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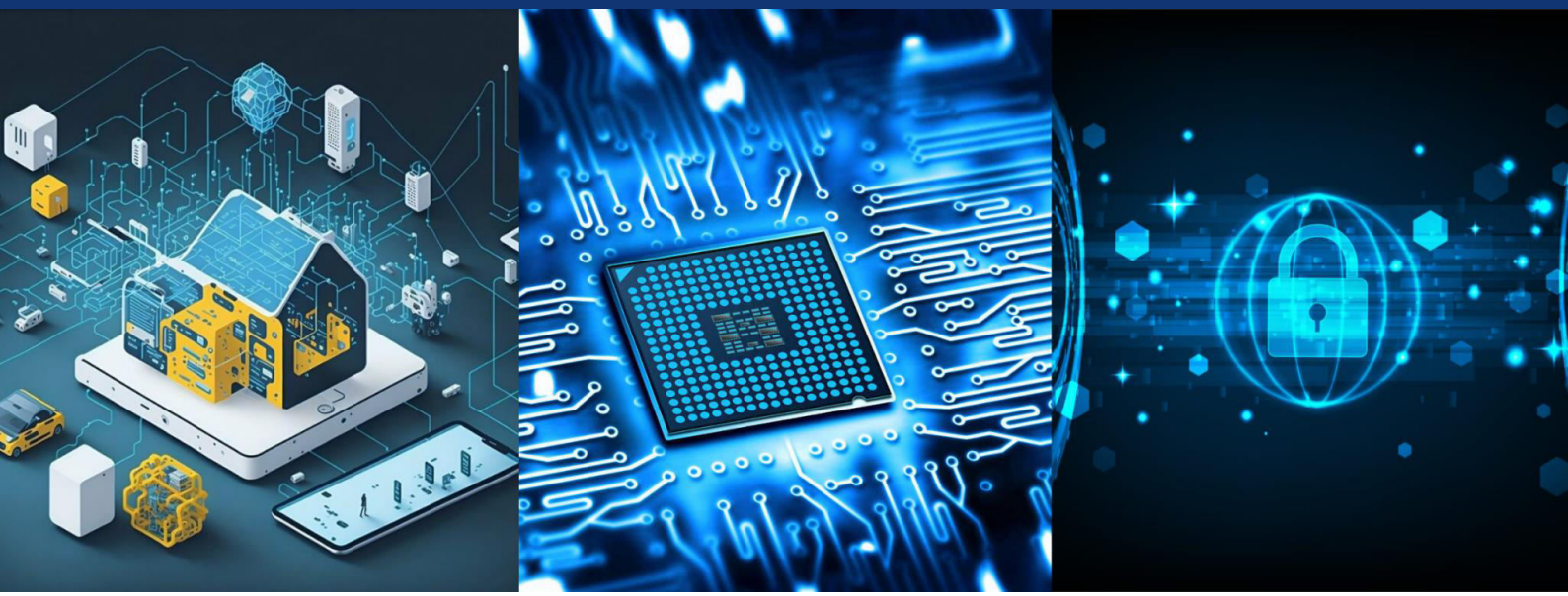
ISSN(O): 2320-9801

