RAJALAKSHMI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

Department of Computer Science and Engineering

VEHICLE COUNT PREDICTION

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Problem Statement and Motivation

Problem Statement:-

In rapidly growing urban areas, managing traffic efficiently has become a major challenge. Traditional traffic monitoring systems often rely on manual counting or basic sensors, which can be inaccurate, time-consuming, and costly. There is a growing need for an automated, data-driven system that can accurately predict the number of vehicles on roads at different times. This project aims to develop a machine learning-based solution that predicts vehicle count using historical traffic data, sensor input, or video feeds, enabling smarter traffic control and infrastructure planning.

Motivation:-

Accurate vehicle count prediction helps city planners and traffic authorities make better decisions regarding road design, traffic signal timing, and congestion control. With the rise of smart cities, using technology like machine learning to forecast traffic volume can significantly reduce traffic jams, lower accident risks, and cut down pollution. This project is motivated by the goal of making urban transportation more efficient, cost-effective, and intelligent through predictive modeling.

Existing System

- Manual Counting: People physically count vehicles, usually for short surveys. This method is labor-intensive, time-consuming, and not accurate for continuous or large-scale monitoring.
- Inductive Loop Sensors: These are embedded in roads and detect vehicles as they pass. While fairly accurate, they are expensive to install and maintain.
- Infrared or Radar Sensors: These devices are used to detect and count moving vehicles. However, their performance can be affected by weather conditions, shadows, and other environmental factors.
- Basic CCTV Cameras with Manual Observation: Some systems use video feeds from traffic cameras, but analysis is often manual or semi-automated, lacking real-time prediction capabilities.
- Rule-Based Systems: Some traffic systems use pre-set thresholds or historical averages to estimate vehicle counts, but they cannot adapt well to changing traffic patterns.

Objectives

- Automatically count vehicles using image or video data to reduce manual effort.
- Predict traffic flow for upcoming hours or days using historical vehicle data.
- Use machine learning models to find patterns and improve prediction accuracy over time.
- Improve traffic management by helping authorities make data-driven decisions.
- Support smart city development by integrating with intelligent transportation systems.
- Reduce congestion by forecasting busy traffic periods and planning accordingly.
- Create a scalable solution that can work for different areas and camera setups.
- Visualize results clearly using graphs or dashboards for better understanding.

