

DENSITY BASED TRAFFIC REGULATOR USING IR SENSORS

B. Vijayakumar, Assistant Professor, Department of Physics, SNS College of Engineering, Coimbatore, India

M. Amrisha Harini, K. Archana, R. Abinaya, R. Chandru, Second Year Student, Department of Electronics and Communication Engineering, SNS College of Engineering, Coimbatore, India

Abstract

The exponential growth of the metropolitan cities of the country has generated and magnified urban sprawl into problematic proportions. Lack of efficient traffic control and Management has many a times lead to loss of lives due to Ambulances getting stuck in traffic jams. To overcome this problem, we propose an IR Sensors based Traffic regulator system. The focus of this paper is to reduce the delay in arrival of the ambulance and other vehicles by automatically clearing the lane in which the greater numbers of vehicles are travelling, before it reaches the traffic signal. This can be achieved by turning the traffic signal, in the path of the vehicles to green when it is at a certain distance from the traffic junction. Also, the use of the RFID tag distinguishes between the emergency and non-emergency cases, thus preventing unnecessary traffic congestion. The communication between the vehicles and the signal is transmitted through the infrared rays emitted from the sensors. The system is fully automated and thus, requires no human intervention at the traffic junctions.

Keywords:

IR sensors, RFID tag, traffic congestion, infrared rays, Arduino microcontroller

Introduction

In today's scenario India has grown exponentially in the past two decades and especially our state like Tamil Nadu. Improvement in the quality of life along with substandard public transportation has resulted in spiralling growth of private automobiles. The resultant offshoot of such a high automobile growth is that now tamandu is one of the most accident-prone cities in India. Moreover, the ambulances often get stuck at the traffic signals where all other vehicles try to squeeze in to all the available space so as to move ahead as soon as the signal turns green. Unlike western countries, Indian cities cannot think of having separate lanes for emergency purpose due to lack of road planning and infrastructure [1]. With the lives of the people depending on the speedy arrival of their works by their vehicles to office, schools and hospitals an alternative solution to the above problem is the need of the hour. The problem of the vehicles getting stuck in a traffic jam can be addressed by ensuring that the lane in which the Highest number of vehicles travelling is cleared. That is, the arrival of the vehicles is to be communicated to the nearest traffic signal by the IR rays emitted by the IR sensors placed so that it can turn the light to green and hence clear the traffic [2]. Hence, the traffic clearing system, if done for all the vehicles must also include the ambulances and such emergency vehicles will certainly pose a traffic problem. To overcome this difficulty, we propose to make a system combining RFID (Radio Frequency Identification) with IR sensors.

Statement of the Problem

With the increase in the motor vehicles in our modern times, insufficient traffic management and improper timer system leads to a lot of unwanted traffic congestions and many injuries and deaths. This has to be stopped definitely and hence this paper on the title Density based traffic regulator using IR sensors is introduced. This is expected to significantly reduce the manpower and unwanted traffic congestions at the signals.

Objectives of the study

1. To avoid the time waiting at the traffic signals that produces unwanted vehicle congestion.
2. To reduce the manpower.
3. To reduce the accidents arising due to the traffic.

Methodology

1. The proposed traffic signal system uses the IR sensors to control the traffic.
2. No need to wait for the vehicles and produce unwanted traffic congestions at the signals.
3. The IR sensors that emit the infrared rays detects the highest density of the vehicles.
4. This detection is sent as signal to the microcontroller which soon after receiving the information opens the signal accordingly as illustrated in fig.1
5. It performs time-consuming tasks.
6. It can be operated in fully automatic mode. No man power is needed.

Review of Literature

Park, H. S., & Kim, K. (2019). Adaptive traffic signal control system based on real-time traffic density using wireless sensor networks. In this work, the authors propose an adaptive traffic signal control system that employs wireless sensor networks to monitor real-time traffic density. Sensors are used to measure the number of vehicles passing through intersections, and the collected data is utilized to optimize signal timings. Experimental results indicate improved traffic flow and reduced waiting times.

Nanda, S., Sahoo, U., & Panda, S. (2017). Design and implementation of density-based traffic signal system. This research presents a prototype of a density-based traffic signal system utilizing ultrasonic sensors. The system dynamically adjusts signal timing based on the vehicle density sensed by the sensors. The authors conducted experiments to evaluate the effectiveness of the proposed system, showing its potential in reducing traffic congestion.

