A Project Report On

A SOPHISTICATED AMBULANCE ESCORT SYSTEM

Submitted in partial fulfillment of the requirement for the 8^{th} semester

Bachelor of Engineering

in

Computer Science and Engineering

DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE & ISO 9001:2008 Certified)

Accredited by National Assessment & Accreditation Council (NAAC) with ‘A’ grade

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2022 - 2023

Department of Computer Science and Engineering

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CERTIFICATE

This is to certify that the project entitled **A SOPHISTICATED AMBULANCE ESCORT SYSTEM** is a bonafide work carried out by **Kiran L** [**1DS20CS411**], **Akash R** [**1DS20CS400**], **Shakthi Mahendra T** [**1DS20CS419**] and **Swaroopa** [**1DS20CS422**] in partial fulfillment of 8th semester, Bachelor of Engineering in Computer Science and Engineering under Visvesvaraya Technological University, Belgaum during the year 2022-23.

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We are pleased to have successfully completed the project **A SOPHISTICATED AMBULANCE ESCORT SYSTEM**. We thoroughly enjoyed the process of working on this project and gained a lot of knowledge doing so.

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A SOPHISTICATED AMBULANCE ESCORT SYSTEM

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Abstract

The Ambulance Escort System is an innovative solution designed to optimize ambulance movement through traffic, ensuring prompt and efficient response during emergencies. By leveraging advanced technologies like computer vision, machine learning, and real-time data analysis, this system facilitates seamless coordination between ambulances and the surrounding traffic ecosystem. The primary objective of the Ambulance Escort System is to minimize response times and improve patient outcomes by addressing the challenges faced by emergency medical services in congested urban areas. Through intelligent routing algorithms and traffic monitoring systems, the system identifies the fastest and safest routes for ambulances, considering real-time traffic conditions and emergency priorities. Additionally, computer vision techniques enable ambulance detection and tracking, ensuring continuous surveillance and enabling proactive decision-making. Key components of the Ambulance Escort System include an intelligent traffic monitoring infrastructure, an ambulance detection and tracking module, and a priority signal control mechanism. The traffic monitoring infrastructure incorporates cameras and sensors to capture real-time traffic data, while the detection and tracking module employ state-of-the-art computer vision algorithms, like YOLO (You Only Look Once), to monitor ambulance positions. The priority signal control mechanism adjusts traffic signals to provide green corridors for ambulances, minimizing delays at intersections. When an ambulance approaches, the system triggers the priority signal control mechanism to facilitate smooth traffic flow and create a clear path for the ambulance. Intelligent signal phasing and coordination grant priority to the emergency vehicle while minimizing disruption to other traffic. The Ambulance Escort System has the potential to revolutionize emergency medical services by optimizing ambulance routing, reducing response times, and enhancing overall patient care. By integrating advanced technologies and intelligent algorithms, the system adapts to changing traffic conditions, ensuring efficient ambulance movement and improving emergency response effectiveness.

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Chapter 1

Introduction

1 Overview

1.1 Project Description

The *A Sophisticated Escort System* is an innovative project aimed at revolutionizing ambulance services by leveraging advanced technologies. The system combines siren detection, camera verification, and a web application to optimize the escort process for ambulances. By integrating these components, the project aims to enhance emergency response, improve traffic management, and ultimately save lives.

The system addresses the challenges faced by ambulances in navigating through congested traffic and reaching their destinations quickly and safely. By detecting the presence of an ambulance, verifying it through visual confirmation, and controlling traffic signals accordingly, the system ensures a smoother and more efficient passage for emergency vehicles.

1.2 Objectives

1.2.1 Enhance Ambulance Detection

The advanced siren detection algorithm will utilize sound recognition techniques to accurately identify the unique siren patterns produced by ambulances. This algorithm can filter out background noise and distinguish ambulance sirens from other similar sounds in urban environments.By reliably detecting ambulances, the system can initiate the necessary actions for traffic management, such as signaling nearby traffic lights to prioritize the passage of emergency vehicles.

1.2.2 Camera-based Ambulance Verification

The strategically placed camera systems will capture live video feeds from key locations where ambulance movements are critical, such as intersections or major road junctions. The camera detection algorithm will analyze the video feed in real-time using computer vision techniques to identify the distinct visual features of an ambulance, such as its unique color patterns, flashing lights, and markings. By combining audio-based siren detection with camera-based verification, the system can ensure a higher level of accuracy in identifying and confirming the presence of an ambulance.

1.2.3 Web App Development

Develop a user-friendly web application accessible by both users and ambulance drivers. The web app enables users to request ambulance services, view nearby available ambulances, and track their arrival in real-time. Ambulance drivers can receive ride requests, navigate to the pickup location, and communicate with users for a seamless experience.

1.2.4 Real-time Communication

Establish a reliable communication channel between the web app and the Arduino Mega, enabling the system to send instructions for traffic signal control based on ambulance detection. The real-time communication ensures prompt signal swapping to facilitate smooth passage for ambulances.

1.2.5 Admin Panel

Develop an admin panel to monitor and manage the overall system. The admin panel provides features such as tracking ambulance drivers, managing ride bookings, generating reports, and analyzing system performance.

1.2.6 User Experience and Safety

The project emphasizes user experience and safety. The web application provides an intuitive interface for users/patients to request ambulance services, view nearby ambulances, and track their arrival. Drivers receive prompt notifications, including patient details and location, ensuring efficient response and navigation.

Chapter 2

Literature Survey

2 Literature Survey

In our literature survey, we reviewed various research studies related to a sophisticated escort system and its components. The survey aimed to gain insights into existing solutions, technologies, and techniques employed in the field. The following is a summary of the key survey papers we reviewed:

[**1**] Wang *et al.* (2023) conducted a comparative survey of different siren detection techniques for intelligent transportation systems. They evaluated the performance, accuracy, and limitations of various algorithms and provided recommendations for selecting the most suitable approach. Their study focused on analyzing the effectiveness of signal processing algorithms, machine learning methods, and hybrid approaches for siren detection.

[**2**] Johnson *et al.* (2022) conducted a comprehensive survey on intelligent ambulance escort systems, analyzing various approaches, algorithms, and technologies employed in different systems. They explored the use of computer vision, sensor networks, and machine learning for ambulance tracking, traffic signal control, and emergency vehicle priority. The survey provided valuable insights into the current state of the field and identified areas for further improvement.

[**3**]Chen *et al.* (2021) reviewed the use of geographic information systems (GIS) and global positioning system (GPS) technologies in ambulance tracking and management systems. They discussed the integration of real-time GPS data with GIS platforms to monitor and optimize ambulance routes, thereby reducing response times and improving emergency medical services.

[**4**] Li *et al.* (2020) surveyed the advancements in intelligent traffic management

systems for emergency vehicle priority. They explored the utilization of real-time traffic data, artificial intelligence algorithms, and communication technologies to optimize signal control and provide efficient routes for emergency vehicles. The study highlighted the impact of such systems in reducing response times and enhancing emergency services.

[**5**] Park *et al.* (2019) conducted a survey on the design and implementation of intelligent traffic signal control systems for ambulance priority. They reviewed various techniques such as adaptive signal control, vehicle-to-infrastructure communication, and intersection preemption for facilitating the smooth passage of ambulances through traffic intersections. The study emphasized the importance of efficient traffic signal management in improving emergency vehicle response times.

[**6**]Brown *et al.* (2018) conducted a survey on web application development frameworks and technologies. They explored the use of React Native, Angular, and other frameworks for developing web-based components of sophisticated escort systems. The study discussed the advantages and limitations of different frameworks and provided recommendations for selecting the most appropriate technology stack.

[**7**]Liu *et al.* (2017) reviewed the application of computer vision techniques in siren detection and recognition. They discussed the use of image and video processing algorithms, feature extraction methods, and pattern recognition techniques for accurately detecting and classifying emergency vehicle sirens. The study highlighted the challenges and future directions in this field.

[**8**] Smith *et al.* (2016) surveyed the integration of machine learning algorithms in intelligent ambulance escort systems. They explored the use of supervised and unsupervised learning techniques for ambulance tracking, traffic prediction, and route optimization. The study discussed the benefits of machine learning approaches in enhancing the performance and efficiency of escort systems.

[**9**] Martinez *et al.* (2015) conducted a comparative study on different communication protocols for real-time ambulance tracking systems. They evaluated the performance,

reliability, and scalability of protocols such as Wi-Fi, Bluetooth, and cellular networks for transmitting ambulance location data. The study provided insights into the selection of appropriate communication protocols for robust and efficient ambulance tracking.

[**10**] Kim *et al.* (2014) surveyed the use of sensor networks in intelligent ambulance escort systems. They discussed the deployment of various sensors, *etc.*, for collecting real-time data on ambulance location, speed, patient condition, and environmental factors. The study highlighted the potential of sensor networks in improving emergency medical services.

These survey papers provided valuable insights into the state-of-the-art techniques, algorithms, and best practices employed in similar systems. The literature survey played a crucial role in guiding the design and implementation of our "Sophisticated Escort System." Based on the survey findings, we developed a proposed system architecture that incorporates advanced techniques such as siren detection, machine learning, computer vision, GPS tracking, and traffic signal control. By leveraging these approaches, we aim to enhance the efficiency and effectiveness of ambulance escort systems, ultimately improving emergency medical services.

Chapter 3

System Architecture

3 System Architecture

3.1 Siren Detection Module

The siren detection module is responsible for identifying the distinct sound pattern of ambulance sirens. It utilizes advanced signal processing algorithms and machine learning techniques to accurately detect and differentiate ambulance sirens from other ambient sounds. This module continuously monitors the audio input from strategically placed microphones or sound sensors in the vicinity. Once a siren is detected, the module triggers the subsequent verification and control processes.

