A Smart Traffic Management System for Efficient Emergency Vehicle Clearance

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ABSTRACT: Rapid urbanization and population growth have led to a significant increase in vehicular traffic, resulting in severe road congestion. This situation not only disrupts daily transportation and business activities but also critically delays the movement of emergency vehicles such as ambulances, fire trucks, and police units, potentially risking human lives. To address this challenge, a dual-system traffic management solution is proposed. The first system leverages RFID technology integrated with intelligent signaling to streamline vehicle flow and minimize bottlenecks. The second system incorporates a strobe-based emergency vehicle detection mechanism, enabling dynamic traffic clearance by notifying surrounding vehicles and traffic signals. The integration of these two systems enhances real-time traffic control and ensures fast and uninterrupted passage for emergency vehicles. This approach presents a promising advancement toward safer and more efficient transportation management in highly congested urban environments.

KEYWORDS: Garcon, Mobile app, Arduous, TV Display, GPS Tracking System,- RFID technology, business signal operation, traffic concurrence;

1. INTRODUCTION

In today's rapidly evolving world, advancements in technology are crucial, particularly in improving healthcare effectiveness amidst the challenges posed by industrialization and urbanization. With the continuous influx of vehicles on roads, major metropolises are grappling with severe business logjams, adversely affecting transportation services, especially ambulances [1], [2]. The critical nature of ambulance services demands swift and unimpeded access to medical facilities, particularly in life-threatening situations. Research indicates that timely arrival at the hospital significantly improves the chances of survival, especially in heart attack cases. Despite the demand for vehicles to clear the way for ambulances, they often get ensnared in business logjams, leading to precious time wastage [3]. To address this issue, leveraging technologies like the Internet of Things (IoT) becomes imperative. IoT enables seamless connectivity and control of various devices through wireless or wired networks, offering digital representation and enhanced functionality. In this context, the concept of "Intelligent Traffic: A Control System for Smart Ambulance" emerges [4], [5]. This system aims to facilitate uninterrupted ambulance movement to designated destinations by integrating traffic lights controlled by ambulance drivers. Essential information about the ambulance's condition, critical or non-critical, guides the traffic light control mechanism. Depending on the urgency of the situation, the ambulance driver triggers signals directing traffic lights to prioritize the ambulance's route, ensuring green lights in its path while turning others red. Through this system, ambulances are granted a clear passage, minimizing transit time and optimizing emergency response.

2. MAJOR PROBLEM IDENTIFY

Problem 1:

In contrast to Western countries, Indian metropolises lack dedicated lanes for emergency vehicles due to inadequate road planning. This deficiency poses a significant challenge as the timely arrival of ambulances to medical facilities is critical for saving lives. Compounded by subpar public transportation and a surge in private vehicle ownership, congestion at business signals further impedes ambulance movement. Amidst the chaotic rush of vehicles jostling for space once the signal changes, ambulances often find themselves stranded, exacerbating delays in emergency response. Addressing this pressing issue is imperative to enhance quality of life and ensure timely medical care for those in need.

Problem 2:

During the transit of a patient from the source to the sanitarium, communication gaps between the patient in the ambulance and the attending physician pose a critical challenge. Without real-time communication, healthcare providers are unable to intervene promptly and provide necessary directions for patient care. Our design addresses this issue by transmitting vital parameters such as heart rate and body temperature to the Sanitarium in real-time. This proactive approach enables healthcare professionals to assess the patient's condition remotely and take appropriate measures even before arrival, ensuring timely and effective medical intervention.

Problem 3:

In hospitals, the process of manually recording patient biodata for hospitalization purposes can be cumbersome and prone to errors. To address this issue, our solution integrates a fingerprint system for seamless access to patient records stored in a centralized database. By capturing and storing patient details in advance, this system eliminates the need for manual data entry, streamlining the hospitalization process and ensuring accurate record-keeping. With the touch of a finger, healthcare providers can instantly retrieve comprehensive patient information, facilitating efficient and personalized care delivery.

Problem 4:

1. The system's operation relies on factors such as viscosity and signal alterations, which are not exclusively tailored to managing ambulance traffic.
2. A notable deficiency in the current setup is the absence of real-time updates to the Sanitarium regarding the patient's current medical condition.
3. The ambulance is equipped with business control capabilities, allowing the driver to manipulate traffic signals as needed.

