Don Bosco Institute of Technology

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SYNOPSIS

On

Smart Ambulance for Traffic Monitoring System Using IOT

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ABSTRACT

With the increase in the number of automobiles in urban cities, the number of accidents has increased manifold. Hence, the need for ambulances is increasing at an alarming rate. In order to increase the survival rates of the patients, an efficient communication of ambulances with the hospital and routing of the ambulances at the signal posts is very essential. Hence, the proposed architecture is distributed in nature. The system not only provides effective communication between the ambulance and the hospital but also helps the ambulance send the signal to nearby traffic signal posts to open up so that the ambulance can easily pass through saving ample amounts of time. The signal posts use a camera to detect the incoming ambulance and open up that lane so that the ambulance need not spend much time waiting for the traffic to get cleared.

Keyword: Smart Ambulance, intelligent traffic monitoring system, Internet of Things, smart city.

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CHAPTER 1

INTRODUCTION

Reducing the travel time of ambulances to increase the chance of casualty's survival has always been a challenge, especially in the urban cities due to high traffic congestion. Ambulances often spend time waiting at signal posts which reduces the chances of survival of the patient. Moreover, when it comes to accidents, every year, India accounts for 5 lakh accidents which is the world's highest. Also there have been many situations where the ambulance couldn't reach the accident spot or the hospital on time due to the traffic congestion.

According to statistics, around 68% of traffic congestion occurs due to the signals. In order to avoid this, we need a system that can not only detect the ambulance but also provide effective communication with the upcoming signals so that the ambulance need not spend much time waiting at the signal posts. Effective communication with nearby hospitals can potentially help the hospital to keep track of the ambulance location and also arrange for the required facilities such as beds, surgeons, etc before the ambulance arrives. Effective communication with nearby ambulances can help in case of ambulance breakdown, so that the patient can be shifted from this ambulance to another easily.

1.1 Motivation

The motivation behind a smart ambulance traffic monitoring system is to improve emergency medical services (EMS) and enhance patient outcomes. The system leverages advanced technologies, such as Internet of Things (IoT) devices, data analytics, and real-time traffic monitoring, to optimize ambulance operations and reduce response times in urban areas. Here are some key motivations for implementing a smart ambulance traffic monitoring system: Saving lives, Enhancing traffic management, Improving resource allocation, Enhancing situational awareness, Enhancing patient experience. In summary, the motivation behind a smart ambulance traffic monitoring system is to optimize ambulance operations, reduce response times, and improve patient outcomes during medical emergencies. By leveraging advanced technologies and real-time data, the system can enhance traffic management, resource allocation, and situational awareness, leading to more efficient and effective emergency medical services.

1.2 Background

A smart ambulance traffic monitoring system using Internet of Things (IoT) technology is a solution that aims to optimize ambulance operations and improve emergency medical services (EMS) by leveraging the capabilities of IoT devices. IoT refers to the network of interconnected devices that communicate and exchange data with each other over the internet. In the context of a smart ambulance traffic monitoring system, IoT devices can include traffic sensors, GPS trackers, vehicle-to-vehicle communication systems, and other relevant devices.

The background of using IoT in a smart ambulance traffic monitoring system can be traced to the increasing challenges faced by EMS providers in urban areas. Traffic congestion, road closures, and changing traffic patterns can significantly impact ambulance response times, which are critical in emergency situations. EMS providers need real-time data and insights to navigate through traffic efficiently, allocate resources effectively, and make informed decisions for ambulance operations.

IoT technology provides a means to collect, analyze, and utilize real-time data from various sources to enhance traffic management, resource allocation, and situational awareness for EMS providers. IoT- enabled smart ambulance traffic monitoring systems can enhance situational awareness by providing real-time information on road conditions, weather, and traffic patterns. This allows EMS providers to make informed decisions about ambulance operations, adjust routes in response to changing conditions, and improve operational efficiency.