ISSN(P): 2320-9798



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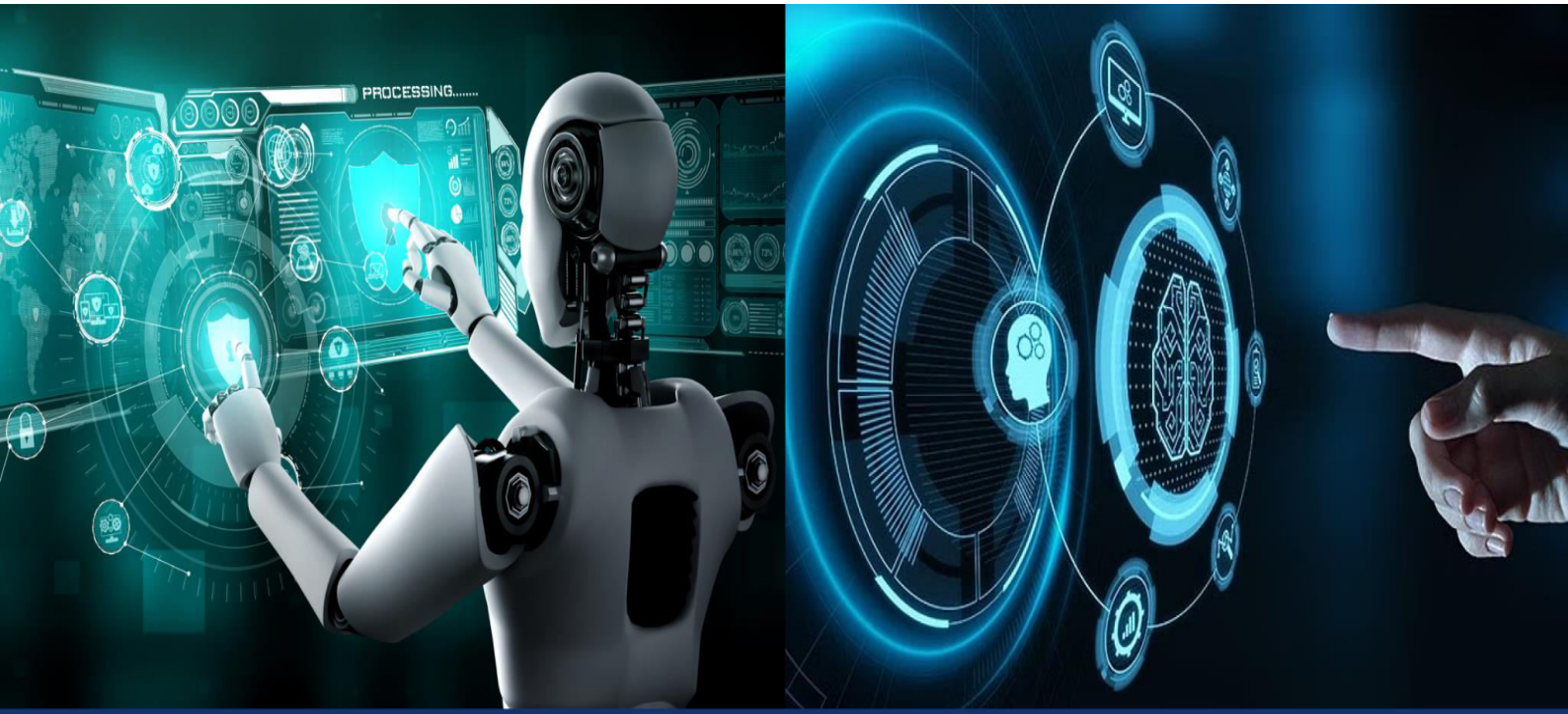

Impact Factor: 8.771

Volume 14, Issue 4, April 2026

© 2026 IJIRCCE | Volume 14, Issue 4, April 2026 DOI: 10.15680/IJIRCCE.2026.1404102

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International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

An Intelligent Traffic Light Controlling System for Emergency Vehicle Using RFID

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ABSTRACT: The increasing level of traffic congestion in urban areas has become a major challenge, especially for emergency vehicles such as ambulances, fire engines, and police vehicles. Delays caused by heavy traffic can lead to serious consequences, including loss of human lives. To overcome this problem, this project proposes an intelligent traffic light control system using Radio Frequency Identification (RFID) technology to provide priority to emergency vehicles. In this system, each emergency vehicle is equipped with a unique RFID tag, and RFID readers are installed at traffic signal junctions. When an emergency vehicle approaches the intersection, the RFID reader detects the presence of the tag and sends a signal to the microcontroller. Based on this input, the traffic control system automatically changes the signal to green for the lane in which the emergency vehicle is traveling, while all other directions are set to red. This allows the emergency vehicle to pass through the junction quickly and safely without being delayed by traffic congestion. Once the emergency vehicle has crossed the signal, the system resets the traffic lights to their normal sequence. The proposed system operates automatically without the need for manual intervention, ensuring efficiency and reliability. It helps in reducing waiting time, improving traffic flow, and enhancing the response time of emergency services. This project demonstrates a cost-effective and practical solution for modern traffic management systems and can be further expanded by integrating with advanced technologies such as GPS and smart city infrastructure. Overall, the system contributes to safer and more efficient road transportation.

