

Smart Traffic Congestion Prediction and Smart Lights Using Mobile Application

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ABSTRACT

Traffic congestion is a major problem in urban areas worldwide, leading to wasted time, increased fuel consumption, and environmental pollution. The Traffic Congestion Prediction and Smart Lights Mobile Application is designed to address these issues by predicting traffic conditions in real time and dynamically controlling traffic signals. The system integrates mobile application technology, IoT devices, and predictive algorithms to provide an efficient and user-friendly traffic management platform. Key features include vehicle registration, real-time traffic monitoring, congestion prediction, and smart traffic light control. By optimizing traffic flow and reducing delays, the system improves urban mobility and road safety. Future developments could include advanced machine learning algorithms, city-wide traffic integration, and emergency vehicle prioritization.

Traffic congestion has become a major challenge in modern urban areas, leading to increased travel time, fuel consumption, and environmental pollution. The Traffic Congestion Prediction and Smart Lights Mobile Application provides a practical solution by combining real-time traffic monitoring, predictive analysis, and adaptive traffic signal control. Using mobile technology and IoT-enabled devices, the system allows drivers to register vehicles, view live traffic updates, and receive congestion alerts, while traffic authorities can optimize signal timings based on predicted traffic density. The application classifies traffic into low, moderate, or high congestion levels and adjusts smart traffic lights dynamically to improve flow and reduce delays. By integrating predictive algorithms, real-time data collection, and user feedback, this system aims to

enhance road safety, minimize travel time, and contribute to the development of smart city traffic management solutions.

improves traffic management efficiency, reduces travel time, minimizes fuel consumption, and supports smart city initiatives. The experimental results show that the proposed approach effectively reduces traffic congestion and enhances overall road utilization.

Keywords:- Traffic Congestion, Smart Traffic Lights, Mobile Application, Machine Learning, Real-Time Traffic Monitoring, Intelligent Transportation System

1. INTRODUCTION:

Urban traffic congestion has become increasingly problematic due to population growth, urbanization, and the rise in the number of vehicles on roads. Congestion not only wastes time but also increases fuel consumption, causes air pollution, and leads to road accidents. Traditional traffic management relies on fixed-time traffic signals, which are inefficient because they cannot respond to dynamic changes in traffic density.

The proposed system combines mobile technology, IoT devices, and predictive algorithms to address these issues. The mobile application allows drivers and traffic authorities to register vehicles, monitor

Traffic congestion prediction plays a vital role in proactive traffic control by estimating congestion levels before they occur. Accurate prediction enables authorities to take timely actions such as dynamic signal control and route diversion.

This paper presents a Traffic Congestion Prediction and Smart Traffic Light Control System implemented

through a mobile application. The proposed system collects real-time traffic data from mobile users and historical traffic datasets. Machine learning algorithms analyze traffic density and flow patterns to predict congestion levels as low, medium, or high. Based on these predictions, traffic signal timings are dynamically adjusted to optimize traffic flow at intersections.

The mobile application provides users with real-time traffic updates, congestion alerts, and alternative route suggestions. This system aims to reduce traffic delays, improve road utilization, minimize fuel consumption, and enhance overall transportation efficiency. The proposed solution demonstrates an effective, low-cost, and scalable approach for modern intelligent transportation systems.

II. LITERATURE REVIEW:

The concept of smart traffic management has gained significant attention in recent years due to the growing challenges of urban congestion. Arif and Khan (2020) explored IoT-based intelligent traffic management systems, demonstrating that real-time monitoring of vehicles and intersections could optimize traffic flow. Their study emphasized the integration of sensors and traffic lights to reduce waiting times at congested intersections, highlighting the potential of IoT devices in urban traffic systems.

Chen and Li (2019) focused on using machine learning techniques for traffic flow prediction. Their research showed that historical traffic data combined with real-time inputs could accurately forecast congestion levels. Algorithms such as decision trees and neural networks were used to classify traffic density as low, moderate, or high. This predictive approach helps traffic authorities make data-driven decisions and dynamically manage traffic signals, improving overall efficiency.

Kumar and Singh (2021) implemented a mobile application-based smart traffic lights control system. Their simulation results demonstrated a reduction in waiting time and improved traffic movement at intersections. Similarly, Zhang et al. (2017) applied data mining and AI techniques to urban traffic prediction, providing insights into optimizing signal timings. However, previous studies often focused on either IoT implementation or traffic prediction alone, and few combined vehicle registration, real-time monitoring,

and dynamic traffic light control in one integrated platform. The current project addresses this gap by offering a complete smart traffic management solution, combining these technologies into a single mobile application system.

Mobile Application for Traffic Monitoring

Some researchers developed mobile applications that provide real-time traffic updates to users. These applications collect traffic information from GPS data and sensors to inform drivers about traffic conditions, roadblocks, and congestion. Drivers can then choose alternative routes to avoid traffic jams.

AI-Based Traffic Congestion Detection

Artificial Intelligence techniques are used to analyze live traffic data collected from cameras and sensors. AI models detect congestion patterns and help authorities take preventive actions. Such systems improve traffic management efficiency and reduce delays in urban areas.

III. SYSTEM ARCHITECTURE:

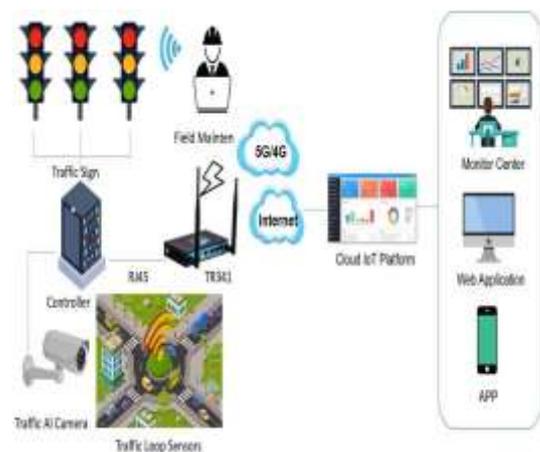


Figure:- System Architecture Diagram

The proposed system consists of four main components: Mobile Application, Data Collection Module, Congestion Prediction Module, and Smart Traffic Light Control Module. The mobile application collects real-time traffic data such as user location, speed, and traffic density from multiple users. Historical traffic data is also stored in the database for analysis.

The congestion prediction module uses machine learning algorithms to analyze real-time and historical data and classify traffic conditions as low, medium, or high congestion. Based on the predicted congestion level, the smart traffic light control module dynamically

adjusts signal timings at intersections to optimize traffic flow.

The system also provides real-time traffic updates and congestion alerts to users through the mobile application. This integrated architecture improves traffic efficiency, reduces waiting time, and supports intelligent transportation and smart city systems.

IV. FEEDBACK LOOP

A feedback loop is a fundamental concept in control systems and process management. It is a mechanism in which the output of a system is measured and fed back as input to control, adjust, or improve the system's future behavior. Feedback loops are essential in many engineering, biological, and social systems because they provide self-regulation, adaptability, and optimization.

In the context of traffic congestion prediction and smart traffic lights, feedback loops ensure that traffic light operations respond dynamically to real-time traffic conditions instead of following fixed schedules.

IV. CONCLUSION

The project on Traffic Congestion Prediction and Smart Traffic Lights Control Using Mobile Application successfully demonstrates how modern technologies can be applied to urban traffic management. By integrating real-time traffic data collection, machine learning-based prediction, smart traffic light control, and a forward-back feedback loop, the system dynamically adjusts traffic signals to optimize vehicle flow.

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