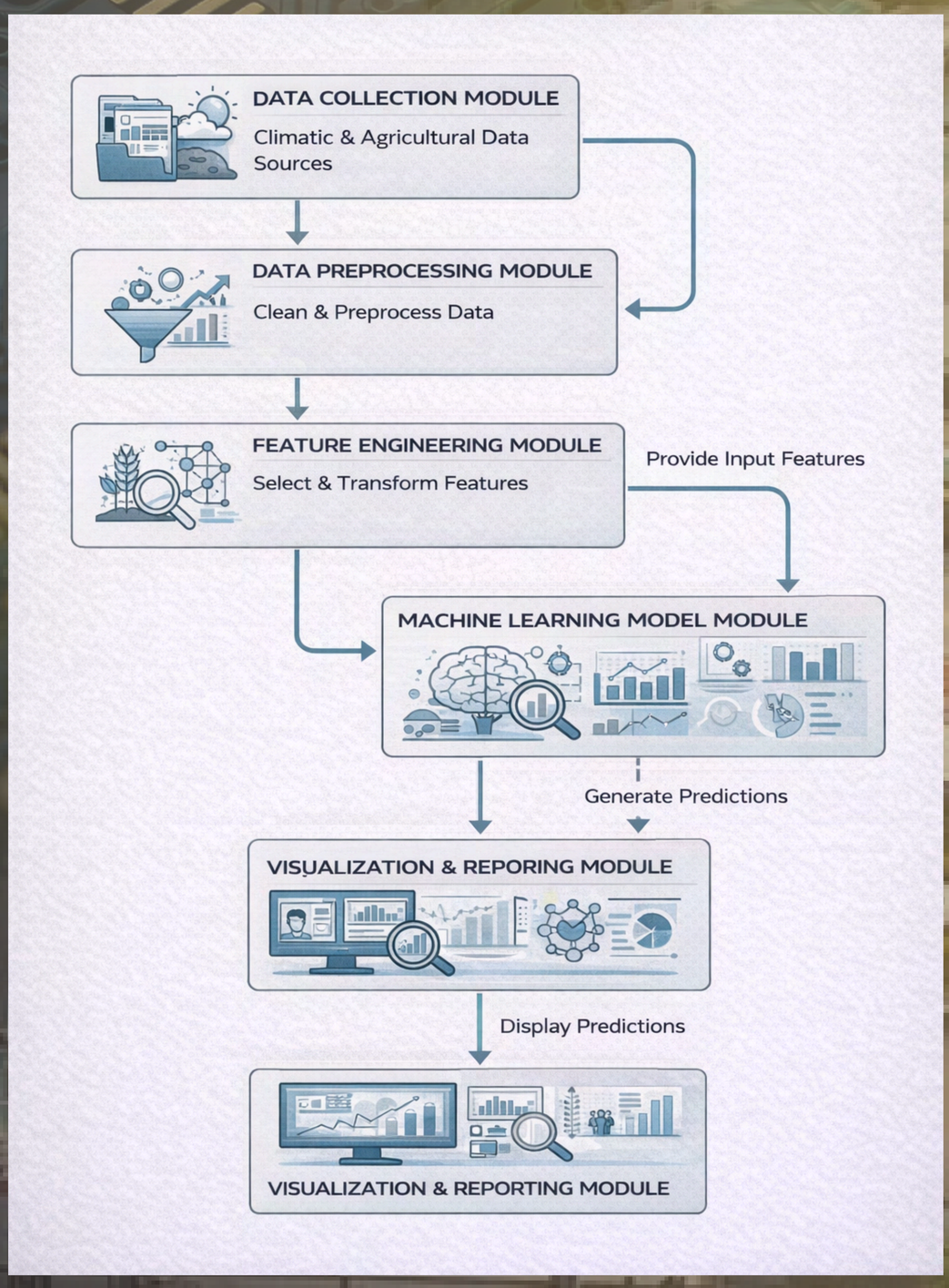
Data preprocessing includes handling missing values, normalization, and feature selection. Various machine learning algorithms such as Linear Regression, Random Forest, Support Vector Machine (SVM), and Gradient Boosting are trained on the dataset.

Model performance is evaluated using metrics such as:

- Mean Absolute Error (MAE)
- Mean Squared Error (MSE)
- R-squared Score

The best-performing model is selected for deployment. The system provides yield predictions based on user input parameters such as location, crop type, and environmental conditions.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining multi-dimensional agricultural data with machine learning techniques to achieve accurate yield prediction.

Unlike traditional estimation methods, this system:

- Uses data-driven predictive analytics
- Adapts to seasonal variations
- Supports region-specific forecasting
- Enables precision agriculture

Integration with IoT-based soil sensors and weather APIs can further enhance real-time prediction capabilities.

PERFORMANCE

System performance is evaluated using:

- Prediction Accuracy
- Error Metrics (MAE, MSE)
- Model Training Time
- Scalability with Large Datasets

Experimental results show improved forecasting accuracy compared to traditional statistical methods. Ensemble models such as Random Forest and Gradient Boosting demonstrate strong predictive performance.

Real-World Application

The proposed system can be deployed in:

- Agricultural advisory platforms
- Government agricultural departments
- Smart farming systems
- Crop insurance companies
- Agri-tech startups

It assists farmers in planning crop cycles, optimizing resource utilization, and improving profitability.

Guide: ***Dr. Y S Deshmukh***

Project Group Members:

1) Murtadak Sarthak Arjun

2) Navale Sandip Babasaheb

3) Ranmale Saisagar Rajendra

4) Sonawane Bhushan Vijay

Cheque Prediction System.

Problem Landscape

Cheque processing remains a critical component of banking and financial institutions, especially in regions where digital payment penetration is still evolving. However, cheque-based transactions are vulnerable to fraud, signature forgery, insufficient funds, post-dated misuse, and processing delays.

Traditional cheque verification relies heavily on manual validation, which is time-consuming, error-prone, and inefficient in high-volume banking environments. Financial institutions face significant losses due to fraudulent cheques and bounced payments.

With advancements in Artificial Intelligence (AI), Optical Character Recognition (OCR), and predictive analytics, it is possible to develop intelligent systems that analyze cheque details and predict potential fraud or dishonor risks before processing.

The proposed Cheque Prediction System aims to automate cheque validation and predict cheque clearance outcomes using machine learning models.

OBJECTIVES

The primary objective of this project is to develop a machine learning-based cheque analysis and prediction system. The specific objectives include:

- To digitize cheque information using OCR technology.
- To detect anomalies in cheque attributes.
- To predict cheque clearance probability.
- To identify fraudulent patterns.
- To reduce manual verification effort.
- To enhance banking security and operational efficiency.

METHOD USED

The proposed system integrates image processing, OCR, feature extraction, and machine learning prediction modules.

Cheque images are scanned or captured through banking systems. OCR techniques extract relevant details such as:

- Account number
- IFSC code
- Date
- Amount
- Signature area
- MICR code

Feature engineering techniques identify patterns such as abnormal amount frequency, signature mismatch indicators, or irregular transaction history.

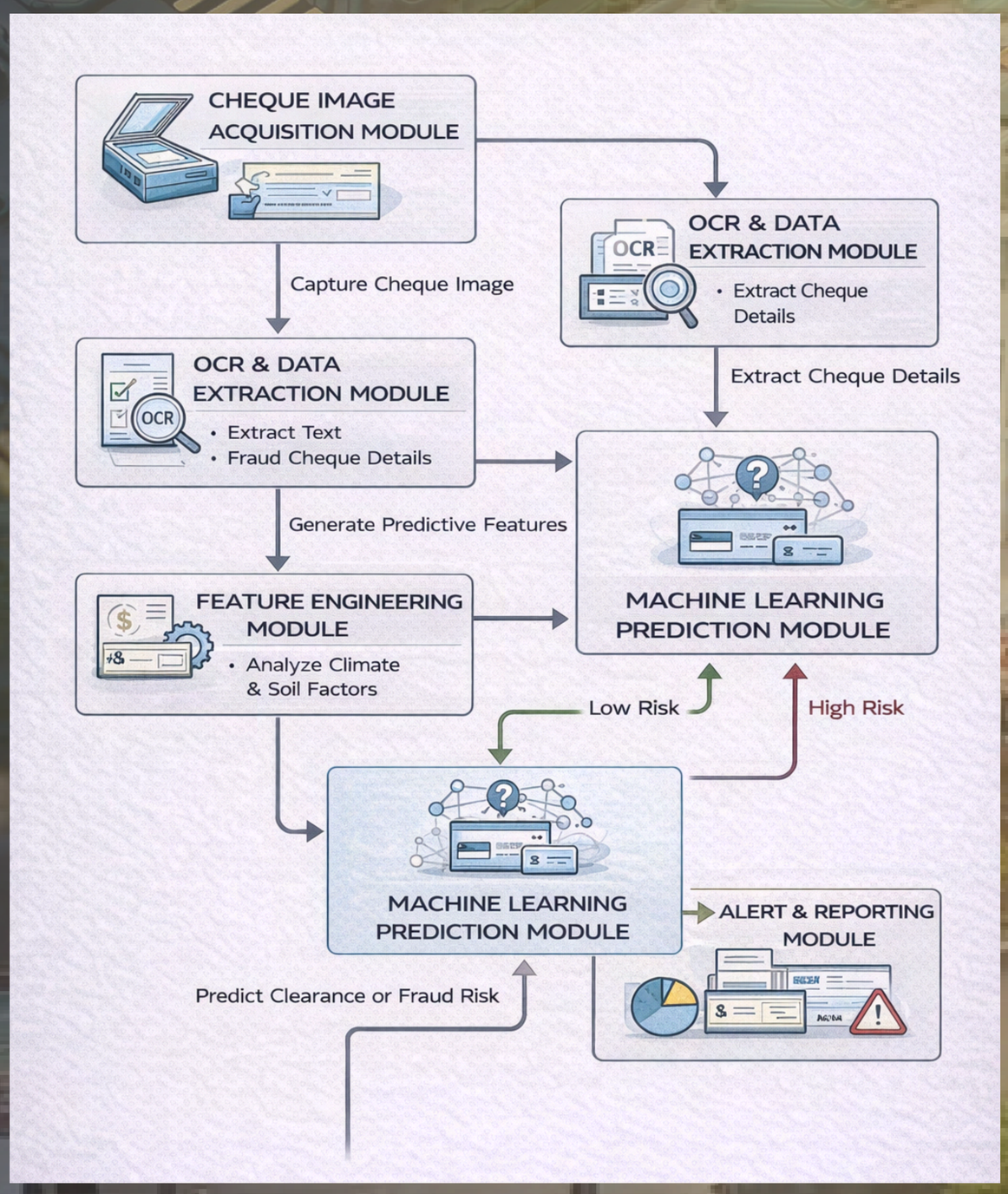
Machine learning models such as Logistic Regression, Random Forest, Support Vector Machine (SVM), or Gradient Boosting are trained on historical cheque clearance data.

The model predicts whether a cheque is:

- Likely to clear
- High risk
- Potentially fraudulent

Alerts are generated for suspicious cases.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining computer vision and predictive analytics for financial fraud prevention.

Unlike traditional manual verification, this system:

- Automates cheque validation
- Reduces processing time
- Enhances fraud detection
- Uses predictive modeling for risk assessment

Integration with core banking systems enables real-time decision support.

PERFORMANCE

The system performance is evaluated using:

- Prediction Accuracy
- Precision & Recall
- Fraud Detection Rate
- False Positive Rate
- Processing Time

Experimental results show improved fraud detection and reduced manual workload. Ensemble models demonstrate strong classification performance.

Real-World Application

The proposed system can be deployed in:

- Commercial banks
- Cooperative banks
- Financial institutions
- Digital banking platforms
- Clearing houses

It enhances financial security and reduces economic losses due to fraudulent cheque transactions.

Guide: ***Dr. D S Jadhav***

Project Group Members:

1) Nikita Ashok Kharat

2) Sonali Prakash Abhale

3) Shrutika Shantaram Jadhav

Distracted Driver Detection

Problem Landscape

Road accidents caused by distracted driving have become a significant global concern. Activities such as mobile phone usage, texting, eating, adjusting navigation systems, or drowsiness while driving drastically increase the risk of accidents. According to traffic safety reports, a large percentage of fatal road accidents are linked to driver inattention.

Traditional traffic monitoring systems primarily focus on vehicle speed and lane violations, but they lack the capability to monitor driver behavior inside the vehicle. Manual monitoring is impractical and inefficient for real-time detection.

With advancements in Artificial Intelligence (AI), deep learning, and computer vision, it is now possible to analyze driver behavior through camera-based systems. The proposed Distracted Driver Detection System uses real-time image processing and deep learning models to identify unsafe driving behavior and generate alerts.

OBJECTIVES

The primary objective of this project is to develop an AI-based system that detects distracted driving behavior in real time. The specific objectives include:

- To capture driver images using in-vehicle cameras.
- To classify driver behavior into attentive or distracted categories.
- To detect activities such as phone usage, yawning, or looking away.
- To generate real-time alerts to prevent accidents.
- To improve road safety through intelligent monitoring.
- To integrate the system with vehicle safety frameworks.

METHOD USED

The proposed system integrates image acquisition, preprocessing, deep learning classification, and alert modules.

A camera installed inside the vehicle captures real-time video frames. Image preprocessing techniques such as face detection, eye tracking, and normalization are applied.

A Convolutional Neural Network (CNN) model is trained on labeled datasets containing various driver behaviors (safe driving, texting, calling, drowsy, etc.). The model classifies each frame into behavior categories.

If distracted behavior is detected for a predefined duration, the system triggers an alert (audio warning, vibration alert, or dashboard notification). The system can also log incidents for future analysis.

PROPOSED MODEL

Technical Innovation

The innovation lies in using AI-driven computer vision to monitor driver behavior continuously. Unlike traditional systems that only monitor vehicle parameters, this system focuses on human behavior analysis.

Key innovative aspects include:

- Real-time deep learning inference
- Eye-tracking and facial analysis
- Behavior-based classification
- Integration with smart vehicle systems

The system can be enhanced with edge computing to minimize latency and improve response time.

PERFORMANCE

The system performance is evaluated using:

- Classification Accuracy
- Precision & Recall
- False Positive Rate
- Real-Time Processing Speed
- Alert Response Time

Experimental results show high classification accuracy using CNN models trained on diverse datasets. The system effectively identifies distracted behaviors under different lighting conditions.