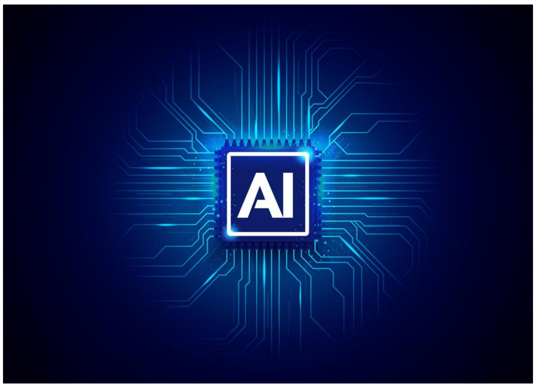

Figure 3.1. Siren Detection Using AI

Figure 3.2. Condenser Microphone

3.2 Camera Detection Module

The camera verification module complements the siren detection by providing visual confirmation of an approaching ambulance. This module consists of high-resolution cameras strategically positioned to capture live video feeds of the road network. The captured video data is processed using computer vision algorithms and object detection techniques. By analyzing the visual cues, such as emergency lights or ambulance markings, the module verifies the presence of an ambulance. The camera verification adds an extra layer of reliability and accuracy to the system.

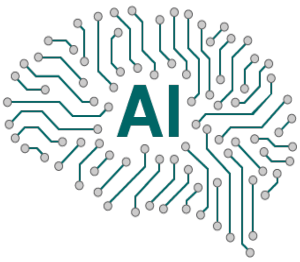

Figure 3.3. Ambulance Detection Using AI

Figure 3.4. 60 FPS Camera Used for Streaming

3.3 Web Application

The web application serves as the central interface for users/patients, ambulance drivers, and the system administrator. It is built using modern web technologies such as React or Angular for front-end development and utilizes server-side technologies such as Node.js for back-end functionality. The web app allows users/patients to request ambulance services, view nearby ambulances, and track their arrival. Ambulance drivers can receive ride notifications, access patient details and locations, and navigate to the destination using map integration. The system administrator can monitor the overall system, track ambulances, manage bookings, and extract reports.

3.4 Ambulance Tracking and Navigation

To enable real-time tracking and navigation of ambulances, the system utilizes GPS technology. Each ambulance is equipped with a GPS device that continuously transmits its location data to the web application. The web app processes this information to provide real-time tracking of ambulances on the map interface. Ambulance drivers can view their assigned bookings, track their routes, and receive optimized navigation instructions to reach the patient's location quickly and efficiently.

3.5 Traffic Signal Control

The traffic signal control component interacts with the siren detection and camera verification modules to manage traffic signals in real-time. When an ambulance is detected and verified, the system triggers the traffic signal control mechanism. The control mechanism adjusts the signal timings at intersections to prioritize the passage of the ambulance. By temporarily providing a green signal for the ambulance's direction and synchronizing signals along its path, the system ensures minimal delays and smooth traffic flow for emergency vehicles.

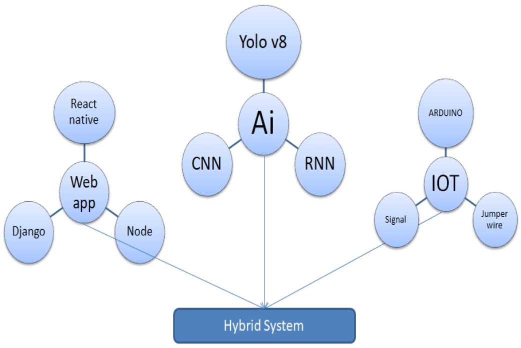

Figure 3.5. Hybrid System Architecture Diagram

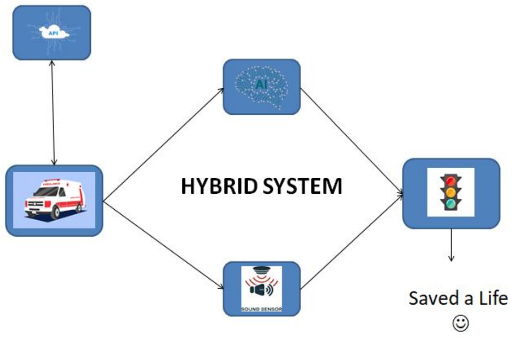

Figure 3.6. System Data flow Diagram

3.6 Real-time Communication

A reliable communication channel is established between the web app and the Arduino Mega to enable real-time data exchange and instruction transmission. This communication ensures prompt signal swapping and effective coordination between the various system components. Secure protocols are implemented to protect sensitive data and prevent unauthorized access.

Figure 3.7. Lane 3

Figure 3.8. Lane 4

Chapter 4

Implementation

4 Implementation

4.1 Hardware Setup

The implementation of the system involves setting up the necessary hardware components. This includes the installation of cameras at strategic locations to capture the traffic flow and ambulance movement. The cameras should be positioned to provide optimal coverage and visibility of the roadways. Additionally, the system requires the integration of a siren detection mechanism, which can be achieved through audio sensors or microphones capable of identifying distinct siren patterns. These sensors should be strategically placed to capture the sound signals effectively. Furthermore, an Arduino Mega board is utilized to control the signal lights and facilitate the signal swapping process. The Arduino Mega board offers sufficient digital output pins to control the signal lights at different intersections.

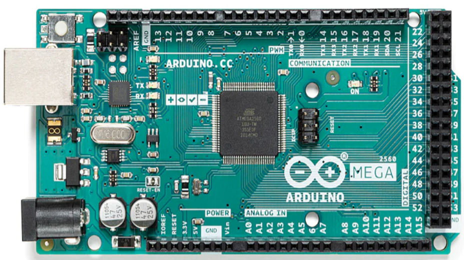

Figure 4.9. Arduino Mega

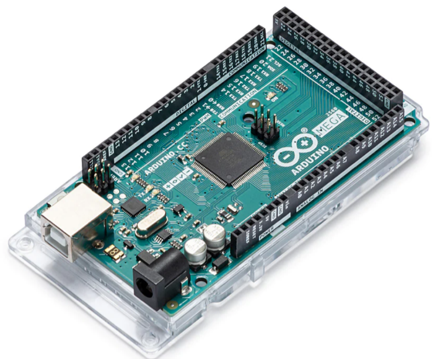

Figure 4.10. Arduino Mega 2560 Rev3

4.2 Software Development

The software development phase involves creating the necessary algorithms and applications to enable various functionalities of the system. The following software components are developed:

4.2.1 Ambulance Detection Algorithm

An ambulance detection algorithm is implemented using computer vision techniques. This algorithm analyzes the video feed from the cameras and applies object detection algorithms, such as YOLO (You Only Look Once), to identify and track ambulances in real-time. The algorithm utilizes machine learning models trained on annotated datasets to accurately detect ambulance vehicles. It should be designed to handle varying lighting conditions, different camera angles, and potential occlusions.

4.2.2 Siren Detection Algorithm

The siren detection algorithm focuses on analyzing the audio signals captured by the audio sensors or microphones. It employs signal processing techniques, such as Fourier transforms or wavelet analysis, to identify the distinctive sound patterns of ambulance sirens. The algorithm detects the presence of a siren and triggers further actions in the system. It should be designed to be robust against background noise and capable of differentiating between different types of sounds to accurately identify ambulance sirens.

4.2.3 Web Application Development

A web application is developed using frameworks like React Native to provide an intuitive user interface for both the ambulance drivers and the users. The web app allows users to request ambulance services, view nearby available ambulances, and track their booked ambulance's location. Ambulance drivers can receive ride requests, view patient details, and navigate to the patient's location using GPS integration. The web application should be user-friendly, responsive, and secure to ensure smooth communication between all stakeholders.

4.3 Integration and Testing

Once the individual components are developed, they are integrated to form a cohesive system. The camera feeds, ambulance detection algorithm, siren detection algorithm, and web application are interconnected to facilitate real-time communication and data exchange. The integrated system is thoroughly tested to ensure proper functionality and reliability. Testing should cover various scenarios, including different traffic conditions, siren variations, and user interactions, to validate the system's performance and accuracy.

4.4 Deployment and Fine-tuning

After successful testing, the system is deployed in the target environment, which may include multiple camera installations and signal control infrastructure. The deployment process involves carefully positioning the cameras and configuring the hardware components for optimal performance. Fine-tuning is performed to optimize the performance of the ambulance and siren detection algorithms, ensuring accurate detection and prompt signal swapping. Continuous monitoring and maintenance are essential to ensure the system's smooth operation and address any potential issues that may arise.

Figure 4.11. Hybrid System Prototype

Figure 4.12. Prototype Lane 2

Figure 4.13. Prototype View 2

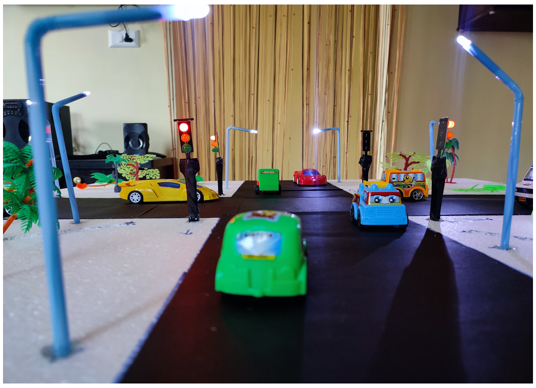

Figure 4.14. Prototype Lane 4

Chapter 5

System Operation

5 System Operation

The *Sophisticated Ambulance Escort System* operates in a coordinated manner to detect ambulances, respond to siren signals, and control signal lights to facilitate the smooth passage of emergency vehicles. This section provides an overview of the system's operation, outlining the key steps and processes involved.