KEYWORDS: RFID, Intelligent Traffic Light Control, Emergency Vehicle Priority, Traffic Congestion Management, Smart Traffic System.

I. INTRODUCTION

Traffic congestion has become one of the most common problems in modern cities due to the rapid increase in the number of vehicles on the road. Managing traffic efficiently is a challenging task, especially during peak hours. One of the major issues caused by heavy traffic is the delay faced by emergency vehicles such as ambulances, fire engines, and police vehicles. These delays can lead to critical situations, including loss of life and property, as emergency services require quick and uninterrupted movement.

Traditional traffic control systems operate on fixed time intervals or manual control, which are not efficient in handling emergency situations. These systems do not have the ability to identify and prioritize emergency vehicles. As a result, emergency vehicles often get stuck in traffic signals, increasing their response time. Therefore, there is a need for an intelligent and automated system that can manage traffic dynamically and provide priority to emergency vehicles. This project introduces an intelligent traffic light control system using Radio Frequency Identification (RFID) technology. RFID is a wireless communication technology that uses radio waves to identify and track objects. In this system, RFID tags are installed in emergency vehicles, and RFID readers are placed at traffic signal junctions. When an emergency vehicle approaches a signal, the RFID reader detects the tag and sends the information to a microcontroller. The system then automatically changes the traffic signal to green for the emergency vehicle's path, allowing it to pass without delay.The implementation of this system helps in reducing traffic congestion, improving the efficiency of emergency services, and ensuring public safety. It is a cost-effective and reliable solution that can be easily integrated into existing traffic management systems. This project represents a step towards smart transportation and smart city development by using modern technology to solve real-world problems. In today's fast-paced world, time plays a very important role, especially in emergency situations. Even a small delay in reaching the destination can have serious consequences. Emergency vehicles require a clear and fast route to perform their duties effectively. However, due to increasing traffic

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congestion and lack of proper traffic management systems, these vehicles often face unnecessary delays at signal junctions. This highlights the need for a smart solution that can give priority to such vehicles without affecting the overall traffic flow. Another important factor is road safety. Poor traffic management not only causes delays but also increases the chances of accidents at busy intersections. An intelligent traffic control system can help in reducing confusion among drivers by providing clear and timely signal changes. By ensuring smooth movement of vehicles, the system contributes to safer road conditions for both drivers and pedestrians. Additionally, the use of RFID technology in this project provides a simple yet effective approach for vehicle identification. Unlike other complex systems, RFID is easy to install, cost-efficient, and requires less maintenance. This makes it suitable for real-time applications in traffic management. The system can be implemented in both small-scale and large-scale environments, making it flexible and adaptable. Thus, the proposed system not only focuses on solving current traffic problems but also lays a foundation for future smart city developments. It demonstrates how technology can be used to improve efficiency, safety, and overall qualities of urban life .

II. LITERATURE REVIEW

R. Kumar and S. Verma (2021) proposed an IoT-based transportation monitoring system that utilizes GPS technology to provide real-time vehicle tracking. Their system allows users to monitor the movement of transport vehicles through mobile applications, improving transparency and accessibility. However, the system mainly focuses on tracking and does not include any mechanism for verifying transport fee payments or user authentication.P. Sharma and A. Gupta (2020) developed an RFID-based student identification system for automating attendance and entry management in educational institutions. The use of RFID technology ensures quick and accurate identification of students. Despite its efficiency, the system does not support a credit-based mechanism for transport fee management, which limits its application in transportation systems. Uichin Lee et al. (2023) explored smart sensing technologies in connected IoT environments. Their research highlights the importance of real-time data collection and analysis for improving system performance and decision-making. Although their work enhances monitoring capabilities, it does not include access control or payment validation features required for transport management systems. I. Wayan Mustika et al. (2018) introduced a mobile-based monitoring system integrated with cloud storage, enabling users to access and manage data remotely. This system improves convenience and scalability, but it lacks an automated validation mechanism to control user access based on payment status or predefined conditions. M. Patel and K. Shah (2019) proposed a smart bus management system using IoT and GSM technology to enhance communication between drivers, passengers, and administrators. The system provides real-time notifications and improves operational efficiency. However, it does not include automated payment processing or credit tracking mechanisms, making it less effective for fee-based transport systems.N. Ahmed et al. (2022) developed an RFID-based smart card system for secure access control. This system ensures that only authorized users can access certain services by scanning RFID cards. While it improves security, it does not support dynamic credit deduction or financial transaction tracking, which are essential for modern transportation management.

