AegisCity: Shielding Lives With Smart Infrastructure

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Abstract: Traffic congestion and road safety are serious challenges in urban areas, especially during emergency situations. This project uses IoT technology to manage traffic signals intelligently by adjusting signal timing based on real-time vehicle density, while also supporting normal signal operation when needed. To reduce delays for emergency vehicles, an RFID based system is used to detect ambulances and give them priority at traffic signals. Additionally, ultrasonic sensors are used to detect open or damaged manholes on the road and provide alerts to ensure safe movement for ambulances. By combining smart traffic control, emergency vehicle priority, and road hazard detection, the system helps improve traffic flow, reduce response time during emergencies, and enhance overall road safety.

Key Words: *Intelligent Traffic Management, Internet of Things (IoT), Traffic Signal Control, Emergency Vehicle Priority, RFID System, Vehicle Density Detection, Ultrasonic Sensors, Road Safety, Smart Transportation System..*

INTRODUCTION

Traffic congestion and road safety have become major challenges in modern cities. With the increasing number of vehicles on the road, fixed-time traffic signals are often unable to handle changing traffic conditions. This leads to long waiting times, traffic jams, and delays, especially during emergency situations where quick movement is very important.

Emergency vehicles such as ambulances often get stuck in traffic, which can delay medical assistance and increase the risk to human life. At the same time, road hazards like open or damaged manholes pose serious safety threats, particularly during emergencies. Traditional traffic systems do not have proper mechanisms to handle these situations efficiently.

Advancements in Internet of Things (IoT) technology make it possible to collect real-time traffic data and control traffic signals intelligently. By using sensors and automated decision-making, traffic flow can be improved and emergency vehicles can be given priority. This project proposes an IoT-based intelligent traffic management system that adjusts traffic signal timings based on vehicle density, provides priority to ambulances using RFID technology, and detects road hazards using ultrasonic sensors. The main aim of the system is to reduce traffic congestion, improve emergency response time, and enhance overall road safety.

LITERATURE SURVEY

Several research works published in **IEEE journals and conferences** have focused on improving traffic management systems using IoT and intelligent control techniques. These studies aim to reduce traffic congestion, improve road safety, and ensure faster movement of emergency vehicles in urban areas.

Karmakar et al. proposed a smart traffic control system that provides priority to emergency vehicles by dynamically adjusting traffic signals. Their IEEE Sensors Journal study shows that sensor-based priority systems can significantly reduce ambulance waiting time at intersections. This work highlights the importance of automated decision-making in traffic control.

Awan et al. presented an IoT-based emergency vehicle priority system using a self-organizing traffic control approach. Published in IEEE Access, the system allows traffic signals to adapt automatically

based on emergency vehicle detection. Their research proves that IoT platforms are effective in managing real-time traffic conditions. Raman et al. introduced a hybrid framework designed specifically for Indian road conditions to speed up emergency vehicle movement. Their IEEE conference paper emphasizes the need for intelligent traffic systems in densely populated cities and supports the use of RFID and sensor technologies for signal control.

Several IEEE conference papers have also explored traffic density-based signal timing control using sensors such as ultrasonic and infrared sensors. These studies show that real-time vehicle density detection helps reduce congestion and improves traffic flow during peak hours. YOLO-based and sensor-driven systems have been found to provide faster and more reliable results. Other IEEE research highlights the role of communication technologies such as VANET and traffic signal preemption for emergency vehicles. These studies support the concept of giving priority to ambulances and emergency services at intersections. However, most existing systems focus mainly on traffic control and give limited attention to road hazards. From the literature, it is observed that while many systems address traffic congestion and emergency vehicle priority, fewer solutions integrate road hazard detection, such as open or damaged manholes. The proposed system builds upon existing IEEE research by combining intelligent traffic signal control, RFID-based emergency vehicle priority, and road safety monitoring to create a more comprehensive and practical solution.

