RAMAIAH
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SMART TRAFFIC CONTROL SYSTEM

Submitted to the

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in partial fulfillment of the course

MCAE31, Programming IoT

By

1MS22MC037, Sachin Kumar Garg
1MS22MC053, Vidip Gupta
1MS22MC060, Yogesh Saini

under the guidance of
Abhishek K L
Assistant Professor

Department of Master of Computer Applications

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Accredited by National Board of Accreditation & NAAC with 'A+' Grade,
MSR Nagar, MSRIT Post,
Bangalore, 560054
www.msrit.edu
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CERTIFICATE

This is to certify that the project work entitled **"Smart Traffic Control System"** is carried out by

1MS22MC037, Sachin Kumar Garg
1MS22MC053, Vidip Gupta
1MS22MC060, Yogesh Saini

Students of **2nd Semester**, MCA, Ramaiah Institute of Technology, Bangalore, in partial fulfillment of the course **MCAE15, Programming IoT**, during the year 2022- 2023.

Faculty-In-Charge	**HOD**
Abhishek K L	**Dr. S. Seema**
Assistant Professor	**Professor and Head**

Name and Signature of the Examiners with Date

1) _____

2) _____

SMART TRAFFIC CONTROL SYSTEM

ABSTRACT

The fact is that, the population of city and numbers of vehicles on the road are increasing day by day. With increasing urban population and hence the number of vehicles, need of controlling streets, highways and roads is major issue. The main reason behind today's traffic problem is the traditional techniques that are used for traffic management. Today's traffic management system has no emphasis on live traffic scenario, which leads to inefficient traffic management systems. This project has been implemented by using the atmega328 microcontroller and it aims to prevent heavy traffic congestion.Infrared sensor is used to detect the traffic density and the traffic lights are controlled based on the input from IR sensors placed along the road side. RF communication is also used to clear away the traffic in case of emergencies such as ambulance or fire truck

INTRODUCTION

Indian city managing system is a combination of many interdependent systems, in which traffic management plays a significant role. Moreover, it can be stated as one of the key aspects of the smart city. The world is moving very fast and it has to keep moving this way for continuous development. On contrary, modern transport is failing to provide smooth transportation system to the people. Excessive traffic jams lead to delays in reaching workplace or home, wastage of fuel, wear and tear on vehicles or even a road rage by the stressed and frustrated motorists. In addition, an increasing population is directly resulting in an increasing traffic related problems such as over speeding, accidents, hit and run, and so on. Criminal activities like mobile snatching at traffic signals also happen in metropolitan cities during long traffic jams. Therefore, an intelligent traffic management has evolved as a compulsory requirement for a prosper civilisation. Currently, smart and adaptable traffic control systems are being preferred over fixed time systems in most of developing nations.

OBJECTIVE

Objective of proposed system is to improve efficiency of existing automatic traffic signalling system. The traffic light timing will be calculated each time and changed automatically adjusted depending upon the traffic load. Proposed system will be functioning based on traditional system along with automated signalling. System will have IR and RF modules that senses the traffic on the road.Estimated traffic load on particular road will be used to calculate the required time duration for controlling of signal lights based on in comparison with experimental results. System will be intelligent and will calculate the time to switch the traffic lights based on the vehicle density. Controls of the signal will be routed through the microcontroller. The signal will be controlled by interrupting the normal functioning. The emergency will set the priority and the requested lane will be open or closed. After emergency is removed the system starts normal functioning.

MOTIVATION

Traffic Management System IoT Project offers a wide range of benefits, including reducing traffic congestion, enhancing safety, improving environmental sustainability, and contributing to economic growth. These motivations make it a compelling and valuable investment for cities and urban areas around the world.

1. Traffic Congestion Reduction : One of the primary motivations is to alleviate traffic congestion in urban areas. Traffic jams not only waste time but also increase fuel consumption and air pollution. A well-designed IoT system can optimize traffic flow and reduce congestion, leading to shorter commute times and environmental benefits.