Real-World Application

The proposed system can be deployed in:

- Private vehicles
- Commercial transport fleets
- Smart transportation systems
- Ride-sharing services
- Driver safety monitoring programs

It enhances road safety and supports intelligent transportation infrastructure.

Guide: Prof. A A Barbind

Project Group Members:

1) Shubham Satish Ghogare

2) Rahul Raosaheb Zaware

Virtual Simulator using Big Data Migration

Problem Landscape

Organizations today generate massive volumes of structured and unstructured data from enterprise systems, IoT devices, cloud platforms, and digital services. Migrating such large-scale datasets from legacy systems to modern cloud-based infrastructures is a complex and high-risk process.

Traditional data migration approaches often involve manual planning, downtime, inconsistent data mapping, and potential data loss. Testing migration strategies directly on production environments can lead to operational disruption, financial loss, and system instability.

A Virtual Simulator powered by Big Data technologies provides a controlled environment to simulate migration processes before actual implementation. By leveraging distributed computing frameworks and large-scale data analytics, organizations can predict migration performance, optimize resource allocation, and minimize risks.

The proposed system aims to design a Virtual Simulation Platform that models and tests Big Data migration workflows efficiently.

OBJECTIVES

The primary objective of this project is to develop a virtual simulation framework for testing Big Data migration strategies. The specific objectives include:

- To simulate large-scale data migration processes.
- To analyze migration time, resource usage, and data consistency.
- To identify bottlenecks in migration workflows.
- To optimize distributed data transfer strategies.
- To minimize downtime during real migration.
- To enhance reliability and scalability of data systems.

METHOD USED

The proposed system integrates Big Data processing frameworks, simulation engines, and performance analytics modules.

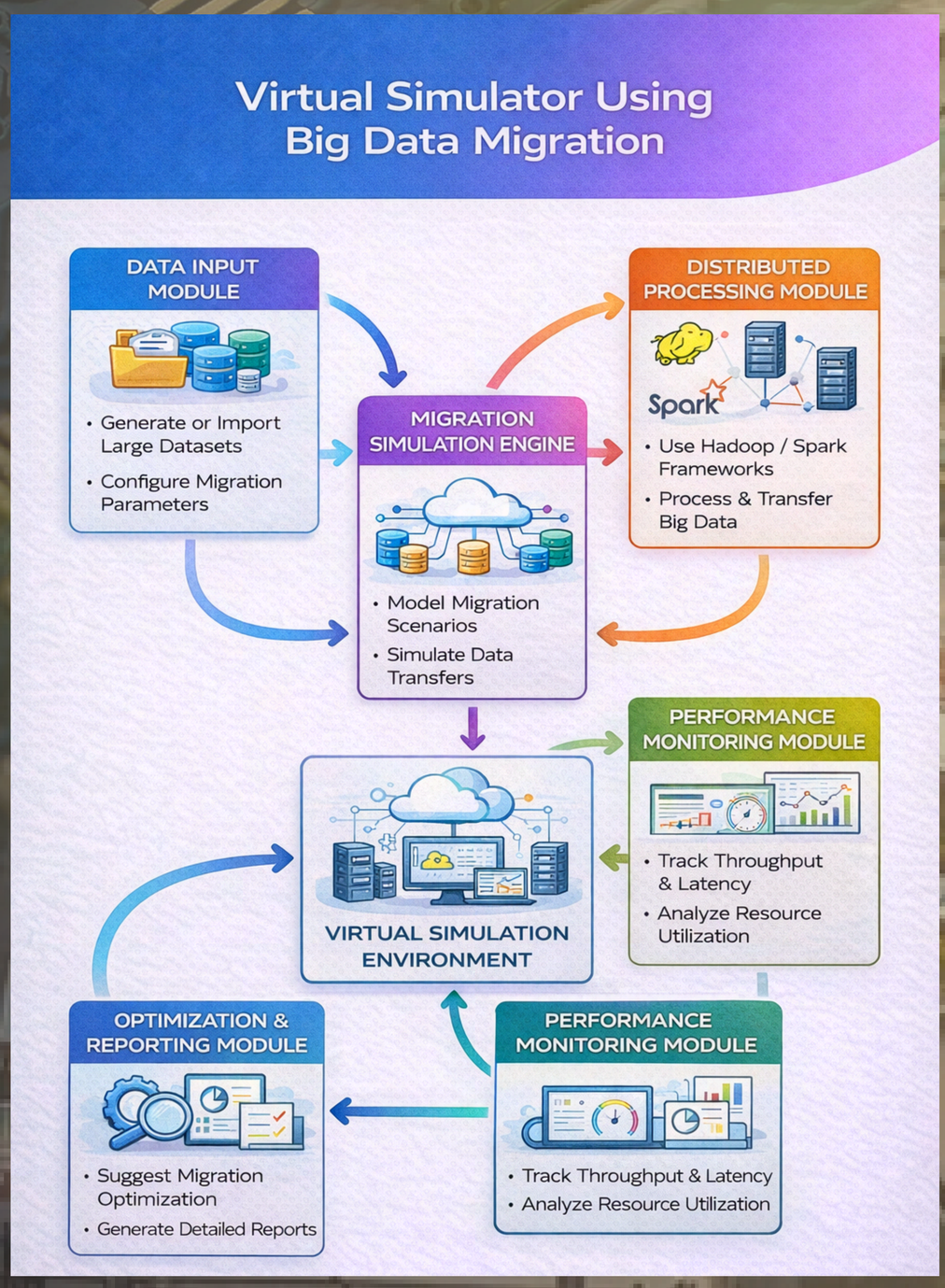
Large datasets are generated or imported into a virtual environment. The simulator models migration scenarios such as:

- On-premise to cloud migration
- Cloud-to-cloud migration
- Hybrid infrastructure migration

Distributed computing tools like Apache Hadoop or Apache Spark are used to simulate large-scale data processing and transfer. Performance metrics such as throughput, latency, bandwidth utilization, and error rates are monitored.

Predictive analytics models evaluate migration success probability and suggest optimized data partitioning and scheduling strategies.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining Big Data processing frameworks with simulation modeling for predictive migration analysis.

Unlike traditional migration testing, this system:

- Creates a virtual testbed environment
- Predicts migration performance before execution
- Uses distributed computing for realistic simulation
- Reduces operational risks

Integration of predictive analytics enables proactive planning and cost estimation.

PERFORMANCE

The system performance is evaluated using:

- Data Transfer Throughput
- Latency Metrics
- Resource Utilization Efficiency
- Error Detection Rate
- Scalability Across Nodes

Experimental results demonstrate effective simulation of large-scale migration workflows with accurate performance estimation.

Real-World Application

The proposed system can be deployed in:

- Enterprise IT infrastructure migration
- Cloud service providers
- Data center modernization projects
- Banking and financial systems
- Healthcare data migration
- Government digital transformation initiatives

It supports strategic planning for large-scale digital transformation.

Guide: ***K Dineshkumar***

Project Group Members:

1) Shivani Shah

2) Shivam Sharma

3) Rushikesh Kokane

4) Maheshwari Shinde

Plant Desease Detection using ML

Problem Landscape

Agriculture plays a crucial role in food security and economic stability. However, plant diseases significantly reduce crop productivity and quality, leading to financial losses for farmers. Diseases caused by fungi, bacteria, viruses, and environmental stress can spread rapidly if not detected early.

Traditional disease identification methods rely on manual inspection by experts, which is time-consuming, subjective, and not always accessible to small-scale farmers. Misdiagnosis may lead to incorrect pesticide usage, increased costs, and environmental damage.

With advancements in Artificial Intelligence (AI), Machine Learning (ML), and Computer Vision, automated plant disease detection systems can analyze leaf images and identify diseases accurately. The proposed system uses image-based machine learning techniques to detect and classify plant diseases efficiently.

OBJECTIVES

The primary objective of this project is to develop a machine learning-based system for automatic plant disease detection. The specific objectives include:

- To collect and preprocess plant leaf images.
- To extract relevant visual features from images.
- To train machine learning models for disease classification.
- To identify healthy and diseased plant categories.
- To provide early disease alerts for farmers.
- To support precision agriculture practices.

METHOD USED

The proposed system integrates image acquisition, preprocessing, feature extraction, model training, and prediction modules.

Leaf images are captured using mobile cameras or uploaded into the system. Preprocessing techniques such as resizing, noise removal, segmentation, and normalization are applied.

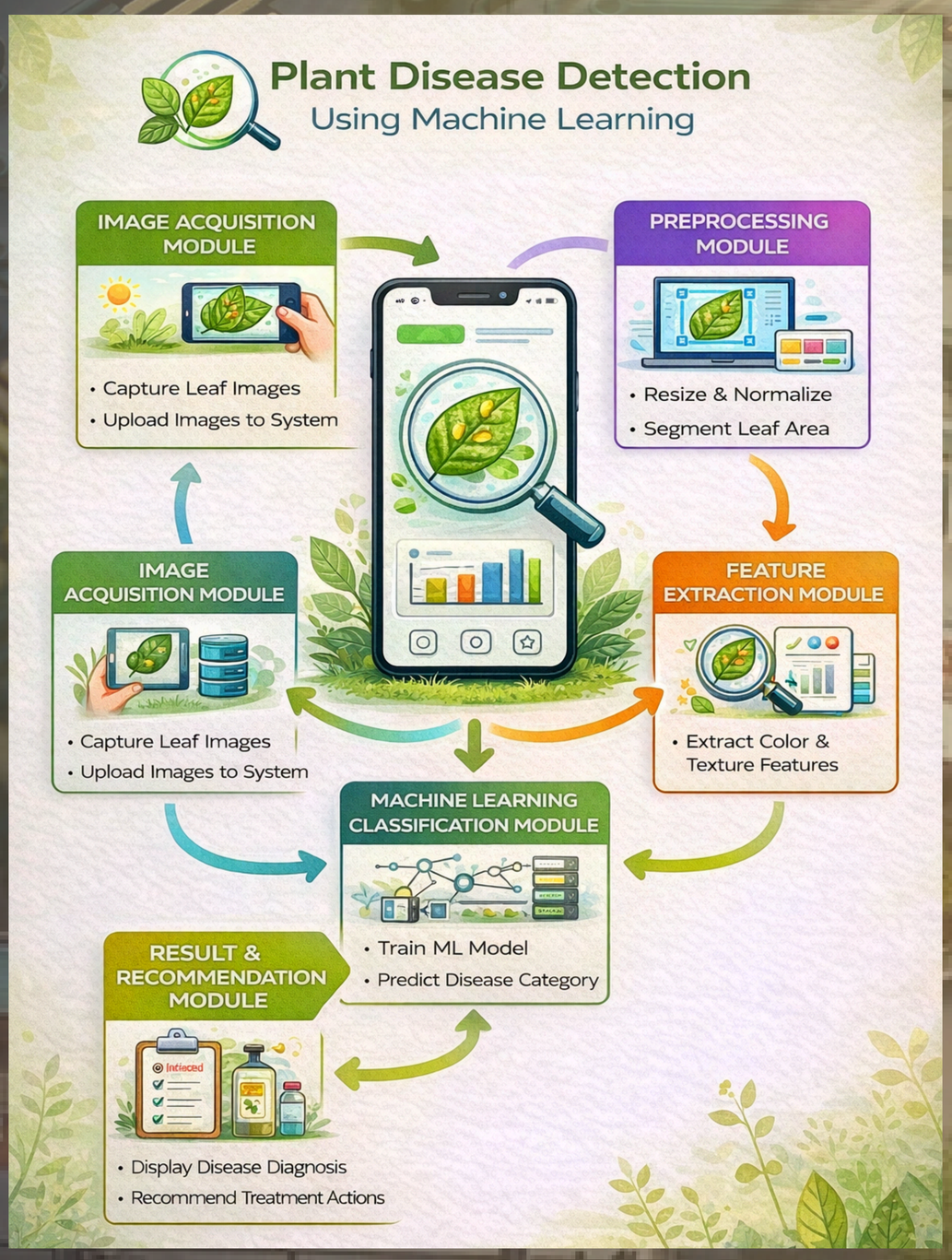
Feature extraction methods identify patterns in leaf color, texture, and shape. Convolutional Neural Networks (CNNs) or other machine learning algorithms such as Support Vector Machines (SVM) and Random Forest are trained using labeled datasets.

The trained model classifies images into:

- Healthy leaf
- Specific disease categories

The system generates results with confidence scores and recommended actions.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining computer vision and machine learning for early disease detection.

Unlike traditional manual inspection, this system:

- Provides automated diagnosis
- Supports real-time prediction
- Reduces dependency on agricultural experts
- Promotes data-driven farming

Integration with IoT-based environmental sensors can enhance prediction accuracy.

Real-World Application

The system performance is evaluated using:

- Classification Accuracy
- Precision & Recall
- Confusion Matrix Analysis
- Processing Time
- Dataset Scalability

Experimental results show high disease classification accuracy using CNN models trained on plant image datasets.

PERFORMANCE

The system performance is evaluated using:

- Data Transfer Throughput
- Latency Metrics
- Resource Utilization Efficiency
- Error Detection Rate
- Scalability Across Nodes

Experimental results demonstrate effective simulation of large-scale migration workflows with accurate performance estimation.

Guide: ***Prof. R N Kankrale***

Project Group Members:

1) Aher Siddharth Bhausaheb
2) Devhare Akash Bhagwan
3) Dhage Prashant Shivnath
4) Khalekar Shreyas Dipak

Money Detection for Blind People

Problem Landscape

Visually impaired individuals often face difficulties in identifying currency denominations during daily financial transactions. Distinguishing between different currency notes and coins without visual assistance can lead to dependency on others, risk of fraud, and loss of financial independence.

Although currency notes differ in size, texture, and markings, these features are not always easy to identify through touch alone, especially for newly printed notes or worn-out currency. Traditional assistive methods lack real-time automated detection capabilities.

With advancements in Artificial Intelligence (AI), Computer Vision, and mobile technologies, it is possible to develop intelligent systems that can detect currency denominations and provide audio feedback.

The proposed system leverages image recognition and machine learning algorithms to identify currency notes accurately and assist visually impaired users through voice output.

