Vehicular Traffic And Adaptive Ambulance Signal Change Using Raspberry Pi

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Abstract- *The increasing traffic congestion in urban areas poses a significant challenge to emergency response times, especially for ambulances, fire trucks, and other emergency vehicles. Delays in these situations can be life-threatening, making it crucial to find solutions that can improve response times. This paper explores the development of a Traffic Control System (TCS) for Ambulance Tracking using RFID technology and adaptive signal management, aimed at enhancing emergency vehicle navigation through congested areas. The system utilizes real-time RFID tracking to monitor ambulance movements and adjust traffic signals accordingly, allowing ambulances to move more efficiently through urban traffic. The proposed solution also includes an emergency mail notification system for alerting relevant authorities in case of emergencies. Through this system, the goal is to optimize traffic flow, improve situational awareness for ambulance drivers, and enhance safety. The paper also discusses the risks associated with the system and outlines risk management strategies. Overall, the system aims to reduce delays, improve emergency response times, and ensure safer and more efficient urban traffic management.*

Keywords- Adaptive traffic control, Emergency response times, RFID tracking, Traffic congestion

I. INTRODUCTION

Emergency vehicles, particularly ambulances, play a crucial role in saving lives. Traffic jams make it hard for ambulances, fire trucks, and police cars to reach emergencies quickly. This can lead to delays in helping people, which can be dangerous. To address this issue, we propose vehicular traffic and adaptive ambulance signal change using Raspberry Pie that utilizes Radio Frequency Identification (RFID) technology to prioritize the passage of ambulances through intersections.

Traditionally, ambulances rely on sirens and flashing lights to signal their presence and request right-of-way. While effective in some situations, this method can be less reliable in heavy traffic conditions. This project, on the other hand, offers a more proactive approach. By equipping ambulances with RFID tags and installing RFID readers at intersections, the system can automatically detect the presence of an approaching ambulance and trigger a signal change to green. This enables the ambulance to pass through intersections without delay, reducing response times and potentially saving lives. This project leverages real-time data from RFID tags and traffic sensors to optimize traffic flow and prioritize emergency vehicles. By implementing this system, we aim to improve the efficiency of emergency response services and enhance public safety.

II. LITERATURE SURVEY

A framework for traffic management in IOT networks

Wireless networks for IOT operations support colorful classes of end bias, each with different uplink and downlink business actions. This paper proposes a general frame for classifying IOT bias grounded on their business patterns. A Software Controller is introduced to learn device biographies using information from the device, IOT driver, and contextual data, including machine literacy ways for gesture vaticination. The paper also suggests a resource operation system acclimatized for 802.11 ah networks. also, it addresses business scripts that may not be well- supported by being device classes, similar as bias taking sporadic low data or large uplink/ downlink communication during specific intervals. To handle these scripts, a new device class and dynamic switching medium are proposed, along with a software- defined regulator for dynamic operation of communication openings at IOT bias and Access Points.

Paper Name: A Novel Assistive On-ramp Merging Control System for Dense Traffic Management.

On- ramps are area of frequent business traffic. Proper business guidance around on- ramp coupling areas exerts a positive effect on the relief of business traffic. The ideal of this paper is to design an assistive ramp- incorporating control (ARMCON) system. It utilizes knowledge about professional motorist gesture and the dynamical relationship among the on- ramp vehicles, to produce timely information so as to guide the on- ramp motorists when incorporating with the main business inflow. Under the guidance of ARMCON,

dislocation of the main business on the express way is minimized while a certain coupling rate is maintained.

Paper Name: Comprehensive Review of Smart Urban Traffic Management in the Context of the Fourth Industrial Revolution

The Fourth Industrial Revolution (4IR) has steered in a new period of effectiveness across colorful disciplines, including the operation of Road Traffic Control (RTC) in metropolitan metropolises. Multitudinous studies have illustrated how smart civic business operation systems (TMS), encompassing 4IR technologies like Artificial Intelligence (AI), Machine literacy (ML), Internet of effects, and indeed Software- Define Networks(SDN) or Block-chain can optimize business inflow and alleviate traffic. Given these results, there's a pressing need to estimate these approaches and inventions in terms of their performance and sustainability. This review aims to check current technologies rested on intelligent business operation. It'll examine the methodologies employed, the benefits deduced from these systems, and implicit challenges that may arise. The study has linked and distributed exploration grounded on the TMS procedure from the seeing process, business data evaluation, and result developments. By furnishing a comprehensive overview of state- of- the- art in intelligent business operation, this review seeks to contribute to the ongoing converse on using 4IR technologies for sustainable civic development.

