IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.05

# AI Based Smart Traffic Management System with Real-Time Dashboard & Traffic Prediction

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**Publication History**
Manuscript Reference: IRJCS/RS/Vol.13/Issue03/CSMR26.MRCS10084
Research Article | Open Access | Double-Blind Peer Reviewed Article ID: IRJCS/RS/Vol.13/Issue03/CSMR26.MRCS10084
Received: 30, January 2026, Revised: 13, February 2026, Accepted: 28 February 2026 Published Online: 25 March 2026
https://www.irjcs.com/volumes/Vol13/iss-03/05.CSMR26.MRCS10084.pdf

**Article Citation: Boopalan,Dhatchana,Karthi,Vijay(2026)**,AI Based Smart Traffic Management System with Real-Time Dashboard & Traffic Prediction, IRJCS:International Research Journal of Computer Science, Volume 13,Issue 03 of 2026 pages 115-122 **Doi:>** https://doi.org/10.26562/irjcs.2026.v1303.05 **BibTeX Key Boopalan@2026AI**
**Orcid:** https://orcid.org/0009-0004-9398-7488
IRJCS papers should be cited as IRJCS (International Research Journal of Computer Science, AM Publications, India 2026, ISSN 2393-9842, https://doi.org/10.26562/ijrcs.2025.v1303.05 The journal's official abbreviation is IRJCS.


**Abstract** Traffic congestion is one of the major challenges in modern urban transportation systems. Traditional traffic signal systems operate using fixed time intervals, which often lead to inefficient traffic management during peak hours and changing traffic conditions. To address this issue, this project proposes an AI-based Smart Traffic Management System with Real-time Dashboard and Traffic Prediction. The proposed system automatically adjusts traffic signal timings based on real-time traffic flowdetectedthroughcamerasandsensorsinstalledatroadintersections.By analyzing the vehicle density on each road, the system dynamically provides longer green signals to heavily congested lanes, thereby reducing waiting time, traffic congestion, fuel consumption, and air pollution. In addition to real- time monitoring, the system integrates a traffic analysis dashboard designed with three main functional modules. The first module, Present Traffic Analysis, displays the current traffic condition using live camera data and vehicle detection algorithms. These cond module, Past Traffic Data Analysis, allows users to review previously recorded traffic data to understand traffic patterns and peak hours. The third module, Future Traffic Prediction, uses machine learning techniques to predict upcoming traffic conditions by combining both present and historical traffic datasets. The dashboard provides an interactive interface with three buttons for accessing each module, enabling traffic authorities to easily monitor, analyze, and predict traffic flow. The collected data is processed using intelligent algorithms to make accurate decisions for signal control and traffic forecasting. By integrating real-time monitoring, historical data analysis, and predictive analytics, the proposed system improves traffic efficiency, reduces manual intervention, and enhances road safety. This intelligent approach supports smartertrafficmanagementandcontributestothedevelopmentofsmartcity transportation systems.
**Keywords:** Artificial Intelligence, Smart Traffic System, Machine Learning, Traffic Prediction, Smart City, Traffic Dashboard

## I. INTRODUCTION

Traffic congestion has become one of the most critical challenges in modern urban transportation systems, particularly in rapidly growing cities where the number of vehicles is increasing significantly every year [1],[2]. In efficient traffic management leads to longer travel times, increased fuel consumption, environmental pollution, and economic losses. Traditional traffic signal systems typically operate based on fixed time intervals without considering real-time traffic conditions. As a result, these systems often fail to respond effectively to dynamic traffic patterns, especially during peak hours, emergencies, or unexpected road situations [3],[4]. Conventional traffic control mechanisms rely heavily on manual monitoring and predefined signal schedules, which cannot efficiently handle fluctuating traffic density at road intersections. These limitations often result in unnecessary waiting times, traffic congestion, and inefficient utilization of road infrastructure [5].With the advancement of intelligent technologies such as Artificial Intelligence (AI), computer vision, and machine learning, it has become possible to design smart traffic management systems that can analyze traffic conditions in real time and dynamically adjust traffic signal operations [6],[7]. Recent developments in AI-based traffic analysis systems have enabled automated vehicle detection and traffic density estimation using surveillance cameras and sensors installed at road intersections[8],[9]. These systems utilize image processing and machine learning techniques to analyze live traffic feeds, detect vehicles, and estimate traffic volume on each lane. By processing this real-time data, intelligent algorithms can optimize signal timings and improve traffic flow efficiency.