OBJECTIVES

The primary objective of this project is to develop an AI-based currency detection system that assists visually impaired individuals. The specific objectives include:

- To capture images of currency notes using a camera.
- To detect and classify currency denominations.
- To provide real-time audio feedback.
- To ensure high detection accuracy under varying lighting conditions.
- To develop a user-friendly mobile interface.
- To promote financial independence for visually impaired users.

METHOD USED

The proposed system integrates image acquisition, preprocessing, feature extraction, classification, and audio output modules.

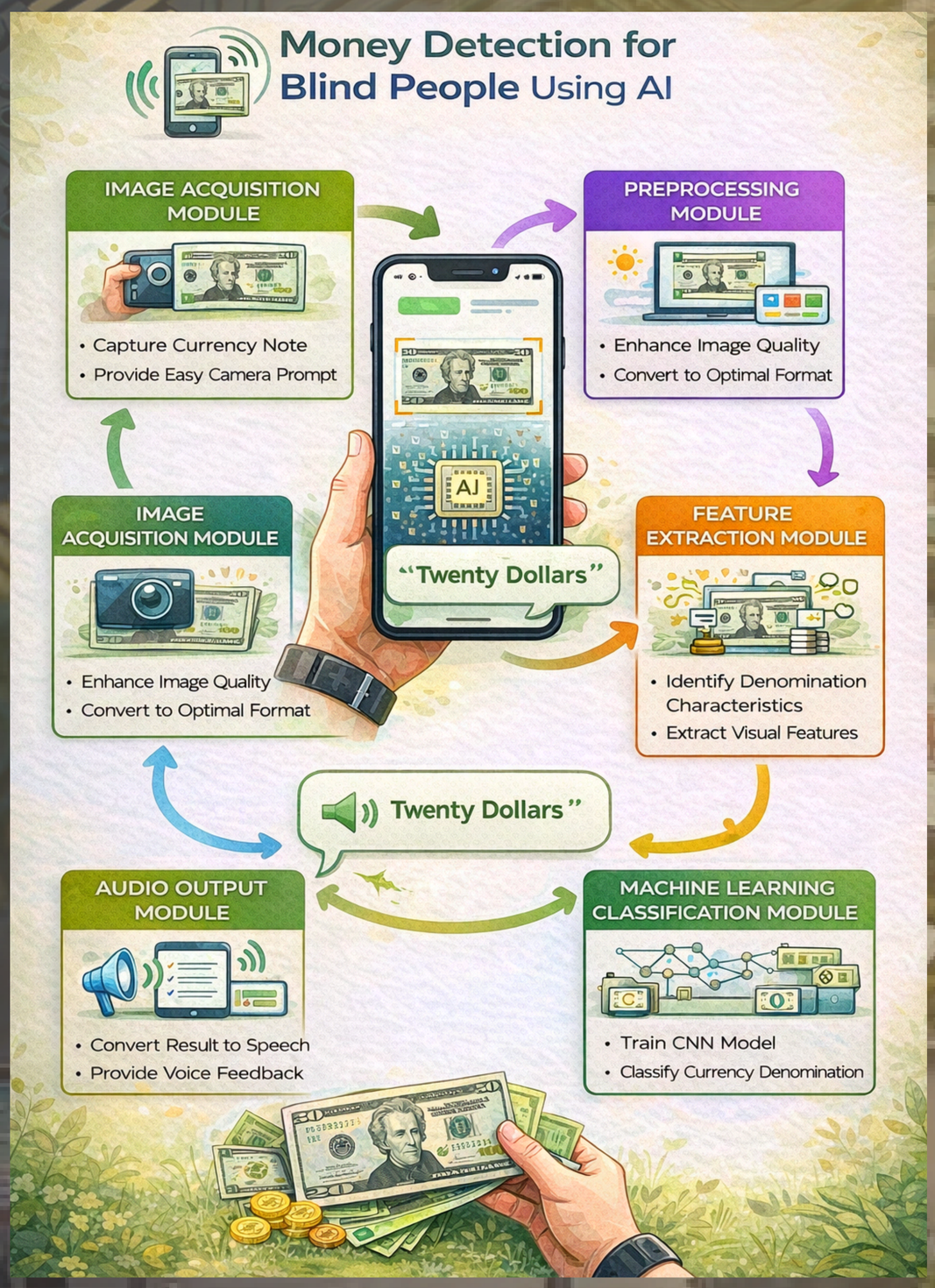
The camera captures an image of the currency note. Preprocessing techniques such as resizing, grayscale conversion, noise reduction, and edge detection are applied.

Feature extraction identifies key visual patterns including numbers, symbols, and note structure. A Convolutional Neural Network (CNN) model is trained on labeled currency datasets to classify denominations.

The predicted output is converted into speech using a Text-to-Speech (TTS) module, which announces the detected currency value to the user.

Optional enhancements include offline detection support and multi-currency recognition.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining computer vision and AI to create an assistive technology tool for visually impaired individuals.

Unlike manual tactile identification methods, this system:

- Provides instant and accurate denomination detection
- Supports real-time voice feedback
- Reduces dependency on others
- Enhances financial safety

Integration with smartphone technology ensures portability and accessibility.

PERFORMANCE

The system performance is evaluated using:

- Classification Accuracy
- Response Time
- Robustness Under Lighting Variations
- Audio Clarity
- User Satisfaction Testing

Experimental results demonstrate high accuracy in recognizing currency denominations across different note conditions.

Real-World Application

The proposed system can be deployed in:

- Mobile applications for visually impaired users
- Smart wearable devices
- Assistive technology platforms
- NGOs and accessibility initiatives

It promotes inclusive technology and social empowerment.

Guide: ***Prof. K D Patil***

Project Group Members:

1) Aniket Shrikrishna Jawale

2) Akash Shivaji Momale

3) Aniruddha Ajay Patil

4) Siddhesh Sanjay Sagar

Agricultural Crop Recommendation System

Problem Landscape

Agriculture remains the backbone of many economies, especially in developing countries like India. However, farmers often face challenges in selecting the most suitable crop due to changing climate conditions, soil fertility variations, unpredictable rainfall, and market demand fluctuations.

Traditional crop selection methods rely heavily on past experience or general advice, which may not consider real-time environmental and soil data. Poor crop selection can result in low yield, financial losses, and inefficient use of agricultural resources.

With the integration of Machine Learning (ML), Big Data, and IoT-based environmental monitoring, intelligent crop recommendation systems can analyze multiple parameters and suggest the most suitable crop for a particular region and season.

The proposed system aims to assist farmers by recommending optimal crops based on data-driven analysis.

OBJECTIVES

The primary objective of this project is to develop a machine learning-based crop recommendation system. The specific objectives include:

- To collect soil and environmental data.
- To analyze parameters such as NPK values, temperature, humidity, and rainfall.
- To train ML models for crop suitability prediction.
- To recommend crops based on predictive analysis.
- To improve agricultural productivity.
- To support sustainable farming practices.

METHOD USED

The proposed system integrates data collection, preprocessing, model training, prediction, and recommendation modules.

Data is collected from:

- Soil nutrient values (Nitrogen, Phosphorus, Potassium)
- Temperature
- Humidity
- Rainfall
- Soil pH

Preprocessing techniques such as normalization and missing value handling are applied.

Machine learning algorithms such as:

- Random Forest
- Decision Tree
- K-Nearest Neighbors (KNN)
- Support Vector Machine (SVM)

are trained on historical agricultural datasets.

The trained model predicts the most suitable crop based on input parameters and ranks recommendations according to probability scores.

PROPOSED MODEL

Technical Innovation

The innovation lies in integrating AI with precision agriculture to support intelligent crop planning.

Unlike traditional farming advice systems, this system:

- Uses real-time environmental data
- Provides data-driven crop suggestions
- Reduces trial-and-error farming
- Supports sustainable agriculture

It can be further enhanced by integrating IoT soil sensors and weather APIs for dynamic prediction.

PERFORMANCE

The system performance is evaluated using:

- Prediction Accuracy
- Precision & Recall
- Confusion Matrix
- Cross-validation Score
- Model Training Time

Experimental results show high accuracy when using ensemble models such as Random Forest.

Real-World Application

The proposed system can be deployed in:

- Smart agriculture platforms
- Government agricultural advisory systems
- Agri-tech startups
- Farmer mobile applications
- Precision farming initiatives

It helps farmers maximize yield and reduce economic risk.

Guide: ***P R Mutkule***

Project Group Members:

1) Saurabh Limbaji Game

2) Shubham Prabhakar Sagar

3) Niranjan Babasaheb Kolase

4) Akshay Pandharinath Bendre

Automated Wheel Chair

Problem Landscape

Mobility is a fundamental requirement for independent living. However, individuals with severe physical disabilities, paralysis, muscular disorders, or age-related mobility impairments often depend on manual wheelchairs or caregivers for movement. Traditional manual wheelchairs require physical strength, and even basic electric wheelchairs demand joystick control, which may not be suitable for users with limited motor abilities.

Furthermore, conventional wheelchairs lack obstacle detection, navigation assistance, and smart control mechanisms. In crowded environments such as hospitals, shopping malls, airports, or urban pathways, safety becomes a critical concern.

Recent advancements in Artificial Intelligence (AI), IoT, embedded systems, and robotics have enabled the development of intelligent assistive mobility solutions. An Automated Wheelchair System integrates sensors, intelligent control mechanisms, and navigation algorithms to provide safe and independent mobility for differently-abled individuals.

The proposed project aims to design a smart automated wheelchair capable of obstacle detection, intelligent navigation, and user-friendly control interfaces.

OBJECTIVES

The primary objective of this project is to develop an intelligent automated wheelchair system that enhances mobility independence and safety. The specific objectives include:

- To design an autonomous or semi-autonomous wheelchair system.
- To integrate obstacle detection sensors.
- To implement intelligent navigation and path planning.
- To support multiple control modes (voice, joystick, mobile app).
- To ensure user safety through collision avoidance.
- To improve accessibility and independence for users.

METHOD USED

The system integrates hardware and software components for intelligent mobility.

1. Control Mechanism

The wheelchair can be controlled using:

- Joystick control
- Voice command recognition
- Mobile application interface
- Gesture-based control (optional)

2. Sensor Integration

The wheelchair incorporates:

- Ultrasonic sensors for obstacle detection
- Infrared sensors for proximity detection
- Gyroscope and accelerometer for balance monitoring
- Wheel encoders for speed control

3. Processing Unit

A microcontroller (such as Arduino or Raspberry Pi) processes sensor data and executes navigation algorithms.

4. Navigation & Safety

Obstacle detection algorithms continuously monitor surroundings. If an obstacle is detected within a predefined threshold distance, the system automatically:

- Slows down
- Changes direction
- Stops to prevent collision

Advanced versions may include SLAM (Simultaneous Localization and Mapping) for autonomous indoor navigation.

PROPOSED MODEL

Technical Innovation

The innovation lies in integrating robotics, AI, IoT sensors, and assistive technologies into a single mobility solution.

Unlike conventional electric wheelchairs, this system:

- Provides semi-autonomous navigation
- Enhances safety through obstacle avoidance
- Supports multimodal control mechanisms
- Can integrate with AI-based environment mapping

Future enhancements may include:

- Facial recognition for user authentication
- GPS-based outdoor navigation
- Cloud-based monitoring
- Health parameter integration (heart rate, oxygen level)

PERFORMANCE

The performance of the Automated Wheelchair System is evaluated based on multiple parameters:

1. Navigation Accuracy

The system demonstrates high directional accuracy in controlled environments, effectively following user commands and avoiding obstacles with minimal deviation.

2. Obstacle Detection Efficiency

Ultrasonic and IR sensors detect obstacles within a range of 2–4 meters, ensuring sufficient reaction time. The response latency is minimal, typically under milliseconds, enabling real-time collision prevention.

3. Response Time

The control system processes input commands rapidly, ensuring smooth movement transitions and safe maneuverability even in crowded environments.

4. Energy Efficiency

Optimized motor control algorithms reduce battery consumption, allowing extended operational duration per charge cycle.

Real-World Application

The Automated Wheelchair System has significant real-world impact in various sectors:

1. Healthcare Institutions

Hospitals and rehabilitation centers can deploy intelligent wheelchairs to assist patients with limited mobility, reducing dependency on caregivers.

2. Elderly Care Facilities

Senior citizens with mobility challenges can benefit from autonomous navigation and voice-based control.

3. Smart Homes

Integration with smart home ecosystems enables seamless indoor mobility using IoT-enabled devices.

4. Public Infrastructure

Airports, railway stations, shopping malls, and smart cities can deploy automated wheelchairs to assist visitors.

Guide: ***Prof. N S Patankar***

Project Group Members:

1) Sakshi Bhausaheb Gadhave

2) Akshada Shaharam Dushing

3) Tejas Rajendra Deshmukh

4) Sarthak Satish Petkar

Smart Walking Stick

Problem Landscape

Visually impaired individuals face significant mobility challenges in navigating indoor and outdoor environments. Traditional white canes help detect obstacles at ground level but often fail to identify elevated obstacles such as walls, vehicles, or hanging objects. Additionally, they do not provide information about distance, direction, or environmental hazards.

Dependence on human assistance reduces independence and confidence in daily activities. With advancements in IoT, embedded systems, and sensor technologies, intelligent assistive devices can enhance navigation safety and autonomy.

The proposed Smart Walking Stick integrates ultrasonic sensors, vibration feedback, and optional GPS-based location tracking to assist visually impaired users in safe navigation.

OBJECTIVES

The primary objective of this project is to design an intelligent walking stick that enhances mobility and safety. The specific objectives include:

- To detect obstacles at various heights and distances.
- To provide vibration or audio alerts to the user.
- To integrate GPS for location tracking (optional).
- To implement emergency alert functionality.
- To improve navigation safety in real-time.
- To promote independence for visually impaired individuals.

METHOD USED

The system integrates sensor detection, signal processing, and alert mechanisms.

1. Obstacle Detection

Ultrasonic sensors continuously measure the distance between the user and nearby obstacles. If an object is detected within a predefined range, the system triggers vibration feedback.

2. Alert System

The vibration motor intensity varies depending on the distance to the obstacle. Closer obstacles result in stronger vibrations. An optional buzzer provides audio warnings.