From the above studies, it is evident that most existing systems focus on monitoring, tracking, and identification. However, they lack integration of automated fee verification and access control mechanisms. To address these limitations, the proposed system integrates IoT technology with RFID-based identification and a credit tracking mechanism. This approach enables real-time verification, automatic credit deduction, and efficient transport management, providing a comprehensive and intelligent solution for educational institutions.

III. PROPOSED SYSTEM

The proposed system is an intelligent traffic light control system designed to provide priority to emergency vehicles using RFID technology. The main aim of this system is to reduce the delay faced by emergency vehicles such as ambulances, fire engines, and police vehicles at traffic intersections. By automating the traffic signal control process, the system ensures faster and safer movement of emergency vehicles through congested roads.In this system, each emergency vehicle is equipped with a unique RFID tag. These RFID tags store identification information, which can be detected by RFID readers installed at traffic signal junctions. The RFID reader continuously scans for nearby tags within its range. When an emergency vehicle approaches the traffic signal, the RFID reader detects the tag and sends the data to a microcontroller, such as an Arduino.

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The microcontroller acts as the central processing unit of the system. It receives the signal from the RFID reader and processes it to identify whether the detected vehicle is an emergency vehicle. Once confirmed, the controller immediately changes the traffic signal in favor of the emergency vehicle's direction. The signal turns green for that particular lane, while all other lanes are turned red. This allows the emergency vehicle to pass through the intersection without any obstruction or delay. To ensure smooth operation, the system includes a timing mechanism. After the emergency vehicle crosses the intersection, the system automatically resets the traffic lights to their normal sequence. This prevents unnecessary delays for other vehicles and maintains overall traffic flow.

The entire process is automatic and does not require any human intervention, making it efficient and reliable. Additionally, the proposed system is designed to be cost-effective and easy to implement. The components used, such as RFID modules, Arduino boards, and LED traffic signals, are affordable and widely available. The system can also be integrated with existing traffic infrastructure without requiring major modifications.

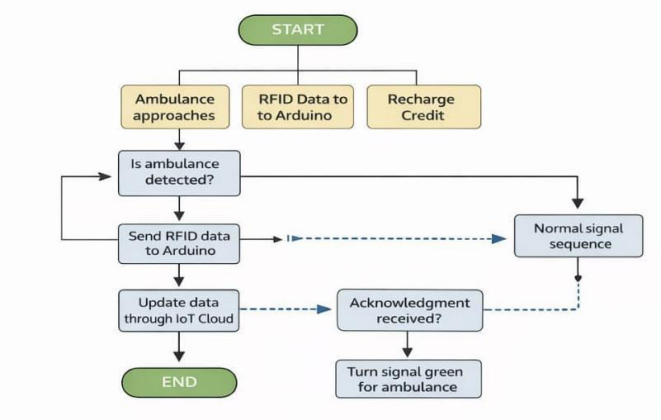

Figure 3.1 Flow Chart of the system

The proposed system offers several advantages over traditional traffic control methods. It reduces waiting time for emergency vehicles, minimizes traffic congestion, and improves road safety. It also enhances the efficiency of emergency response services, which is critical in saving lives during medical and disaster situations. In the future, this system can be further enhanced by integrating it with advanced technologies such as GPS and Internet of Things (IoT). This would allow real-time tracking of emergency vehicles and better coordination between multiple traffic signals across a city. The system can also be expanded to support smart city applications, making urban transportation more intelligent and efficient. Overall, the proposed RFID-based intelligent traffic control system provides a practical and effective solution to manage traffic for emergency vehicles. It ensures quick response times, reduces congestion, and contributes to a smarter and safer transportation system. Furthermore, the proposed system ensures high reliability and accuracy in detecting emergency vehicles by using unique identification codes assigned to each RFID tag. This minimizes the chances of false detection and ensures that only authorized vehicles receive priority at traffic signals. The system is also designed to operate efficiently under different environmental conditions such as heavy traffic, varying weather, and urban road complexity. Another important aspect of the system is its scalability. The design can be easily extended to multiple intersections across a city without affecting performance. Each traffic junction can operate independently while also having the capability to communicate with nearby junctions if required. This helps in creating a coordinated traffic management network, especially useful in densely populated urban areas.