Such approaches provide significant advantages over traditional systems by adapting signal control according to actual road conditions rather than relying on fixed schedules [10],[11]. In addition to real-time traffic monitoring, data-driven traffic analysis and predictive modeling have become essential components of modern smart city transportation systems. By analyzing historical traffic datasets and identifying traffic patterns, machine learning models can forecast future traffic conditions and assist authorities in proactive traffic management and urban planning [12], [13]. Traffic prediction techniques enable better decision-making by identifying peak traffic hours, potential congestion zones, and future traffic trends. The proposed system presents an AI-Based Smart Traffic Management System with a Real-Time Dashboard and Traffic Prediction module. The system utilizes cameras and sensors installed at road intersections to capture real-time traffic data and analyze vehicle density using intelligent algorithms. Based on the detected traffic density, the system dynamically adjusts traffic signal timings by allocating longer green signals to roads with higher vehicle density, thereby reducing waiting time and improving traffic flow efficiency. Furthermore, the system integrates an interactive traffic analysis dashboard consisting of three main functional modules: Present Traffic Analysis, Past Traffic Data Analysis, and Future Traffic Prediction. The Present Traffic Analysis module monitors live traffic conditions using real-time data captured from cameras and sensors. The Past Traffic Data Analysis module enables users to review previously recorded traffic data to understand traffic patterns and peak hours. The Future Traffic Prediction module applies machine learning techniques to analyze both current and historical traffic datasets to forecast upcoming traffic conditions. By combining real-time monitoring, historical data analysis, and predictive analytics, the proposed system provides an intelligent and automated solution for traffic management. The integration of AI-based decision- making and interactive dashboards improves traffic efficiency, reduces manual intervention, and enhances road safety. This approach contributes to the development of smart city transportation infrastructure by enabling data-driven traffic control and efficient urban mobility.

## II. LITERATURE REVIEW

Traffic congestion has become a major concern in modern cities due to rapid urbanization and the continuous growth of vehicle populations. Traditional traffic signal systems operate based on fixed-time intervals, which do not adapt to dynamic traffic conditions. These limitations often lead to increased waiting time, fuel consumption, and environmental pollution. Researchers have therefore explored intelligent traffic management systems that utilize Artificial Intelligence (AI), machine learning, and Internet of Things (IoT) technologies to improve traffic flow efficiency and reduce congestion [1]. Several studies have focused on the development of adaptive traffic signal control systems that dynamically adjust signal timings according to traffic conditions. Adaptive traffic systems collect real-time data from sensors and cameras to estimate traffic density and optimize signal phases at intersections. These systems aim to reduce congestion and green house gas emissions by improving traffic flow efficiency [2]. Traditional fixed-time signal systems treat all traffic lane sequally regardless of actual traffic density, which leads to inefficient traffic management during peak hours [3]. Computer vision and deep learning technologies have significantly improved the ability to detect and monitor vehicles in real time. Researchers have proposed AI-based vehicle detection systems using Convolutional Neural Networks (CNN) and object detection models such as YOLO to accurately identify and count vehicles from live traffic camera feeds. These models can operate under complex traffic conditions and provide real-time traffic data that can be used for intelligent traffic signal control [4]. Such systems reduce the need for manual monitoring by traffic authorities and enable automated traffic management. Machine learning techniques have also been widely applied in traffic prediction and traffic flow analysis. Various algorithms such as Random Forest, Support Vector Machines (SVM), Gradient Boosting, and Neural Networks have been used to analyze historical traffic data and predict future traffic conditions. These models help identify traffic patterns, peak hours, and potential congestion zones, allowing authorities to implement preventive measures before traffic congestion occurs [5]. In recent years, reinforcement learning methods have also been explored for traffic signal optimization, where intelligent agents learn optimal signal control strategies through interaction with traffic environments [6]. Another important approach in intelligent transportation systems is the integration of IoT-based traffic monitoring systems. IoT technologies enable the collection of traffic data using sensors, cameras, and connected devices installed at road intersections. These systems provide continuous monitoring of traffic conditions and allow centralized traffic management centers to analyze traffic patterns and coordinate traffic signals across multiple intersections [7]. Such interconnected systems improve overall traffic efficiency and enable data-driven decision-making for urban transportation planning. Researchers have also explored the use of predictive analytics and digital twin technologies for smart traffic management. Digital twin models create virtual representations of real-world traffic networks and allow researchers to simulate traffic conditions and test different traffic control strategies. By integrating real-time data with simulation models, digital twins can improve traffic forecasting accuracy and enhance decision-making in intelligent transportation systems [8]. Despite the significant progress in AI-based traffic management, many existing solutions focus primarily on either traffic detection or traffic prediction individually. Few systems integrate real-time traffic monitoring, historical data analysis, and predictive analytics into a single platform. To address these limitations, the proposed system integrates real- time vehicle detection, historical traffic analysis, and machine learning-based traffic prediction within an interactive dashboard. This integrated approach provides a comprehensive traffic management solution that supports efficient monitoring, analysis, and prediction of traffic conditions in urban environments.