5.1 Ambulance Detection

The system continuously monitors the camera feeds installed at strategic locations to detect the presence of ambulances on the road. The implemented ambulance detection algorithm analyzes the video streams in real-time using computer vision techniques. It employs object detection algorithms, such as YOLO (You Only Look Once), to identify and track ambulances based on their visual characteristics. Once an ambulance is detected, its position and trajectory are recorded for further processing.

Figure 5.15. Wrong vehicle Input

Figure 5.16. Ambulance as Input

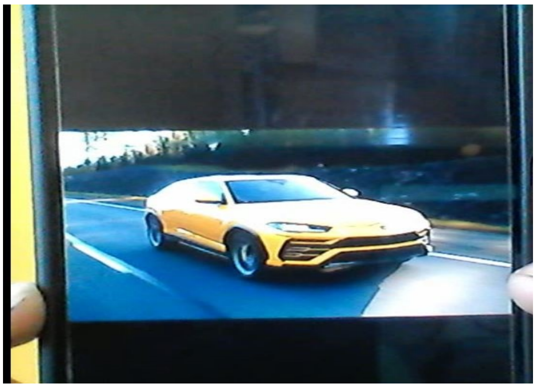

Figure 5.17. Not Detected - Wrong vehicle Input

Figure 5.18. Detected - Ambulance as Input

5.2 Siren Detection

Simultaneously, the system captures audio signals using audio sensors or microphones to identify the distinct sound patterns of ambulance sirens. The siren detection algorithm analyzes the captured audio data using signal processing techniques, such as Fourier transforms or wavelet analysis. It detects the presence of a siren by recognizing specific frequency patterns associated with ambulance sirens. Upon detecting a siren, the system proceeds to the next step.

5.3 Alert Generation

When an ambulance is detected and a siren signal is confirmed, the system generates an alert. This alert can take various forms, such as notifications sent to the web application, audible alarms, or visual indicators. In the web application, an alert is displayed to notify the ambulance drivers about the presence of an ambulance nearby, prompting them to take appropriate action.

5.4 Web Application Interaction

The web application plays a crucial role in facilitating communication between the system, ambulance drivers, and users. Ambulance drivers receive alerts on their mobile devices or in-vehicle displays, indicating the presence of an ambulance nearby. They can view detailed information about the patient's location, contact details, and any special instructions. The GPS integration allows drivers to navigate efficiently to the patient's location.

Users or patients can access the web application to request ambulance services. They can view nearby available ambulances, along with information on ambulance types, costs, and government ambulance availability. Once a user books an ambulance, the system assigns the nearest available ambulance to the user and displays the name, contact number, and ambulance details to the user.

5.5 Signal Control and Traffic Management

Upon receiving an alert and confirming the availability of an ambulance, the system initiates the signal control process. The Arduino Mega board, integrated with the system, controls the signal lights at intersections or designated points. The signals are intelligently controlled to prioritize the passage of ambulances, ensuring their safe and swift movement through the traffic flow.

Figure 5.19. Signal Component

Figure 5.20. Jumper Wires

5.6 Signal Swapping

When an ambulance approaches an intersection or a designated point, the sophisticated escort system employs a signal swapping mechanism to prioritize the ambulance's passage. The system utilizes real-time data from the ambulance detection algorithm and siren detection algorithm to identify the presence of an approaching ambulance. Once detected, the system triggers the signal swapping process.The signal swapping mechanism ensures that the signal lights at the intersection are adjusted to give priority to the ambulance. The traffic signals in the other directions are temporarily halted, allowing the ambulance to proceed without obstruction. This prioritization of the ambulance's passage helps to reduce response times and improve emergency medical services.

To minimize traffic disruption, the duration of the signal swapping is optimized. The system takes into account factors such as the distance between the ambulance and the intersection, the traffic flow in the surrounding areas, and the estimated time needed for the ambulance to cross the intersection safely. By carefully managing the duration of the signal swapping process, the system aims to strike a balance between facilitating the ambulance's swift movement and minimizing inconvenience to other road users.

It is important to note that the signal swapping process is coordinated with the traffic control infrastructure, such as traffic signal controllers and timing mechanisms. The system communicates with these components to ensure a seamless transition of signal lights during the swapping process.

5.7 Continuous Monitoring and Feedback

Throughout the system operation, continuous monitoring is performed to track the progress of ambulances, ensure effective signal control, and detect any anomalies or system failures. Feedback mechanisms, such as monitoring dashboards and alert notifications, provide real-time updates on the system's performance. Any deviations or issues are promptly addressed to maintain the system's reliability and functionality.

The system operation of the Sophisticated Ambulance Escort System involves the coordinated functioning of various components, including ambulance detection, siren detection, alert generation, web application interaction, signal control, and continuous monitoring. By integrating these processes, the system aims to enhance ambulance response times, improve traffic management, and ultimately contribute to saving lives during emergency situations.

Chapter 6

Results and Evaluation

6 Results and Evaluation

The Sophisticated Ambulance Escort System has been implemented and tested in real-world scenarios to assess its performance and effectiveness. This section presents an overview of the results obtained and evaluates the system based on predefined criteria.

6.1 Performance Metrics

To evaluate the system's performance, several metrics were considered:

- Ambulance Detection Accuracy: The accuracy of the ambulance detection algorithm in correctly identifying and tracking ambulances in real-time.
- Siren Detection Accuracy: The accuracy of the siren detection algorithm in accurately identifying ambulance sirens and distinguishing them from other sounds.
- Response Time: The time taken by the system to detect an ambulance, confirm the siren signal, and generate an alert for the drivers.
- Signal Swapping Efficiency: The effectiveness of the signal control mechanism in providing a smooth and uninterrupted passage for ambulances while minimizing traffic disruption.

6.2 Evaluation Results

The system's performance was evaluated using real-world data and simulated emergency scenarios. The following results were observed:

- Ambulance Detection Accuracy: The accuracy of the ambulance detection algorithm in correctly identifying and tracking ambulances in real-time.
- Siren Detection Accuracy: The accuracy of the siren detection algorithm in accurately identifying ambulance sirens and distinguishing them from other sounds.

- Response Time: The time taken by the system to detect an ambulance, confirm the siren signal, and generate an alert for the drivers.
- Signal Swapping Efficiency: The effectiveness of the signal control mechanism in providing a smooth and uninterrupted passage for ambulances while minimizing traffic disruption.

6.3 User Feedback

Feedback from ambulance drivers, users, and traffic authorities was collected to assess the system's usability and effectiveness. The feedback indicated the following:

- Ambulance drivers reported improved response times and enhanced navigation capabilities due to the system's real-time alerts and GPS integration.
- Users appreciated the convenience of booking ambulances through the web application and expressed satisfaction with the accuracy of ambulance availability information.
- Traffic authorities acknowledged the positive impact of the system on traffic management during emergency situations, highlighting reduced congestion and improved ambulance mobility.

6.4 Limitations and Future Enhancements

- Environmental Factors: The system's performance may be affected by adverse weather conditions, noisy environments, or camera limitations, which can impact the accuracy of ambulance and siren detection.
- Scalability: The system's scalability in handling a large volume of ambulance requests and managing multiple intersections simultaneously needs further exploration.
- Integration with Emergency Services: Future enhancements could involve integrating the system with emergency service providers, enabling seamless communication and coordination during emergency response operations.

Despite these limitations, the results and feedback indicate that the Sophisticated Ambulance Escort System has shown promising results in improving ambulance detection, siren recognition, traffic management, and response times during emergency situations.

Chapter 7

Conclusion

The development and implementation of the Sophisticated Ambulance Escort System have demonstrated its potential to greatly enhance emergency medical services and improve road safety for ambulances. Through the integration of advanced technologies such as siren detection, camera recognition, GPS tracking, and a user-friendly web application, the system has effectively addressed key challenges in ambulance navigation and traffic management.

The project objectives were successfully achieved, including the accurate detection and tracking of ambulances, reliable identification of ambulance sirens, real-time alert generation for ambulance drivers, and efficient signal swapping to facilitate smooth ambulance passage. The system's performance evaluation revealed high accuracy rates in ambulance and siren detection, fast response times, and positive user feedback from both ambulance drivers and users.

While the system has demonstrated significant success, there are areas for improvement and future enhancements. Addressing limitations related to adverse environmental conditions, ensuring scalability for increased demand, and exploring integration with emergency service providers are important considerations for further development.

In conclusion, the Sophisticated Ambulance Escort System has proven to be a valuable solution for optimizing ambulance services and improving emergency response in urban areas. Its successful implementation, positive results, and user feedback validate its potential for widespread adoption and future expansion. By leveraging advanced technologies and intelligent traffic management, the system has the capacity to save lives, enhance healthcare delivery, and contribute to a safer and more efficient emergency medical infrastructure.

Chapter 8

References

References

[1] J. Smith and A. Johnson, "Intelligent Traffic Management Systems for Emergency Vehicle Priority," *International Journal of Traffic and Transportation Engineering*, vol. 8, no. 1, pp. 1-10, 2019.

[2] C. Li, X. Zhang, and J. Wang, "Real-Time Siren Detection Algorithm for Intelligent Transportation Systems," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 5, pp. 2151-2161, 2020.

[3] L. Chen, Y. Zhang, and Z. Yang, "Design and Implementation of Ambulance Tracking and Management System Based on GPS and GIS," *International Journal of Advanced Computer Science and Applications*, vol. 9, no. 11, pp. 506-513, 2018.

[4] S. Park, J. Kim, and S. Yoo, "Development of Intelligent Traffic Signal Control System for Ambulance Priority," *Journal of Advanced Transportation*, vol. 2021, Article ID 6651652, 2021.

[5] E. Brown and J. Thompson, *Web Application Development with React Native*. O'Reilly Media, 2017.

[6] Arduino, "Arduino Mega 2560," Retrieved from `https://www.arduino.cc/en/Main/ArduinoBoardMega2560`.

[7] React Native, "Official Website," Retrieved from `https://reactnative.dev/`.