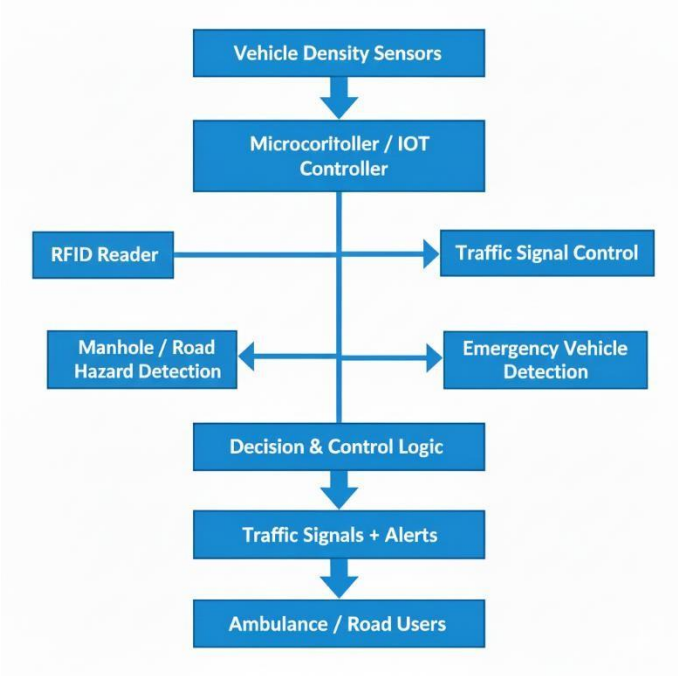
METHODOLOGY

The proposed system follows a step-by-step process to detect animals and generate alerts in real time. A webcam is installed in the monitoring area to continuously capture live video footage. The video stream is divided into individual frames, which are preprocessed to enhance image quality and reduce noise caused by lighting or environmental conditions.

These frames are then passed to a machine learning–based animal detection model, which analyzes important visual features to identify the presence of animals. Once an animal is detected, the system classifies the animal and generates detection details such as the time and location of occurrence. Confidence scores from the model are also checked to ensure reliable detection.

The generated detection information is forwarded to the Django-based web application, which manages user authentication and data handling. All detection records are stored securely in a database, allowing users to view past detections through the dashboard. When a dangerous animal is identified, the email alert module is triggered to notify all registered users instantly. This approach provides continuous monitoring, improves response time, and helps in reducing human–wildlife conflict.

BLOCK DIAGRAM



The block diagram represents an IoT-based intelligent traffic management system designed to improve traffic flow and road safety. Vehicle density sensors collect real-time traffic data and send it to the microcontroller or IoT controller, which analyzes the traffic conditions and adjusts traffic signal timings accordingly. This helps reduce congestion by allocating signal time based on actual vehicle density rather than fixed timings.

In addition, an RFID reader is used to detect emergency vehicles such as ambulances and give them priority at traffic signals. Road hazard sensors monitor conditions like open or damaged manholes and send alerts to ensure safer movement. All sensor inputs are processed by the decision and control logic, which controls traffic signals and generates

alerts, ensuring smooth traffic flow and quick passage for emergency vehicles and other road users.

OBJECTIVE

- To design an intelligent traffic management system using IoT technology.
- To monitor real-time vehicle density and adjust traffic signal timings dynamically.
- To provide priority to emergency vehicles such as ambulances using RFID technology.
- To detect road hazards like open or damaged manholes to improve road safety.
- To reduce traffic congestion and minimize delays during emergency situations.
- To improve overall traffic flow and ensure safe movement for all road users.

PROBLEM DEFINATIONS

Urban areas face serious challenges due to traffic congestion and road safety issues, especially during emergency situations. Conventional traffic signal systems operate on fixed timings and cannot adapt to real-time traffic conditions or prioritize emergency vehicles. Additionally, road hazards such as open or damaged manholes increase the risk of accidents. Hence, there is a need for an intelligent traffic management system that can dynamically control traffic signals, provide priority to emergency vehicles, and improve overall road safety.

FUCTIONAL REQUIREMENTS

1. The system shall monitor real-time vehicle density using traffic sensors.
2. The system shall dynamically adjust traffic signal timings based on traffic conditions.
3. The system shall detect emergency vehicles using an RFID-based identification system.
4. The system shall provide priority passage to ambulances at traffic signals.
5. The system shall detect road hazards such as open or damaged manholes and generate alerts.

NON FUCTIONAL REQUIREMENTS

1. The system should operate in real time with minimal delay in decision making.
2. The system should be reliable and function continuously under varying traffic conditions.
3. The system should be scalable to support multiple intersections.
4. The system should ensure secure and accurate processing of sensor data.
5. The system should be easy to maintain and adaptable to future upgrades.

CONCLUSION

This project presents an IoT-based intelligent traffic management system designed to improve traffic flow and enhance road safety in urban areas. By using realtime vehicle density sensing, the system dynamically adjusts traffic signal timings to reduce congestion. The inclusion of RFID-based emergency vehicle detection ensures priority passage for ambulances, helping to minimize response time during emergencies. Additionally, road hazard detection improves overall safety for road users. The proposed system provides an effective and reliable solution for managing traffic efficiently and supporting emergency services in smart city environments.

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