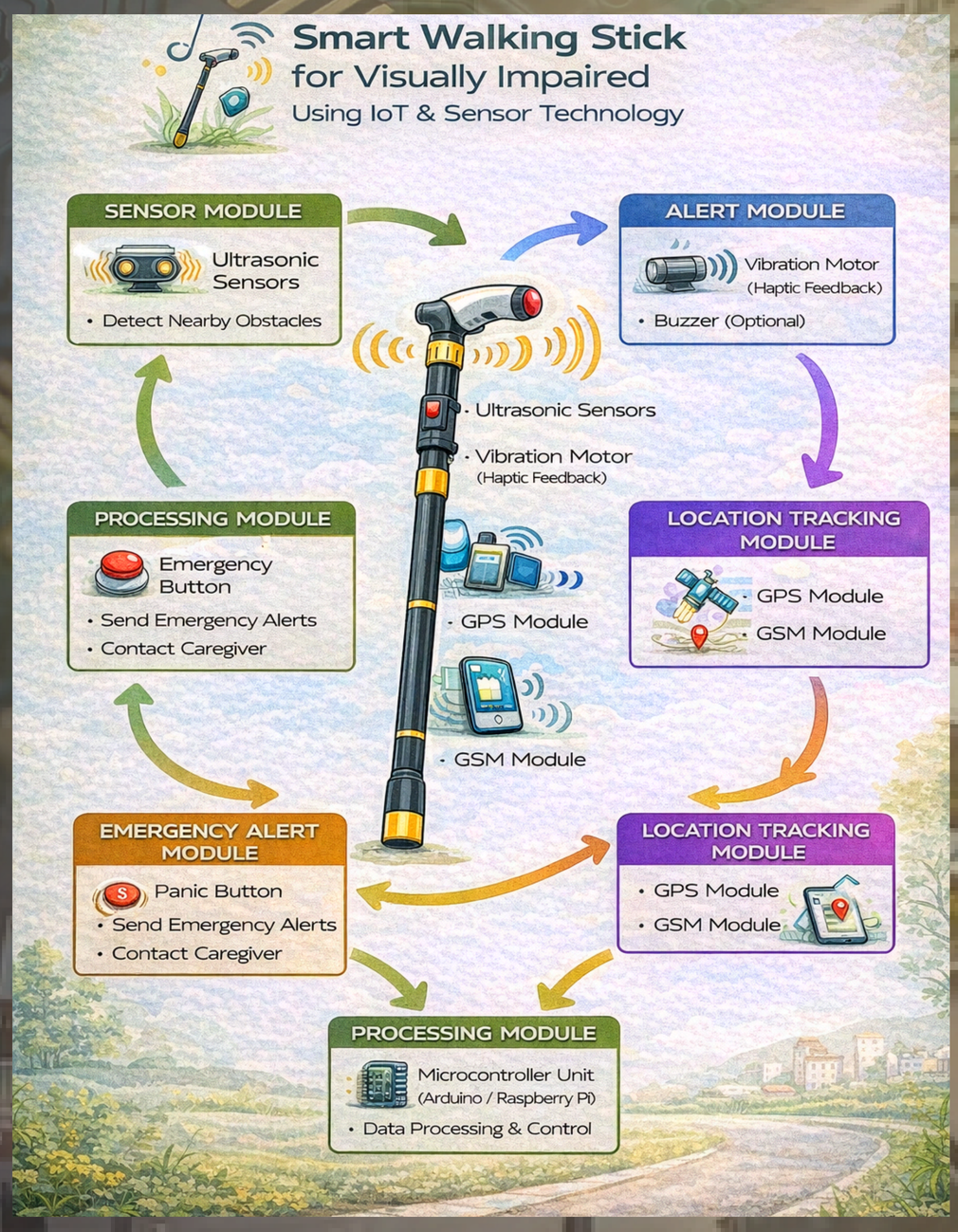
3. GPS & GSM Integration (Optional)

The walking stick can send real-time location data to caregivers using GSM modules. In emergency situations, a panic button can transmit alert messages.

4. Microcontroller Processing

A microcontroller (Arduino/Raspberry Pi) processes sensor inputs and controls output mechanisms.

PROPOSED MODEL



Technical Innovation

The innovation lies in integrating real-time obstacle detection with IoT-based tracking features.

Unlike traditional white canes, this system:

- Detects obstacles beyond physical reach
- Provides real-time feedback
- Supports location tracking
- Enhances personal safety

Future enhancements may include AI-based object recognition and smart navigation guidance.

PERFORMANCE

The performance of the Smart Walking Stick is evaluated based on:

1. Detection Accuracy

Ultrasonic sensors detect obstacles within a 2–3 meter range with high reliability.

2. Response Time

The system provides instant vibration feedback with minimal processing delay.

3. Battery Efficiency

Optimized circuitry ensures long battery life for daily usage.

4. Real-World Testing

The device performs effectively in indoor corridors, sidewalks, and moderately crowded areas.

5. User Safety

Emergency alert functionality enhances user security in critical situations.

Real-World Application

The Smart Walking Stick can be deployed in:

- Daily mobility assistance for visually impaired individuals
- Smart city accessibility initiatives
- NGO and social welfare programs
- Rehabilitation centers
- Public infrastructure integration

It promotes inclusive technology and social empowerment.

Guide: ***Prof. N S Patankar***

Project Group Members:

1) Maind Rohit

2) ware Bhushan

3) Dhorde Prithviraj

4) Harshal Patil

Automatic Helmet & Tripple Seat Detection

Problem Landscape

Road safety violations such as riding without helmets and triple-seat riding on two-wheelers are major contributors to traffic accidents and fatalities. Despite strict traffic regulations, manual monitoring by traffic police is limited and often ineffective in high-density urban areas.

Traditional CCTV systems record violations but require manual inspection, which is time-consuming and inefficient. Automated traffic monitoring solutions are essential to improve enforcement efficiency and reduce road accidents.

With advancements in Artificial Intelligence (AI), Deep Learning, and Computer Vision, real-time traffic violation detection systems can automatically identify helmet violations and triple riding using surveillance cameras.

The proposed Automatic Helmet & Triple Seat Detection System uses AI-based object detection and image classification techniques to monitor traffic violations in real-time.

OBJECTIVES

The primary objective of this project is to develop an automated traffic monitoring system for detecting helmet violations and triple riding. The specific objectives include:

- To detect two-wheelers from surveillance video streams.
- To identify whether riders are wearing helmets.
- To detect triple seat riding violations.
- To capture vehicle number plates for enforcement.
- To generate automated violation reports.
- To enhance road safety through intelligent monitoring.

METHOD USED

The system integrates video processing, object detection, classification, and violation reporting modules.

1. Video Acquisition

CCTV cameras capture real-time traffic footage.

2. Vehicle Detection

A deep learning-based object detection model (e.g., YOLO) detects two-wheelers.

3. Rider & Helmet Detection

The system detects rider heads and classifies whether helmets are worn using CNN-based classification models.

4. Triple Seat Detection

Human detection models count the number of riders on the vehicle. If more than two riders are detected, the system flags a violation.

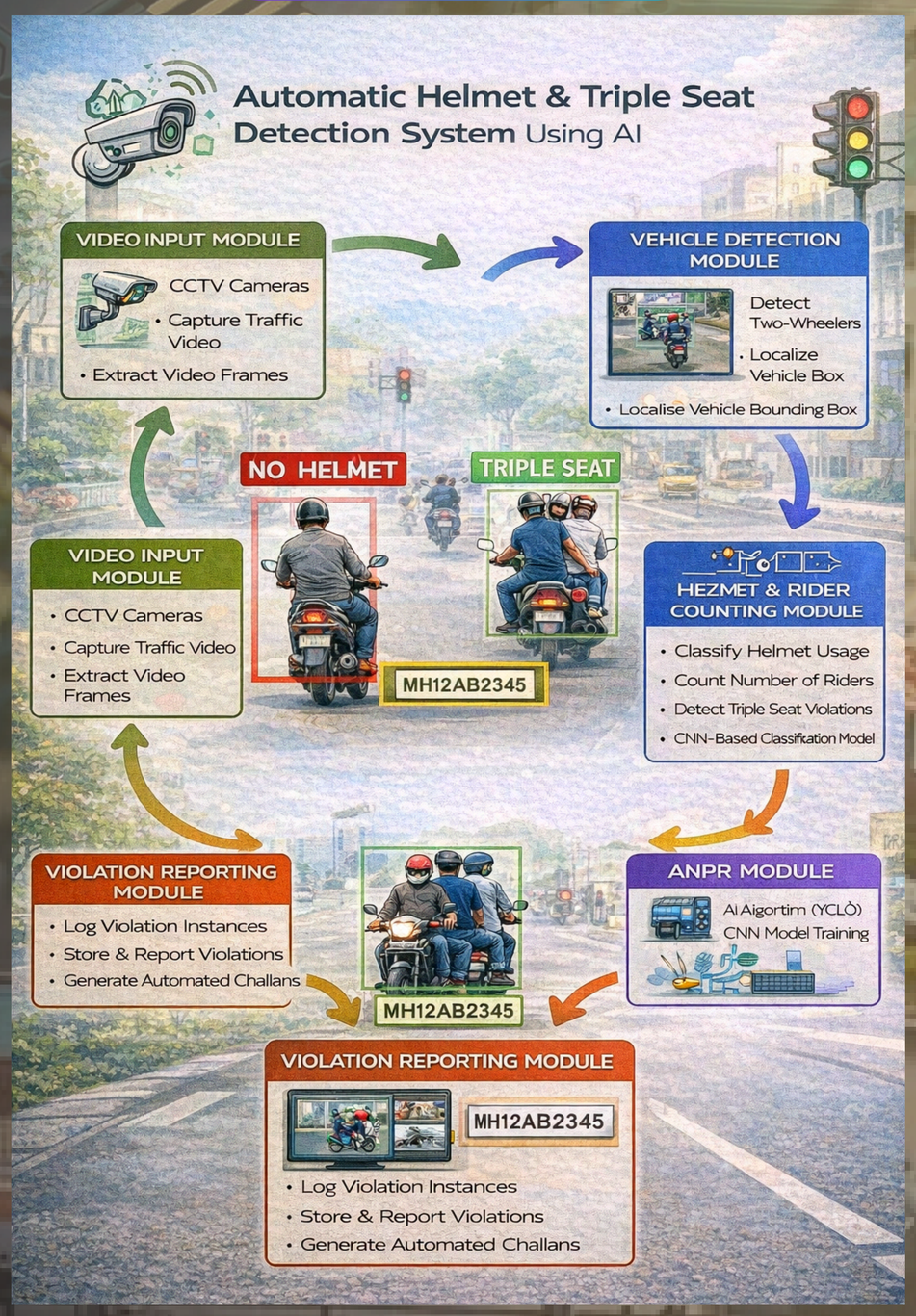
5. Number Plate Recognition

Automatic Number Plate Recognition (ANPR) extracts vehicle details for reporting.

6. Violation Reporting

The system logs violations and sends alerts to traffic authorities.

PROPOSED MODEL



Technical Innovation

The innovation lies in integrating multiple AI models for real-time traffic enforcement.

Unlike traditional manual monitoring, this system:

- Detects violations automatically
- Reduces human intervention
- Supports real-time enforcement
- Integrates ANPR for automated challan generation

The system can be deployed using edge computing for faster processing.

PERFORMANCE

The performance of the system is evaluated based on:

1. Detection Accuracy

Deep learning models achieve high accuracy in detecting helmets and counting riders.

2. Real-Time Processing

The system processes video frames in real-time with minimal latency.

3. Precision & Recall

High precision reduces false violation alerts, ensuring reliable enforcement.

4. Scalability

The system supports multiple CCTV feeds simultaneously.

5. Environmental Robustness

Performs effectively under varying lighting conditions and camera angles.

Real-World Application

The system can be deployed in:

- Smart city traffic monitoring systems
- Highway toll plazas
- Urban intersections
- School and college zones
- Automated traffic control centers

It supports automated challan generation and digital traffic enforcement systems.

Additionally, integration with government databases can streamline penalty processing.

Guide: ***Prof. M S Kurhe***

Project Group Members:

1) Jadhav Vishal Walmik

2) Valte Shreya Purushottam

3) Shaikh Asad Sajid

4) Daware Sanket Sanjay

Optimization in ETL

Problem Landscape

In modern data-driven enterprises, ETL (Extract, Transform, Load) processes play a critical role in data warehousing, business intelligence, and analytics. Organizations continuously collect vast amounts of structured and unstructured data from multiple sources such as databases, APIs, cloud platforms, and IoT devices.

However, traditional ETL systems often suffer from:

- High processing latency
- Inefficient data transformation logic
- Increased storage costs
- Bottlenecks in data pipelines
- Poor scalability with growing datasets

As data volumes increase exponentially, inefficient ETL workflows lead to delayed reporting, reduced business agility, and higher operational costs.

Optimization of ETL processes is essential to improve performance, ensure data consistency, and support real-time analytics. The proposed project focuses on enhancing ETL efficiency using performance tuning, parallel processing, indexing strategies, and big data frameworks.

OBJECTIVES

The primary objective of this project is to design and implement an optimized ETL pipeline. The specific objectives include:

- To analyze existing ETL workflow inefficiencies.
- To reduce data processing time.
- To implement parallel and distributed data processing.
- To minimize memory and storage usage.
- To enhance scalability of ETL systems.
- To support real-time and near-real-time data analytics.

METHOD USED

The project involves analyzing traditional ETL workflows and applying optimization strategies.

1. Extraction Optimization

- Incremental data extraction instead of full loads
- Source-side filtering
- Index-based querying

2. Transformation Optimization

- Parallel transformation tasks
- Efficient data partitioning
- Optimized join operations
- Data caching techniques

3. Loading Optimization

- Bulk loading techniques
- Batch processing
- Database indexing
- Compression strategies

PROPOSED MODEL

Technical Innovation

The innovation lies in applying advanced optimization techniques and distributed computing principles to ETL workflows.

Unlike traditional ETL pipelines, this system:

- Uses incremental loading instead of full refresh
- Implements parallel data transformation
- Reduces redundant computations
- Utilizes distributed big data frameworks
- Incorporates real-time monitoring dashboards

PERFORMANCE

The optimized ETL system demonstrates significant improvements across key performance metrics:

1. Reduced Processing Time

Parallel execution reduces overall ETL runtime significantly compared to sequential processing.

