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Smart Traffic Signal Technology Reduces Network Traffic Using Internet of Things (IoT) and Computer Based Digital Signaling

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Abstract - Smart traffic signal technology has been created and is being utilized to minimize car emissions in the city. Unlike conventional dynamic control signals, which alter the timing and phasing of lights based on controller programming restrictions, this system integrates current technology with artificial intelligence. The most severe issue in metropolitan areas is traffic. Greater traffic control is required for people to enjoy a problem-free, pleasurable driving experience and to live in a pollution-free environment. When the intersection's traffic intensity is recognized, the signal timing automatically changes. In an emergency, every second matter when it comes to saving someone's life. Many lives are lost before the individual arrives in an ambulance at the hospital, or lives are lost due to a lack of fundamental information on the patient's condition. The Internet of Things (IoT) is a network in which objects, animals, or humans are assigned unique IDs. This paper will go through the RFID, computer vision, and sensor-based technologies that are used in Smart Traffic Systems. The fundamental idea of this project is that when a patient is in an ambulance in an emergency situation, the ambulance should arrive at the hospital as soon as possible.

Keywords: Smart traffic signal technology, Internet of Things (IoT), RFID, computer vision, Smart Traffic Systems

1. INTRODUCTION

We are growing as a country in nearly every aspect. India has one of the world's biggest road networks, covering 5.6 million kilometers. District and country roads account for 95% of total length, national highways account for 2%, and state highways account for the remaining 3%. A country like India, need a smart, automatically regulated traffic system to support its infrastructure and roadways. With advancements in wireless technology, it is possible to apply and execute a cost-effective and smart system in road transportation. RFID is a wireless technology that we are discussing. RFID is an abbreviation for Radio Frequency Identification, which is a wireless technology that involves the interchange of radio frequency electromagnetic energy between RFID tags and RFID readers. Currently, the usage of cars is rising across the country. As its primary identity, each of these cars has a unique vehicle identification number. Every vehicle on the planet must have its own number plate, which must be placed on the vehicle's body. The requirement to identify cars is growing in lockstep with the number of vehicles. This identifying system aids in safety, automated switching, highway speed detection, light detection, stolen vehicle detection, and human and non-human loss collecting systems.

2. RELATED WORK

[1] The problem of efficiently collecting and disseminating traffic information in an urban area is investigated. Road congestion and traffic-related pollution have a large negative social and economic impact on several economies worldwide. This paper investigates the problem of efficiently collecting and disseminating traffic information in an urban setting.

[2] To enhance traffic safety and management, cooperative vehicular technologies are being developed. Cooperative automobiles would become highly important mobile sensors in this context, from which infrastructure pieces installed throughout the road network would collect traffic information. The disadvantage of this technique is that selecting the cluster head generally results in additional communication costs.

[3] In major cities, traffic is the most pressing issue. Traffic control becomes more important in order to offer people a problem-free, pleasant driving experience and a pollution-free way of life. The project's goal is to create a density-based dynamic traffic light system. When the traffic intensity at the junction varies, the signal time changes automatically. The traffic system is equipped with a camera. The visual basic programming is used to regulate the glowing time of traffic lights dependent on the number of vehicles on the road. When deployed on the road, the entire system allows for quick traffic clearing for emergency vehicles, eliminating the need for a sergeant.

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[4] The basic idea of the document is to create a fluid flow for ambulances to arrive at hospitals on time, avoiding delays caused by traffic congestion. Radio Frequency Identification (RFID) is a small electrical device that consists of a small chip and an antenna. The information is received from the RFID locator mounted on the ambulance by the RFID reader stationed at the traffic light. To minimize unnecessary traffic light changes, we use a mobile app registered by the ambulance driver to cross-reference the ambulance's present position and the patient's health.