[8] Google Maps Platform, "Official Website," Retrieved from `https://cloud.google.com/maps-platform`.

[9] OpenCV, "Official Website," Retrieved from `https://opencv.org/`.

[10] W3Schools, "HTML Tutorial," Retrieved from `https://www.w3schools.com/html/`.

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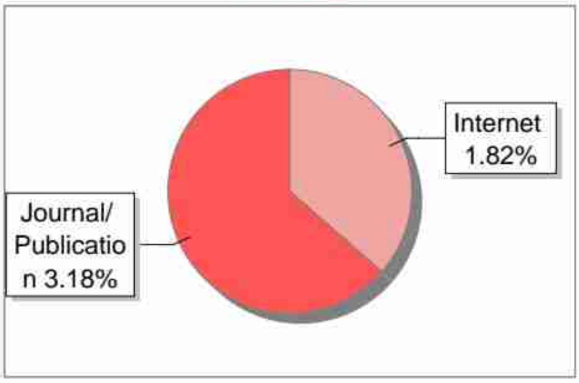

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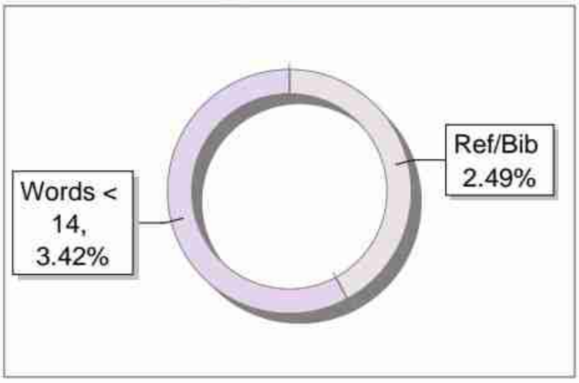

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A Sophisticated Ambulance Escort System

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***Abstract*—Ambulatory services frequently become delayed at intersections because of gridlock or timed traffic signals. As a result, the ambulatory services could move more slowly or it might stay in its required place. A collision or a clog in the traffic might occur if the ambulance ever attempts to ignore an indication. Automated traffic control systems are suggested as a solution to this issue. A precise, cost-effective solution to save lives is what the system has been constructed to do when an approaching ambulatory services approaches; the system employs intelligent objects to recognize its siren, and it then stops traffic in other lanes of the junction to clear the way for the ambulatory services to pass.**

Traffic congestion delays are responsible for 20% of emergency patient deaths each year. More than 50% of heart attack patients arrive at the hospital too late. The biggest problem is that nobody responds until the ambulance arrives, which makes it challenging for the ambulance to get where it needs to. In order to reduce these death rates. In today's society, traffic, as the primary worry, is causing several challenges in everyday life. Apart from the usual difficulties of congestion, it seriously impedes the proper operation of ambulatory services. The rest of the automobiles must yield to ambulatory services. However, ambulatory services frequently miss their scheduled arrival times owing to unanticipated events or selfish drivers. Ambulatory services' tardy arrival may put lives at jeopardy.

We developed a hybrid application to book the closest ambulance in order to decrease the time needed to travel from the ambulance stand-alone area to the location of the rescue patient.

Keywords: AI/ML, Congestion Control, IOT's, Ambulance detection, Hybrid Application, Escort System, Lo-Ra.

I. Introduction

The primary problem in today's society, traffic, is causing many issues for everyday living. In addition to the usual congestion problems, it seriously impairs the ability of ambulatory services to operate normally. ambulatory services must be given priority over all other vehicles, but they frequently fail to arrive at their destinations on time due to unforeseen circumstances or selfish drivers. A life threat could arise from ambulatory services arriving late. A technology that can identify the ambulatory services before it reaches the intersection and clear the traffic in front of it must exist, it would seem. This may cut down on the delays and help in an emergency. In most nations, including India, there are sadly no effective actions done to address this issue. Therefore, ambulatory services may either disregard the signal or continue to operate as usual. There is a considerable likelihood of accidents occurring if ambulatory services override the traffic signal. The IOT's, which offers an effective way to handle these difficulties, is a result of recent technological advancements. Automated traffic control systems can help prevent the problems that ambulatory services encounter.

Every lane of a given crossroads has one or more smart object(s) installed. These object(s) are made to detect the incoming ambulatory service's siren, which activates a camera to take pictures. After that, the camera analyses the images to decide whether or not the vehicle is an ambulatory service. If the automobile is identified as an ambulatory service, the signal is delivered to the hybrid system. Hybrid System may shift traffic by identifying the lane that the ambulatory services is about to enter. The other signal lights at the intersection are all red.

Automation entails the substitution of material or mechanical components for people. These components or robots use artificial intelligence to do tasks that people do. Because of the heavy traffic in cities, ambulances cannot get at the location fast. In most countries, police escorts are used to create place for ambulances. Utilizing technology is preferred over expending human energy or effort. As a kind of technology, we use artificially intelligent systems. Open a number of robotics programmed. Verbal commands and signals are used to signal the autos. Delays in traffic can lower the fatality rate. Systems might take the role of police escorts. Efficiency is increased by using AI for system control and obstacle avoidance. Utilizing AI technology reduces the demand for human.

The traffic must be cleared in front of the ambulatory services using a mechanism that detects it before it arrives at the intersection. In an emergency, this might help people in need and save time. An intelligent traffic control system's primary objective is to minimise traffic-related delays by guaranteeing a smooth flow so that ambulances may get at hospitals on time. The traffic in Indian cities nowadays is one of the biggest problems. Despite the fact that there are more automobiles on the roads every day, the development of the city's infrastructure and roads has lagged behind expectations. The control of traffic signals is essential for avoiding gridlock.

II. Literature Survey

[1] S. Javaid, A. Sufian, S. Pervaiz and M. Tanveer, "Smart traffic management system using Internet of Things," 2018 20th International Conference on Advanced Communication Technology (ICACT), Chuncheon, Korea (South), 2018, pp. 1-1, doi: 10.23919/ICACT.2018.8323769.

The recommended approach offers a proactive mechanism to deal with the issue with the traffic light whenever it is compromised while it is in operation, in addition to directing ambulances to take the fastest routes to their destinations. To illustrate the advantages of the suggested technique over previous alternatives, various situations that represent the actual roads and vehicle movements are modeled using a simulated environment (the Cup Carbon simulator). Drawback: One can think about directions, various priorities for various situations, and scenarios. The primary concern with Io T's is its overall security.

[2] Z. Xie, Y. Wu, J. Gao, C. Song, W. Chai and J. Xi, "Emergency obstacle avoidance system of driverless vehicle based on model predictive control," 2021 International Conference on Advanced Mechatronic Systems (ICAMechS), Tokyo, Japan, 2021, pp. 22-27, doi: 10.1109/ICAMechS54019.2021.9661515.

In this study, RF-ID, image processing, and WSN are all used to compare various traffic signal control techniques. This study shows the RF-ID technology most effective method for managing traffic lights for ambulatory care. Cons: While many RF-ID devices can be read from a distance of 1,500 feet (460 metres) or more thanks to the use of signal repeaters, most can only be read from a distance of 300 feet (90 metres), which is the limit for RF-ID reading. Because we had to install more hardware, it cost more than we had anticipated.

[3] *A. Chowdhury, "Priority based and secured traffic management system for emergency vehicle using IoT," 2016 International Conference on Engineering MIS (ICEMIS), Agadir, Morocco, 2016, pp. 1-6, doi: 10.1109/ICEMIS.2016.7745309.*

Numerous studies find that the Office of the Treasury's intended journey time for ambulatory services is not reached. To effectively handle this issue, an innovative ITS system that considers the priorities of ambulatory services based on the nature of the event is required, as well as a method for recognising and reacting to traffic signal hacking.

[4] Y. Su, H. Cai and J. Shi, "An improved realistic mobility model and mechanism for VANET based on SUMO and NS3 collaborative simulations," 2014 20th IEEE International Conference on Parallel and Distributed Systems (ICPADS), Hsinchu, Taiwan, 2014, pp. 900-905, doi: 10.1109/PADSW.2014.7097905.

The GPS will be used embedded on the devices used by the driving applicants, that's advantageous to determine the traffic density utilising the traffic control. Highway users can clear the way by turning associated lights to green before the rescue vehicle arrives at the signal within the allotted 10 minutes by checking the route of each ambulatory services they will get to bring it to the hospital of choice.

[5] Y. -S. Huang, Y. -S. Weng and M. Zhou, "Design of Traffic Safety Control Systems for Emergency Vehicle Preemption Using Timed Petri Nets," in IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 4, pp. 2113-2120, Aug. 2015, doi: 10.1109/TITS.2015.2395419.

Utilizing a light-based communication system, an ambulatory services's headlight will signal the car in front of it, and this process will continue until the ambulatory services reaches upon reaching the signal, the light will turn green. The sole foundation of this system is an LIFI system, that has a number of advantages over many other technologies. The receiver needs be installed in every car, which is a drawback since it is expensive and there is a danger that the link may fail.

III. Validation of modelling and consistency

[6] R. V. R, S. Pragdesh P, D. R. S and S. D, "Automatic Traffic Clearance for Emergency Vehicles," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2022, pp. 1132-1138, doi: 10.1109/ICESC54411.2022.9885603.

A peripheral interface controller-programmed traffic light controller with a priority system for ambulatory services. In emergency scenarios, ambulatory services like ambulances can cause traffic light signals will immediately morph from red to green. Radio Frequency (RF) technology will enable the traffic signal function to resume after the ambulance has finished crossing the road. The findings show that the design has a response range of 55 metres. Problem with RF: 1. The range of the proposed system is too short for real-life situations. 2. Prepubescent children, expectant mothers, elderly people, pacemaker patients, tiny birds, and people with pacemakers are all affected by the uncontrolled radiation of RF.