## III. PROPOSED METHODOLOGY ARCHITECTURE

The proposed methodology architecture for the AI-Based Smart Traffic Management System with Real-Time Dashboard and Traffic Prediction consists of several interconnected modules that work together to collect traffic data, analyze traffic conditions, and control traffic signals intelligently. The architecture is designed to process both real-time traffic information and historical traffic datasets to provide efficient traffic management and future traffic prediction.

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The dashboard is designed with three key modules: Present Traffic Analysis, Past Traffic Data Analysis, and Future Traffic Prediction. The Present Traffic Analysis module displays the real-time traffic status by processing live camera feeds and visualizing vehicle density information. The Past Traffic Data Analysis module stores and analyzes previously collected traffic data to identify traffic patterns, peak hours, and congestion trends. The Future Traffic Prediction module utilizes machine learning algorithms to forecast upcoming traffic conditions by combining both historical and real- time traffic datasets. These predictive insights assist authorities in making proactive traffic management decisions. The integration of real-time monitoring, adaptive signal control, historical data analysis, and predictive modeling significantly improves traffic efficiency and reduces traffic congestion, waiting time, and fuel consumption. Furthermore, the system minimizes manual intervention and provides a scalable solution that can be integrated into smart city infrastructures. By leveraging artificial intelligence, computer vision, and data analytics, the proposed system offers a reliable and intelligent approach tomodernurbantrafficmanagement.Theoverallarchitectureofthesystem includes the following main components.

### A. Traffic Data Acquisition Layer

The first layer of the architecture is responsible for collecting real-time traffic data from road intersections. Traffic cameras and sensors installed at strategic locations capture live traffic images and vehicle movement information. These devices continuously monitor traffic flow and send the collected data to the processing unit.

### B. Data Processing Layer

In this stage, the collected traffic data is processed using image processing and computer vision techniques. The system analyzes the captured images to detect vehicles and extract relevant traffic features. The processing module performs the following operations: Image preprocessing Vehicle detectionVehiclecountingTrafficdensityestimation.Theprocesseddatais then forwarded to the traffic analysis module.

### C. Traffic Analysis Module

The traffic analysis module evaluates the processed traffic data to determine the level of congestion on each road segment. The system calculates vehicle density for each lane and compares it with predefined traffic thresholds.

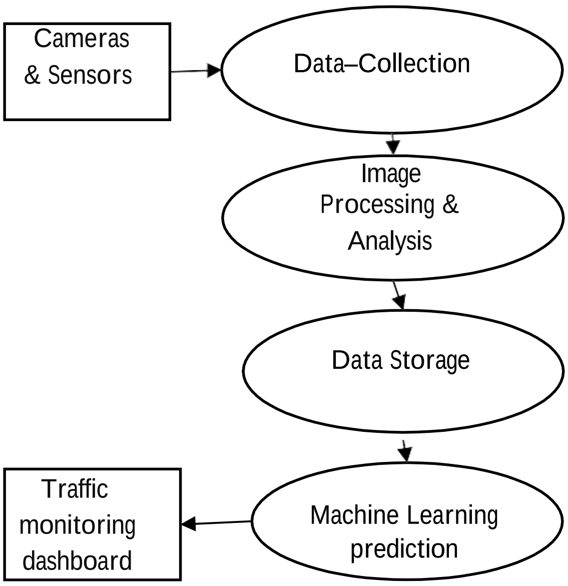


**Fig.1.**Architecture Diagram

Based on the traffic density values, the system classifies traffic conditions into different categories such as: Low traffic Moderate traffic High traffic congestion. This information is used to determine appropriate signal timing adjustments.