3. OBJECTIVES

The project's major goal is to allow communication between emergency vehicles and different equipment at traffic signals in order to decrease the risk of traffic congestion. Vehicles are detected and analyzed using image methods in the proposed system. Electronic sensors are not required in this case. To record image frames, a web camera is installed near the traffic signal. The proposed system's goal is to minimize traffic congestion and the time it takes for the system to operate in the absence of cars on the road. It requires additional attention for vehicle estimates by predicting the metal content of each vehicle.

4. SYSTEM MODELS

The overall system can be subdivided into the software model and hardware model. The section will discuss the both models in detail.

A. Hardware Model

The hardware model consists of IR sensor, renesas microcontroller, a liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology, and a light - emitting diode (LED) is a semiconductor light source, PC on which algorithm is executed, and RFID card reader and tag. In our proposed system we have used RFID tags & an RFID reader with a base frequency of 125 kHz. When a vehicle enters the range, the receiver sends a unique RFID to the reader. The RFID reader's microprocessor will count the number of times the tags are scanned in a given amount of time. If the counter surpasses 10, the duration of the green light glow is increased to 15 seconds in the suggested system. If the counter is between 5 and 9, the length of the green light is set to 10 seconds. If the counter value falls below 5, the duration of the green light is reset to 5 seconds. As previously stated, the red light will last 5 seconds and the orange light will last 2 seconds as referred.

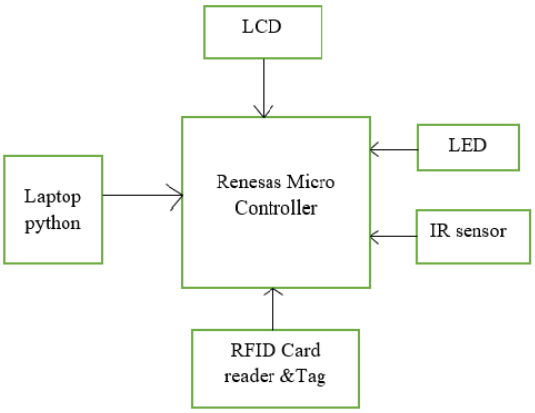

Fig -1: Block diagram of hardware setup

B. Software Model

A computer system that identifies any digital picture on a license plate was known as License Plate Recognition. This system can take photos, localize the number pad, truncate characters, and do OCR from alphanumeric characters. The main idea behind this system is to use the Open Computer Vision Library to design and develop effective image processing techniques and algorithms for localizing the license plate in the captured image, dividing the characters from that number plate, and identifying each character of the segment. The resolution of the number plate recognition system is determined by the image recorded. The RGB image recorded must be transformed to a grayscale image.

Number plate localization: The license plate is retrieved using either a shape analysis or a color analysis approach. The General License Panel is rectangular in design. As a result, algorithms seek geometrical forms with a rectangular proportion. Because most license plates in India are white or yellow, color analysis can also be used. Before you can locate the rectangle in a picture, it must be in binary format or the image's edges must be identified. Then you must locate and connect the necessary rectangle corners. Finally, all rectangular regions of interest are removed and the areas related to the box are connected.

5. CONCLUSIONS AND FUTURE ENHANCEMENT

The topic of traffic lights is clearly an important one that both residents and governments are concerned about. The impact of a traditional transportation system that is inefficient has an impact on the economic, health, financial, and environmental sectors. Transportation system problems and inadequate management can lead to automobile accidents, traffic jams, and road congestion, having an impact on companies and workers. A traffic light controller operates the traffic lights at a "+" junction of mono-directional roadways in the proposed smart traffic system. Using IR sensors installed

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on each side of the road, the system can estimate traffic density. Based on this information, the duration allotted for the green light will be increased to allow for a significant flow of automobiles in the event of a traffic jam or decreased to save excessive waiting time when no cars are present on the opposite road. The system is supplemented with a portable controller for emergency vehicles that are stranded in traffic. This system is more precise due to the use of an advanced microcontroller board, which reduces network traffic for the Internet of Things (IoT). The system may also be integrated with the proposed system and offers an amount of opportunity for development. This enhancement would raise awareness about the precise area.

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