Moreover, IoT devices can facilitate communication and coordination among ambulances, traffic signals, and other devices, enabling real-time collaboration and coordination for better traffic management and resource allocation. In summary, the background of using IoT in a smart ambulance traffic monitoring system is driven by the need for real-time data, enhanced traffic management, efficient resource allocation, improved situational awareness, and scalability and flexibility. By leveraging IoT capabilities, EMS providers can optimize ambulance operations, reduce response times, and improve patient outcomes during medical emergencies in urban areas.

1.3 Literature Survey

- **Automatic traffic density control system with wireless speed limit notification, in: IEEE 11th Annual Computing and Communication Workshop and Conference, CCWC), 2021.**

  The proposed system is designed and implemented to control traffic signal timer automatically according to input traffic volume in a particular lane, which is detected by the sensor unit. As per the level of traffic congestion, the timer value is increased/decreased automatically and at necessary emergency situation like high volume traffic for long time, the system will automatically trigger predefined alert SMS to the authority. The system also notifies the previous lane by sending alert message on LCD to avoid lanes ahead which has high traffic density. A conventional method of controlling signals manually is also provided for emergency situation. The smart pole is installed with LCD to display the alert message and it contains emergency alert buttons which are used to alert police, traffic, ambulance, fire authorities if any problem occurred in a particular lane. Wireless speed limit notifier is installed in desired lanes which notifies the driver about the speed limit of a zone via wireless technology.[2]

- **Sonal Agrawal, Prakhar Maheshwari, Controlling of smart movable road divider and clearance ambulance path using IOT cloud", in: 2021 International Conference on Computer Communication and Informatics, ICCCI, 2021.**

  In this paper, we design a movable road divider that moves depending on the traffic conditions. Real-time data of the traffic compiled using IoT in such that it will connect a link between traffic and divider with the help of computer vision. This proposed system provides the free path for an ambulance which ensures the ambulance to reach the destination on time or without any delay and the life of humans is more important. It also reduces the time of journey in peak hours and save time and fuel. Deep learning is used to acquiring the current situation of traffic and these data will store in clouds using cloud computing and big data handling over IOT. Cloud database sends the message to embedded system over IOT protocols to shift the divider left or right. Smart moveable road divider system help to clearing the traffic on road during peak hours of the day and whenever any ambulance stuck in traffic it will automatically recognize the ambulance and clearing the path using this device.[3]

- **Qingfang Liu, Baosheng Kang1 Keping Yu, (Member, Ieee), Xin Qi, Jing Li, Shoujin Wangv, Hong-an Li, Contour - Maintaining - Based Image Adaption for an Efficient Ambulance Service in Intelligent Transportation Systems" School of Information Science and Technology, Northwest University IEEE, 2020.**

  The main aim of this project is to contour-maintaining-based image adaptation method, called SC- OE, for an efficient ambulance ITS service. Firstly, the method combines weighted gradient, saliency, and edge maps into an importance map. Secondly, according to the slope and curvature of the edge in unimportant areas, serrated channels are set in the gentle edge area that can guide the optimal seams to evenly pass through edge areas. This method protects the integrity and display proportion of prominent object, improves the continuity and smoothness of edges and contours, and maintains their shape in non-salient areas. To improve the visual effect of adapted images, a contour-maintaining- based image adaption method for an efficient ambulance service in ITS is proposed here. Finally, applying the sub-procedure of a forward seam carving method, the optimal seams can more evenly pass through the contour areas. The experimental results demonstrate that the proposed method is more effective than other similar methods. [4]

- **Willy Carlos Tchoutchoua, Christophe Bobda, Md Jubaer Hossain Pantho, Internet of smart- cameras for traffic lights optimization in smart cities, Sci Direct 11 (2020), 100207**