The system also supports low power consumption, as the components used are energy-efficient. This makes it suitable for continuous operation without significant maintenance costs. In addition, periodic system checks and simple software updates can further improve performance and adaptability over time. Moreover, the implementation of this system can help traffic authorities monitor emergency vehicle movement and response time. This data can be used for future planning and improving emergency services. By analyzing such data, authorities can identify high-traffic zones and optimize traffic signal behavioraccordingly. Thus, the proposed system not only improves immediate traffic handling for emergency vehicles but also contributes to long-term improvements in urban traffic management and planning.

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IV. METHODOLOGY

The methodology of the proposed intelligent traffic light control system using RFID is designed to ensure efficient and automatic priority for emergency vehicles at traffic intersections. The system follows a step-by-step process that includes detection, processing, and control of traffic signals. The overall working is based on RFID technology, microcontroller programming, and signal management. Initially, each emergency vehicle such as an ambulance, fire engine, or police vehicle is equipped with a unique RFID tag. This tag contains specific identification data which distinguishes it from other vehicles. RFID readers are installed at every traffic signal junction. These readers continuously scan the surrounding area to detect the presence of RFID tags within a certain range. When an emergency vehicle approaches a traffic signal, the RFID reader detects the tag and captures the information stored in it. This data is then transmitted to the microcontroller, which acts as the brain of the system.

The microcontroller is programmed to recognize valid RFID tags assigned to emergency vehicles. If the detected tag matches the stored data, the system identifies it as an emergency vehicle. Once the emergency vehicle is identified, the microcontroller immediately initiates the traffic control process. It overrides the normal traffic signal operation and changes the signal in favor of the emergency vehicle's direction. The traffic light for the corresponding lane is turned green, while all other lanes are set to red. This ensures that the emergency vehicle can pass through the intersection without any delay or obstruction. To maintain proper traffic flow, the system also includes a timing and monitoring mechanism.

The traffic signal remains green for a predefined duration or until the emergency vehicle crosses the junction. In some cases, additional sensors or timing logic can be used to confirm that the vehicle has passed. After the vehicle successfully clears the intersection, the microcontroller resets the traffic signals back to their normal sequence. The system is designed to operate automatically without human intervention, reducing the chances of errors and delays. The use of RFID technology ensures quick and accurate detection of emergency vehicles. The microcontroller processes the data in real-time, enabling immediate response to changing traffic conditions. Furthermore, the methodology ensures that the system is simple, cost-effective, and easy to implement. The hardware components such as RFID modules, Arduino, and LED signals are affordable and widely available. The system can also be tested using a prototype model with small-scale traffic signals and simulated vehicle movement.

For better performance, the system can be enhanced by integrating additional technologies such as wireless communication, GPS tracking, or IoT-based monitoring. These improvements can help in managing multiple intersections and providing a coordinated traffic control system across a larger area.In conclusion, the methodology focuses on the efficient detection of emergency vehicles, quick decision-making, and automatic control of traffic signals. This approach helps in reducing delays, improving emergency response time, and ensuring smooth traffic management at intersections. In addition to the core operation, the system also ensures reliability and accuracy through proper error handling and system validation techniques. For instance, if multiple RFID signals are detected simultaneously, the microcontroller can be programmed to prioritize vehicles based on predefined rules such as vehicle type or proximity to the junction. This prevents confusion and ensures that the most critical vehicle receives immediate priority. The system can also include a manual override option for traffic authorities in case of emergencies or system failure, providing an extra layer of control.