Paper Name: An Automated Game Theoretic Approach for Cooperative Road Traffic Management in Disaster

Transportation system gets paralyzed when a place affected by any disastrous natural disaster. Some roads get blocked and vehicle viscosity increases in all the other remaining routes. Each vehicle stuck at different position of the road network and tries to reach its destination in minimal time. A collaborative game proposition grounded approach is proposed to regulate road business and minimize the waiting time of individual vehicles in any disaster situation. Each vehicle acts as a player and tries to increase its lucre value. Lucre value is grounded on the different parameters of the vehicle like its appearance time, haste, precedence and business viscosity. Lucre value is acclimated according to the being vehicle viscosity in the road member. Business viscosity of each road is minimized contemporaneously which increases the inflow of the vehicles in the network cooperatively. Staying time of a vehicle is directly commensurable to the number of conterminous edges of the corresponding knot and its viscosity. The system also shows that any vehicle with advanced precedence will cross the road in minimal time. New indispensable road creation process is also proposed grounded on graph proposition for the worst situation. The indispensable path will join the affected road with a minimal employed knot in the 6 network to void the affected business. Experimental results suggest that our proposed system achieve minimal average waiting time compare to the being system. The shortest time trip path is set up for each vehicle from its source to the asked destination in post disaster situation.

Paper Name: A Review of IOT devices for Traffic Management System

In recent times, business traffic has increased at a snappy speed especially in metropolitan metropolises. Business traffic leads to increase in noise pollution, traveling time, pollution, and energy destruction etc. There are short term and long term causes of business traffic. Short term causes include business signal failures, hamstrung law enforcement, shy road structure, accidents etc. Long term causes are attributed to profitable growth of

Feature\Title	**A Framework for Traffic Management in IoT Networks**	**A Novel Assistive On-ramp Merging Control System for Dense Traffic Management**	**Comprehensive Review of Smart Urban Traffic Management in the Context of the Fourth Industrial Revolution**	**An Automated Game Theoretic Approach for Co-operative Road Traffic Management in Disaster**	**A Review of IoT devices for Traffic Management System**
Focus	Device classification in IoT-based networks	On-ramp merging using driver behaviour models	Review of smart urban traffic systems using 4IR tech	Disaster response traffic using cooperative game theory	Review of IoT device usage in traffic management
Approach	Dynamic device class management	Expert systems + LSTM + ad	Literature analysis, taxonom	Graph-based model + clusteri	Survey of sensor and IoT

	using SDN and ML	hoc mobile network	y, and best practices	ng + game theory	devices and architectures
Technology	IEEE 802.11ah, LoRaWAN, SDN, ML	LSTM neural networks, Zigbee, virtual trail modeling	AI, ML, Block-chain, SDN, IoT	Cooperative game theory, graph theory, IoT	RFID, WSN, IR, load cells, adaptive control
Use Case	Optimizing wireless IoT traffic patterns	Smoother vehicle mergin g during dense traffic	Broad review to guide future urban TMS design	Traffic optimization during and after disasters	Practical deployment of traffic sensors and control systems
Strengths	Network-specific framework; dynamic traffic handling	Predictive, driver-aware system; field-ready	Strategic insight; categorizes methods and gaps	Efficient, priority-based routing during crises	Covers physical layer (sensor) tech for real-world use
Limitations	Focused mostly on IEEE 802.11ah & LoRaWAN	Limited to mergin g scenarios and simulation data	Pure review; lacks specific implementation	Only focused on post-disaster situations	Technological survey; no system-level integration
Innovation	Introduces new "S-Type" device class for traffic bursts	Integrates expert systems with real-time control	Proposes 4IR-centric TMS model classification	Payoff-driven routing algorithm + new route generation	Detailed classification of IoT hardware for traffic

Table 1.Comparative literature survey

the society, changes in life of people etc. As a result, business operation has come one of the vital areas to be looked into. It includes monitoring of business viscosity, communication, rerouting of business to avoid farther detention. Internet of effects can help in smooth perpetration of business operation system. There are different styles of business operation- videotape analysis, wireless detector network, adaptive business control system that are nearly knit around IOT bias.

