

SMART TRAFFIC MANAGEMENT SYSTEM FOR URBAN CONGESTION

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ABSTRACT:

This project introduces a smart traffic management system that improves traffic flow at a four-way junction using a camera and RFID technology. A camera is placed at the signal to monitor traffic in real time and detect which road has more vehicles. Based on the traffic density, the system automatically gives priority to the road with heavy traffic and clears it first. The system also supports emergency vehicles like ambulances, fire engines, and police vehicles. These vehicles have RFID tags, and when they come near the signal, the RFID reader detects them and sends information to the control unit. The signal timing is immediately changed to clear the way for the emergency vehicle. This system helps reduce traffic congestion, improve road safety, and allows fast movement of emergency services, making it useful for smart city development.

KEYWORDS

Smart Traffic control, Urban Congestion, Real-Time traffic control monitoring, Traffic Density Detection, Intelligent signal control, Arduino Uno, Ultra sonic sensor, RFID Technology, Emergency vehicle Priority, Automation Fuel Efficiency, Air pollution Reduction.

INTRODUCTION:

Traffic congestion is increasing in many cities because the number of vehicles is growing every day. Traditional traffic signals use fixed timing, which cannot manage heavy traffic properly. This leads to long waiting times, fuel waste, and air pollution.

A Smart Traffic Management System is designed to solve this problem. It uses sensors and cameras to monitor traffic in real time. Based on vehicle density, the signal timing changes automatically. This system helps reduce congestion and improve road safety.

TYPES OF METHODS FOR IMPLEMENTATION

ARDUINO:

Arduino is a small electronic board. It is used to control lights, motors, and sensors. We can write a simple program and upload it to the board. It is used in projects like smart traffic systems and robots.

RFID: (Radio Frequency Identification)

RFID is a technology used to identify objects using radio signals. It has two parts: tag and reader. The reader reads information from the tag without touching it. It is used in ID cards and toll gates.

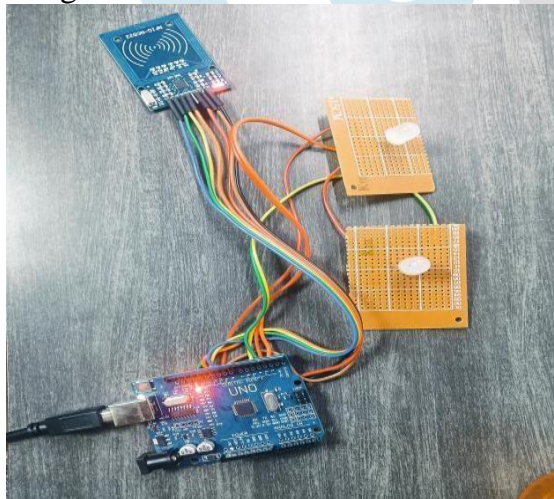


Fig.1

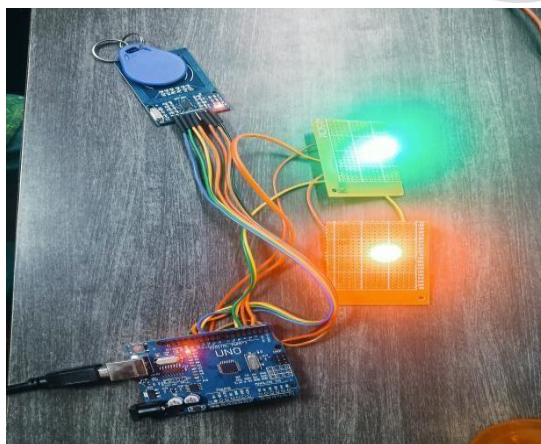


Fig.2

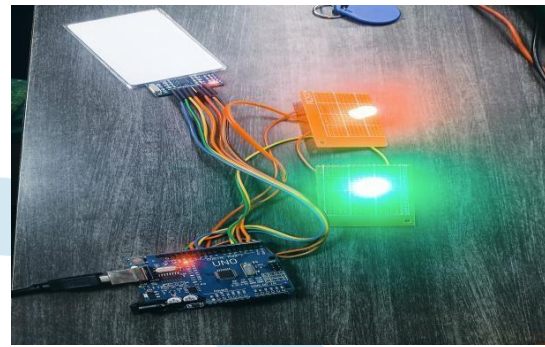


Fig.3

Existing System

The existing traffic management system in urban areas mainly works using fixed-time traffic signals. The signals change based on a pre-set timer without considering the actual traffic density on the road. During peak hours, this system causes heavy congestion because it does not adjust according to the number of vehicles. Traffic police sometimes manually control the signals to manage traffic flow.