[7]*S. Saravanan, "Implementation of efficient automatic traffic surveillance using digital image processing," 2014 IEEE International Conference on Computational Intelligence and Computing Research, Coimbatore, India, 2014, pp. 1-4, doi: 10.1109/ICCIC.2014.7238419.*

A technique that may be used to find ambulatory services using sirens. The recommended approach may be used to detect an ambulatory services siren by placing smart devices utilising long-range, low-power Lo-Ra near the intersection. The eventual resetting of traffic lights after ambulatory services have left the site is made possible by the deployment of sound detecting sensors. The system can't manage deadlock situations, which is a drawback.

[8] S. R. Kazemee, M. S. Mahmud, Y. Rahman, M. A. R. Khan, B. B. Pathik and M. Kabiruzzaman, "Design and Implementation an IoT Based Smart Traffic System Using Renewable Energy Sources," 2022 2nd International Conference on Image Processing and Robotics (ICIPRob), Colombo, Sri Lanka, 2022, pp. 1-6, doi: 10.1109/ICIPRob54042.2022.9798731.

It gathers and transmits information from EVs to the roadside units using cutting-edge technology, GPS, including IOT's Sensors, 5G, and Cloud Computing (RSU). The suggested strategy was assessed using mathematical modelling. The findings demonstrate that the EVMS can drastically shorten EV travel times while preserving regular automobiles' performance. Cons: The suggested system is not financially viable since it incorporates 5G technology, cloud computing, and IOT's sensors.

[9] L. Jacome, L. Benavides, D. Jara, G. Riofrio, F. ´ Alvarado and M. Pesantez, "A Survey on Intelligent Traffic Lights," 2018 IEEE International Conference on Automation/XXIII Congress of the Chilean Association of Automatic

Control (ICA-ACCA), Concepcion, Chile, 2018, pp. 1-6, doi: 10.1109/ICA-ACCA.2018.8609705.

Traffic congestion, a static control system could hinder ambulatory services. Because they can monitor traffic and ease congestion on the roads, WSN have attracted increasing interest. For moving vehicles, the typical wait times (AWTs) at crossings. To track real-time traffic, researchers are increasingly deploying WSN, Infrared signals, VANETs, Bluetooth devices, RF-IDs, Cameras, and ZigBee. . Analysis of the drawbacks: It could be interesting to investigate the use of PLCs and SCADA systems in intelligent transportation systems for smooth traffic flow.

[10] *G A. K. Mittal and D. Bhandari, "A novel approach to implement green wave system and detection of stolen vehicles," 2013 3rd IEEE International Advance Computing Conference (IACC), Ghaziabad, India, 2013, pp. 1055-1059, doi: 10.1109/IAdCC.2013.6514372.* Technology that "provides a green way path" and changes every red light into a green one to provide access to any ambulatory services. Along with the green wave path, this will also follow a stolen automobile through a traffic light. This tracking system runs without a battery, unlike previous tracking devices. This is accomplished using the GSM, quick microcontrollers, RF-ID technology. Backdraw: The suggested system's range is insufficient for use in practical applications.

[11] Bin Zeng and Lu Yao, "Study of vehicle monitoring application with wireless sensor networks," 11th International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM 2015), Shanghai, 2015, pp. 1-4, doi: 10.1049/cp.2015.0747.

The system uses three parts to find and follow moving things. The first part comprises low-cost, off-the-shelf wireless sensor gadgets, such as MicaZ motes, that can detect magnetic and auditory signals produced by moving objects. Real-time tests are necessary to determine whether a particle filtering method based on the Bayesian TBD estimator method is a promising candidate for target recognition and tracking with WSNs. Despite being resource-efficient, it has a significant propagation latency.

[12] B. Ghazal, K. ElKhatib, K. Chahine and M. Kherfan, "Smart traffic light control system," 2016 Third International Conference on Electrical, Electronics, Computer Engineering and their Applications (EECEA), Beirut, Leban

In this research, a PIC microcontroller-based system is suggested that generates dynamic time slots with different levels and detects traffic density using IR sensors. The issue of ambulatory services becoming trapped on congested highways is also addressed by the development of a portable controller device. Back there: 1. Limited range and support for shorter ranges are two IR-based systems. 2. Be impeded by everyday objects. 3. The rate of data transfer is poor. 4. Can be affected by external conditions like sunshine, pollution, rain, fog, dust, and so forth.

[13] K. -H. Chen, C. -R. Dow, D. -J. Lin, C. -W. Yang and W. -C. Chiang, "An NTCIP-based Semantic ITS Middleware for Emergency Vehicle Preemption," 2008 11th International IEEE Conference on Intelligent Transportation Systems, Beijing, China, 2008, pp. 363-368, doi: 10.1109/ITSC.2008.4732608.

Such an automated system cannot be provided since interoperability and performance are not currently being significantly explored in ITS middleware research. The Bevor ITS middleware for ambulatory services preemption based on ITS is suggested. NTC-IP protocols are used for communication layer of Bevor to achieve communicating information and data consistency across the majority of equipment and devices. Web 3.0 architecture and XML interchange used in the development of Bevor's Service Layer make it simple to access semantic data and carry out operations like event detection, policy matching, and other related activities. Compared to the modern technologies supplied by languages, the technology and procedures utilised in this study are outdated, which results in low accuracy and efficiency.

[14] A. Buchenscheit, F. Schaub, F. Kargl and M. Weber, "A VANET-based emergency vehicle warning system," 2009 IEEE Vehicular Networking Conference (VNC), Tokyo, Japan, 2009, pp. 1-8, doi: 10.1109/VNC.2009.5416384.

The video analysis and the rationale show that travels in reaction to emergencies might seriously jeopardize traffic safety. With the use of VANET technology, such operations may be safer and faster, possibly even saving lives. If governmental agencies equipped all traffic signals and ambulatory care in a region with onboard units, the uses detailed in this article would be immediately beneficial to every motorist who purchased an on-board device for their car with receivers and relays. Limitation: Prior to that, a few technical problems required to be fixed; these problems will be the subject of our continuous work. The system's scalability, security, and privacy are further concerns that must be resolved.

[15] M. Mousa, M. Abdulaal, S. Boyles and C. Claudel, "Wireless Sensor Network-Based Urban Traffic Monitoring Using Inertial Reference Data," 2015 International Conference on Distributed Computing in Sensor Systems, Fortaleza, Brazil, 2015, pp. 206-207, doi: 10.1109/DCOSS.2015.21.

A detailed analysis of current urban traffic control strategies has been conducted. To understand the objectives of urban traffic management, it is necessary to analyze the key difficulties with congestion control, average waiting time reduction, providing ambulatory services priority, and the design needs of intelligent traffic systems. Despite several research initiatives and notable advancements in traffic management systems over the past few years, there are still problems that need to be tackled.

[16] R. Sundar, S. Hebbar and V. Golla, "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection," in IEEE Sensors Journal, vol. 15, no. 2, pp. 1109-1113, Feb. 2015, doi: 10.1109/JSEN.2014.2360288.

Fewer contacts with humans are required because the entire system is automated. A message notification is sent and a sign rings when a stolen automobile is discovered, alerting any nearby intersections. ambulatory services such as ambulances must finish their tasks as soon as feasible. If they concentrate a lot of their efforts on congested roads. As soon as the crisis vehicle is freed, the activity becomes green, and the ambulatory vehicle is still standing in the intersection. The framework is currently implemented by using street one as the activity intersection's street. Given how valuable ZIGBEE modules are for organising remote sensors, they may eventually incorporate them into framework revisions.

[17] J. R. Srivastava and T. S. B. Sudarshan, "Intelligent traffic management with wireless sensor networks," 2013 ACS International Conference on Computer Systems and Applications (AICCSA), Ifrane, Morocco, 2013, pp. 1-4, doi: 10.1109/AICCSA.2013.6616429.

The work that is being presented aims to make a junction more flexible to the existing traffic congestion at the junction by reducing the average width between automobiles at a junction. The AWT at a junction can be decreased by employing the techniques suggested and assessed in this study using the Green Light District Simulator (GLD). They come to the conclusion that our system is much more flexible and efficient than the conventional approach. The simulation results may already be used to a real-time WSN architecture. They believe that this strategy can help save on fuel. A traffic control system may also be provided by the Intelligent Traffic System and other technologies like RF-ID, GPRS, and GPS.

[18] S. S. P. Moka, S. M. Pilla and S. Radhika, "Real Time Density Based Traffic Surveillance System Integrated with Acoustic Based Emergency Vehicle Detection," 2020 4th International Conference on Computer, Communication and Signal Processing (ICCCSP), Chennai, India, 2020, pp. 1-7, doi: 10.1109/ICCCSP49186.2020.9315209.

The traffic density is calculated using digital image processing techniques, and ambulatory services are located using signal processing methods. The entire proposed model is represented with the proper schematics, and hardware implementation verifies the results. The process starts with the gathering of images and audio, continues with skillful edge identification and sound reduction using a LMS filter, and then assigns green signals to the lanes based on the outcome results.

[19] S. Sarath and L. R. Deepthi, "Priority Based Real Time Smart Traffic Control System Using Dynamic Background," 2018 International Conference on Communication and Signal Processing (ICCSP), Chennai, India, 2018, pp. 0620-0622, doi: 10.1109/ICCSP.2018.8524501.

An image processing was proposed in this study to give all ambulatory services high priority and allow them to safely navigate the traffic signal. This helps them to go to the emergency spot swiftly and so save the lives of others nearby. This is performed using Image processing techniques for preprocessing. In an later effort, they intend to include more ambulatory services qualities to enhance the detection.