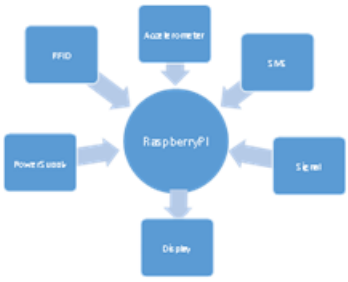

Fig.1 3D View of Building

HARDWARE DESCRIPTION

1. **Raspberry Pi**-Functions such as serving as a server/cloud server, print server, security monitoring, web camera, gaming, wireless access point, and environmental sensing/monitoring (e.g., weather station). The specifications of the Raspberry Pi include a Broadcom BCM2837 64bit Quad Core Processor, operating voltage of 3.3V, raw voltage input of 5V with a 2A power source, flash memory of 16Gbytes SSD memory card, internal RAM of 1Gbytes DDR2, and a clock frequency of 1.2GHz.
2. **System Processors**-The proposed system requires a Core2Duo processor with a speed of 2.4GHz.
3. **RFID: RFID (Radio Frequency Identification)** technology is a valuable tool in modernizing traffic management systems, particularly for prioritizing emergency vehicles like ambulances.
4. **Accelerometer**- Device that measures the acceleration of an object depending upon the x,y,x direction.
5. **l;ight-emitting diode(LED)**-is a semiconductor device that emits light when current flows through it. Red for stop, yellow is for light is about to turn red and driver should slow down and red is to stop vehical.

SOFTWARE DESCRIPTION

The software requirements for the proposed In Traffic Control System for Ambulance Tracking using RFID, as outlined in the document, are as follows

Operating System-Windows 10

Programming Language:-Python

These software components are essential for the development and operation of the proposed system. Python is a versatile programming language commonly used for various applications, including software development, data analysis, artificial intelligence, and more. Windows 10 is specified as the operating system, indicating the compatibility and intended environment for the system.

III. IMPLEMENTATION

The proposed project aims to implement an Intelligent Traffic Control System for Ambulance Tracking using RFID technology. Here's a detailed explanation of how the system is intended to work

1. **RFID Tagging-**Ambulances will be equipped with RFID tags. When an ambulance halts at a traffic signal due to congestion, the RFID reader installed at the traffic signal will track the RFID- tagged ambulance.
2. **Data Transmission-**The RFID reader will then send the data related to the ambulance's presence to the cloud for processing and analysis.
3. **Mobile Acknowledgment-**Once the data is received in the cloud, an acknowledgment mail will be sent to the user (presumably the ambulance driver or staff) through a mobile or laptop. Mail will sent.
4. **Traffic Signal Control-**Upon acknowledgment, the particular traffic signal at the intersection will be changed to green, allowing the ambulance to pass through the intersection without delay.
5. **Reverting to Normal Operation-**After the ambulance passes the intersection, the traffic signal will revert to its original flow of signalling(its old algorithm) , resuming normal traffic operations.
6. **Automation and Time Saving-**The system is designed to be fully automated, enabling it to quickly identify the ambulance's location, control the traffic lights, and save crucial time during emergency situations.

IV. CONCLUSION

The project offers a comprehensive solution to address the challenges of navigating through congested urban areas during emergency medical situations. By integrating RFID technology, real-time traffic data analysis, and mail, the aim is to optimize ambulance traffic, enhance situational awareness for ambulance drivers, improve traffic management, and ultimately enhance public safety and well-being.

The system's ability to dynamically adjust traffic signals to prioritize the passage of ambulances through intersections during emergency situations is a critical feature. This capability is expected to significantly reduce delays and improve the efficiency of ambulance movement in urban areas, ultimately contributing to saving lives during critical medical emergencies.

Furthermore, the proposed system's automation and real- time communication features are designed to provide timely responses to emergency calls, ensuring that ambulances can reach their destinations without unnecessary delays caused by traffic congestion.

In conclusion, the Traffic Control System for Ambulance Tracking using RFID technology presents a promising solution to address the challenges faced by emergency response services in congested urban environments, with the potential to significantly improve the efficiency of ambulance navigation and enhance public safety.

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