### D. Dynamic Traffic Signal Control

The dynamic traffic signal control module adjusts the signal timings based on traffic density. Roads with higher vehicle density receive longer green signal durations, while roads with fewer vehicles receive shorter signal durations. This dynamic signal allocation helps in: Reducing vehicle waiting time, Improving traffic flow, Minimizing congestion at intersections. The system automatically controls traffic signals without manual intervention.

### E. Traffic Data Storage

All collected and processed traffic data is stored in a centralized database. This historical traffic data is used for further analysis and future traffic prediction. The stored data includes: Vehicle count records Traffic density data Time-based traffic patterns. This database enables long-term traffic analysis and pattern identification.

### F. Traffic Prediction Module

The traffic prediction module uses machine learning algorithms to analyze both real-time and historical traffic datasets. The model learns traffic patterns and predicts possible congestion in upcoming time intervals. This predictive analysis helps traffic authorities to: Anticipate traffic congestion, Plan alternative routes, and Improve traffic control strategies

### G. Traffic Analysis Dashboard

The final layer of the architecture is the traffic analysis dashboard, which provides an interactive user interface for monitoring traffic conditions. The dashboard includes three main modules: Present Traffic Analysis: Displays live traffic conditions based on real- time data collected from cameras and sensors.

Past Traffic Data Analysis: Allows users to analyze historical traffic datasets to identify traffic patterns and peak traffic hours. Future Traffic Prediction. Displays predicted traffic conditions generated using machine learning algorithms. The dashboard provides easy access to these modules through three main buttons, enabling traffic authorities to monitor and analyze traffic efficiently.

## IV. TECHNOLOGIES USED

The proposed Smart Traffic Management System utilizes several modern technologies including Artificial Intelligence, computer vision, machine learning, and web-based dashboard tools to monitor and analyze traffic conditions efficiently. The main technologies used in this system are described below. to ensure efficient traffic monitoring, analysis, and prediction. Artificial Intelligence (AI) and Machine Learning (ML) techniques are used to analyze traffic data and make intelligent decisions for adaptive traffic signalcontrol.Computervisiontechnologyplaysacrucialroleindetecting and counting vehicles from real-time camera feeds. Deep learning models such as YOLO are used for accurate vehicle detection and classification under different traffic conditions. The system processes video frames to identify vehicle density on each lane, which helps dynamically adjust signal timings. Additionally, data collected from cameras and sensors are stored and analyzed using machine learning algorithms to identify traffic patterns and support future traffic prediction. For system development and data processing, programming tools such as Python are used because of their strong support for artificial intelligence and data analysis libraries. Frameworks like Tensor Flow and OpenCV assist in implementing deep learning models and image processing tasks. The traffic monitoring dashboard is developed using web technologies such as HTML, CSS, and JavaScript to create an interactive user interface that allows traffic authorities to view present traffic conditions, past traffic data, and future traffic predictions. Data visualization tools and chart libraries are used to present traffic statistics through graphs and charts for easier analysis. By combining AI, computer vision, and web-based dashboard technologies, the proposed system provides an intelligent and user-friendly solution for modern traffic management in smart cities.

### A. Artificial Intelligence (AI)

Artificial Intelligence plays a crucial role in the proposed system by enabling automated traffic analysis and intelligent decision-making. AI algorithms are used to analyze traffic patterns, detect vehicle density, and optimize traffic signal timings. The integration of AI allows the system to dynamically respond to changing traffic conditions and improve traffic flow efficiency.

### B. Machine Learning

Machine learning techniques are used for analyzing historical traffic data and predicting future traffic conditions. By training models on past and present traffic datasets, the system can identify traffic patterns and forecast possible congestion. Machine learning helps in improving the accuracy of traffic prediction and enables proactive traffic management. data exfiltration,lateralmovement,andcommand-and-controlcommunication.