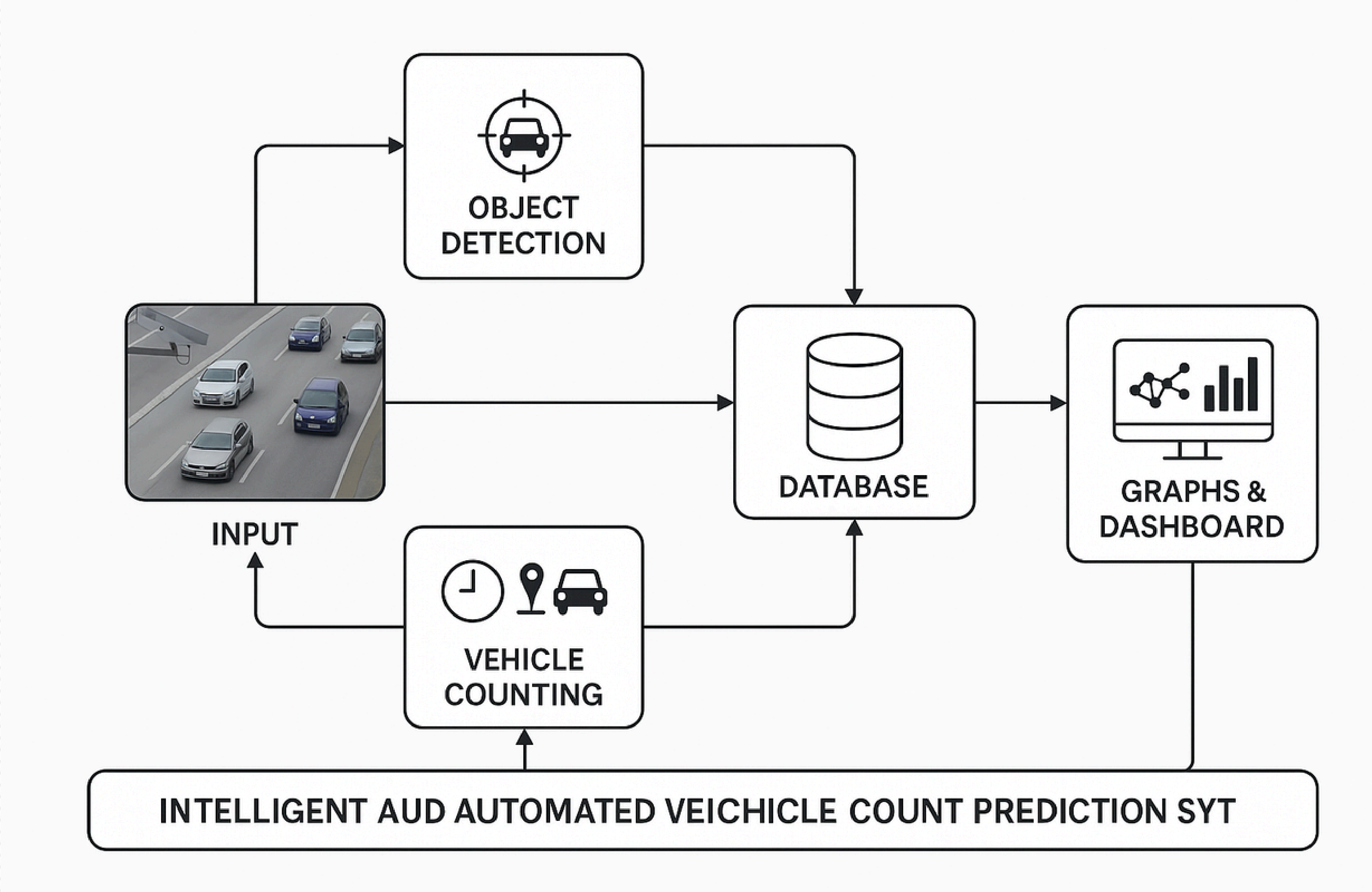
Abstract

Vehicle count prediction is an important task in modern traffic management and smart city development. This project presents a machine learning–based system designed to automatically count vehicles and predict future traffic volumes using real-time or historical traffic data, such as images or video feeds. Traditional methods of vehicle counting often involve manual observation or fixed sensors, which are time-consuming, costly, and limited in scale. Our approach uses computer vision techniques and predictive models to analyze traffic scenes, detect vehicles, and forecast the number of vehicles that may appear at a specific time or location.the system begins with data collection from traffic cameras or open datasets. It then preprocesses the data by detecting and counting vehicles using object detection algorithms like YOLO or OpenCV-based methods. Next, the system uses machine learning models such as linear regression, decision trees, or LSTM (for time series) to predict future vehicle counts. The predictions are visualized through charts, helping city planners and traffic departments make informed decisions about road usage, signal control, and congestion management.this solution is cost-effective, adaptable to different environments, and scalable for large cities. Overall, it contributes to reducing traffic jams, improving road safety, and supporting efficient transportation systems through data-driven insights.

Proposed System

The proposed system for vehicle count prediction is an intelligent and automated approach that leverages computer vision and machine learning to detect, count, and forecast vehicle traffic. Instead of relying on manual methods or basic sensors, this system uses video footage from traffic cameras to identify vehicles in real-time. Object detection techniques like YOLO (You Only Look Once) or OpenCV help detect and count each vehicle frame by frame. The system then records these counts along with the corresponding time and location data, building a dataset that reflects real-world traffic patterns. Using this dataset, machine learning algorithms such as Linear Regression, Random Forest, or LSTM are trained to analyze trends and predict future vehicle counts. This enables proactive traffic management, resource allocation, and congestion control. Additionally, the system provides visual insights through graphs and dashboards, helping authorities and city planners make data-driven decisions. The solution is scalable, adaptable to different locations, and capable of continuous improvement as more data becomes available.