2. Safety Improvement : Traffic accidents are a major concern, causing injuries and fatalities. IoT technologies can be used to monitor traffic conditions in real-time and detect accidents or road hazards promptly. This enables faster emergency responses and enhances overall road safety.

3. Economic Benefits : Traffic congestion costs economies billions of dollars annually in terms of lost productivity and increased fuel consumption. Implementing an IoT-based Traffic Management System can lead to economic benefits by reducing these costs and improving overall productivity.

4. Smart City Integration : Traffic management is a crucial component of smart city initiatives. IoT can help integrate traffic data with other smart city systems like energy management, waste collection, and public safety, leading to more efficient overall urban management.

5. Reduced Fuel Consumption : By reducing the time spent idling in traffic, IoT can help drivers save on fuel costs and decrease the carbon footprint associated with vehicles.

6. Improved Quality of Life : Less time stuck in traffic, reduced stress, and improved air quality can significantly enhance the quality of life for residents in urban areas.

7. Emergency Response Optimization : IoT systems can provide real-time traffic data to emergency services, enabling faster and more efficient responses to accidents and emergencies.

LITERATURE SURVEY

1. HOG, LBP and SVM based Traffic Density Estimation at Intersection Devashish Prasad; KshitijKapadni; Ayan Gadpal; Manish Visave; Kavita Sultanpure IEEE 2020

Increased amount of vehicular traffic on roads is a significant issue. High amount of vehicular traffic creates traffic congestion, unwanted delays, pollution, money loss, health issues, accidents, emergency vehicle passage and traffic violations that ends up in the decline in productivity. In peak hours, the issues become even worse. Traditional traffic management and control systems fail to tackle this problem. Currently, the traffic lights at intersections aren't adaptive and have fixed time delays. There's a necessity of an optimized and sensible control system which would enhance the efficiency of traffic flow. Smart traffic systems perform estimation of traffic density and create the traffic lights modification consistent with the quantity of traffic. We tend to propose an efficient way to estimate the traffic density on intersection using image processing and machine learning techniques in real time. The proposed methodology takes pictures of traffic at junction to estimate the traffic density. We use Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP) and Support Vector Machine (SVM) based approach for traffic density estimation.

2. Real-Time Traffic Light Management System with Manual Control Pratham Kataria; AnshulRani IEEE 2020

Congestion at road intersections is a widespread problem. Congestion is a result of improper management of traffic. To make this traffic management process less hectic and automated, Traffic Lights are used at intersections which are effective too. Various researches focus on making traffic lights more reliable and effective which include a) Survey System b) Induction Loops c) Proximity Sensors d) Image Classification. Every proposed technique computes the vehicle count using any technique and accordingly timing of lights is set. In this paper, a system has been proposed which primarily utilizes image classification and has three main parts: Vehicle Count using Image Classification, Decision making Algorithm and Manual Control. Real-time traffic is analysed using image processing and computed vehicle count is given as input to decision-making algorithm, in return algorithm sets the timing of green signal to a selected lane.

3. A Review of IoT Application in a Smart Traffic Management System by Md Khurram Monir Rabby, Muhammad Mobaidul Islam and Salman Monowar Imon (2019). This research presents an IoT-based control system uses real-time traffic information for controlling the traffic loads by changing the traffic signals. The mounted sensors and cameras at strategic traffic junction collect vehicle density of the roads and divert the vehicle direction by changing the traffic signals frequently.

4. Syed Arshad Basha, Deep Rakesh, Chirag, Mahesh, Prof. Satish Kumar published a journal on Smart Traffic Control using Arduino UNO and RF module. It is developed with integration of all hardware components Utilizing an IR sensor and RF technology, to effectively reduce the delay time for emergency vehicles.

5. Harshal Gunda, Rishikesh Waghunde, Suraj Malwatkar, Aditya Desai, Pallavi Baviskar, Smart Traffic Management System Using Arduino and RFID Tags (2018). Using this system, there will be fewer chances for disobeying of traffic rules and number of accidents. Also, time delay for vehicles of emergency services to reach their destinationwill be less.