CCTV cameras are used only for monitoring purposes and not for intelligent decision-making. Emergency vehicles like ambulances often face delays, and air pollution levels are not monitored in real time. Due to these limitations, the existing system leads to traffic jams, fuel wastage, increased pollution, and longer waiting times at signals.

PROPOSED SYSTEM

The proposed system introduces an intelligent, automated, and adaptive traffic management solution using computer vision and RFID technology to overcome the limitations of traditional traffic control methods. A camera installed at the intersection continuously captures real-time traffic footage, and image-processing algorithms analyze vehicle density in each direction. Based on the detected congestion level, the system dynamically

adjusts traffic signal timings to prioritize busier lanes, ensuring smoother vehicle flow and reduced waiting time.

To improve emergency response, the system incorporates RFID-based vehicle priority management. Emergency vehicles such as ambulances, fire engines, and police vehicles are equipped with RFID tags.

When any such vehicle approaches the junction, an RFID reader placed near the traffic signal detects the tag instantly. The detection is sent to the control unit, which immediately overrides the current signal cycle and clears the lane for the emergency vehicle, minimizing delays during critical situations.

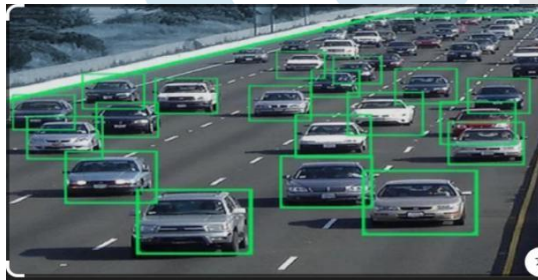


Fig.4

The proposed system eliminates manual interference and provides a reliable, efficient, and intelligent method for traffic regulation. By combining vision-based traffic density estimation with RFID-based emergency detection, the system offers greater accuracy, faster response, improved safety, and is well suited for modern smart-city applications.

Advantages of proposed system

- **Reduced Traffic Congestion:** Real-time traffic density analysis helps optimize signal timing and reduce delays.
- **Fast Emergency Clearance:** RFID detection ensures immediate response for

ambulances, fire engines, and police vehicles.

- **Improved Road Safety:** Avoids traffic buildup and minimizes the chances of accidents at busy intersections.
- **Automation:** Operates without human intervention using AI, sensors, and RFID technology.
- **Scalability:** Can be expanded to multiple intersections and integrated with smart city platforms.
- **Cost-Effective:** Uses readily available components like cameras and RFID modules.

METHODOLOGY

The methodology of the proposed intelligent traffic management system involves a sequence of hardware and software processes that work together to detect traffic density, identify emergency vehicles, and control traffic signals intelligently. The system deployment begins with installing a camera module at the four-way intersection to capture continuous real-time video footage. This video input is processed using computer vision algorithms that detect vehicles and calculate the density of traffic in each lane.

Image-processing techniques such as frame extraction, object detection, contour analysis, and region segmentation are used to estimate congestion levels accurately.

Simultaneously, an RFID subsystem is deployed to detect emergency vehicles. Each ambulance, fire engine, or police vehicle is equipped with an RFID tag. As the vehicle approaches the intersection, an RFID reader installed near the traffic pole detects the tag's unique ID. This data is transmitted to the system's microcontroller or processing unit, which

recognizes the emergency condition and triggers a priority response.

The control unit acts as the decision-making module. It receives input from both the camera-processing system and the RFID module. Based on traffic density analysis, the control unit dynamically adjusts signal timings, giving extended green time to heavily congested lanes. When an emergency vehicle is detected, the control unit immediately overrides the normal cycle and provides a dedicated green signal to that direction. Signal lamps are driven using relays or electronic drivers to ensure reliable switching.