  In this paper, we propose a new and versatile method that uses distributed smart cameras along with advance image understanding to supply the waiting queue in realtime with traffic data (vehicles count, types, density, etc...). This information can then be used by a central authority to control the whole traffic infrastructure. In a survey has been made on adaptive algorithms for traffic control. However, these approaches haven't considered the priority for emergency vehicles, and in case of changing traffic rules or maintenance at the intersection, the algorithm fails to adapt. We have used open-source OpenCV [27] version 4.0.0 in C++ language. The main challenges associated with traffic congestion and emergency vehicles were discussed and an adaptive algorithm was presented. Our future works will attempt to first extend the simulation to multiple intersections data-set while introducing new elements like pedestrian crossing, and secondly port this work on edge devices to perform computation.[5]

- **Chakkaphong Suthaputchakun, Yue Cao, Ambulance-to-Traffic light controller communications for rescue mission enhancement, in: A Thailand Use Case" IEEE Communications Magazine December, 2019.**

  The main objectives of this paper are to improve road safety and traffic flow. However, the paper focuses on network performance in terms of network throughput and end-to-end delay rather than the rescue mission performance, such as travel time and speed of the ambulances. Without a comprehensive performance evaluation, this approach becomes unconvincing. The proposed A2T aims to promote information sharing between ambulances and traffic light controllers along rescue routes in advance, through V2I communications. As a result, the traffic light controllers can switch to a green traffic light to allow the approaching ambulances to pass any intersections immediately and safely.[6]

1.4 Problem Statement

The problem statement is categorized into 3 modules namely **Ambulance Detection and traffic control, Ambulance communication system and Hospital side software**. In this step the components that are required for each module taking into considerations the following aspects:

- Long range transmission between signal poles.
- Receiver efficiency at the hospital.
- Logging data and files on a collective server.
- Speed into consideration (Shortest available storage).
- Consistency into consideration (Main storage).
- Database for various data information with variable schema design.
- Security management system.
- Road traffic management system.

CHAPTER 2

METHODOLOGY

This chapter elucidates the methodology of this project.It works on internet of things.It is divided as existing methodology followed by the proposed methodology.The figure 2.1 depicts the block diagram given below which represents the general methodology:

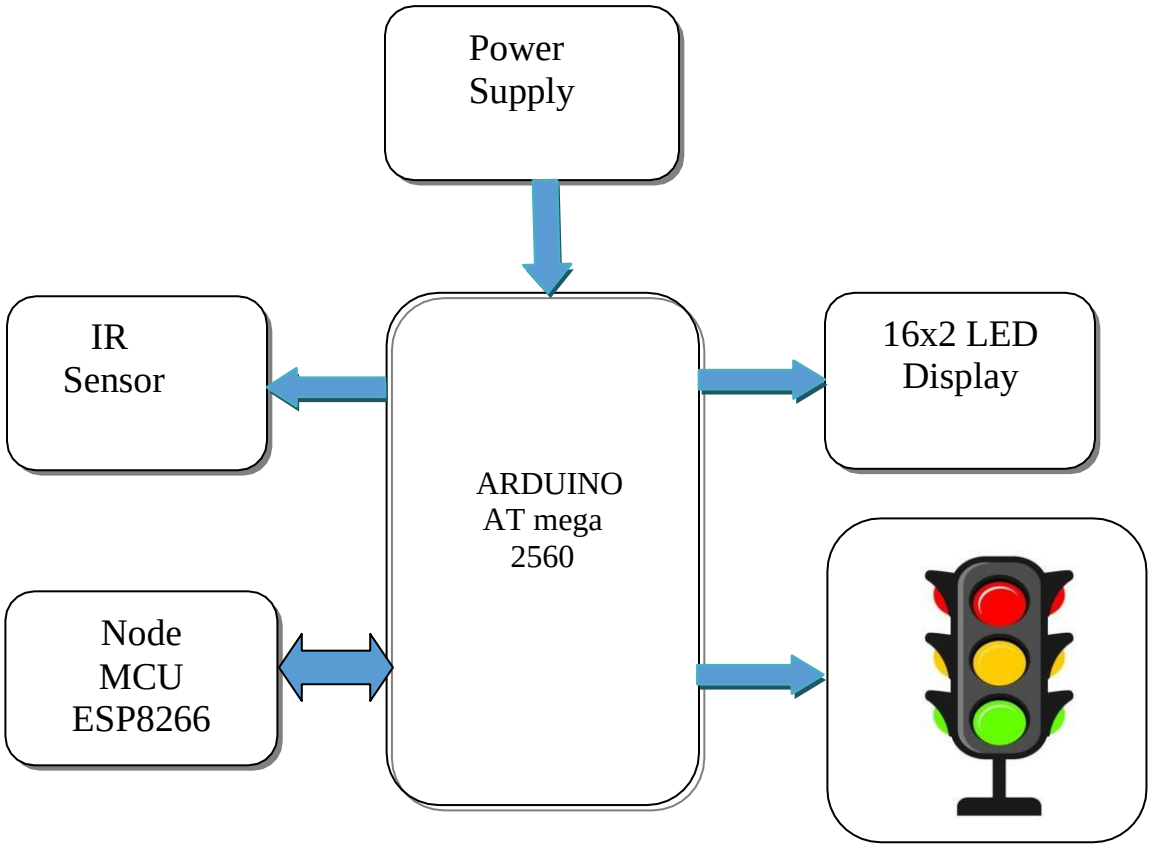

Fig 2.1 Smart Ambulance Traffic Monitoring System Using IOT

2.2 Limitations of Existing System

IoT devices and systems from different manufacturers may use different communication protocols and standards, making interoperability a challenge. This can hinder seamless integration and communication among different components of the system, such as ambulances, traffic sensors, and traffic management centers, leading to potential data inconsistencies and inefficiencies. The accuracy and coverage of traffic data used in the system can vary, and some areas may have limited or no data available. This can affect the system's ability to provide accurate and real-time traffic information, leading to suboptimal routing decisions for ambulances.

2.3 Proposed System/Approach

Our proposed system proposes the following features:

- Ambulance Detection and traffic control is a surveillance system which identifies the vehicle and the computer system reads the vehicle from image processing. If the vehicle is identified as an ambulance, then it sends the message to signal to make the light green or keep it green.
- Ambulance communication systems however involve sending log data and have effective communication between the ambulance and the hospital.
- Hospital side software which receives the information from the nearest signal post and pops up an alert message, which the hospital can use to make arrangements for utilities such as bed, surgeon, etc

3.Tools or Languages Used

Arduino is an open-source platform composed of hardware and software that will allows for rapid development of interactive electronics projects. The emergence of Arduino drew the attention of professionals from many different industries, contributing to the start of the Maker Movement.

With the growing popularity of the Maker Movement and the concept of Internet of things, Arduino has become one of the main platforms for electronic prototyping and the development of MVPs.

Arduino uses its own programming language, which is similar to C++. However, it's possible to use Arduino with Python or another high-level programming language. In fact, platforms like Arduino work well with Python, especially for applications that require integration with sensors and other physical devices.

4.Applications and Advantages

This section of the chapter discusses the application and advantages of utilising this system in Traffic monitoring.

Applications:

- Real-time Traffic Monitoring: IoT sensors and devices can collect data on traffic conditions, such as congestion, accidents, road closures, and construction, in real-time. This information can be used to dynamically route ambulances to the most optimal and fastest routes, avoiding traffic congestion and reducing response time.
- Emergency Vehicle Priority: IoT-enabled traffic management systems can prioritize emergency vehicles, such as ambulances, by providing them with green signal priority at traffic signals.
- Data Integration and Sharing: IoT-enabled ambulance traffic monitoring systems can integrate and share data with other systems, such as hospital information systems, electronic health records, and emergency management systems.

Advantages:

- Emergency notification and coordination by integrating with emergency call centers and providing acommunication platform for ambulance drivers, dispatchers, and hospitals.
- Safety hazard alerts to provide timely information to ambulance drivers about potential safety hazardson the roads.
- Remote patient monitoring by integrating IoT devices in ambulances to monitor patient vital signs andtransmit data to hospitals in real-time.
- Vehicle health monitoring to track ambulance maintenance needs, fuel consumption, and optimizevehicle performance.

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