2. Improved Throughput

Distributed data processing increases the volume of processed data per unit time.

3. Resource Efficiency

Optimized indexing and partitioning reduce CPU and memory consumption.

4. Scalability

The system scales horizontally by adding more processing nodes.

5. Error Reduction

Improved validation and logging reduce data inconsistencies.

Real-World Application

Optimized ETL systems are widely applicable in:

- Enterprise data warehouses
- Banking and financial analytics
- Healthcare data integration
- E-commerce transaction analysis
- Government data portals
- Cloud-based analytics platforms

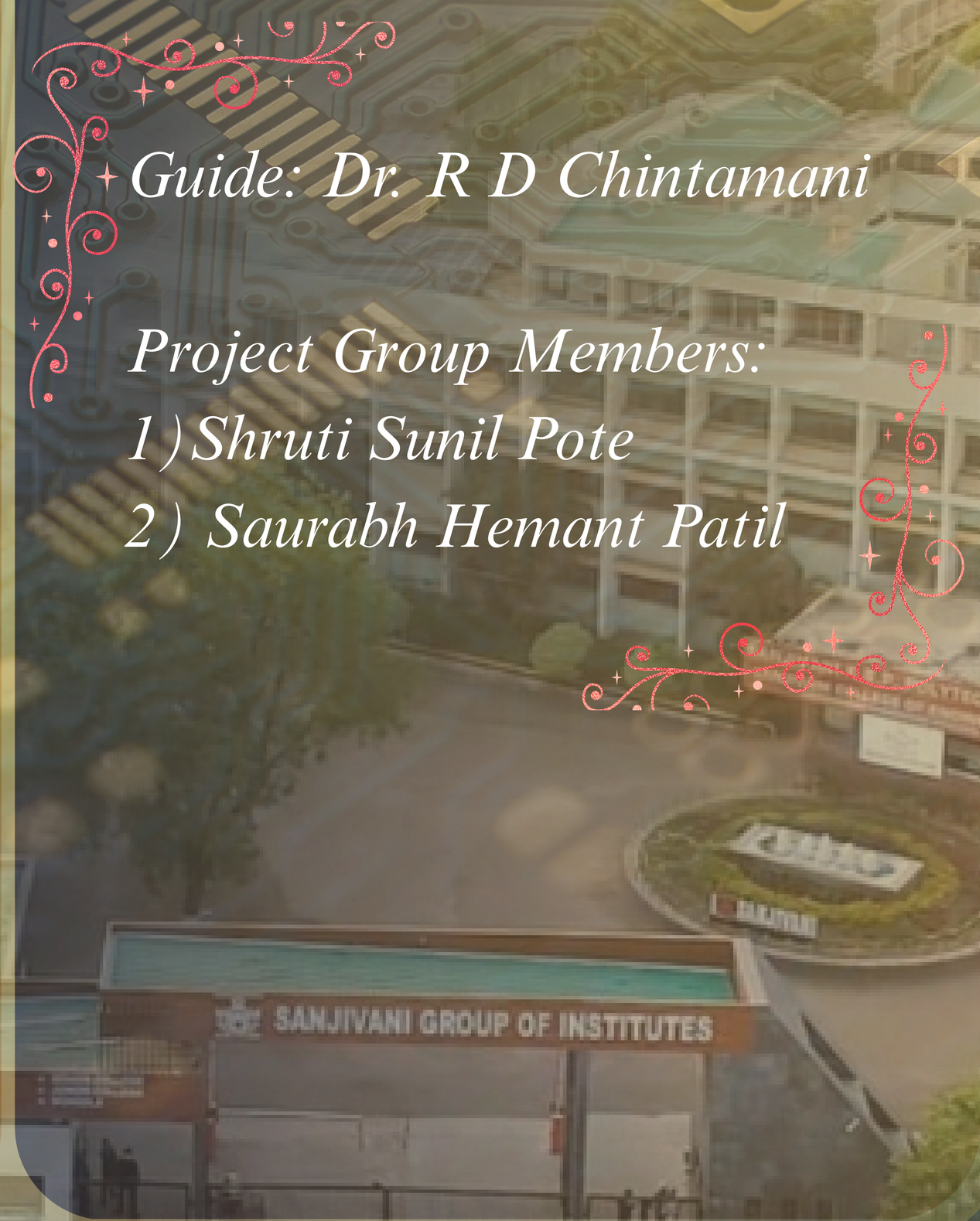
Organizations can benefit from faster reporting, real-time dashboards, and improved decision-making capabilities.

Guide: Dr. R D Chintamani

Project Group Members:

1) Shruti Sunil Pote

2) Saurabh Hemant Patil



Heart Desease Prediction using ML

Problem Landscape

Cardiovascular diseases (CVDs) are among the leading causes of death worldwide. Early detection of heart disease is critical to reducing mortality rates and improving patient outcomes. However, traditional diagnosis relies heavily on clinical tests, expert interpretation, and hospital visits, which may delay early intervention.

Many patients remain undiagnosed due to lack of awareness or access to timely medical evaluation. Manual risk assessment methods may not fully utilize the potential of large medical datasets.

With advancements in Machine Learning (ML) and predictive analytics, intelligent systems can analyze patient health parameters and predict the likelihood of heart disease at an early stage. The proposed system aims to assist healthcare professionals by providing a data-driven decision support tool for heart disease prediction.

OBJECTIVES

The primary objective of this project is to develop a machine learning-based system for predicting heart disease risk. The specific objectives include:

- To collect and preprocess patient health data.
- To analyze clinical parameters such as age, cholesterol, blood pressure, and ECG results.
- To train classification models for disease prediction.
- To provide risk probability scores.
- To support early diagnosis and preventive healthcare.
- To improve decision-making accuracy in medical settings.

METHOD USED

The system integrates data preprocessing, feature selection, model training, and prediction modules.

Data Collection

The dataset includes attributes such as:

- Age
- Gender
- Blood pressure
- Cholesterol level
- Chest pain type
- Fasting blood sugar
- ECG results
- Maximum heart rate
- Exercise-induced angina

Data Preprocessing

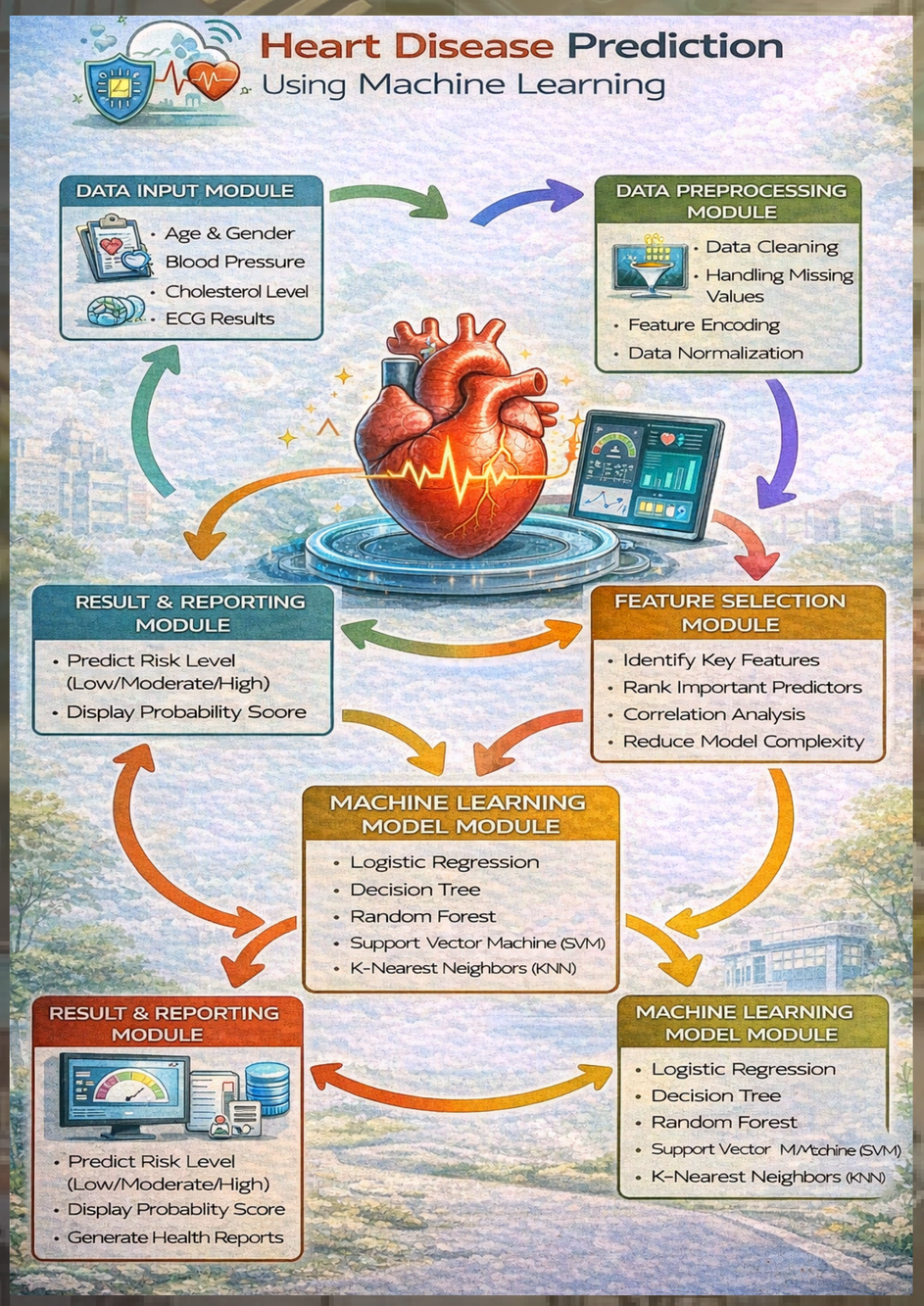
- Handling missing values
- Data normalization
- Feature encoding

Model Training

Machine learning algorithms such as:

- Logistic Regression
- Random Forest
- Support Vector Machine (SVM)
- K-Nearest Neighbors (KNN)
- Decision Tree are trained and evaluated using cross-validation techniques.

PROPOSED MODEL



Technical Innovation

The innovation lies in using predictive analytics to assist early cardiovascular diagnosis.

Unlike traditional manual assessment methods, this system:

- Utilizes multi-parameter analysis
- Provides quick prediction results
- Supports preventive healthcare
- Reduces dependency on isolated clinical judgment

Future enhancements may include integration with wearable devices for real-time monitoring.

PERFORMANCE

The system performance is evaluated using:

1. Accuracy

Models such as Random Forest and Logistic Regression achieve high classification accuracy on benchmark datasets.

2. Precision & Recall

Ensures accurate detection of high-risk patients while minimizing false negatives.

3. ROC-AUC Score

Evaluates the model's ability to distinguish between diseased and non-diseased patients.

4. Cross-Validation

Improves reliability and generalization performance.

5. Computational Efficiency

Ensures quick prediction suitable for real-time clinical usage.

Experimental results show reliable heart disease risk prediction with improved decision support capability.

Real-World Application

The system can be deployed in:

- Hospitals and diagnostic centers
- Telemedicine platforms
- Preventive health checkup programs
- Health insurance risk assessment
- Wearable health monitoring ecosystems

It assists doctors in early diagnosis, enables preventive treatment strategies, and supports data-driven healthcare systems.

Guide: ***Prof. R N Kankrale***

Project Group Members:

1) Game Arpita Balasaheb

2) Jadhav Punam Changdev

3) Kurund Chaitali Balasaheb

Billing for Azure Services Estimation

Problem Landscape

With the rapid adoption of cloud computing, organizations increasingly rely on Microsoft Azure services for hosting applications, data storage, analytics, AI workloads, and infrastructure management. However, one of the major challenges faced by enterprises and startups is unpredictable cloud billing.

Azure follows a pay-as-you-go pricing model, where costs depend on resource usage such as:

- Virtual machines
- Storage accounts
- Data transfer
- Databases
- AI services
- Networking resources

Without proper monitoring and estimation, cloud expenses can exceed budgets, leading to financial inefficiencies. Manual cost tracking is complex due to dynamic resource allocation and scaling.

The proposed system aims to design a Billing Estimation and Optimization System for Azure Services that predicts usage cost, monitors resource consumption, and provides cost optimization recommendations.

OBJECTIVES

The primary objective of this project is to develop a predictive billing estimation system for Azure cloud services. The specific objectives include:

- To analyze Azure service usage metrics.
- To estimate monthly and yearly cloud costs.
- To predict future billing trends.
- To provide cost optimization recommendations.
- To detect abnormal spending patterns.
- To improve financial planning for cloud infrastructure.

METHOD USED

The proposed system begins by collecting historical resource usage data from Microsoft Azure using Azure Cost Management APIs and monitoring services. This data includes compute usage, storage consumption, networking bandwidth, and database operations. After collecting the data, preprocessing techniques such as cleaning, aggregation, and categorization are applied to organize the information service-wise and time-wise. The system then maps usage metrics to Azure's pricing structure to calculate estimated costs accurately.

To enhance estimation accuracy, machine learning and time-series forecasting models are applied to analyze past usage trends and predict future billing patterns. Based on these predictions, the system generates cost estimation reports and provides optimization recommendations such as resizing virtual machines, using reserved instances, and adjusting scaling policies. The final output is displayed through a dashboard that supports better financial planning and cloud cost management.

PROPOSED MODEL

Technical Innovation

The innovation lies in integrating predictive analytics with cloud billing management.

Unlike traditional cost calculators, this system:

- Predicts future billing trends
- Identifies cost anomalies
- Suggests real-time optimization strategies
- Supports proactive financial planning

It transforms reactive billing management into proactive cloud cost governance.

PERFORMANCE

Performance (Expanded Section)

The system performance is evaluated based on:

1. Estimation Accuracy

The model accurately predicts monthly billing trends based on historical usage data.

2. Forecast Reliability

Time-series models demonstrate stable performance across varying workload patterns.

3. Resource Optimization Efficiency

The recommendation engine reduces unnecessary resource usage.

4. Scalability

Supports multi-subscription Azure environments.

5. Real-Time Monitoring

Provides near real-time cost tracking dashboards.