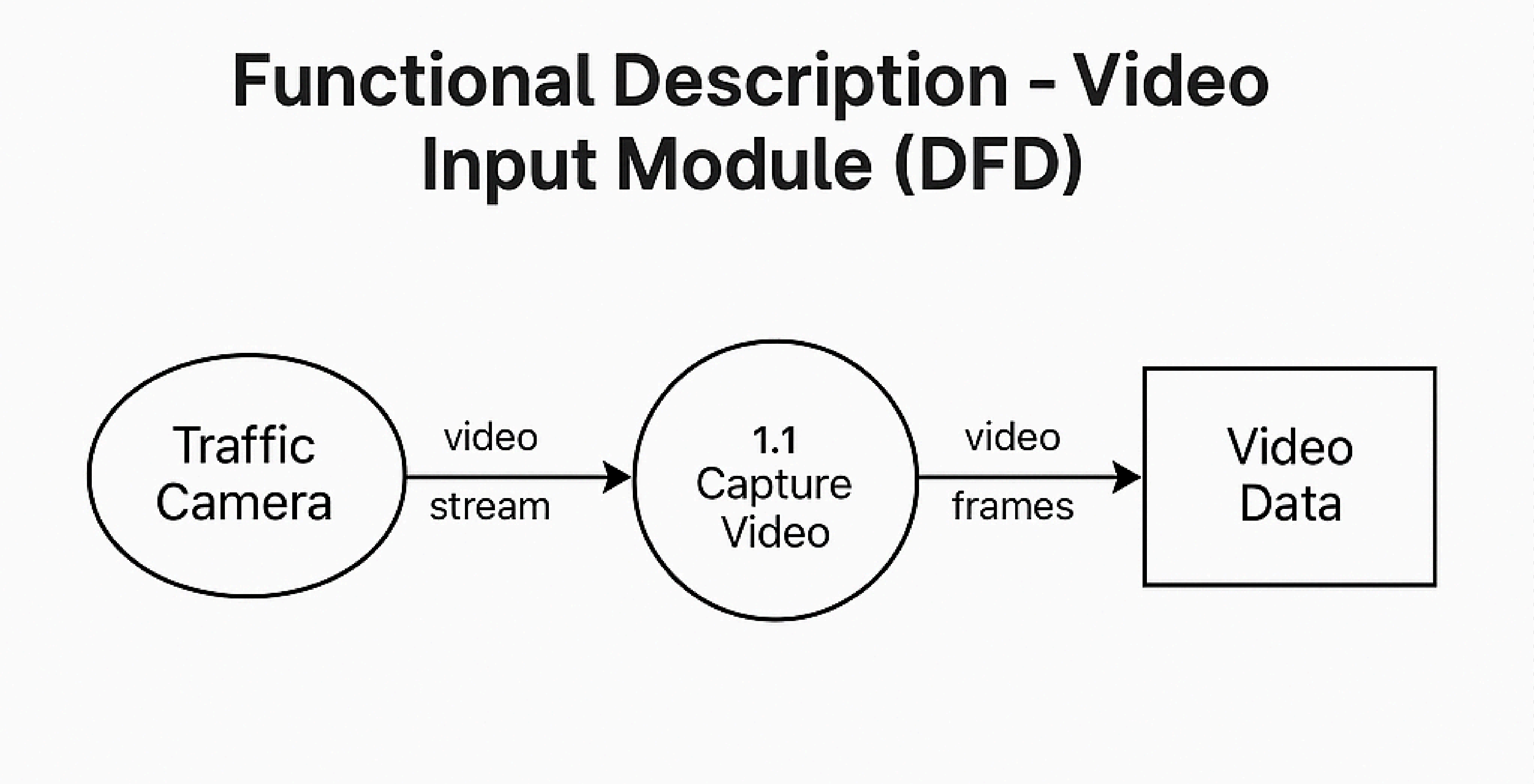
System Architecture



List of Modules

- Video Input Module: Captures live video from traffic cameras.
- Object Detection Module: Detects and identifies vehicles in video frames using computer vision.
- Vehicle Counting Module: Counts vehicles and tracks them frame by frame.
- Data Storage Module: Saves vehicle counts along with time and location data.
- Data Preprocessing Module: Cleans and prepares data for machine learning.
- Prediction Module: Predicts future vehicle counts using ML algorithms like Linear Regression, Random Forest, or LSTM.
- Visualization & Dashboard Module: Shows real-time and predicted data using graphs and charts.
- Alert & Notification Module: Sends alerts in case of heavy traffic or unusual patterns .
- Admin & Configuration Module: Manages system settings, camera sources, and user controls.

