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Atmega Based Automatic Traffic Control Using Traffic Density and Ambulance Detection System

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ABSTRACT—

An intelligent traffic control system may be powered by an ATmega microcontroller. This system dynamically modifies traffic light timing based on actual congestion by employing traffic density sensors, such as infrared or ultrasonic ones. Priority access is provided during emergency situations through emergency vehicle detection, which is accomplished through specific RF signals or flashing light recognition. This strategy can greatly enhance emergency service response times and traffic flow.

I. Introduction

In today's cities, traffic congestion is a major problem that causes fuel waste, higher emissions, and longer response times for emergencies. Conventional fixed-time traffic signals frequently can't change to accommodate these shifting circumstances. With their clever traffic control system, ATmega microcontrollers provide a convincing answer. This system uses sensors to measure traffic density in real-time, such as ultrasonic or infrared detectors. The microcontroller can optimise flow in each direction by dynamically adjusting traffic light timings through analysis of this data. Additionally, the system uses specific RF signals or flashing light detection to prioritise emergency vehicles. The simultaneous implementation of emergency vehicle prioritisation and traffic density control has the potential to greatly improve both public safety and traffic flow.

II. LITERATURE REVIEW

A. Intelligent Traffic Controller Using Traffic Density and Emergency Vehicle Prioritisation

Especially in cities during rush hour, traffic lights are essential for preventing gridlock. The harsh reality is that the traffic jams that happened during peak hours were caused by poor traffic management during off-peak hours. This study extensively discusses the use of ultrasonic sensors and microcontrollers to prioritise traffic flow on the road according to vehicle density. In the proposed prototype, emergency vehicles are prioritised and identified by RFID technology. A prototype for a portable smart traffic management system is constructed with an RFID reader, microprocessor, and inductive sensor components. After a thorough investigation and testing of the smart traffic control system prototype in controlled environments, conclusions were drawn. When compared to the conventional traffic control system, the acquired data unequivocally demonstrate that the smart traffic controller is highly effective at removing traffic.

B. Traffic Control System Based on Density and Ambulance

In most cities across the world, traffic congestion is a serious issue that has turned into a nightmare for the locals. It is brought on by signal delays, improper traffic light timing, etc. Traffic light delays are hard coded and independent of flow of traffic. Thus, there is a growing need for systematic quick automatic systems to optimise traffic control. The goal of this research is to create a dynamic traffic signal control system based on density. As soon as the junction's traffic density is detected, the signal time automatically adjusts.The Arduino microcontroller is the one utilised in this project. The system's transmitter and receiver infrared sensors will be positioned atop poles on either side of the street. When a car approaches it, it activates and receives the signal.

C. Using RFID technology to monitor and manage traffic congestion

For the majority of urban regions, traffic congestion is a significant concern. Finding a solution to this problem is critical given the daily increase in the number of automobiles. While there has been recent research on the use of popular technologies for traffic congestion and detection control, none of them offer an automated system that controls traffic based on the level of congestion that is identified. The aim of this study is to present a reliable, completely automated road traffic management scheme that can keep up with the ever increasing traffic in urban areas.In this work, we address the most popular and currently in use methods for traffic sensing and congestion management, along with its drawbacks, and we also suggest a different approach that makes use of RFID technology. This traffic management system's primary idea is to utilise an algorithm to make decisions about how to operate the traffic signal based on data gathered from RFID devices in order to identify and control congestion.

B. **Density-based Traffic Control System with Ambulance**

Traffic congestion is a severe problem in most of the cities across the world and it has become a nightmare for the citizens. It is caused by delay in signal, inappropriate timing of traffic signaling etc. The delay of traffic light is hard coded and it does not depend on traffic. Therefore, for optimizing traffic control, there is an increasing demand in systematic quick automatic system. This paper is designed to develop a density based dynamic traffic signal control. The signal timing changes automatically on sensing the traffic density at the junction. The microcontroller used in this project is ARDUINO. The system contains IR sensors (transmitter and receiver) which will be mounted on the either side of the road on poles. It gets activated and receives the signal as the vehicles passes close by it.

C. Traffic congestion detection and control using RFID technology

Road traffic poses a major challenge for most of the urban areas. With the growing number of vehicles each day, resolving this issue is paramount. Though use of existing popular technologies for traffic congestion and detection control have been studied in recent times, none of them provides an automated system that manages traffic based on detected level of congestion. The objective of this paper is to propose an effective scheme for road traffic management which is fully automated and foolproof considering the rate of ever growing traffic in urban areas. In this paper, we discuss the existing and most widely employed technologies for traffic detection and congestion control with their limitations and also propose an alternative model for the same which employs RFID technology. The basic idea used for traffic management here is to detect and control congestion by using a decision making algorithm which determines how the traffic light operates based on the information collected from RFID devices.

D. RFID-powered dynamic traffic control system

Daily increases in traffic in urban areas give rise to serious problems with traffic management. Time is lost, opportunities are squandered, and other negative effects of traffic congestion are common. The suggested solution makes use of RFID technology to solve these issues. Each car is given an RFID tag, which is read by an RFID reader as soon as the vehicle approaches a traffic intersection. Green passage will be dynamically regulated based on the number of vehicles, and the proposed system gives emergency vehicles—such as police cars, ambulances, VIP cars, etc.—special rights.