### C. Computer Vision

Computer vision techniques are used to process images captured from traffic cameras. The system analyzes video frames to detect vehicles, count the number of vehicles on each lane, and estimate traffic density. Vehicle detection algorithms help the system automatically identify traffic congestion without manual monitoring.

### D. Traffic Cameras and Sensors

Traffic cameras and sensors are installed at road intersections to collect real-time traffic data. Cameras capture live video feeds of vehicles, while sensors detect vehicle presence and movement. These devices act as the primary source of traffic information for the system.

### E. Python Programming Language

Python is used as the primary programming language for implementing the traffic analysis and machine learning algorithms. Python provides powerful libraries for data analysis, machine learning, and image processing, making it suitable for developing intelligent traffic management systems.

### F. Machine Learning Libraries

Various Python libraries are used for implementing machine learning and data analysis tasks, including: NumPy Used for numerical computations and data manipulation. Pandas Used for handling and analyzing traffic datasets. Scikit-learn Used for implementing machine learning models for traffic prediction.

### G. Computer Vision Libraries

The system uses computer vision libraries such as: OpenCV – Used for image processing, vehicle detection, and video analysis from traffic cameras.

### H. Data Storage System

A database is used to store historical traffic data for analysis and prediction. The stored data includes vehicle counts, traffic density, and time-based traffic patterns.

### I. Web-Based Dashboard

A web-based dashboard is developed to visualize traffic information. The dashboard provides an interactive interface with three main modules Present Traffic Analysis, Past Traffic Data Analysis, Future Traffic Prediction

## V. IMPLEMENTATIONS AND RESULTS

The proposed AI-Based Smart Traffic Management System was implemented using a combination of computer vision, machine learning, and data visualization technologies. The system collects real-time traffic data using traffic cameras and sensors installed at road intersections. These devices continuously monitor vehicle movement and capture traffic density information.

IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.05
The captured video frames are processed using computer vision techniques for vehicle detection and counting. A deep learning model is used to identify different types of vehicles determine the traffic density in each lane. The processed data is then sent to the central data processing unit where traffic analysis and prediction algorithms are executed. The system dynamically adjusts the traffic signal timing based on the detected traffic density. If one road contains a higher number of vehicles, the system automatically allocates a longer green signal duration to reduce congestion and waiting time. A web-based dashboard was developed to provide an interactive interface for monitoring and analyzing traffic conditions. The dashboard contains three main modules

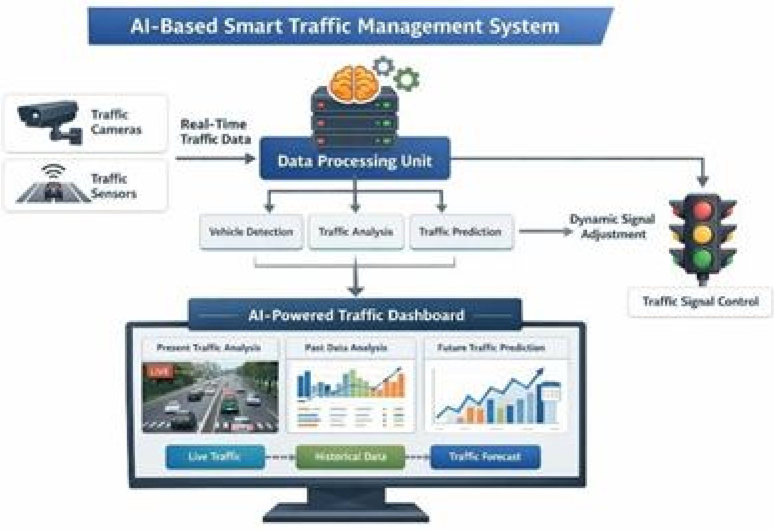


**Fig.2:** System Implementation

**Present Traffic Analysis:** This module displays the real-time traffic condition using live camera data. Vehicle detection algorithms calculate the number of vehicles and display the traffic density visually. Past Traffic Data Analysis: Historical traffic data collected from previous observations are stored in a database. The dashboard presents this data using bar charts and graphs to identify traffic patterns and peak traffic hours. Future Traffic Prediction: Machine learning models analyze both real-timeandhistoricaltrafficdatasetstopredictfuturetrafficconditions. This helps traffic authorities plan signal timings and traffic control strategies more efficiently.