PROPOSED SYSTEM ARCHITECTURE

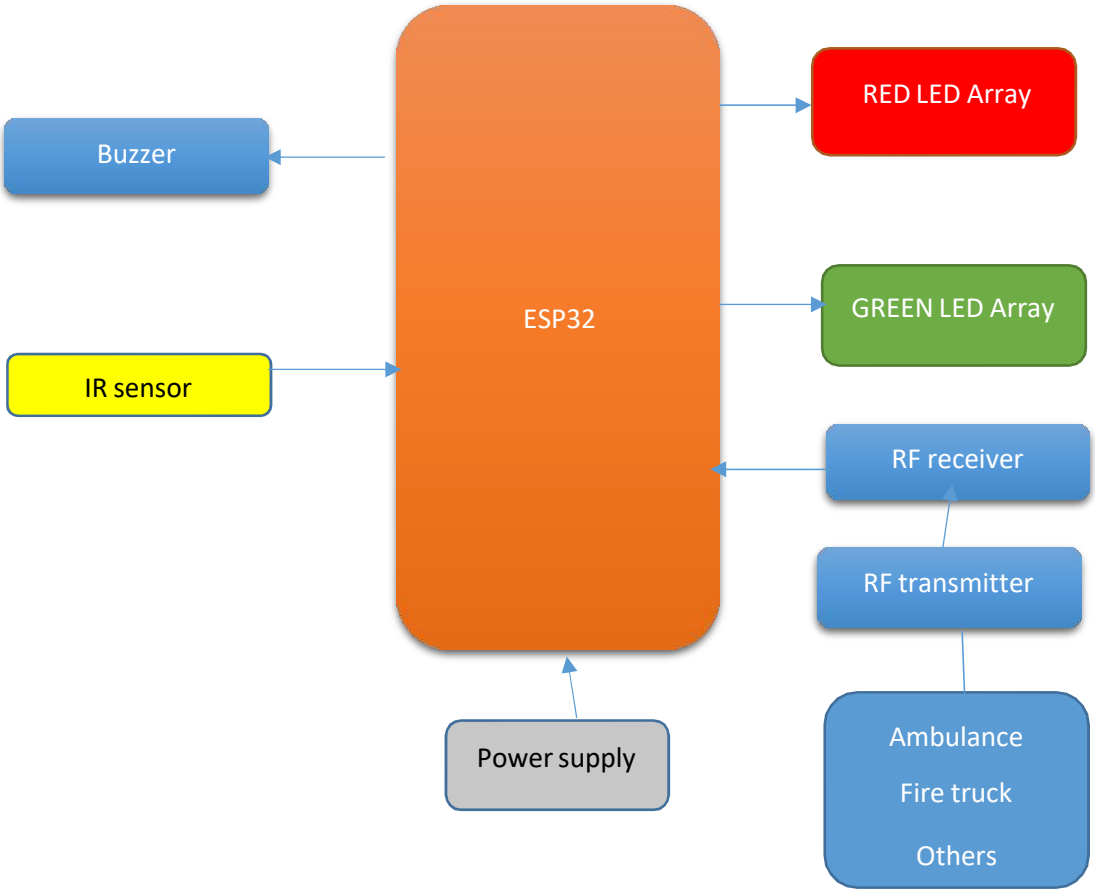
Nowadays congestion in traffic is a serious issue. The traffic congestion can also be caused by large Red-light delays, etc. The delay of respective light is hard coded in the traffic light and it is not dependent on traffic. Therefore, for simulating and optimizing traffic control to better accommodate this increasing demand is arises. In this paper the optimization of traffic light controller in a City using Arduino UNO is done. The system tries to reduce possibilities of traffic jams, caused by traffic lights, to an extent. The system contains IR transmitter and IR receiver which are mounted on the either sides of roads respectively. The IR system gets activated whenever any vehicle passes on road between IR transmitter and IR receiver.

The first part is the controller which represents the brain of the traffic system and we have used atmega328 Microcontroller module. It consists of a computer that controls the selection and timing oftraffic movements in accordance to the varying demands of traffic. IR sensor and RF module(receiver) are inputs to the microcontroller. IR sensors detects the traffic density and if the density is more the LED light timings are adjusted accordingly. At first when the traffic is normal the lights are switchedon automatically i.e. each lane gets the same amount of timings(the time the led remains on or off).

