IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Big Data And I2x Communication Infrastructure For Traffic Optimization And Accident Prevention On Automated Roads

Mr. S. Bhoopalan*[1], Assistant Professor
K.Ajay*[2], S.SharanKumar*[3], M.Gowtham*[4]UG Student,
Muthayammal Engineering College, Department of ECE

ABSTRACT

Traffic congestion is a severe problem in many major cities across the world and it has become a major issue for the commuters in all the cities. The delay of respective light is hardcoded in the traffic light and it is not dependent on traffic. This creates unnecessary waiting for drivers, which could not be endurable in every case, as being in time, is important to everyone. Density, speed, and flow are the three critical parameters for road traffic analysis. As the number of road Users constantly increases, and resources provided by current infrastructures are limited, the control of traffic has become a very important issue in the present. Also, one of the major problems faced by heavy traffic is by Ambulances. The aim of this project is to solve traffic congestion which is a severe problem in many modern cities all over the world. The traffic density is controlled using a microcontroller. This the system contains IR transmitter and IR receiver which are mounted on either side of roads respectively. The IR system gets activated whenever any vehicle passes on the road between IR transmitter and IR receiver. The objective for usage of IR sensor is to detect obstacles. The microcontroller controls the IR system and counts a number of vehicles passing on the road. The microcontroller also stores vehicles count in its memory. Based on different vehicles count, the microcontroller takes a decision and updates the traffic light delays as a result. By measuring the traffic lined up on a particular road the signal timings are adjusted to let that particular way clear out and then the next populated one. It also consists of an emergency override that allows traffic authorities to remotely let go a particular signal in case an ambulance or important vehicle arrives on that way.

KEYWORDS: Smart Traffic, IoT, Emergency Vehicle (Ambulance), Autonomous Management.

1. INTRODUCTION

A smart traffic management system utilizing camera data, communication and automated algorithms is to be developed to keep traffic flowing more smoothly. The aim is to optimally control the duration of green or red light for a specific traffic light at an intersection.

The traffic signals should not flash the same stretch of green or red all the time, but should depend on the number of vehicles present. When traffic is heavy in one direction, the green lights should stay on longer; less traffic should mean the red lights should be on for a longer time interval.

This solution is expected to eliminate inefficiencies at intersections and minimize the cost of commuting and pollution

2. AIM

The aim of this project is to develop a Smart Traffic Monitoring System that uses real-time traffic analytics to dynamically adjust signal timings based on current vehicle density. And also open the path for emergency vehicle (ambulance)

2.1 SCOPE OF THE PROJECT

Functional Scope (What the system does)

This section outlines the specific features you are implementing in your prototype or proposed model.

Real-Time Monitoring: Capturing live data on vehicle density, speed, and flow at specific intersections.

Adaptive Signal Control: Dynamically adjusting green/red light durations based on current vehicle counts rather than fixed timers.

Emergency Vehicle Prioritization: Using RFID module to automatically grant "Green" signals to ambulances and fire trucks.

Violation Detection: Identifying specific traffic rule breaks, such as Red Light Jumping or speeding.