Finally, the system updates traffic flow continuously, repeating the cycle in real time. The integration of camera vision and RFID detection ensures that both common traffic situations and emergency scenarios are handled automatically, efficiently, and with minimal human involvement.

APPLICATIONS

- **Urban Traffic Control Systems** for smart cities.
- **Emergency Vehicle Priority Management** at busy junctions.
- **Automated Traffic Monitoring** in metropolitan and semi-urban areas.
- **Integration with Intelligent Transportation Systems (ITS)** for centralized control.
- **Industrial Area Traffic Regulation** where critical vehicles require priority.

CONCLUSION

In conclusion, the intelligent traffic management system helps reduce traffic congestion and improves road safety. By using a camera, the system monitors real-time traffic and gives priority to the road with heavy vehicles. With the help of RFID technology, emergency vehicles like ambulances and fire engines can pass quickly without delay. This automatic system reduces waiting time, saves fuel, and supports faster emergency response. Therefore, it is very useful for modern smart cities.

REFERENCES

- [1]. Juniardi nur Fadila, Nur Haliza Abdul Wahb, Ahmad Alshammari Ali Aqarni, Arafat Al-Dhaqm, And Norshakirah Aziz, "Comprehensive Review of Smart Urban Traffic Management in the Context of the Fourth Industrial Revolution" IEEE Access, Vol.12, 31 dec 2024 (juniardi@graduate.utm.my)
- [2]. Arjun K, Manoj Kumar HK, Preethi, Bhargavi K, Swaroop K Gudigar, "Smart Traffic Management System Using Iot" Vol 3, 2024 arjun.k.shetty.cs@gmail.com, manojkumarhk@gmail.com, preethipkr2@gmail.com, haru.258@gmail.com, swaroopkgudugar123@gmail.com
- [3]. Bharti Kumari, Vinod Mahor "Review: Smart Traffic Management System" Published in International Journal of Trend in Scientific Research and Development (IJTSRD) ISSN:2456-6470, Vol 6, Issue-5, Aug 2022, pp.1118-1125, URL: www.ijtsrd.com/papers/ijtsrd50595.pdf
- [4]. Yusuf Patanwala, Advait More, Dashrath Patel Prof. Shaikh, Dr. Varsha Shaikh "Journal of Emerging Technologies And Innovative Research (JETIR) ISSN:2349-5162, Vol 9, Issue-9, April 2022, yusufpatanwal1792@eng.rizvi.edu.in, advaitmo

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dashrath@eng.rizvi.edu.in,

[5]. Kamyadhingra, Hardik Gossian, Bhavya Sharma Maninder BirSingh, "International Journal of Engineering Research And Technology (IJERT)" ISSN: 2278-0181, Vol.9, Issue 05, May 2020
<http://www.ijert.org>

[6]. Giridhar Manikanta S, Malar Selvi G, Surya Narayana Raju K, "International Journal Of Advance Research, Ideas And Innovations In Technology" ISSN: 2454-132X, Vol 5, Issue 2, 2019, Available Online at: www.ijariit.com

[7]. Ansh Sakhuja, "Intelligent Traffic Management System Using Computer Vision And Machine Learning" ISSN: 2454, Vol.09, Issue:05, oct-dec 2023 doi: <https://doi.org/10.36676/irt.2023-v9i5-001>

[8]. Mohanaleela K, Tejaswi, Bhavanich, Gayatri G, "A Smart Approach For Traffic Management" Invention Journal Of Research Technology in Engineering And Management (IJRTEM) ISSN: 2455-3689, Vol.2 Issue:05, May 2018 PP40-43, www.ijrtem.com

[9]. Snehal Naik, Prof. Shruti Patail, "A Review For Traffic Management System Using Different IOT Devices" International Journal Of Scientific Engineering And Science ISSN(Online): 2456-7361, Vol3, Issue 11, pp.1-4, 2019
<http://ijses.com/all rights reserved>

[10]. Sarjo Das, Priyankar Roychowdhury, "Smart Urban Traffic Management System" Trends In Transport Engineering And Applications ISSN: 2394-7284(Online), Vol 4, Issue 1, TTEA(2017)56-65
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