**Fig.3** Use case Diagram

The proposed system was tested using multiple traffic datasets to evaluate its performance in traffic monitoring and prediction. The results demonstrate that the AI-based system can effectively detect vehicles, analyze traffic flow, and provide accurate predictions. The real-time traffic analysis module successfully detected vehicle density and dynamically adjusted traffic signals. Compared with traditional fixed-time traffic signal systems, the proposed system significantly reduced vehicle waiting time at intersections. The past traffic data analysis module helped identify peak traffic hours and congestion patterns, which are useful for long-term traffic planning. The future traffic prediction module generated traffic forecasts based on machine learning algorithms. The prediction accuracy improved when both real-time and historical data were combined. Graphs and bar charts were generated on the dashboard to visualize traffic conditions, allowing traffic authorities to easily interpret the data and make informed decisions. Overall, the system demonstrated improved traffic efficiency, reduced congestion levels, and enhanced decision- making capabilities. The above graph illustrates the Future Traffic Prediction Trend represented using a line chart, where the x-axis indicates the time of day and they-axis represents the predicted number of vehicles. The graph shows how the proposed system predicts traffic volume at different time intervals using machine learning analysis of present and historical traffic data. According to the prediction results, traffic density is relatively low during the early morning at 6 AM, with approximately 50 vehicles, indicating minimal congestion during this time. A significant increase in traffic flow is observed at 8 AM, reaching around 130 vehicles, which represents the morning peak hour when people commute to work or educational institutions.

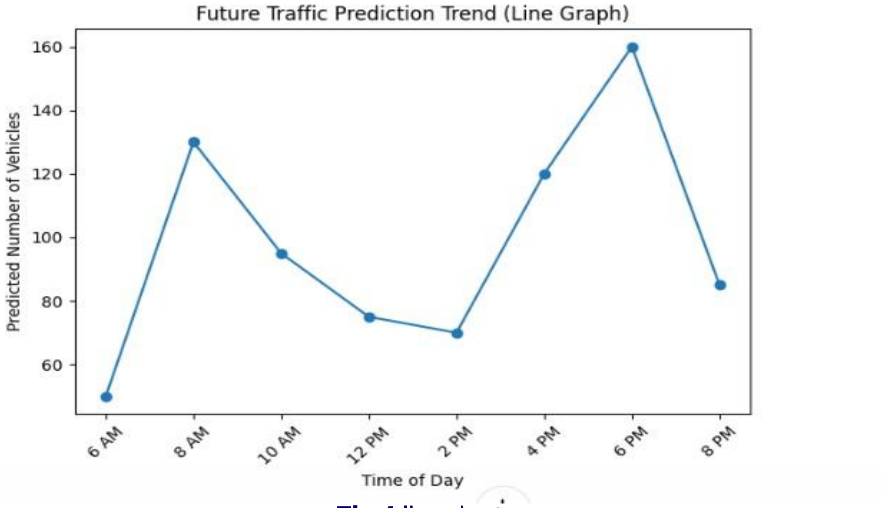


**Fig.4** line chart

After the morning peak, the traffic volume gradually decreases to around 95 vehicles at 10 AM and continues to decline to 75 vehicles at 12 PM and 70 vehicles at 2 PM, indicating moderate traffic conditions during mid-day hours. In the evening period, traffic begins to increase again, reaching approximately 120 vehicles at 4 PM and peaking at around 160 vehicles at 6 PM, which represents the highest traffic congestion level due to evening office closing hours and increased road activity. Finally, traffic volume decreases to around 85 vehicles at 8PM, reflecting reduced vehicle movement during late evening hours. This prediction analysis demonstrates the capability of the proposed system to identify traffic patterns and forecast congestion periods effectively. By utilizing these predictions, traffic authorities can proactively adjust traffic signal timings and implement congestion management strategies. The ability to predict traffic flow helps improve traffic efficiency, reduce waiting time at intersections, and support smarter urban transportation planning. The accuracy of the proposed AI-Based Smart Traffic Management System was evaluated by comparing the number of vehicles detected by the system with the actual number of vehicles present in the traffic video dataset. The system uses computer vision and machine learning algorithms to identify and count vehicles in real-time traffic footage. To measure the performance of the system, multiple traffic video samples were tested under different traffic conditions such as low traffic, medium traffic, and high traffic density. The results indicate that the system is capable of detecting vehicles with high precision and reliability. During the experiment, the system correctly detected most vehicles in the traffic frames with minimal detection errors. The results show that the proposed model achieved an average detection accuracy of approximately 92% to 95%, depending on lighting conditions and traffic density. The results also demonstrate that the prediction module was able to forecast traffic conditions with good reliability by analyzing both present and historical traffic datasets. This improves decision-making for traffic signal control and helps reduce traffic congestion. Overall, the high accuracy of vehicle detection and traffic prediction confirms that the proposed system is effective for real-time traffic monitoring and intelligent traffic signal management.