E. IR Sensor-Based Density-Based Traffic System

Since traffic lights are the most effective means of supervising and controlling traffic at any congested crossroads or junction, this article proposes an innovative prototype traffic light that is specifically employed at junction roads. The goal of this project is to create a density-based traffic signal system that senses the amount of traffic at an intersection and automatically modifies its signal timing. The quantity of vehicles clogged at a specific location, in this case an intersection, is known as the traffic density. The traffic density increases with the number of available automobiles.As there are more cars on the road, there will be more traffic congestion, which will increase the risk of accidents. Fixed times for conventional traffic lights make it difficult to regulate traffic flow. The layout of this traffic signal will assist in lessening the amount of traffic backed up at a specific spot, which will help to solve the issue. This traffic light employs an infrared (IR) sensor to determine the traffic density and an Arduino UNO microcontroller to generate an automation function. Every car has a 3 second setting.

Every car that goes through the traffic light is counted and handled in accordance with any delays. It will switch to another traffic signal if no vehicle is seen on the road for at least one second. This will lengthen the time it takes for the green light to appear at each traffic signal, even in situations when there may be a lot of traffic. All vehicles will be counted and interacting with the system. As a result, it will lessen issues that can arise from intersection traffic congestion.

III. METHODOLOGY

KEY COMPONENETS

1.ATMEGA 328 MICROCONTROLLER

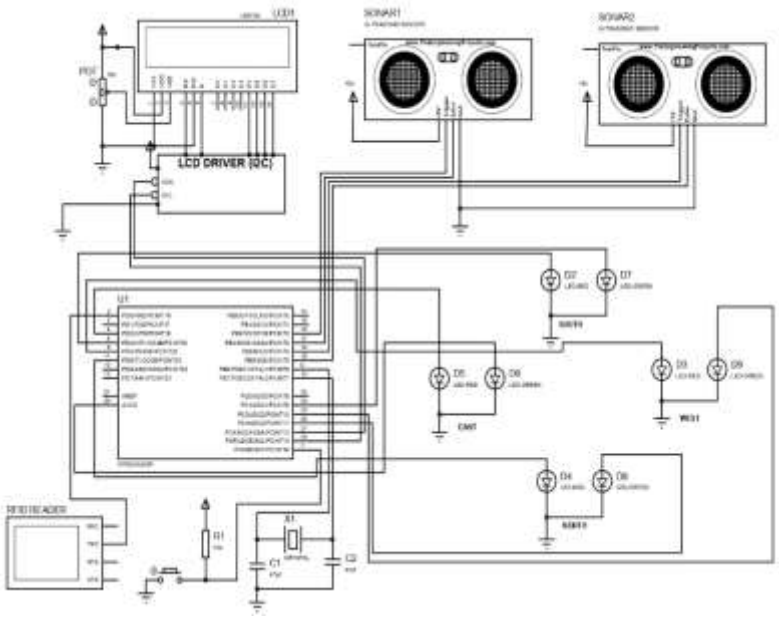
2.4 RED,4 GREEN LED’s

3. LMO16L LCD display

4. RFID reader

5. ultrasonic sensors

CIRCUIT DIAGRAM



WORKING

This project's working is divided into two, mainly the traffic density detection system and the emergency vehicle detection system. The traffic density system works by using the data from an array of ultrasonic sensors placed on the side of the road. If multiple vehicles are present in front of ultrasonic sensors, it sends the data to the microcontroller which interprets it as high density of traffic and increases the delay time of green light. When the density of vehicles is reduced, the system then goes back to normal delay timing of green light thereby reducing congestion across signal junction.

The next part of this project is the emergency vehicle detection. Emergency vehicle detection is achieved by using a RFID reader that would be placed at a distance from the traffic intersection. This RFID reader is placed over the lane so it can read the RFID tags of any emergency vehicles passing under its field of vision. If a valid tag is detected, it then sends the data to the microcontroller. The microcontroller then sets the traffic junction in an emergency response mode, and sets the lane of the emergency vehicle to green while all other lanes are set to red. After the emergency vehicle passes through, the system then goes back to its normal mode of operation.

IV. WORKING MODEL

V. CONCLUSION

In conclusion, the development and implementation of an ATmega-based automatic traffic control system leveraging traffic density and emergency vehicle detection offer significant advancements in traffic management and safety. Through this project, we have successfully demonstrated the capability to optimize traffic flow based on real-time traffic conditions, enhancing efficiency and reducing congestion. Moreover, the integration of emergency vehicle detection ensures prompt and prioritized clearance for emergency services, potentially saving crucial time during critical situations. This project not only showcases the potential of microcontroller-based systems in traffic control but also underscores their importance in creating smarter and safer urban environments. Further refinement and deployment of such systems hold promise for addressing modern traffic challenges and improving overall road safety and efficiency.

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