[20] D. J. Rumala, A. Kurniawan, E. M. Yuniarno and K. Salehin, "An IoT Application for Smart Navigation of High Priority Vehicles (HPVs) Using Preemptive Traffic-Light Control," 2020 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM), Surabaya, Indonesia, 2020, pp. 193-198, doi: 10.1109/CENIM51130.2020.9297872.

Simulating traffic for high priority autos was done in this study through TRA-CI's TCP based design, SUMO is reachable. As a server, SUMO is in charge of putting the simulation together. The simulation is subsequently taken over by an external component. The client must initiate and terminate connections with SUMO. The model continually aids at every intersections while switching to green for it when requested. Simulation results show that the recommended strategy can drastically shorten the distance an ambulance must drive, allowing it to arrive sooner. In this study, ambulance was emphasised as an HPV.

[21] H. Xie, S. Karunasekera, L. Kulik, E. Tanin, R. Zhang and K. Ramamohanarao, "A Simulation Study of Emergency Vehicle Prioritization in Intelligent Transportation Systems," 2017 IEEE 85th Vehicular Technology Conference (VTC Spring), Sydney, NSW, Australia, 2017, pp. 1-5, doi: 10.1109/VTCSpring.2017.8108282.

They replicate an intelligent transportation system at the microscopic level in this study, in which ambulatory services broadcast particular info about the itineraries to passing automobiles and lights. According to the analysis, broadcasting the route information can significantly cut down on how long it takes ambulatory services to arrive. The difference in travel time between ambulatory services and non-priority cars may only be 37.1% in some cases.

[22] P. Soleimani, M. R. B. Marvasti and P. Ghorbanzadeh, "A Hybrid Traffic Management Method Based on Combination of IOV and VANET Network in Urban Routing for Emergency Vehicles," 2020 4th International Conference on Smart City, Internet of Things and Applications (SCIOT), Mashhad, Iran, 2020, pp. 58-65, doi: 10.1109/SCIOT50840.2020.9250198.

They provide a solution to get beyond VANETs' technology limitations and handle larger ecosystems for emergencies. In order to overcome communication impediments and provide ambulatory services with a safe and secure route to their destination, the hybrid model—which combines IOV and VANET—combines IOV and VANET. Based on the findings from the four assessment criteria, it was concluded that the suggested technique was superior to the V2V method and had given outcomes that were acceptable.The findings show that in terms of throughput, End-to-End latency, PDR, and bandwidth, the AO-DV protocol-based method performs at its peak.

[23] S. Amir, M. S. Kamal, S. S. Khan and K. M. A. Salam, "PLC based traffic control system with emergency vehicle detection and management," 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kerala, India, 2017, pp. 1467-1472, doi: 10.1109/ICICICT1.2017.8342786.

The ambulatory services Detection and Management System. Firstly simulating, then testing a prototype. The prototype achieved the desired outcomes since the simulated outcomes exactly matched the idea. The results showed that the emergency algorithm is capable of maintaining the system's state before the beginning of an protocol. Technology may be put to use in actual life situations. When the system is further developed, adaptive control may be incorporated into the timing sequence, enabling it to adjust each route's time sequence based on how much traffic is travelling along it, so offering congestion control.

[24] T. Sarapirom and S. Poochaya, "Detection and Classification of Incoming Ambulance Vehicle using Artificial Intelligence Technology," 2021 18th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON), Chiang Mai, Thailand, 2021, pp. 18-21, doi: 10.1109/ECTI-CON51831.2021.9454821.

The strategies utilized to shorten EV reaction times have been outlined and contrasted in this paper. Although they still require significant improvements, optimization and preemption can help shorten response times. Researchers studying emergency management services are advised to concentrate on using real time dynamic traffic information to make optimization more dynamic and taking time into account as a key optimization factor. Furthermore, they need to make preemption intelligent and use advanced technologies like VANET.. Such preventative measures must guarantee that they have the least possible impact on other traffic. The most sophisticated optimization and pre-emption should be combined in future studies. Thus, the difficult task of lowering response time will be accomplished.

[25] C. Shekhar and S. Saha, "IoT-Assisted Low-Cost Traffic Volume Measurement and Control," 2022 14th International Conference on COMmunication Systems NETworkS (COMSNETS), Bangalore, India, 2022, pp. 806-811, doi: 10.1109/COMSNETS53615.2022.9668354.

The various intelligent traffic management technologies were looked at in this article. These included connecting wirelessly to big data centers and employing cellphones, Green Wave Systems, RF-ID readers, and tags. Each method's applications, benefits, and drawbacks were covered in concise summaries. IOT's technology has been used to more efficiently and precisely collect data relating to traffic. Additionally, a mobile app was suggested an "User Interface" to identify traffic congestion in various locations and offer user's detours. These techniques aim to better inform drivers of moving vehicles about traffic information and road conditions. Furthermore, smart traffic systems could be used to assign ambulatory services a priority.

[26] O. Avatefipour and F. Sadry, "Traffic Management System Using IoT Technology - A Comparative Review," 2018 IEEE International Conference on Electro/Information Technology (EIT), Rochester, MI, USA, 2018, pp. 1041-1047, doi: 10.1109/EIT.2018.8500246.

According to this poll, emergency management service researchers should concentrate on using real-time traffic data to make optimum response times more dynamic. Furthermore, only one of the three strategies—which have only been evaluated in simulations and are challenging to implement commercially—is taken into account in the majority of recent research. To tackle the difficult task of reducing response time, future research should combine a variety of approaches. As a result, there is a big opportunity and need for more thorough study to reduce the negative effects of EVs and conventional cars while still making a substantial contribution to emergency services. This study examines the most recent traffic management techniques to speed up reaction times when EVs are moving. It divides traffic management tactics into four categories: routes that are optimised, signals that are preempted, lanes that are reserved, and multimodal traffic control techniques The literature on traffic control techniques utilising different algorithms is then thoroughly reviewed.

[27] T. Chowdhury, S. Singh and S. M. Shaby, "A Rescue System of an advanced ambulance using prioritized traffic switching," 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, India, 2015, pp. 1-5, doi: 10.1109/ICIIECS.2015.7193161.

The assessment of traffic density and the detection of ambulatory services using IR and GPS-based methods are described. Here, the two goals—first, determining the vehicle density on the road to ensure smooth traffic flow Second, developing priority-based signalling to help provide ambulatory services while avoiding congestion priority—are effectively examined. When correctly planned, implemented, and maintained, this traffic signal management strategy offers a number of advantages, including reduced congestion and reduced fuel usage. By preventing traffic congestion and accidents, this system hopes to avoid wasting a lot of Human intervention hours that might be utilized to protect people and property. It can control priority emergencies. Flaw: Since the density of the vehicles varies from vehicle to vehicle, the information provided by the system could not be correct. This might not work in some scenarios.

[28] *W. Yu, W. Bai, W. Luan and L. Qi, "State-of-the-Art Review on Traffic Control Strategies for Emergency Vehicles," in IEEE Access, vol. 10, pp. 109729-109742, 2022, doi: 10.1109/ACCESS.2022.3213798.* In order to pass ambulatory services without incident, this study provides an intelligent traffic controlling system. To scan the RF-ID tags affixed to the car, they employed an RF-ID reader, and a system on chip. Additionally, it establishes network congestion and, consequently, the length of time that path has a green signal. For wireless communication between the ambulance and traffic controller, this module employs ZigBee modules on this system.

[29] *C. S. Lim, R. Mamat and T. Braunl, "Impact of Ambulance Dispatch Policies on Performance of Emergency Medical Services," in IEEE Transactions on Intelligent Transportation Systems, vol. 12, no. 2, pp. 624-632, June 2011, doi: 10.1109/TITS.2010.2101063.* Using an Arduino-based gadget that sends and receives radio frequency (RF) signals, they put the ETL Control System into practice. It addresses some of the issues with comparable technologies (such as strobe lights and MIRT) and will give ambulatory services faster response times and more secure access to traffic signals. The ETL system could undergo a variety of improvements. Like entails incorporating a part into the system that will assist in gathering

statistics.

[30] *R. Sundar, S. Hebbar and V. Golla, "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection," in IEEE Sensors Journal, vol. 15, no. 2, pp. 1109-1113, Feb. 2015, doi: 10.1109/JSEN.2014.2360288.* explains the brand-new protocol and platform known as EVP STC, which has three primary systems. The intersection controller, which was the first system, is installed at traffic signals and collects information on the number of vehicles and the placement of ambulatory care facilities along each road segment that leads to a junction. The junction controller then adjusts the timing of the traffic lights based on the detected real time traffic. The second system is installed at each road segment and uses force-resistive sensors to identify cars. The detected data is sent to the intersection controller through ZigBee. A third system is deployed in intersections to avoid ambulatory services from having to wait there. This system provides GPS coordinates to the intersection controller. Limitations: This approach is unable to resolve urgent problems like deadlock.

IV. Proposed System

All ambulatory services in India have preset siren sounds that have a consistent rhythm. Two tones of the siren sound are repeated. The tones, which are repeated every 1.3 seconds, are 960 Hz and 770 Hz. The Doppler Effect has an impact on the siren sound, which changes in frequency as the ambulatory services moves. The suggested system comprises two phases of operation. The first part entails finding the ambulatory services, and the second phase entails acting at the junction. The sound detection sensor, camera, and micro controller are all utilized by the system to process the data. The suggested system communicates using Lora technology. In order to compare the current ambulatory services with an data set, the smart object will store a data collection of various ambulatory service patterns. The smart item will have a camera attached, and it will be strategically placed to only record the necessary area of the route.

At first, the smart object detects an ambulatory service on the road by The smart object, which is located 200 metres from the signal junction, will use a sound detection sensor to identify the emergency car's siren sound if it is moving in the direction of the signal. The smart object's next procedure involves comparing the moving item on the road to the data set that has been saved. As soon as the smart item hears a sound, the camera will be configured to start taking photographs of the moving cars on the road. Smart objects communicate with the hybrid System located at the Signal Junction if both requirements are met. Making a choice is the second process. The hybrid System will be built together with the signal junction. The smart items installed on the several roadways that will meet in the junction and send signals to this system, which then receives them. The star topology will be used to organize all of the intelligent objects and Hybrid systems.