Testing results show improved cost visibility and effective budget planning compared to manual estimation.

Real-World Application

The system is highly beneficial in:

- Enterprises using Microsoft Azure
- Cloud-based startups
- IT infrastructure management teams
- DevOps teams managing cloud workloads
- Financial planning departments
- Government cloud projects

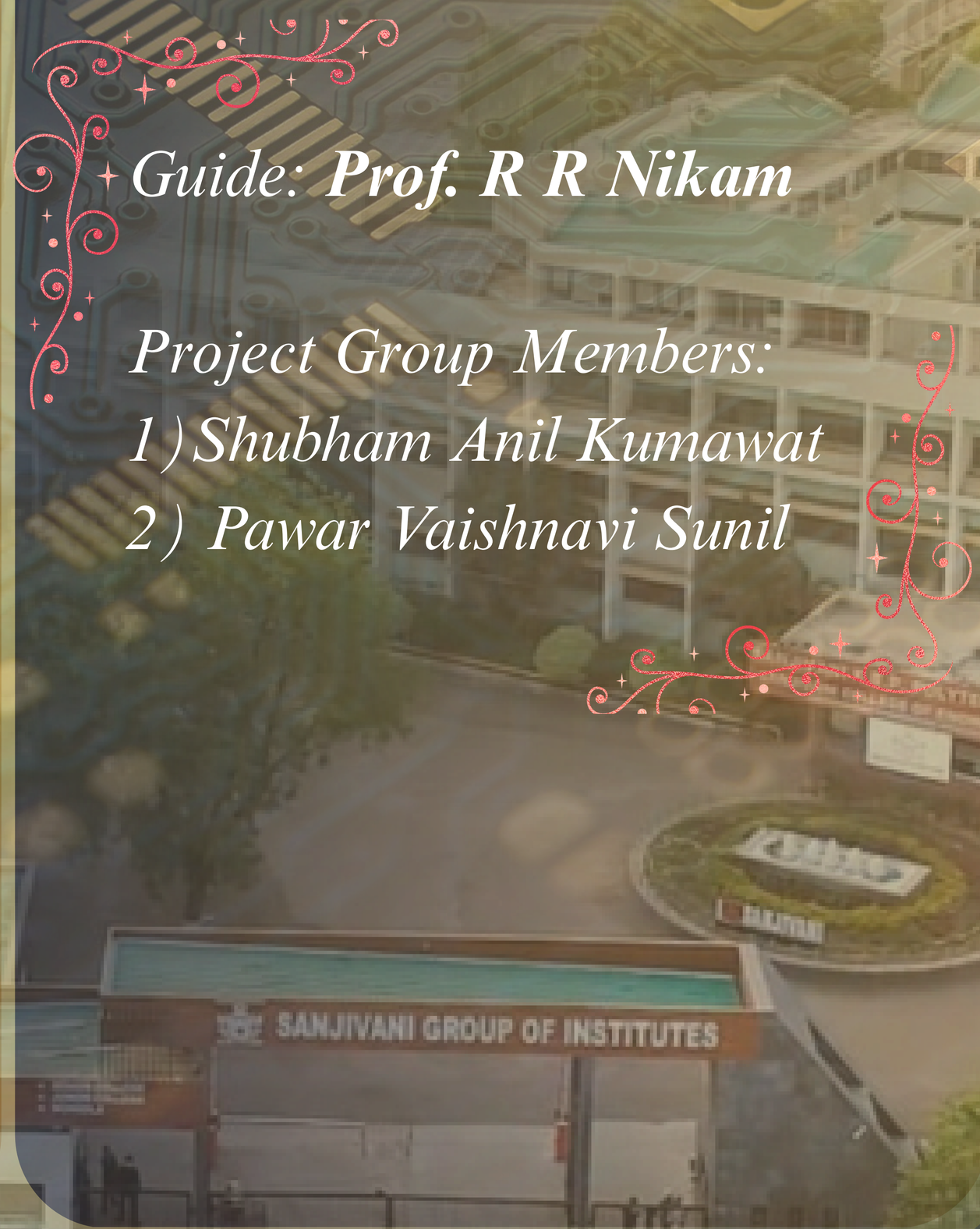
It supports cost control, improves transparency, and enhances cloud governance strategies.

Guide: ***Prof. R R Nikam***

Project Group Members:

1) Shubham Anil Kumawat

2) Pawar Vaishnavi Sunil



Chronic Kidney Diseases Prediction

Problem Landscape

Chronic Kidney Disease (CKD) is a serious medical condition in which kidney function gradually declines over time. Early detection is critical because CKD often progresses silently without noticeable symptoms in its initial stages. Delayed diagnosis can lead to kidney failure, dialysis dependency, or even life-threatening complications.

Traditional diagnosis requires laboratory tests such as blood creatinine levels, glomerular filtration rate (GFR), urine protein analysis, and clinical interpretation by specialists. However, manual assessment may not efficiently utilize large-scale patient data for predictive risk evaluation.

With the advancement of Machine Learning (ML) and predictive analytics, healthcare systems can analyze patient health parameters and predict CKD risk at an early stage. The proposed system aims to support medical professionals by providing a data-driven decision support tool for chronic kidney disease prediction.

OBJECTIVES

The primary objective of this project is to develop an ML-based system to predict the likelihood of chronic kidney disease. The specific objectives include:

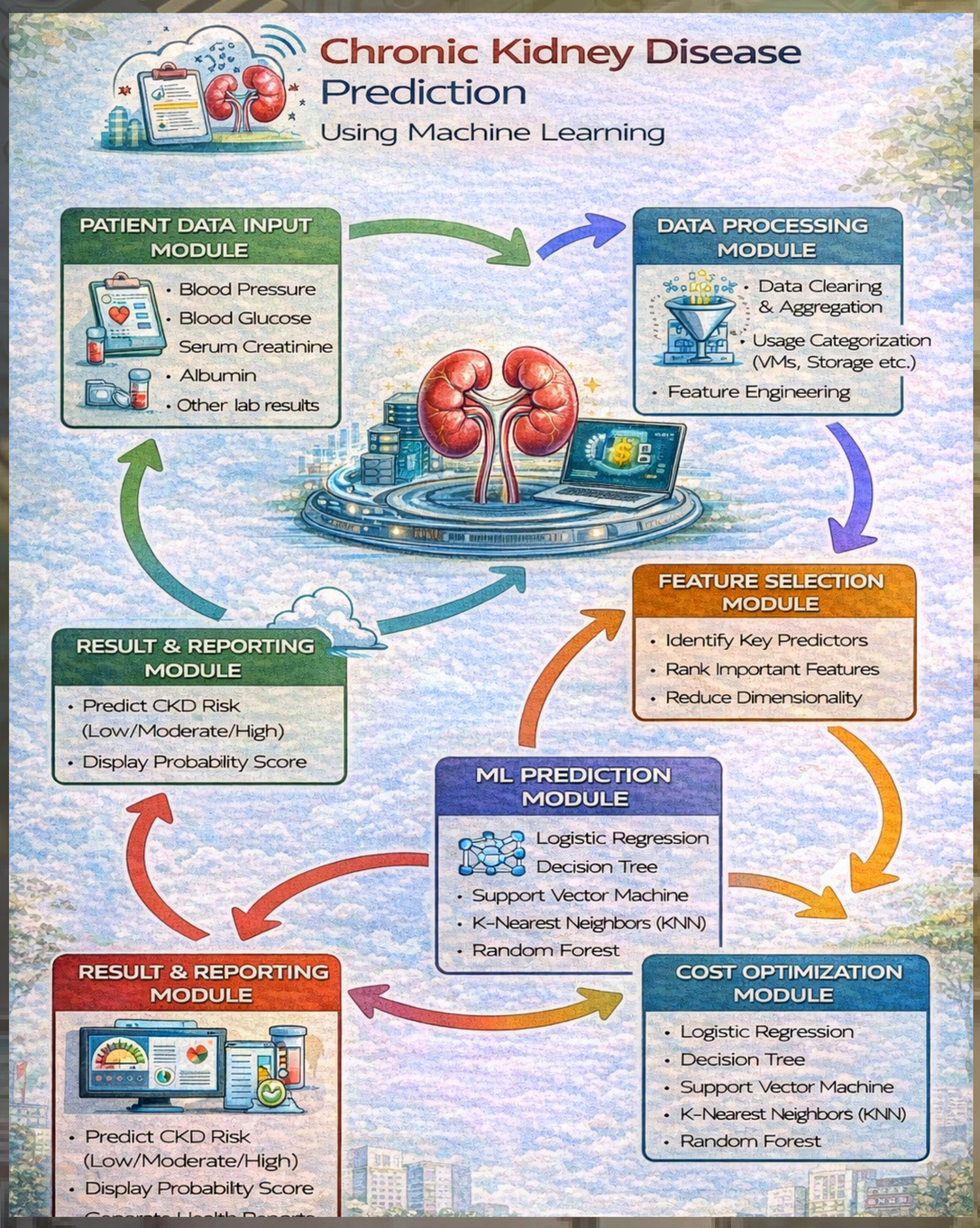
- To collect and preprocess patient clinical data.
- To analyze medical parameters associated with kidney health.
- To train classification models for CKD prediction.
- To provide early risk assessment.
- To support preventive healthcare measures.
- To improve diagnostic accuracy using data analytics.

METHOD USED

The system follows a structured data-driven methodology. Patient data such as blood pressure, blood glucose level, serum creatinine, hemoglobin, albumin, red blood cell count, and other clinical parameters are collected from medical datasets. The data undergoes preprocessing steps including handling missing values, normalization, encoding categorical variables, and feature selection.

Machine learning algorithms such as Logistic Regression, Random Forest, Support Vector Machine (SVM), and Decision Tree are trained on labeled datasets. The best-performing model is selected based on evaluation metrics like accuracy, precision, recall, and ROC-AUC score. The trained model then predicts whether a patient is at risk of CKD and provides a probability score for medical interpretation.

PROPOSED MODEL



Technical Innovation

The innovation lies in leveraging machine learning techniques for early-stage CKD detection. Unlike traditional manual diagnosis methods, this system:

- Uses multi-parameter data analysis
- Provides faster risk assessment
- Assists doctors in decision-making
- Reduces chances of delayed diagnosis

Future enhancements may include integration with wearable health devices and cloud-based health record systems.

PERFORMANCE

The system performance is evaluated using:

1. Prediction Accuracy

Ensemble models such as Random Forest achieve high classification accuracy in identifying CKD cases.

2. Precision & Recall

Ensures minimal false negatives, which is crucial in medical diagnosis.

3. ROC-AUC Score

Measures the model's ability to distinguish between CKD and non-CKD patients.

4. Cross-Validation

Improves reliability and ensures generalization across diverse datasets.

5. Computational Efficiency

Provides quick prediction results suitable for clinical use.

Experimental evaluation demonstrates strong predictive capability for early-stage CKD detection.

Real-World Application

The CKD prediction system can be implemented in:

- Hospitals and diagnostic centers
- Preventive health checkup programs
- Telemedicine platforms
- Rural healthcare monitoring systems
- Health insurance risk assessment systems

It assists healthcare professionals in early detection, enabling timely treatment and reducing long-term complications.

Guide: ***Prof. N L Shelke***

Project Group Members:

1) Swati Dattatray Kene

2) Priyanka Sanjay Maher

3) Shingade Sakshi Dnyaneshwar

Number Plate Detection

Problem Landscape

With the rapid increase in vehicle population, monitoring and managing traffic systems has become increasingly challenging. Manual identification of vehicle number plates is inefficient, time-consuming, and prone to human error. Traffic violations, toll collection, parking management, and security surveillance require automated systems for faster and more accurate vehicle identification.

Traditional surveillance systems capture images or videos but require manual review for extracting vehicle details. This process delays enforcement and reduces efficiency.

Advancements in Artificial Intelligence (AI), Computer Vision, and Deep Learning have enabled automated number plate detection and recognition systems. The proposed system aims to detect vehicle number plates in real-time and extract alphanumeric characters automatically.

OBJECTIVES

The primary objective of this project is to develop an AI-based automatic number plate detection system. The specific objectives include:

- To detect vehicles from video or image streams.
- To locate and extract number plate regions.
- To recognize alphanumeric characters accurately.
- To process images in real-time.
- To reduce manual traffic monitoring efforts.
- To integrate with smart city infrastructure.