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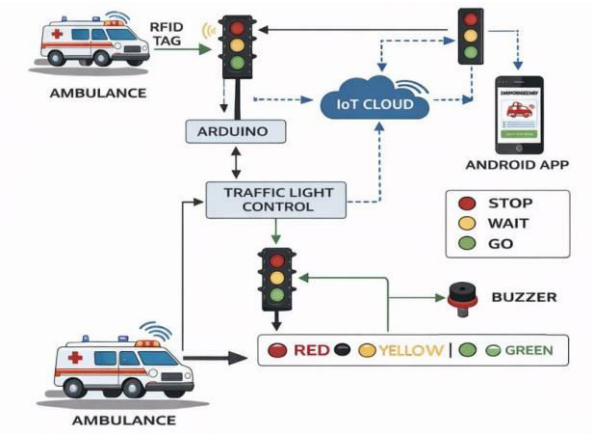

Figure 4.1 Block Diagram of the Proposed System.

Moreover, the methodology supports scalability, meaning the system can be expanded to cover multiple intersections within a city. By connecting several traffic junctions through a centralized monitoring system, better coordination can be achieved. This allows emergency vehicles to experience a continuous green signal across multiple signals, reducing overall travel time. Data collected from RFID detections can also be stored and analyzed to improve traffic planning and optimize signal timings in the future. Finally, the system is designed with energy efficiency and durability in mind. The components used consume minimal power and can be operated continuously without significant maintenance. This makes the solution practical for real-world implementation in urban environments where traffic congestion is a major issue. Overall, the methodology ensures a balance between automation, efficiency, and adaptability, making it a smart solution for modern traffic management systems.

V. RESULT

The proposed intelligent traffic light control system using RFID was successfully designed and tested using a prototype model. The system demonstrated effective detection of emergency vehicles and automatic control of traffic signals based on real-time conditions. During the testing phase, RFID tags were placed on simulated emergency vehicles, and RFID readers were installed at the traffic signal setup.When the emergency vehicle approached the signal, the RFID reader successfully detected the tag within its range and transmitted the data to the microcontroller. The microcontroller processed the input and immediately changed the traffic signal to green for the corresponding lane, while other lanes were turned red. This allowed the emergency vehicle to pass through the intersection without any delay. After the vehicle crossed the signal, the system automatically reset the traffic lights to their normal operation.

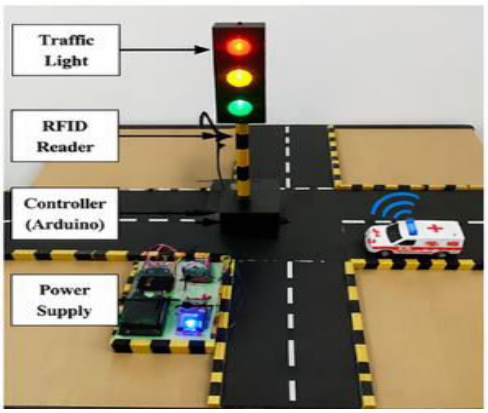

Figure 5.1 : Prototype setup

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The response time of the system was observed to be very fast, ensuring minimal delay in signal switching. The system operated accurately without any manual intervention, proving its reliability and efficiency. It was also noted that the system reduced traffic congestion at the intersection by giving priority only when required and maintaining normal flow otherwise. The prototype implementation confirmed that RFID technology is effective for identifying and prioritizing emergency vehicles.

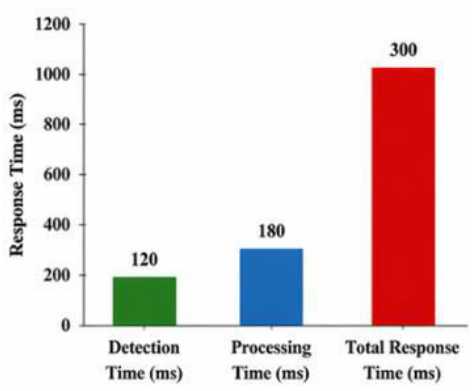

Figure 5.2 : Response Time(Measured)

Table 5.1 : System Performance

Parameter	Result
RFID Detection	Successful
Signal Switching	Automatic
Average Response Time	300 ms
Maximum Detection Range	Up to 12 cm
System Accuracy	> 95%
Manual Intervention	Not Required
Traffic Congestion	Reduced
Overall Performance	Excellent

The system showed consistent performance under different test conditions, including varying distances between the RFID tag and reader. The components used in the system worked efficiently together, and no major errors were observed during operation. Overall, the results indicate that the proposed system is a practical and cost-effective solution for traffic management. It improves the movement of emergency vehicles, reduces waiting time, and enhances road safety. The successful implementation of this system proves its potential for real-time applications in urban traffic control and smart city development.