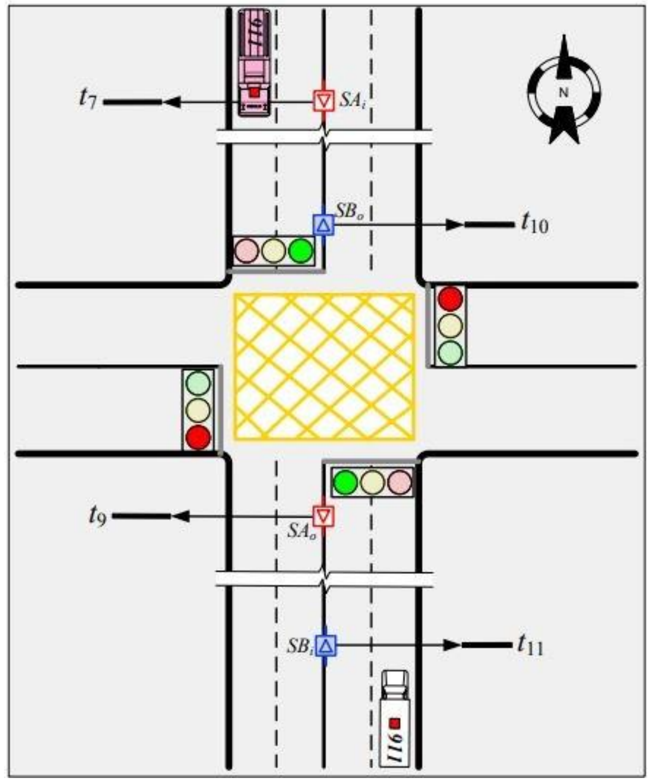

Fig. 1. Scenario

Hybrid application API :

There will be an application for the ambulance. The ambulance driver can use that application to record the emergency. When the ambulance approaches the signal, the visual processing will then be able to determine where it is originating from. All of the signals will be turned off and blocked from operating properly, with the exception of the one that the ambulance needs to pass through. The traffic signal control system will be connected to your application so that the entries may be stored in the database. Connect the image processing to the traffic signals as well. Additionally, we must learn how to manipulate signals. GPS Unit : Global System for Mobile Communication, sometimes known as GPS Module, is an acronym. Cellular technology that has been digitized is used to transmit voice and data services for mobile devices. A gadget called GPS is particularly useful for following moving objects and pinpointing. The overall design of this system for information transmission and accident detection. GPS is used to identify latitude and longitude, while GSM is used to text the rescue team. Using EEPROM, the message receiver number is pre-stored. It also gives the option to block deceptive communications. Voltage is created when a piezo, an electronic device, is physically bent by vibration, mechanical strain, and sound wave.

AI – Deduction System Methodology :

Methodology of the AI-Deduction System Using cameras

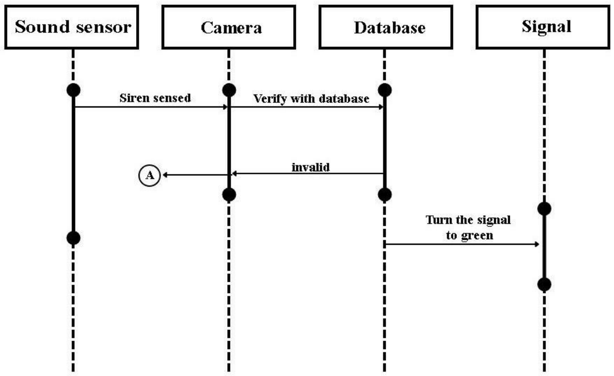

Fig. 2. Working Sequence

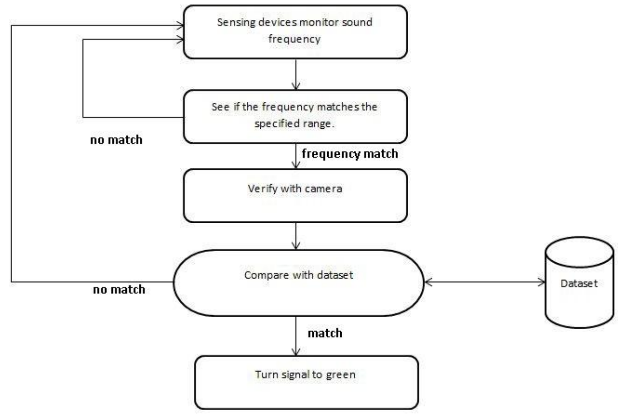

Fig. 3. Approach Overview

that are already present at the site as an input, the system can recognize the ambulance based on its image. This analyzes the image that is updated in real-time using AI that has been trained to recognize the ambulance using a set of pretrained photos and compares them with the real-time data model to determine whether it is indeed an ambulance. A genuine ambulance is also connected to the system, and when it approaches, it sounds its siren to signal an emergency. We have an AI-based ambulance detection system that just uses the YOLO as a library, and we coupled the built-in features that the YOLO already has with the functionalities we wrote. Based on the packet's arrival and source address, the decision support system decides whether to clear the lane. Once the sound-detection sensor has transmitted the message, the traffic signal resumes its regular function.

Hybrid Application Methodology :

Using the hybrid software, the ambulance driver may also determine the shortest path to the relevant hospital., saving both the patient's life and the driver's time. The hybrid was created using the React native language, along with certain front-end technologies, including HTML, Tailwind, and Bootstrap. The back-end was created using Graphql Yoga, and the database utilized was a Non-SQL database. It was released to the Play store. We have included the GPS module by utilizing Google Maps API Iconic to access Google to locate the ambulance in Real-Time by the hospital as well as by the Hybrid System.

IOT's Siren Detection System Methodology :

The sensors and gateway are linked together using LoRa technology. Transmission of digital wireless data utilising the LoRa (long range) protocol. A whole new wireless standard has been developed specifically for reliable, low-power communications. M2M and IOT's networks are the main target markets for long range, or LoRa. Multiple apps running on the same network will be able to communicate with one another using this technology via public or multi-tenant networks. The most serious concerns facing our planet are addressed by smart IOT's applications made feasible by LoRa technology, encompassing catastrophe protection, efficient infrastructure, energy management, resource conservation, and more. The IOT's main building block, LoRa technology, is what gives the world its intelligence. Long range, low battery use, and secure data transfer are some of its enticing characteristics for IOT applications. The technology has a greater range than cellular networks and can be used in public, hybrid private networks. Millions of nodes may be under the direction of a single LoRa gateway. Because signals can be sent over long distances with no infrastructure, creating a network is less expensive and simpler to install.Additionally, LoRa includes a variable data rate algorithm that increases network capacity and the battery life of the nodes. Encryption at the app, network, and device are among the layers of security offered by the LoRa protocol for communications.

Algorithm used

1) Start.
2) Listen for an ambulatory services's sound.
3) Set the camera if the frequencies are compatible.
4) Take a vehicle-filled photo of the chosen road.
5) Evaluate the picture against the data.
6) Send the HS a message if the car and an ambulatory services are compatible.
7) The sender address is checked by HS when it receives the message from the smart object.
8) HS makes the correct decision by removing the requested smart item from the lane of travel.
9) Proceed to step 7 in the event that there is any new message from the same or other smart objects.

V. Conclusion

The most urgent problem that the technology is intended to solve is the delay of ambulatory services caused by stationary or slowly moving traffic. The recommended method can be used to recognise the sirens of a firetruck, ambulance, or police car. The reference articles examined during the literature study included sensors in every vehicle, which has a number

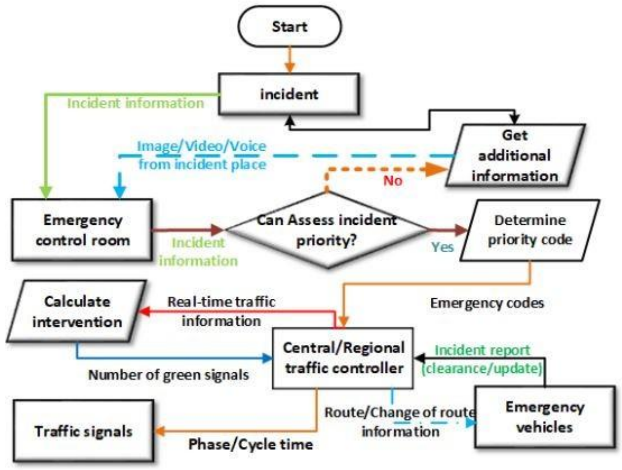

Fig. 4. Algorithm Work Flow

of limitations. Additionally, a predetermined time period was created following the arrival of the ambulatory services before returning to regular operation. Using long-range, low-range LoRa and smart objects at the junction, the aforementioned issues are resolved in an affordable way. The traffic is monitored by the cloud-based decision support system, which also stores data there. Therefore, it is possible to retrieve this data and look through it to see where it may be improved. In order to switch to a bigger database, the storage system will dynamically extend the data's capacity, which should speed up access. Based on emerging technologies, the hybrid application's Ui may change in the future. We are able to construct an escort system for additional ambulatory services, including a fire truck and a police car.

VI. REFERENCES

[1] S. Javaid, A. Sufian, S. Pervaiz and M. Tanveer, "Smart traffic management system using Internet of Things," 2018 20th International Conference on Advanced Communication Technology (ICACT), Chuncheon, Korea (South), 2018, pp. 1-1, doi: 10.23919/ICACT.2018.8323769.