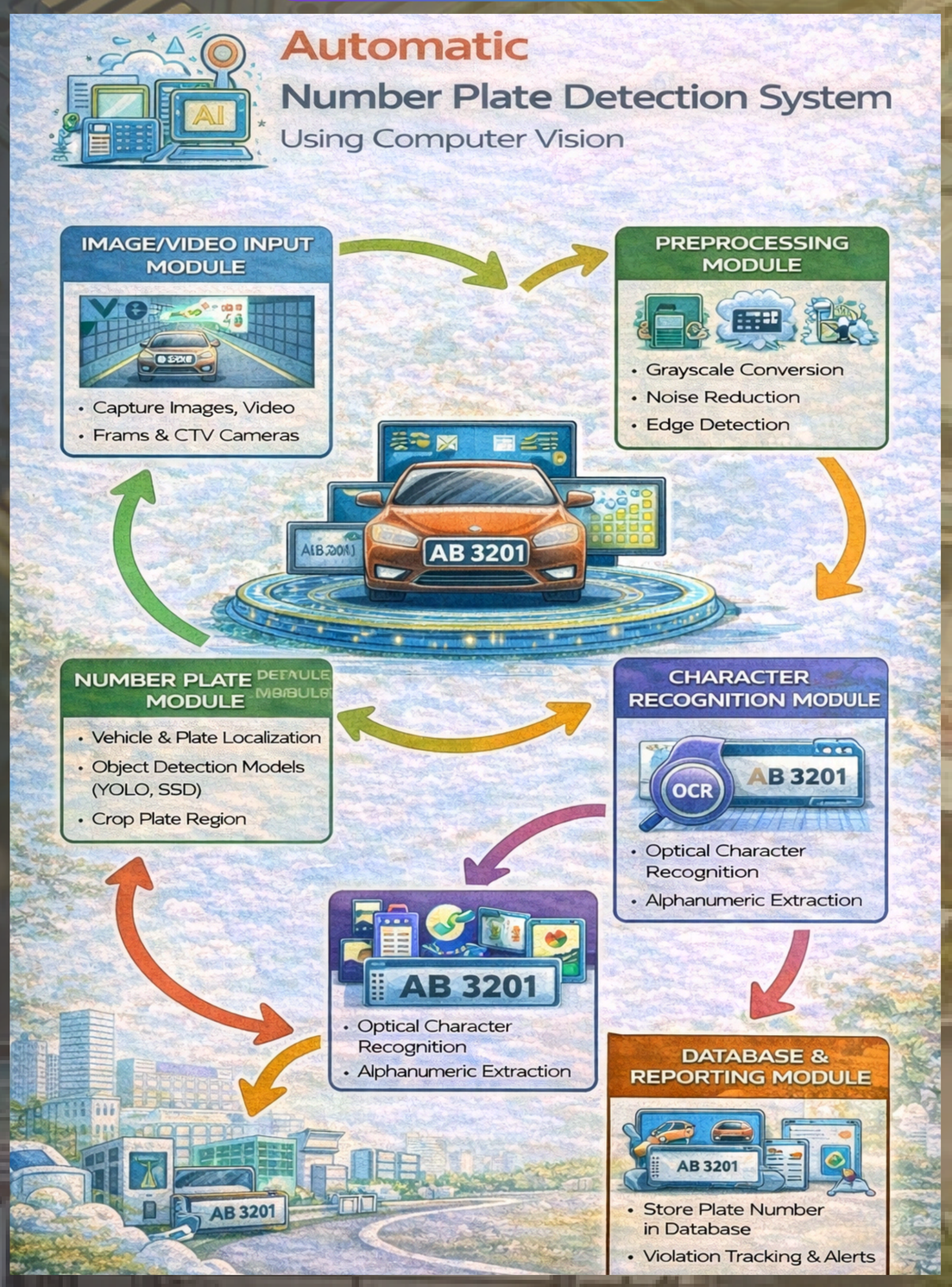
METHOD USED

The system integrates image processing and deep learning techniques. First, images or video frames are captured from CCTV cameras. Preprocessing steps such as grayscale conversion, noise removal, and edge detection are applied to enhance image quality.

A deep learning-based object detection model (such as YOLO or SSD) detects the vehicle and localizes the number plate region. Once detected, the number plate is cropped and passed to an Optical Character Recognition (OCR) module. The OCR model extracts the alphanumeric characters and converts them into digital text format.

The recognized number is then stored in a database for further action such as violation tracking, toll billing, or access control.

PROPOSED MODEL



Technical Innovation

The innovation lies in integrating object detection and OCR technologies into a unified automated solution.

Unlike traditional monitoring systems, this system:

- Provides real-time number plate recognition
- Reduces human intervention
- Supports automated challan generation
- Integrates with law enforcement databases

Future enhancements may include night vision support and multi-lane detection capability.

PERFORMANCE

The performance of the system is evaluated based on:

1. Detection Accuracy

Deep learning models achieve high accuracy in detecting number plates under various lighting conditions.

2. Recognition Accuracy

OCR module ensures precise extraction of alphanumeric characters.

3. Real-Time Processing

Processes video frames efficiently with minimal latency.

4. Robustness

Performs effectively under varying weather conditions and camera angles.

5. Scalability

Supports multiple CCTV streams simultaneously.

Real-World Application

The system can be deployed in:

- Smart city traffic monitoring systems
- Automated toll collection booths
- Parking management systems
- Border security checkpoints
- Law enforcement surveillance systems

It enhances traffic management efficiency and public safety.

*Guide: **Prof. N L Shelke***

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2) Shubhangi Gunjal

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Career Guidance using AIML

Problem Landscape

Choosing the right career path is one of the most critical decisions in a student's life. However, many students make career choices based on peer influence, societal pressure, or incomplete information rather than data-driven assessment of their skills, interests, and academic strengths.

Traditional career counseling methods rely on manual questionnaires and human advisors, which may not always provide personalized, data-backed insights. Additionally, large student populations make individualized counseling difficult in educational institutions.

With the advancement of Artificial Intelligence (AI) and Machine Learning (ML), intelligent career guidance systems can analyze multiple parameters such as academic performance, aptitude test scores, interests, personality traits, and market trends to recommend suitable career paths.

The proposed system aims to develop an AI-driven Career Guidance Platform that provides personalized career recommendations based on predictive analytics.

OBJECTIVES

The primary objective of this project is to design an AI-based career recommendation system. The specific objectives include:

- To analyze student academic records and skill profiles.
- To evaluate aptitude and interest assessment results.
- To apply machine learning models for career prediction.
- To recommend suitable career domains.
- To provide skill-gap analysis and improvement suggestions.
- To assist institutions in academic and career planning.

METHOD USED

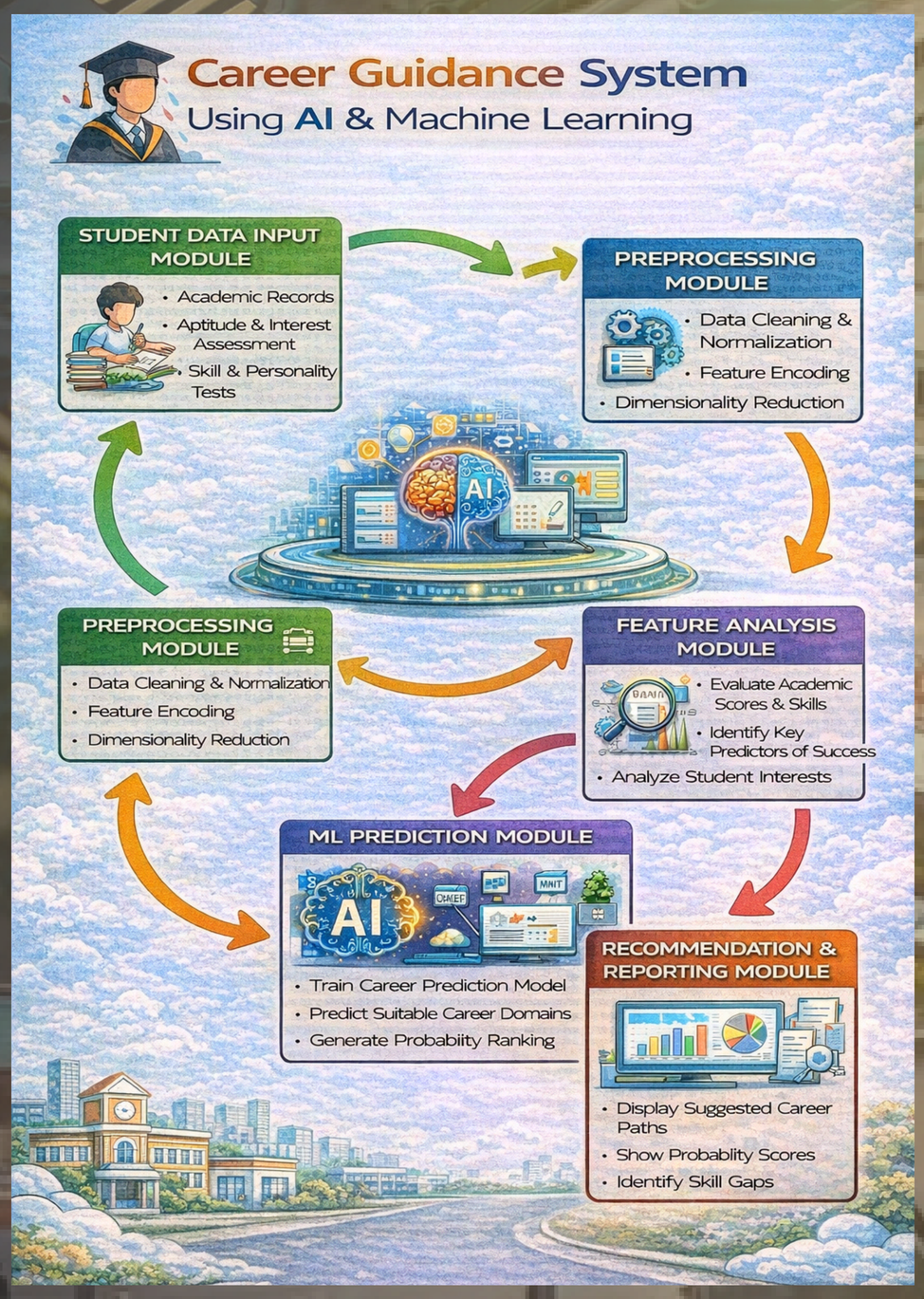
The system collects student data including:

- Academic performance
- Aptitude test scores
- Interest-based questionnaires
- Personality assessment results
- Skill assessment data

The collected data undergoes preprocessing such as normalization, feature encoding, and dimensionality reduction. Machine learning algorithms such as Decision Trees, Random Forest, K-Nearest Neighbors, and Logistic Regression are trained on labeled career datasets.

The trained model predicts the most suitable career domain (e.g., Engineering, Data Science, Civil Services, Business Management, Healthcare, etc.) based on the student's profile. The system also provides probability-based ranking and suggests additional skills required to excel in the recommended field.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining predictive analytics with personalized career mapping.

Unlike traditional counseling systems, this AI-based system:

- Provides data-driven recommendations
- Supports multi-factor analysis
- Adapts to evolving job market trends
- Offers skill enhancement suggestions

Future enhancements may include integration with job market analytics APIs and LinkedIn-based skill tracking.

PERFORMANCE

The performance of the system is evaluated based on:

1. Prediction Accuracy

Machine learning models achieve high accuracy in mapping student profiles to career domains.

2. Personalization Capability

Provides tailored recommendations based on individual data.

3. Scalability

Supports large student datasets efficiently.

4. Recommendation Reliability

Validated through cross-validation and model testing.

5. User Satisfaction

Improves student confidence in career decision-making.

Real-World Application

The system can be deployed in:

- Colleges and universities
- Career counseling centers
- Online education platforms
- EdTech startups
- Skill development initiatives

It assists students in making informed career decisions and helps institutions improve placement outcomes.

*Guide: **Prof. M Muthuraj***

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4) Kanchan Rahul Suralkar

Smart Agriculture/Irrigation System

Problem Landscape

Agriculture is highly dependent on water availability, climate conditions, and soil health. Traditional irrigation methods often lead to overwatering, water wastage, and inefficient resource utilization. In many regions, water scarcity has become a serious concern, making efficient irrigation management essential.

Manual irrigation systems rely on fixed schedules rather than real-time soil and weather conditions. This approach results in inconsistent crop growth, reduced yield, and increased operational cost.

With advancements in Internet of Things (IoT), sensor technology, and Artificial Intelligence (AI), smart irrigation systems can monitor soil moisture, temperature, humidity, and weather data in real-time. The proposed system aims to automate irrigation decisions using data-driven insights to optimize water usage and improve crop productivity.

OBJECTIVES

The primary objective of this project is to develop an intelligent irrigation system for precision farming.

The specific objectives include:

- To monitor soil moisture and environmental conditions.
- To automate water supply based on real-time data.
- To reduce water wastage.
- To improve crop yield and soil health.
- To provide remote monitoring through mobile applications.
- To support sustainable agricultural practices.

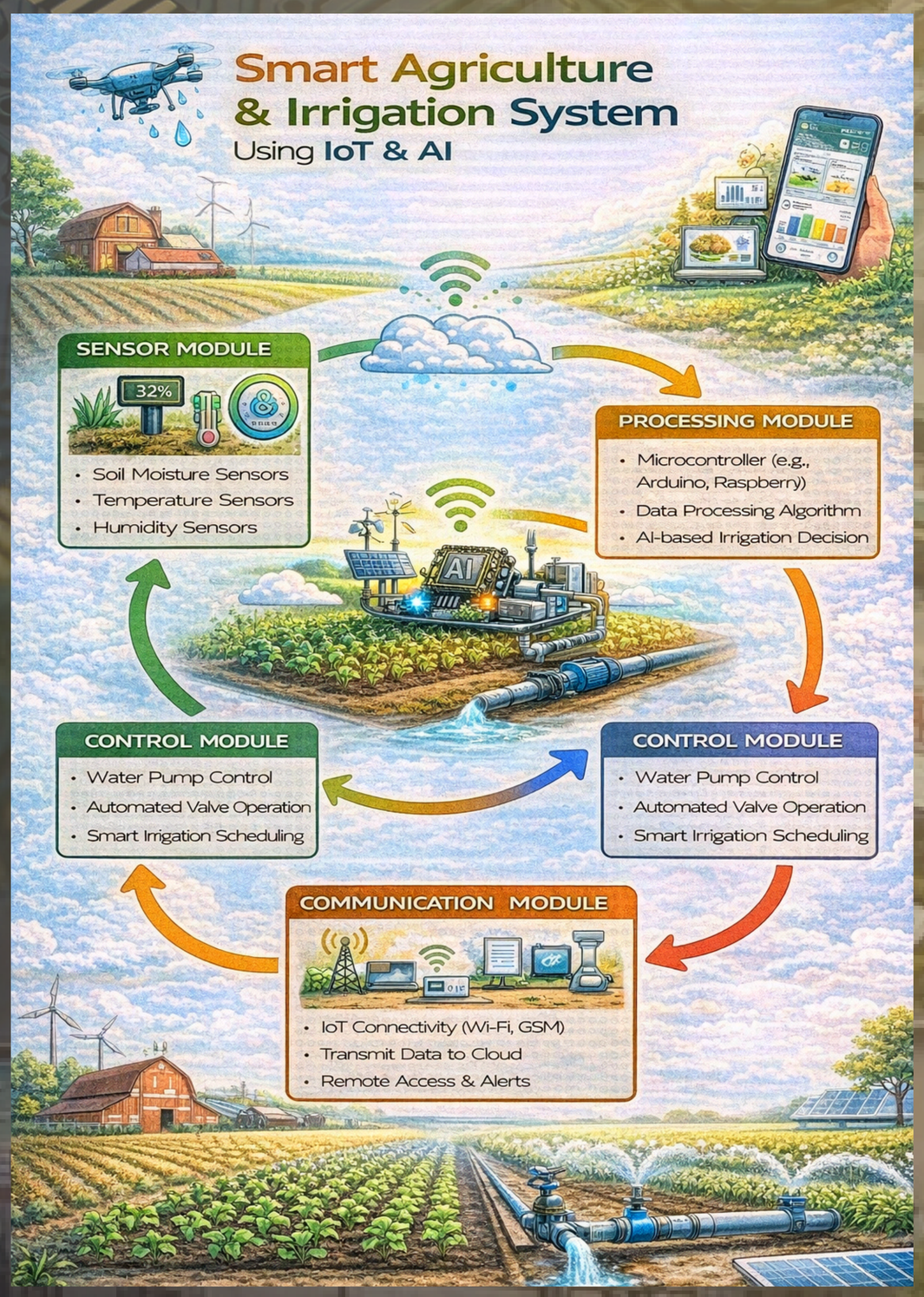
METHOD USED

The system integrates soil moisture sensors, temperature and humidity sensors, and a microcontroller-based control unit. Sensors continuously collect environmental data and transmit it to the processing unit.