CHAPTER 3

3.1 EXISTING SYSTEM

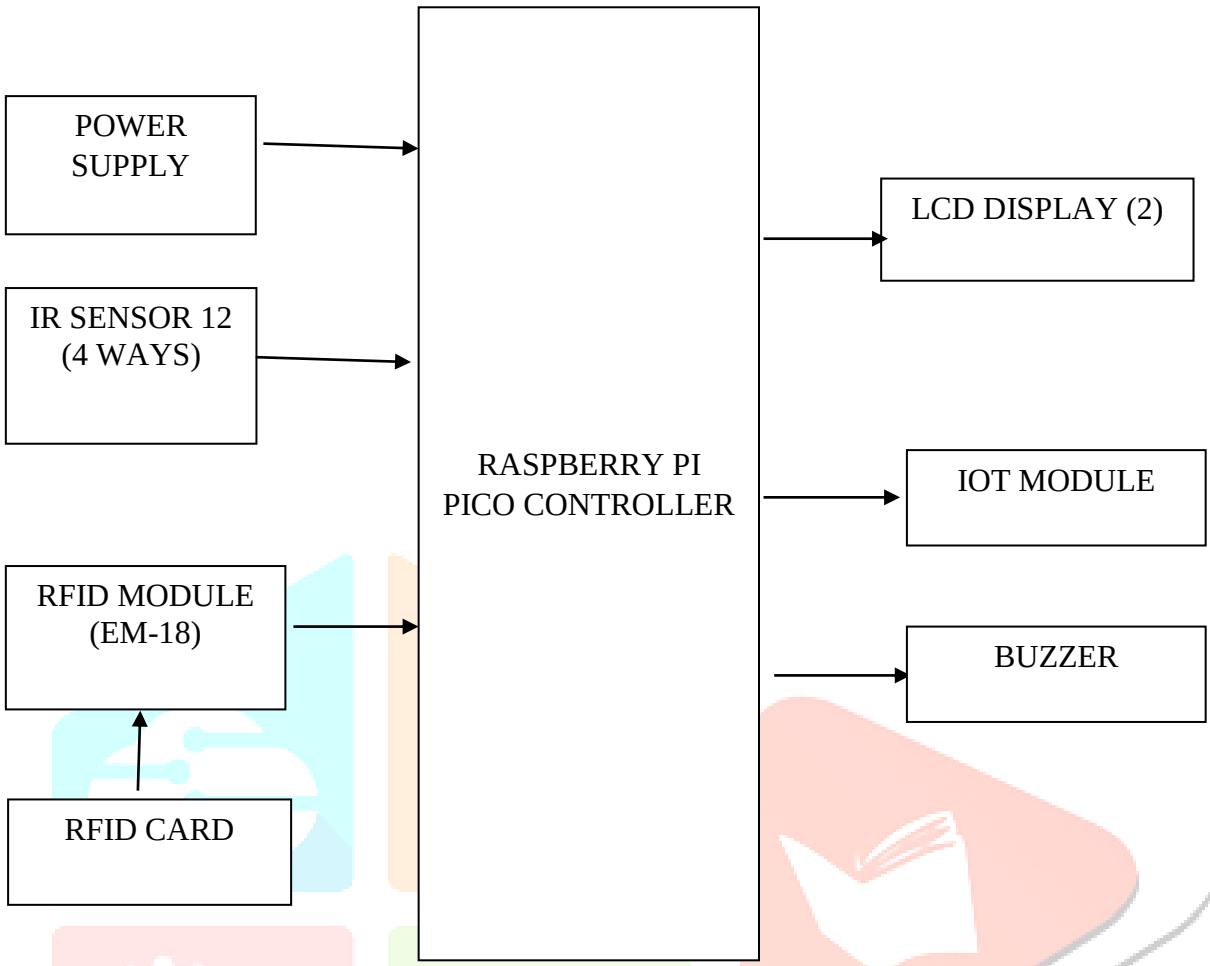
In many regions, traffic is still managed by Public service personnel who use hand signals or whistles to direct vehicles. Other most common automated system where traffic lights operate on preset time intervals. Monitoring traffic rules is largely done through manual Challenging Systems.

3.1.1 DISADVANTAGES

- Human Error: Decisions can be biased or inconsistent, leading to inefficient traffic flow.
- Safety Risks: Officers are exposed to harsh weather, pollution, and the risk of accidents
- No Emergency Priority: Ambulances or fire trucks must wait in line just like any other vehicle unless manually intervened

3.2 PROPOSED SYSTEM

3.2.1 BLOCK DIAGRAM



3.2.2 WORKING PRINCIPAL

The paper uses the IR interruption concept for generation logic gates to the input of microcontroller. To achieve the same a number of IR diodes are used facings photodiodes. While the IR light falls on the photodiode the resistance of the photodiode falls increasing the bias voltage. The voltage at the non-inverting terminal will be greater than that of inverting terminal and the led connected to the comparator glows continuously.

Whenever there is an obstacle between the IR led and photodiode the resistance of the photodiode increases to a high value and the voltage at the non-inverting will be less than that of inverting and the output obtained is of negative logic. The led connected to the comparator turns of indicating that there is a vehicle passing the road

Depending on the number of vehicle passing the time required to turn the green signal also increases Whenever an emergency occurs a direct interrupt signal is send to the RFID receiver through the RF technology for emergency vehicle and theses causes to clear the way to the emergency vehicle. Logic high sensed by the microcontroller input changes the green ON time to a higher value for allowing more vehicles to pass through. After sometime in case any other way gets more logic high, the sequential gets automatically increased for that way

Based on the IR interruption the green ON time increases thus more the vehicle longer will be green signal time. This dynamic time control is achieved based on the traffic density.