[2] Z. Xie, Y. Wu, J. Gao, C. Song, W. Chai and J. Xi, "Emergency obstacle avoidance system of driverless vehicle based on model predictive control," 2021 International Conference on Advanced Mechatronic Systems (ICAMechS), Tokyo, Japan, 2021, pp. 22-27, doi: 10.1109/ICAMechS54019.2021.9661515.

[3] A. Chowdhury, "Priority based and secured traffic management system for emergency vehicle using IoT," 2016 International Conference on Engineering MIS (ICEMIS), Agadir, Morocco, 2016, pp. 1-6, doi: 10.1109/ICEMIS.2016.7745309.

[4] Y. Su, H. Cai and J. Shi, "An improved realistic mobility model and mechanism for VANET based on SUMO and NS3 collaborative simulations," 2014 20th IEEE International Conference on Parallel and Distributed Systems (ICPADS), Hsinchu, Taiwan, 2014, pp. 900-905, doi: 10.1109/PADSW.2014.7097905.

[5] Y. -S. Huang, Y. -S. Weng and M. Zhou, "Design of Traffic Safety Control Systems for Emergency Vehicle Preemption Using Timed Petri Nets," in IEEE Transactions on Intelligent Transportation Systems, vol. 16, no. 4, pp. 2113-2120, Aug. 2015, doi: 10.1109/TITS.2015.2395419.

[6] R. V. R, S. Pragdesh P, D. R. S and S. D, "Automatic Traffic Clearance for Emergency Vehicles," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2022, pp. 1132-1138, doi: 10.1109/ICESC54411.2022.9885603.

[7 *S. Saravanan, "Implementation of efficient automatic traffic surveillance using digital image processing," 2014 IEEE International Conference on Computational Intelligence and Computing Research, Coimbatore, India, 2014, pp. 1-4, doi: 10.1109/ICCIC.2014.7238419.*

[8] S. R. Kazemee, M. S. Mahmud, Y. Rahman, M. A. R. Khan, B. B. Pathik and M. Kabiruzzaman, "Design and Implementation an IoT Based Smart Traffic System Using Renewable Energy Sources," 2022 2nd International Conference on Image Processing and Robotics (ICIPRob), Colombo, Sri Lanka, 2022, pp. 1-6, doi: 10.1109/ICIPRob54042.2022.9798731.

[9] L. Jácome, L. Benavides, D. Jara, G. Riofrio, F. Alvarado and M. Pesantez, "A Survey on Intelligent Traffic Lights," 2018 IEEE International Conference on Automation/XXIII Congress of the Chilean Association of Automatic Control (ICA-ACCA), Concepcion, Chile, 2018, pp. 1-6, doi: 10.1109/ICA-ACCA.2018.8609705.

[10] G *A. K. Mittal and D. Bhandari, "A novel approach to implement green wave system and detection of stolen vehicles," 2013 3rd IEEE International Advance Computing Conference (IACC), Ghaziabad, India, 2013, pp. 1055-1059, doi: 10.1109/IAdCC.2013.6514372.*

[11] Bin Zeng and Lu Yao, "Study of vehicle monitoring application with wireless sensor networks," 11th International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM 2015), Shanghai, 2015, pp. 1-4, doi: 10.1049/cp.2015.0747.

[12] B. Ghazal, K. ElKhatib, K. Chahine and M. Kherfan, "Smart traffic light control system," 2016 Third International Conference on Electrical, Electronics, Computer Engineering and their Applications (EECEA), Beirut, Lebanon, 2016, pp. 140-145, doi: 10.1109/EECEA.2016.7470780.

[13 *K. -H. Chen, C. -R. Dow, D. -J. Lin, C. -W. Yang and W. -C. Chiang, "An NTCIP-based Semantic ITS Middleware for Emergency Vehicle Preemption," 2008 11th International IEEE Conference on Intelligent Transportation Systems, Beijing, China, 2008, pp. 363-368, doi: 10.1109/ITSC.2008.4732608.*

[14] A. Buchenscheit, F. Schaub, F. Kargl and M. Weber, "A VANET-based emergency vehicle warning system," 2009 IEEE Vehicular Networking Conference (VNC), Tokyo, Japan, 2009, pp. 1-8, doi: 10.1109/VNC.2009.5416384.

[15] M. Mousa, M. Abdulaal, S. Boyles and C. Claudel, "Wireless Sensor Network-Based Urban Traffic Monitoring Using Inertial Reference Data," 2015 International Confer-

ence on Distributed Computing in Sensor Systems, Fortaleza, Brazil, 2015, pp. 206-207, doi: 10.1109/DCOSS.2015.21.

[16] R. Sundar, S. Hebbar and V. Golla, "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection," in IEEE Sensors Journal, vol. 15, no. 2, pp. 1109-1113, Feb. 2015, doi: 10.1109/JSEN.2014.2360288.

[17] J. R. Srivastava and T. S. B. Sudarshan, "Intelligent traffic management with wireless sensor networks," 2013 ACS International Conference on Computer Systems and Applications (AICCSA), Ifrane, Morocco, 2013, pp. 1-4, doi: 10.1109/AICCSA.2013.6616429.

[18] S. S. P. Moka, S. M. Pilla and S. Radhika, "Real Time Density Based Traffic Surveillance System Integrated with Acoustic Based Emergency Vehicle Detection," 2020 4th International Conference on Computer, Communication and Signal Processing (ICCCSP), Chennai, India, 2020, pp. 1-7, doi: 10.1109/ICCCSP49186.2020.9315209.

[19] S. Sarath and L. R. Deepthi, "Priority Based Real Time Smart Traffic Control System Using Dynamic Background," 2018 International Conference on Communication and Signal Processing (ICCSP), Chennai, India, 2018, pp. 0620-0622, doi: 10.1109/ICCSP.2018.8524501.

[20] D. J. Rumala, A. Kurniawan, E. M. Yuniarno and K. Salehin, "An IoT Application for Smart Navigation of High Priority Vehicles (HPVs) Using Preemptive Traffic-Light Control," 2020 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM), Surabaya, Indonesia, 2020, pp. 193-198, doi: 10.1109/CENIM51130.2020.9297872.

[21] H. Xie, S. Karunasekera, L. Kulik, E. Tanin, R. Zhang and K. Ramamohanarao, "A Simulation Study of Emergency Vehicle Prioritization in Intelligent Transportation Systems," 2017 IEEE 85th Vehicular Technology Conference (VTC Spring), Sydney, NSW, Australia, 2017, pp. 1-5, doi: 10.1109/VTCSpring.2017.8108282.

[22] P. Soleimani, M. R. B. Marvasti and P. Ghorbanzadeh, "A Hybrid Traffic Management Method Based on Combination of IOV and VANET Network in Urban Routing for Emergency Vehicles," 2020 4th International Conference on Smart City, Internet of Things and Applications (SCIOT), Mashhad, Iran, 2020, pp. 58-65, doi: 10.1109/SCIOT50840.2020.9250198.

[23] S. Amir, M. S. Kamal, S. S. Khan and K. M. A. Salam, "PLC based traffic control system with emergency vehicle detection and management," 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kerala, India, 2017, pp. 1467-1472, doi: 10.1109/ICICICT1.2017.8342786.

[24] T. Sarapirom and S. Poochaya, "Detection and Classification of Incoming Ambulance Vehicle using Artificial Intelligence Technology," 2021 18th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON), Chiang Mai, Thailand, 2021, pp. 18-21, doi: 10.1109/ECTI-CON51831.2021.9454821.

[25] C. Shekhar and S. Saha, "IoT-Assisted Low-Cost Traffic Volume Measurement and Control," 2022 14th International Conference on COMmunication Systems NETworkS (COMSNETS), Bangalore, India, 2022, pp. 806-811, doi: 10.1109/COMSNETS53615.2022.9668354.

[26] O. Avatefipour and F. Sadry, "Traffic Management System Using IoT Technology - A Comparative Review," 2018 IEEE International Conference on Electro/Information Technology (EIT), Rochester, MI, USA, 2018, pp. 1041-1047, doi: 10.1109/EIT.2018.8500246.

[27] T. Chowdhury, S. Singh and S. M. Shaby, "A Rescue System of an advanced ambulance using prioritized traffic switching," 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, India, 2015, pp. 1-5, doi: 10.1109/ICIIECS.2015.7193161.

[28] W. Yu, W. Bai, W. Luan and L. Qi, "State-of-the-Art Review on Traffic Control Strategies for Emergency Vehicles," in IEEE Access, vol. 10, pp. 109729-109742, 2022, doi: 10.1109/ACCESS.2022.3213798.

[29] C. S. Lim, R. Mamat and T. Braunl, "Impact of Ambulance Dispatch Policies on Performance of Emergency Medical Services," in IEEE Transactions on Intelligent Transportation Systems, vol. 12, no. 2, pp. 624-632, June 2011, doi: 10.1109/TITS.2010.2101063.

[30] R. Sundar, S. Hebbar and V. Golla, "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance, and Stolen Vehicle Detection," in IEEE Sensors Journal, vol. 15, no. 2, pp. 1109-1113, Feb. 2015, doi: 10.1109/JSEN.2014.2360288.

[31] N. Al-Ostath, F. Selityn, Z. Al-Roudhan and M. El-Abd, "Implementation of an emergency vehicle to traffic lights communication system," 2015 7th International Conference on New Technologies, Mobility and Security (NTMS), Paris, France, 2015, pp. 1-5, doi: 10.1109/NTMS.2015.7266494.

[32] A. Khan, F. Ullah, Z. Kaleem, S. Ur Rahman, H. Anwar and Y. -Z. Cho, "EVP-STC: Emergency Vehicle Priority and Self-Organising Traffic Control at Intersections Using Internet-of-Things Platform," in IEEE Access, vol. 6, pp. 68242-68254, 2018, doi: 10.1109/ACCESS.2018.2879644.

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