**Table.1**

| Test Scenario | Total Vehicles | Detected Vehicles | Accuracy |
|---|---|---|---|
| Low Traffic | 120 | 115 | 95.8% |
| Medium Traffic | 210 | 198 | 94.2% |
| Heavy Traffic | 340 | 312 | 91.7% |
| Average Accuracy | - | - | 93.9% |

Although the proposed AI-Based Smart Traffic Management System shows promising results in real-time traffic monitoring and prediction, several improvements can be implemented in the future to enhance the system's performance and scalability. In the future, the system can be integrated with Internet of Things (IoT) device**s** to improve real-time data collection from multiple road intersections. By installing additional smart sensors and connected cameras, traffic information can be gathered more accurately and transmitted instantly to the central processing system. Another important enhancement is the use of advanced deep learning models for vehicle detection and traffic prediction. More sophisticated algorithms can improve detection accuracy under challenging conditions such as low lighting, heavy rain, or dense traffic congestion. The system can also be expanded to support city-wide traffic management by connecting multiple intersections through a centralized traffic control platform. This would allow traffic authorities to monitor and control traffic signals across the entire city from a single dashboard. In addition, future versions of the system can include emergency vehicle priority detection. When an ambulance, fire truck, or police vehicle is detected, the system can automatically provide a green signal to ensure faster movement through intersections. The above bar chart represents the Traffic Volume Analysis at an Intersection at different time intervals throughout the day. The x-axis indicates the time of day, while they-axis shows the number of vehicles detected by the traffic monitoring system.