3.2.3 ADVANTAGES

- Reduced Congestion: Minimizes "ghost waiting" (waiting at a red light when the cross-street is empty).
- Lower Emissions: Reduces vehicle idling time, leading to lower CO2 levels and fuel savings.
- Automated Enforcement: Incorporates Automatic Number Plate Recognition (ANPR) to identify and fine violators without human intervention.

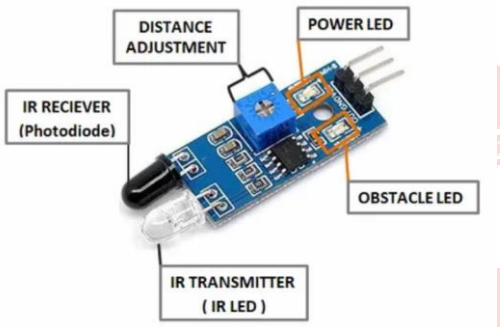
CHAPTER 4

4.1 HARDWARE MODULE DESCRIPTION

4.1.1 POWER SUPPLY

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

4.1.2 IR SENSOR



An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

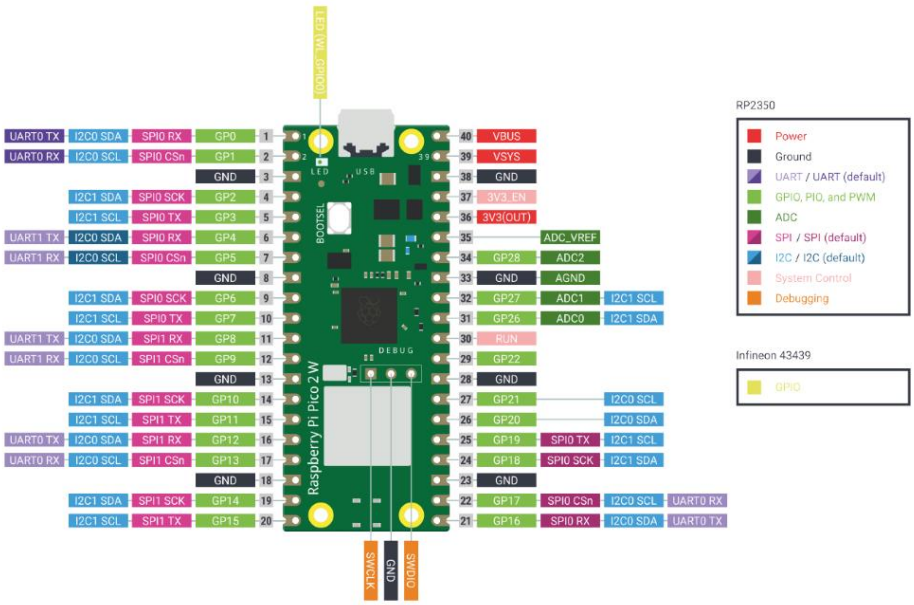
4.1.3 RFID MODULE

Radio frequency Identification (RFID) is a wireless identification technology that uses radio waves to identify the presence of RFID tags. Just like Bar code reader, RFID technology is used for identification of people, object etc. presence.

In barcode technology, we need to optically scan the barcode by keeping it in front of reader, whereas in RFID technology we just need to bring RFID tags in range of readers. Also, barcodes can get damaged or unreadable, which is not in the case for most of the RFID.

RFID is used in many applications like attendance system in which every person will have their separate RFID tag which will help identify person and their attendance. RFID is used in many companies to provide access to their authorized employees. It is also helpful to keep track of goods and in automated toll collection system on highway by embedding Tag (having unique ID) on them.

4.1.4 PICO MICROCONTROLLER



The Pico microcontroller, specifically referring to the Raspberry Pi Pico, is a small yet powerful microcontroller board developed by the Raspberry Pi Foundation. It features the RP2040 microcontroller chip, which was designed by Raspberry Pi and is based on the ARM Cortex-M0+ architecture. The Raspberry Pi Pico is known for its affordability, versatility, and ease of use, making it a popular choice for hobbyists, educators, and professionals alike.

Some key features of the Raspberry Pi Pico include:

➢ RP2040 microcontroller: This powerful chip features a dual-core ARM Cortex-M0+ processor running at up to 133MHz, providing plenty of processing power for a wide range of applications.

➢ GPIO Pins: The Pico has 26 multi-function GPIO pins, which can be used for digital input/output, analog input, PWM (Pulse Width Modulation) output, SPI (Serial Peripheral Interface), I2C (Inter-Integrated Circuit), UART (Universal Asynchronous Receiver-Transmitter), and more.