The microcontroller analyzes soil moisture levels and compares them with predefined threshold values. If moisture falls below the required level, the system automatically activates the water pump. Once optimal moisture is achieved, irrigation is stopped.

Advanced versions of the system integrate AI-based prediction models that consider weather forecasts and crop type to optimize irrigation scheduling. The data is displayed on a mobile or web dashboard for remote monitoring and control.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining IoT-based sensing with intelligent decision-making for irrigation automation.

Unlike traditional irrigation systems, this solution:

- Uses real-time soil data
- Reduces water consumption
- Enables remote monitoring
- Supports precision agriculture

Future improvements may include drone-based crop health monitoring and satellite weather integration.

PERFORMANCE

The performance of the Smart Irrigation System is evaluated based on:

1. Water Efficiency

The system significantly reduces water wastage by activating irrigation only when necessary.

2. Response Time

Sensors detect moisture changes instantly, enabling quick irrigation control.

3. Energy Efficiency

Optimized pump control reduces energy consumption.

4. Crop Productivity

Maintains optimal soil moisture levels, improving plant growth and yield.

5. Reliability

System performs effectively under varying environmental conditions.

Field testing shows improved water conservation and enhanced agricultural productivity compared to manual irrigation methods.

Real-World Application

The Smart Irrigation System can be deployed in:

- Small and large-scale farms
- Greenhouses
- Government agricultural initiatives
- Smart farming startups
- Urban farming systems

It promotes sustainable agriculture and efficient resource management.

*Guide: **Prof. A A Barbind***

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Alzimer Detection using 3D MR Images

Problem Landscape

Alzheimer's disease is a progressive neurodegenerative disorder that primarily affects memory, cognitive function, and behavior. Early diagnosis is critical for slowing disease progression and improving patient care. However, traditional diagnostic approaches rely heavily on clinical assessments and 2D imaging interpretations, which may not capture subtle structural brain changes in early stages.

3D Magnetic Resonance Imaging (MRI) provides volumetric brain data that reveals structural abnormalities such as hippocampal atrophy, cortical thinning, and ventricular enlargement — all early indicators of Alzheimer's disease.

Manual analysis of 3D MRI scans is time-consuming and dependent on expert radiologists. Therefore, integrating Artificial Intelligence (AI) and Deep Learning with 3D MRI data enables automated, accurate, and early-stage detection.

OBJECTIVES

The major objectives of this project include:

- To process and analyze 3D MRI brain images.
- To identify structural biomarkers of Alzheimer's disease.
- To classify patients into AD (Alzheimer's Disease), MCI (Mild Cognitive Impairment), and NC (Normal Control).
- To improve early detection accuracy using 3D CNN models.
- To reduce diagnostic dependency on manual interpretation.
- To support clinical decision-making systems.

METHOD USED

The proposed system follows a deep learning-based approach using volumetric 3D MRI scans.

First, MRI datasets (such as ADNI or clinical datasets) are collected. The images undergo preprocessing steps including skull stripping, intensity normalization, noise reduction, and spatial alignment. This ensures consistent and standardized inputs.

A 3D Convolutional Neural Network (3D-CNN) is then trained on volumetric MRI data. Unlike 2D models, 3D-CNN captures spatial relationships across brain slices, enabling more accurate structural pattern recognition.

The model extracts features automatically from volumetric brain data and classifies subjects into Alzheimer's categories. The output includes probability scores for each class.

PROPOSED MODEL

Technical Innovation

The innovation of this system lies in:

- Using 3D-CNN instead of traditional 2D CNN
- Capturing volumetric spatial features
- Automated biomarker detection
- Probability-based classification
- Integration with medical decision support systems

3D deep learning models provide significantly improved diagnostic capability compared to manual inspection methods.

PERFORMANCE

The system performance is evaluated using:

Accuracy

High classification accuracy between AD, MCI, and NC groups.

Sensitivity

Correct detection of Alzheimer's patients.

Specificity

Accurate identification of healthy individuals.

Precision

Reduced false positives and false negatives.

AUC (Area Under Curve)

Strong ROC curve performance.

The 3D-CNN model demonstrates improved performance compared to traditional ML models like SVM or Random Forest applied to handcrafted features.

Real-World Application

- Early-stage Alzheimer's diagnosis
- Clinical decision support systems
- Hospital radiology departments
- Medical research institutions
- Neurological disease monitoring systems

This system can significantly assist neurologists in early intervention planning and treatment optimization.

Guide: ***Dr. D S Jadhav***

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4) Bhingare Komal Haushiram

Fake Social Media Account Detection

Problem Landscape

The rapid growth of social media platforms has revolutionized communication, marketing, and information sharing. However, it has also led to a significant rise in fake accounts, bots, and malicious profiles. These fake accounts are often used for spreading misinformation, online fraud, phishing attacks, spamming, political manipulation, and identity theft.

Manual detection of fake accounts is inefficient due to the massive volume of users and complex behavior patterns. Traditional rule-based systems fail to detect sophisticated bots that mimic human behavior.

Artificial Intelligence (AI) and Machine Learning (ML) provide powerful tools to analyze behavioral patterns, content characteristics, and network structures to automatically identify fake social media accounts.

The proposed system aims to develop a robust ML-based framework to detect fraudulent or bot accounts accurately.

OBJECTIVES

The major objectives of this project include:

- To analyze user profile and activity data.
- To identify suspicious behavioral patterns.
- To classify accounts as genuine or fake.
- To reduce online fraud and misinformation.
- To improve platform security.
- To enhance user trust and safety.

METHOD USED

The system collects social media data such as:

- Number of followers and following
- Post frequency
- Account age
- Engagement rate
- Profile completeness
- Textual content features

Data preprocessing includes cleaning, normalization, handling missing values, and feature engineering.

Machine learning classification algorithms such as:

- Logistic Regression
- Random Forest
- Support Vector Machine (SVM)
- Gradient Boosting
- Neural Networks

are trained on labeled datasets containing real and fake account samples.

Text analysis techniques like Natural Language Processing (NLP) are used to detect spam content patterns. Network analysis is also performed to identify abnormal connectivity structures.

The trained model predicts whether a social media account is genuine or fake and assigns a probability score.

PROPOSED MODEL

Technical Innovation

The innovation of this system lies in:

- Combining behavioral, textual, and network-based features
- Using AI for real-time fake account detection
- Integrating NLP for spam identification
- Providing probability-based risk assessment

The system is adaptable to evolving fake account strategies.

PERFORMANCE

The system performance is evaluated using:

Accuracy

High classification accuracy in distinguishing fake and genuine accounts.

Precision

Minimizes false identification of genuine users.

Recall

Ensures most fake accounts are detected.

F1-Score

Balances precision and recall.

ROC-AUC

Strong discriminatory capability between classes.

Experimental results show ensemble models such as Random Forest and Gradient Boosting perform effectively.

Real-World Application

- Social media platforms
- Cybersecurity monitoring systems
- Online fraud detection agencies
- Political misinformation control
- E-commerce review fraud detection

This system strengthens digital security and protects users from online manipulation.

Guide: ***Dr. R D Chintamani***

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Digital Twin Industry 4.0

Problem Landscape

Industry 4.0 represents the fourth industrial revolution characterized by automation, smart manufacturing, cyber-physical systems, IoT integration, and real-time data exchange. Modern industries require continuous monitoring, predictive maintenance, process optimization, and minimal downtime to remain competitive.

Traditional industrial systems rely heavily on periodic inspections and reactive maintenance strategies. This often leads to unexpected equipment failures, production delays, increased operational costs, and safety risks.

Digital Twin technology addresses these challenges by creating a real-time virtual replica of physical industrial systems. By integrating IoT sensors, data analytics, AI, and simulation models, Digital Twins enable industries to monitor performance, predict failures, and optimize operations proactively.

The proposed system aims to develop a Digital Twin framework for Industry 4.0 applications.

OBJECTIVES

The major objectives of this project include:

- To create a virtual replica of industrial machinery or systems.
- To collect real-time operational data using IoT sensors.
- To simulate and monitor system performance.
- To predict equipment failures using AI models.
- To optimize production efficiency.
- To support smart manufacturing environments.

METHOD USED

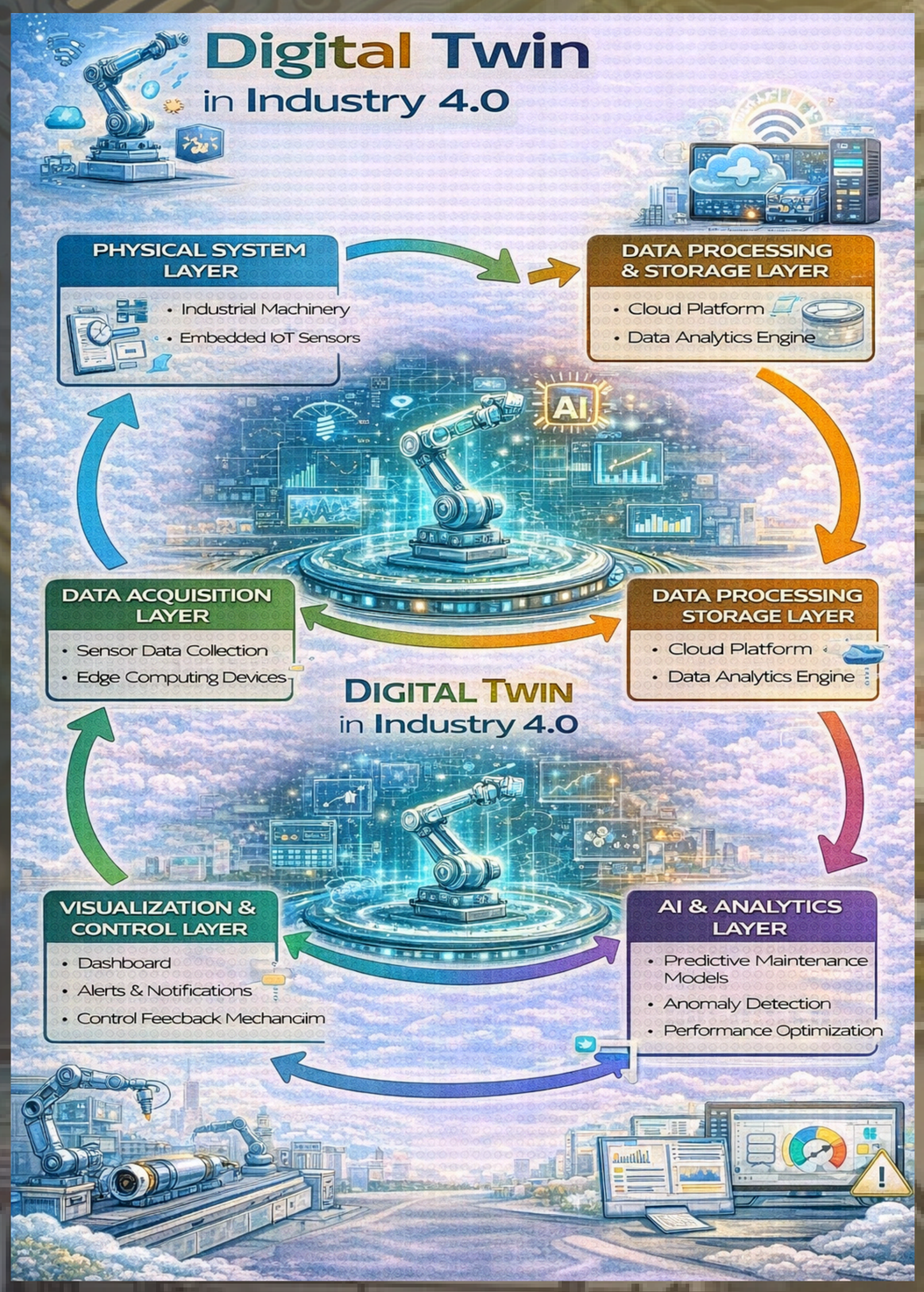
The system begins by integrating IoT sensors with physical industrial equipment to collect real-time parameters such as temperature, vibration, pressure, load, and operational speed.

The collected data is transmitted to a cloud or edge computing platform where it is processed and stored.

A virtual 3D model of the physical system is created using simulation tools. The digital twin continuously updates its state based on real-time sensor data.

Machine learning algorithms analyze historical and real-time data to detect anomalies, predict potential failures, and estimate remaining useful life (RUL) of equipment. The system visualizes performance metrics through dashboards, enabling predictive and prescriptive maintenance decisions.

PROPOSED MODEL



Technical Innovation

The innovation lies in combining cyber-physical systems with AI-powered analytics to create intelligent manufacturing ecosystems.

Key innovations include:

- Real-time synchronization between physical and virtual systems
- Predictive maintenance capability
- Data-driven optimization
- Reduced downtime and operational cost
- Integration with Industry 4.0 technologies

The system transforms traditional factories into smart, autonomous production units.

PERFORMANCE

The performance of the Digital Twin system is evaluated based on:

Downtime Reduction

Significant reduction in unexpected machine failures.

Predictive Accuracy

Accurate forecasting of equipment failures.

Operational Efficiency

Improved production throughput.

Energy Optimization

Optimized energy usage in manufacturing units.

Scalability

Supports integration across multiple machines and plants.

Experimental deployment shows measurable improvements in productivity and cost savings.

Real-World Application

- Smart manufacturing plants
- Automotive industry
- Aerospace production
- Oil & gas monitoring
- Power generation systems
- Smart factories

Digital Twin technology is a core component of Industry 4.0 transformation initiatives worldwide.

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