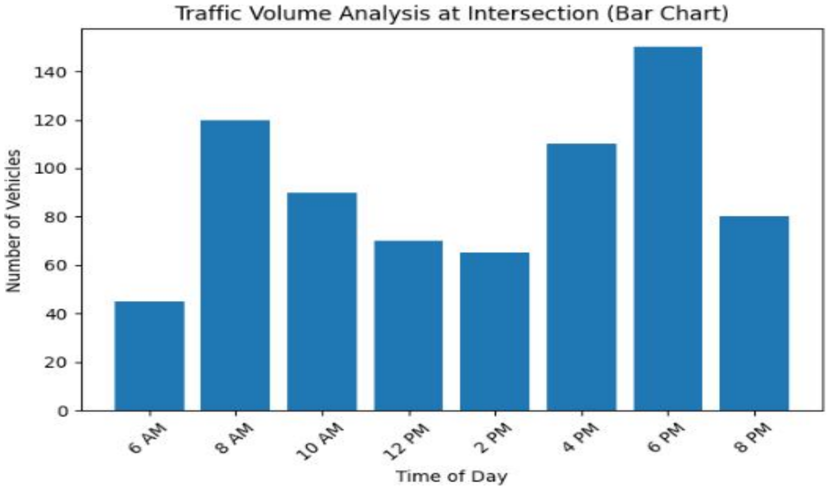


**Fig.5** Bar chart

This visualization helps in understanding the variation in traffic density during different hours and assists in identifying peak and non-peak traffic periods. According to the graph, the traffic volume is relatively low at 6AM, with approximately 45 vehicles, which indicates minimal road usage during early morning hours. A significant increase in traffic is observed at 8AM, where the vehicle count rises to around 120 vehicles. This increase represents the morning peak hour, when people travel to workplaces, schools, and other daily activities. After the morning rush, traffic flow decreases to about 90 vehicles at 10 AM and further drops to around 70 vehicles at 12 PM, reflecting moderate traffic conditions during the late morning period.Duringtheearlyafternoonat2PM,thetrafficvolume slightly decreases to around 65 vehicles, indicating relatively smooth traffic movement. The traffic density begins to rise again in the late afternoon, reaching approximately 110 vehicles at 4 PM, as people start returning from offices and educational institutions. The highest traffic volume occurs at 6PM, with around 150 vehicles, which represents the evening peak hour and indicates heavy congestion at the intersection. After this peak period, the traffic volume gradually decreases to around 80 vehicles at 8 PM, suggesting reduced road usage during late evening hours. This analysis highlights clear traffic patterns throughout the day and demonstrates how the proposed smart traffic management system can utilize such data to optimize signal timing. By identifying peak congestion periods, the system can allocate longer green signal durations to heavily congested lanes and reduce waiting time at intersections. Such data- driven insights improve traffic flow efficiency, reduce fuel consumption, and support better urban traffic planning within smart city environments.

## VI. CONCLUSION

Traffic congestion has become a major challenge in modern urban transportation systems due to the increasing number of vehicles and the limitations of traditional fixed-time traffic signal systems. In this project, an AI-Based Smart Traffic Management System with Real-Time Dashboard and Traffic Prediction was proposed to improve traffic flow and reduce congestion at road intersections. The system uses traffic cameras and sensors to collect real-time traffic data and applies computer vision techniques to detect and count vehicles. Based on the detected vehicle density, the system dynamically adjusts traffic signal timings, allowing more time for heavily congested lanes. This intelligent approach helps reduce vehicle waiting time, improve traffic efficiency, and minimize fuel consumption and air pollution. In addition to real-time traffic monitoring, the developed dashboard provides three main functionalities: Present Traffic Analysis, Past Traffic Data Analysis, and Future Traffic Prediction. These modules allow traffic authorities to monitor current traffic conditions, analyze historical traffic patterns, and predict future traffic flow using machine learning techniques. The experimental results demonstrate that the proposed system achieves highaccuracyinvehicledetectionandtrafficpredictionwhileimproving the overall efficiency of traffic signal management. By combining real- time monitoring, historical data analysis, and predictive analytics, the system provides an effective solution for intelligent traffic control. Traffic congestion has become a major challenge in modern urban transportation systems due to the increasing number of vehicles and the limitations of traditional fixed-time traffic signal systems. In this project, an AI-Based Smart Traffic Management System with Real-Time Dashboard and Traffic Prediction was proposed to improve traffic flow and reduce congestion at road intersections. The system uses traffic camerasandsensorstocollectreal-timetrafficdataandappliescomputer vision techniques to detect and count vehicles. Based on the detected vehicle density, the system dynamically adjusts traffic signal timings, allowing more time for heavily congested lanes. This intelligent approach helps reduce vehicle waiting time, improve traffic efficiency, and minimize fuel consumption and air pollution. In addition to real-time traffic monitoring, the developed dash board provides three main functionalities: Present Traffic Analysis, Past Traffic Data Analysis, and Future Traffic Prediction. These modules allow traffic authorities to monitor current traffic conditions, analyze historical traffic patterns, and predict future traffic flow using machine learning techniques. The experimental results demonstrate that the proposed system achieves high accuracy in vehicle detection and traffic prediction while improving the overall efficiency of traffic signal management. By combining real- time monitoring, historical data analysis, and predictive analytics, the system provides an effective solution for intelligent traffic control.

ISSN: 2393-9842
https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.05

Furthermore, the proposed system contributes to the development of smart city transportation infrastructure by enabling automated and data-driven traffic management. The integration of artificial intelligence, computer vision, and machine learning technologies allows the system to continuously learn from traffic data and adapt to changing traffic conditions. The centralized dashboard also improves decision-making for traffic authorities by providing clear visualizations and insights into traffic patterns and congestion levels. As a result, the system not only enhances traffic efficiency but also improves road safety and environmental sustainability. Overall, the proposed AI-based traffic management system demonstrates a scalable and intelligent solution that can be implemented in urban areas to supports marter, safer, and more efficient transportation networks.

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