When the density of traffic is more in a particular lane the IR sensor gets triggered and that lane is given a green light. When an ambulance is in the lane, the RF transmitter module (located in the ambulance) send a signal to RF receiver which is input to the microcontroller.

In the Proposed System, the ambulance carries an RF transmitter and RF receiver will be there few meters prior to the signal. The RF receiver detects ambulance then automatically the signal turns to green and at every traffic post will have an RF receiver. So whenever the ambulance comes near the traffic signal, the ambulance will transmit the signals and the receiver will receive the signal and it immediately makes the particular lane signal to green.

BLOCK DIAGRAM



Block diagram of proposed system architecture

Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0.

IR Transmitter

IR transmitter looks like an LED. This IR transmitter always emits IR rays from it. The operating voltage of this IR transmitter is 2 to 3V. These IR (infra red) rays are invisible to the human eye. But we can view these IR rays through camer. Infrared is an invisible radiant energy, electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 700 nanometres (frequency 430 THz) to 1000000 nm (300 GHz) (although people can see infrared up to at least 1050 nm in experiments). Most of the thermal radiation emitted by objects near room temperature is infrared. Infrared radiation is used in industrial, scientific, and medical applications. Nightvision devices using active near infrared illumination allow people or animals to be observed without the observer being detected. Infrared astronomy uses sensor-equipped telescopes to penetrate dusty regions of space such as molecular clouds, detect objects such as planets, and to view highly red-shifted objects from the early days of the universe. Infrared thermal imaging cameras are used to detect heat loss in insulated systems, to observe changing blood flow in the skin, and to detect overheating of electrical apparatuses.

IR Receiver (Photodiode)

A photodiode is a semiconductor device that converts light into current. The current is generated when photons are absorbed in the photodiode. A small amount of current is also produced when no light is present. Photodiodes may contain optical filters, built-in lenses, and may have large or small surface areas. Photodiodes usually have a slower response time as their surface area increases. The common, traditional solar cell used to generate electric solar power is a large area photodiode. Photodiodes are similar to regular semiconductor diodes except that they may be either exposed (to detect vacuum UV or X-rays) or packaged with a window or optical fiber connection to allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiode use a PIN junction rather than a p–n junction, to increase the speed of response. A photodiode is designed to operate in reverse bias.

The new system will provide the following features:

- It allows the ambulance to pass traffic signal without interruption.
- Manages traffic congestion based on traffic density.
- Provides the shortest path to hospital.
- Provides accurate results.

HARDWARE AND SOFTWARE REQUIREMENTS

Hardware Used

- ESP32 Microcontroller
- Traffic signals(led)
- Buzzer
- IR sensor
- RF trans receiver

Software Used

- Embedded C
- Arduino IDE

Advantages:

• Avoids wastage of time due to the traffic

• Fully automatic

• Low power consumption

• It provides the easy access in the traffic light

• Low cost to design the circuit, maintenance of the circuit is good

•By using this Arduino Uno, we can create many more controls to the appliances

• Easy convenience to handle.

Disadvantages:

• Security Breaches

• High-Tech Network Infrastructure

• Increased Investments

GAPS IDENTIFIED

In a Traffic Management System IoT Project, several critical gaps have been identified. Firstly, data collection and accuracy pose significant challenges, with incomplete or inaccurate data compromising the system's ability to make informed decisions. Secondly, sensor deployment and maintenance issues such as limited coverage and unreliable sensors create blind spots and lead to system downtime. Thirdly, interoperability problems arise from the lack of standardization and difficulties in integrating the system with other city infrastructure. Additionally, ensuring security and regulatory compliance remains a key gap, as the project must address cybersecurity risks and navigate complex data privacy and safety regulations to protect the system and maintain legal adherence. Addressing these gaps is essential for the project's effectiveness and long-term success in efficiently managing traffic.

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