3. IMPLEMENTATION

This composition presents an innovative idea aimed at expediting emergency response to save lives swiftly. When an ambulance halts at a signal, the driver promptly transmits an emergency command to the control station, accompanied by GPS coordinates. Utilizing this information, the nearest signal is identified, and an emergency command is relayed accordingly [6]. Based on the input received from the control station, the designated signal switches to green, facilitating the ambulance's unimpeded passage. To further optimize real-time operations, the system incorporates an advanced GPS navigation module, significantly reducing the risk of fatalities during critical situations. The system comprises two distinct

modules: a software module employing Android technology and a hardware module dedicated to managing traffic signals. This multifaceted approach ensures swift and effective emergency response, underscoring its potential to mitigate risks and save lives.

First:

The initial module operates on the Android platform. Upon arriving at an accident site, the ambulance driver utilizes an Android application to input crucial information about the case. This includes the patient's name, age, blood type, gender, and current condition, which is assessed through various tests such as EKG and blood pressure monitoring. This data is then transmitted to the Sanitarium control station, enabling medical staff to prepare accordingly for the patient's arrival. Additionally, depending on the urgency of the situation, the driver can send an emergency command through the Android app to the control station. This module functions on the principles of the Internet of Things (IoT), facilitated by a REST API, ensuring seamless communication and coordination between the ambulance and the Sanitarium.

Second:

The alternative module focuses on the management of traffic signals, employing Arduino technology. This module integrates a Wi-Fi module, enabling communication with the control station. Utilizing the Wi-Fi module, the module receives instructions and data directly from the control station, establishing a seamless connection between the Android operation and the traffic signal. This direct connectivity streamlines the process, ensuring efficient and synchronized control of the business lights based on real-time inputs received from the control station.

Hardware Requirements:

- Arduous Microcontroller
- RF reader
- RF transmitter and Receiver
- Traffic light
- GPS
- LED's

Software Requirement:

- Arduous IDE
- Embedded C

4. ADVANTAGE AND DISADVANTAGE

ADVANTAGES

- **Efficiency in Emergency Response:** Ambulance services will no longer be hindered by business logjams, ensuring swift and timely response to emergencies.
- **Enhanced Connectivity:** Utilizing radio frequency signals, unhindered by physical obstacles, guarantees seamless communication and coordination, ensuring prompt assistance during critical situations.

- **Cost-effective Solution:** With a one-time investment cost, implementing this system promises long-term benefits, making it a financially viable option for sustained operations.
- **Saving Lives:** The paramount objective of this initiative is to safeguard lives, ensuring that individuals receive immediate medical attention when faced with emergencies.
- **Modernized Business Control:** This approach represents a contemporary method of managing businesses, integrating technology to streamline operations and optimize efficiency.
- **Simplified Regulation:** Facilitating easy business regulation, particularly in bustling urban centers like Delhi and Mumbai, this system ensures smoother operations and compliance with regulatory standards.

DISADVANTAGES

- **Infrared Transmission Constraints:** The line-of-sight nature of infrared waves restricts their ability to penetrate obstacles like walls and doors, limiting their transmission range and effectiveness in certain environments.
- **Obstruction by Common Objects:** Line-of-sight transmission can be disrupted by everyday objects such as people or large items, impeding the seamless flow of communication or data transfer.
- **Cost Differential with Barcodes:** RFID systems entail higher costs compared to traditional barcode systems, making them a more substantial investment for businesses seeking to implement them.
- **RFID Technology Sensitivity:** RFID technology requires delicate handling and maintenance to preserve its functionality and reliability, necessitating careful management and attention to operational details.

5. FUTURE SCOPE

The current system fails to provide the shortest route to the nearest sanitarium, nor does it automatically adjust signals along the way. It appears more makeshift than fully automated. However, there's immense potential for improvement. By automating the system, it could efficiently identify the shortest route to the nearest sanitarium. Additionally, if an ambulance halts at a signal, the system could automatically adjust the signal to expedite the ambulance's journey along the shortest route. Such automation not only saves crucial time but also ensures that cases are transferred to the sanitarium in the swiftest manner possible, potentially saving lives in critical situations.

6. CONCLUSION

The existing system lacks transparency in providing routes for emergency vehicles during business logjams. Through extensive literature review, we identified that implementing an RFID-based intelligent business operation system could address this issue effectively. By integrating this system, we ensure a clear path for emergency vehicles even amidst heavy traffic congestion. Moreover, we have successfully integrated vital data sharing capabilities with nearby sanitariums, facilitating seamless communication during emergencies. To enhance the system's functionality, we streamlined the Arduino UNO with an Arduino Mega board, enabling it to store crucial case parameters while simultaneously monitoring the status of business signals on adjacent roads. Additionally, we deployed another system at crossroads to monitor lane viscosity, allowing the system to automatically prioritize routes with lower

traffic density. This approach significantly reduces traffic for emergency vehicles, ensuring expedited arrival at their destinations and ultimately saving numerous lives.

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