➢ Programmability: It can be programmed using a variety of programming languages, including MicroPython, CircuitPython, C/C++, and even assembly language.

➢ USB Connectivity: It features a micro-USB port for both power supply and data communication, making it easy to connect to a computer for programming and debugging.

➢ Low Power Consumption: The RP2040 chip is designed to be power-efficient, making it suitable for battery-powered applications.

➢ Integrated Temperature Sensor: The Pico includes an integrated temperature sensor, allowing it to measure its own temperature and adjust its operation accordingly.

➢ Versatility: Due to its small size, low cost, and wide range of features, the Raspberry Pi Pico can be used in a variety of projects, including robotics, home automation, IoT (Internet of Things) devices, and more

4.1.5 LCD DISPLAY (16*2)

LCD 16x2 is a 16-pin device that has 2 rows that can accommodate 16 characters each. LCD 16x2 can be used in 4-bit mode or 8-bit mode. It is also possible to create custom characters. It has 8 data lines and 3 control lines that can be used for control purposes.

SPECIFICATIONS OF 16X2 LCD:

1. Display Size: 16 characters × 2 rows
2. Operating Voltage: 4.7V to 5.3V
3. Current Consumption: 1mA (without backlight)
4. Interface: Parallel (4-bit or 8-bit mode)
5. Driver IC: HD44780 (or compatible)
6. Character Size: 5×8 pixel matrix
7. Backlight: LED (optional)

4.1.6 BUZZER

An Arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set. The buzzer produces sound based on reverse of the piezoelectric effect.

4.1.7 IOT MODULE

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

HOW IT WORK

The RX and TX pins of the ESP8266 Module are connected to RX and TX Pins on the Arduino board. Since the ESP8266 SoC cannot tolerate 5V, the RX Pin of Arduino is connected through a level converter consisting of a 1KΩ and a 2.2KΩ Resistor. Finally the GPIO2 pin is connected to an LED to test the working of the program

CHAPTER 5

5.1 CONCLUSION

Smart Traffic Management System has been developed by using multiple features of hardware components in IoT. Traffic optimization is achieved using IoT platform for efficient utilizing allocating varying time to all traffic signal according to available vehicles count in road path.

Smart Traffic Management System is implemented to deal efficiently with problem of congestion and perform re-routing at intersections on a road. This research presents an effective solution for rapid growth of traffic flow particularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in view the state-of-the-art approach for traffic management systems, a smart traffic management system is proposed to control road traffic situations more efficiently and effectively.

It changes the signal timing intelligently according to traffic density on the particular roadside and regulates traffic flow by communicating with local server more effectively than ever before. The decentralized approach makes it optimized and effective as the system works even if a local server or centralized server has crashed. The system also provides useful information to higher authorities that can be used in road planning which helps in optimal usage of resources.

CHAPTER 6

6.1 REFERENCE

[1]. Soufiene Djahel,Ronan Doolan, Gabrial-Miro Muntean, John Murphy, “A communications-oriented perspective on traffic management systems for smart cities: Challenges and innovative approaches, IEEE Communications Surveys and Tutorials, vol 10.pp,Nov 2013.

[2]. Lien-Wu Chen, Pranay Sharma, “Dynamic traffic control with fairness and throughput optimization using vehicular communications”, IEEE journal on selected areas in communications/supplement, Vol.31.No.9.pp.504-512,September 2013.

[3]. Luigi Atzori,Antonio Iera and Giacomo Morabito, “The Internet of Things: A survey”,Computer networks,vol.54,pp 2787-2805,2010.

[4]. Chen Wang, Bertrand David,Rene Chalon,Chuantoa Yin, “Dynamic road lane management study A smart City application”, Transport research Part E,2015

[5]. Dongbin Zhao,Yujie Dai,Zhen Zhang, “Computational Intelligence in urban traffic signal control: A survey”,IEEE Transactions onsystems,man,and cyberbetics-part c applications and reviews,Vol.42.No.4.pp. 485-494,July 2012.

[6]. Andreas Janecek,Danilo Valerio,and Karin Anna Hummel, “The cellular Network as a sensor:From Mobile phone data to real-time road traffic monitoring”,IEEE transactions on intelligent transportation systems,vol.16.no.5,pp 2551-2572 ,October 2015.

[7]. Peter Handel,Jens Ohlsson,Martin Ohlsson,Isaac Skog,Elin Nygren, “Smartphone-based measurement systems for road vehicle traffic monitoring and usage-based insurance”, IEEE systems journal,Vol.8.No.4,pp 1238-1248,December 2014.