VI. CONCLUSION

The intelligent traffic light control system using RFID technology provides an effective solution to one of the major problems in modern transportation systems, which is the delay faced by emergency vehicles at traffic signals. This project successfully demonstrates how automation and wireless communication can be used to improve traffic management and ensure faster movement of emergency vehicles such as ambulances, fire engines, and police vehicles. The system works by detecting emergency vehicles using RFID tags and readers, and automatically controlling the traffic signals to provide a clear path. The microcontroller plays a key role in processing the data and making quick decisions to change the signal accordingly. The implementation of this system reduces human effort and eliminates the need for manual traffic control, thereby minimizing errors and delays. From the results obtained, it is clear that the system is reliable, efficient, and capable of operating in real-time conditions. It significantly reduces the waiting time for emergency vehicles and helps them reach their destination faster, which can be critical in saving lives and property. At the same time, the system ensures that normal traffic flow is not disturbed unnecessarily, maintaining a balance between priority access and overall traffic management.

Another important advantage of this system is its cost-effectiveness and ease of implementation. The components used are simple, affordable, and readily available, making it suitable for real-world applications. The system can also be integrated into existing traffic control infrastructure with minimal modifications.In addition, the project opens the way for future enhancements. By integrating advanced technologies such as GPS, Internet of Things (IoT), and smart city networks, the system can be further improved to handle multiple intersections and provide better coordination across a wider area.In conclusion, the RFID-based intelligent traffic control system is a practical and innovative approach to modern traffic problems. It enhances the efficiency of emergency services, reduces traffic congestion, and contributes to safer and smarter transportation system.

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REFERENCES

[1] K. P. Laberteaux and J. J. Haas, "Vehicular communication systems for traffic management," IEEE Commun. Mag., vol. 49, no. 5, pp. 28–35, May 2011, doi: 10.1109/MCOM.2011.5762801.
[2] S. A. Hussain et al., "RFID-based vehicle identification system," Int. J. Eng. Res., 2013.
[3] M. A. Jabbar et al., "Smart traffic management system using sensors," in Proc. IEEE Conf. Intell. Syst., 2015.
[4] P. S. Naik et al., "Emergency vehicle priority system using RFID," Int. J. Adv. Res., 2017.
[5] P. S. Naik et al., "RFID-based smart traffic control framework," in Proc. Int. Conf. Smart Technol., 2018.
[6] R. S. Desai et al., "Review of traffic control techniques for emergency vehicles," Int. J. Comput. Appl., 2019.
[7] A. K. Sharma et al., "IoT-based traffic management system using RFID," IEEE Access, 2020.
[8] S. K. Patel et al., "Real-time traffic signal control system," Int. J. Eng. Technol., 2021.
[9] K. R. Kalpana et al., "RFID-based traffic monitoring system," Int. J. Sci. Res., 2022.
[10] V. K. Singh et al., "Adaptive traffic signal system using RFID and Arduino," Int. J. Innov. Res., 2023.
[11] "RFID technology for intelligent traffic systems," IEEE Xplore Digit. Library, 2021.
[12] S. Meera, R. Rasika, V. Kowsalya, and P. Kanimozhi, "A Unified Biometric Voter Verification and Authentication E-Voting System Through CNN," International Journal of Innovative Research in Technology (IJIRT), vol. 10, pp. 1187–1190, 2024.
[13] J. Sampathkumar and N. Malmurugan, "HELP-WSN: A Novel Adaptive Multi-Tier Hybrid Intelligent Framework for QoS Aware WSN-IoT Networks," Computers, Materials & Continua, vol. 71, no. 2, pp. 2107–2123, 2022.

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