Functional Description for each modules with DFD and Activity Diagram



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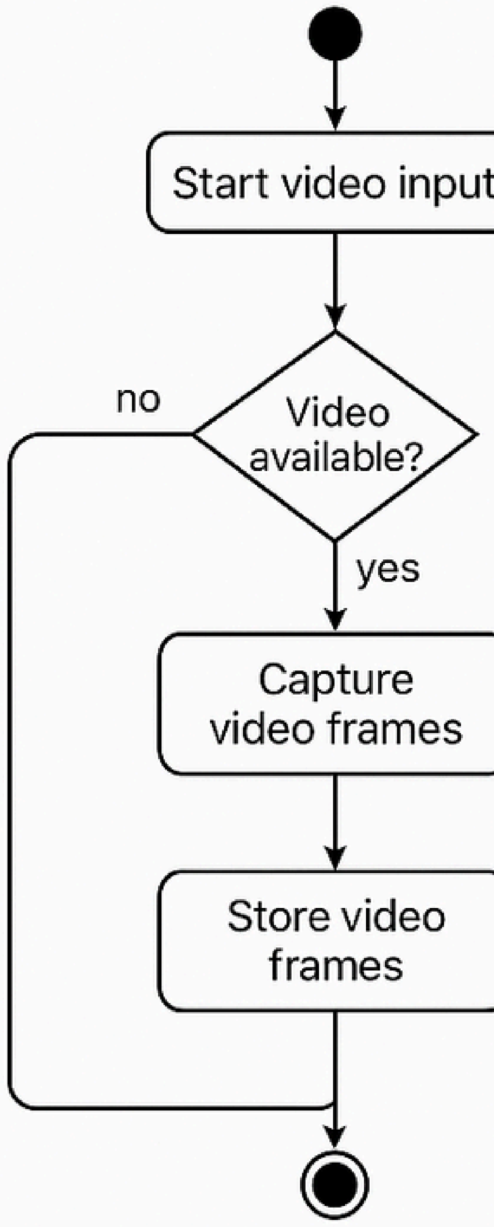
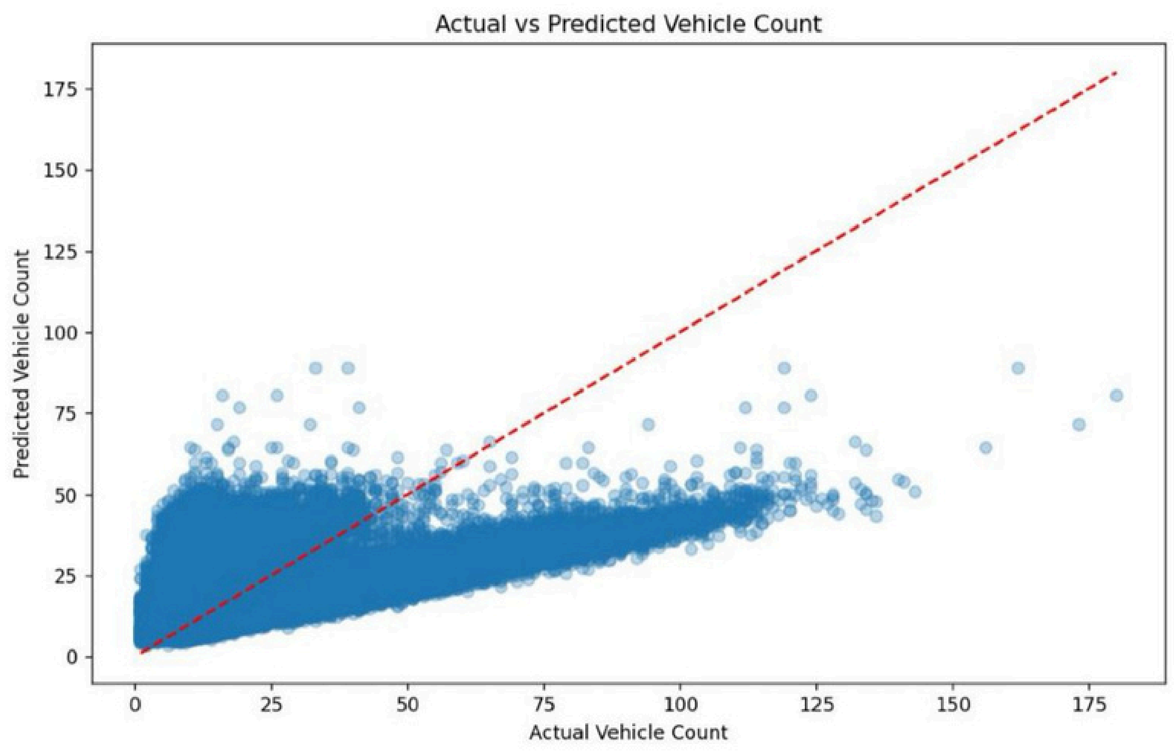
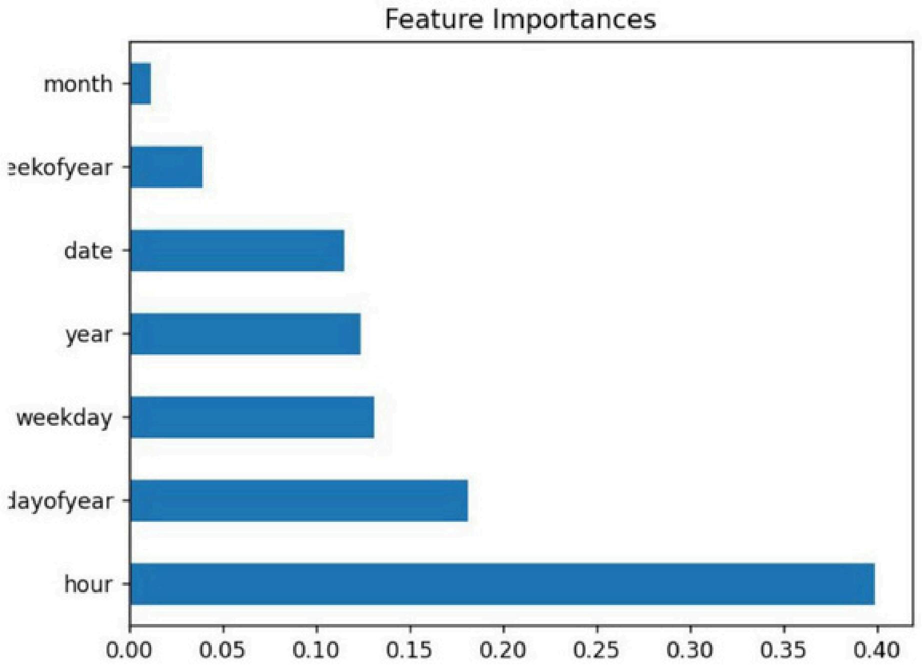
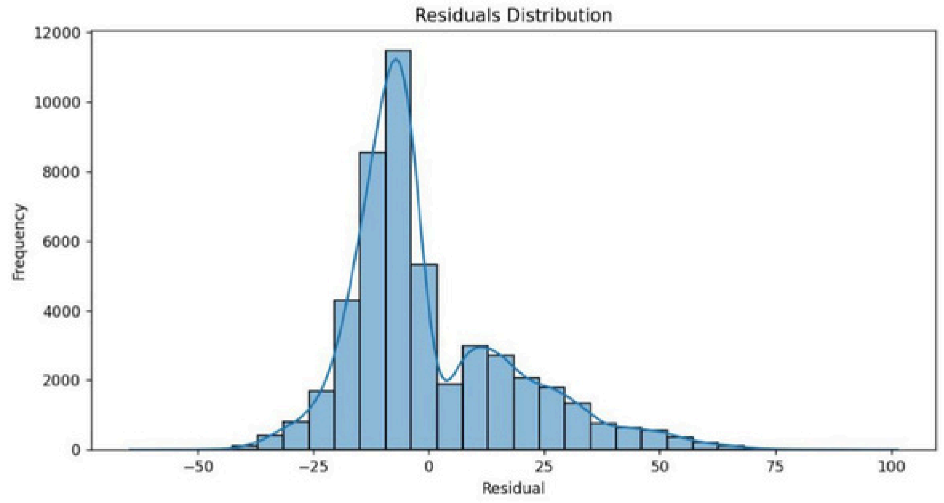


Implementation & Results of Module

1.SUBMITTING SOIL AND ENVIRONMENTAL DATA







Conclusion & Future Work

This study presents a machine learning-driven system for vehicle count prediction using time, weather, and historical traffic data. Among several models tested, XGBoost delivered the highest accuracy due to its strength in handling complex, nonlinear patterns. Effective preprocessing and feature engineering—such as outlier removal and peak-hour tagging—further enhanced model performance. The system has strong potential for integration into intelligent traffic management to support real-time decision-making and urban planning. Future improvements include real-time data streaming, deep learning models, anomaly detection, IoT integration, and user-friendly dashboards for scalable, smart city deployment.

References

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Thank You