Block Diagram

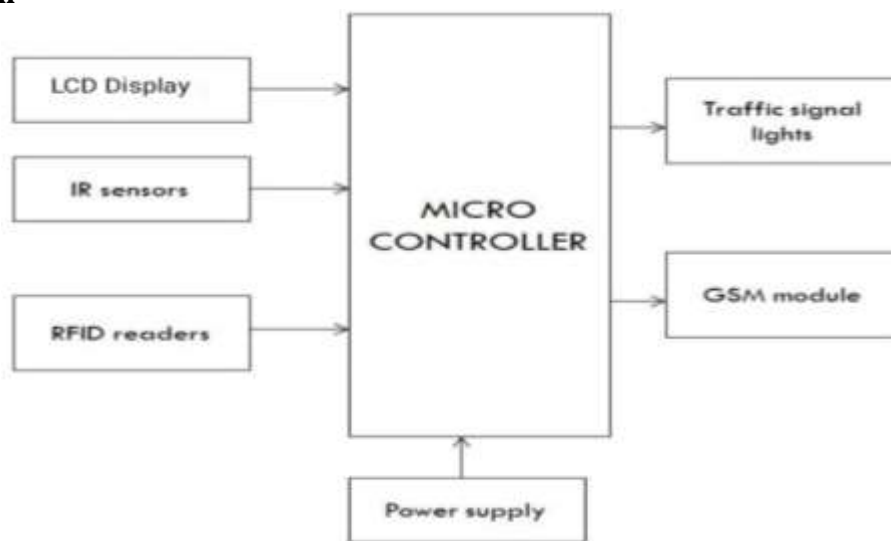


Fig.1 Control unit

Hardware Description

Power Supply

The significant part of the prototype model is the power supply. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 780[3].

IR Sensor

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor [4]. The emitter is simply an IR

LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR sensors

Arduino UNO

It is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board.

LCD Display

The mode of display used here is 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 [6].

LED (Light Emitting Diode)

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Here an operational amplifier (opamp) of LM 339 is used as comparator circuit. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus, the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus, the output of the comparator (LM 339) goes high and the LED starts glowing.

GSM Module

A Global system for mobile or GSM modem is a device that uses GSM mobile telephone technology to provide a wireless data link to a network [7]. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network.

RF Module

It is a cheap wireless communication module for low-cost application [8]. RF Module comprises of a transmitter and a receiver that operate at a radio frequency range. Usually, the frequency at which these modules communicate will be 315 MHz or 434 MHz

Working

After proper study of each and every type of hardware and software out there, we started working on this design. Not only it is user friendly but the manufacturing of this system will be handy and the modifications that can be done in future with this device is quite immense. In proposed system, we have used IR sensors that detects the motion of the vehicles depending upon the highest number of vehicles and RFID reader which will be placed in the emergency vehicles such as ambulance and fire engines for those which the reader is kept on the junctions [9]. The sensors detect the vehicles and opens the green signal accordingly and the reader reads the code on the specific tag that detects the vehicle. After the detection of the vehicle the respective junction or the respective road opens the signal letting the vehicle move. So that the vehicles can reach the spot-on time. The Arduino UNO acts as the controller of the entire system. It sends the signal which has been detected by their IR sensors, RFID reader and the Tag and reacts accordingly. This then makes it to display in the LCD display to show us the signals [10]. We added an LCD display to show the signals in Fig .2

Result and Discussion

In this section, a system prototype has been built and all the modules of the system are working according to the desired requirement. The foremost objective of this investigational work is to implement a novel framework namely Density based traffic regulator using IR sensors that can make short term decision about the traffic management, thus the accurate and efficient traffic clearance can

be achieved. By clearing the traffic on the road, emergency vehicle can easily pass through and save lives. In this research method, data set is gathered from the multiple traffic profiles which includes attributes such as time consumption, traffic rate, number of vehicles and so on. It can accurately learn the traffic profile information with reduced time.

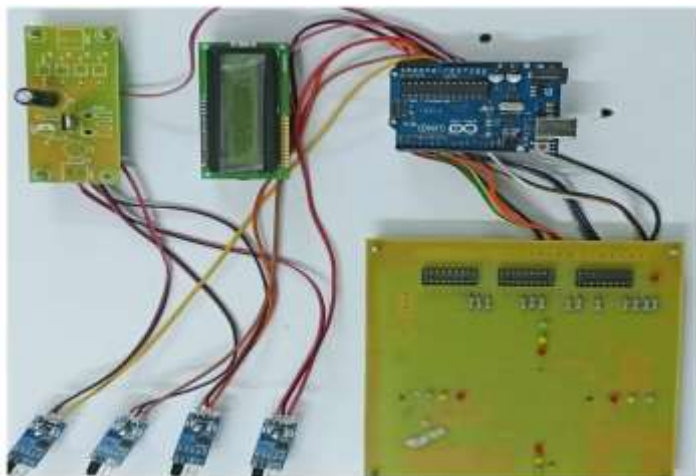


Fig:2 Prototype Model

Conclusion

In this paper, we presented a traffic signal system using the IR sensors for smart city which can be implemented to any vehicles and also emergency vehicles. This system is a mandatory now as the traffic in our cities are drastically increasing leading to lot of injuries and also creating unwanted tensions among people. By this technology numerous accidents are prevented and the unwanted traffic congestions are avoided. Some of that technology has readily available today and the rest of them are still on the assuring process step to guarantee safe and reliable operation.

References

1. Uttara E. Prakash, Athira Thankappan, Vishnupriya K. T., Arun A. Balakrishnan. Density Based Traffic Control System Using Image Processing, Proceedings of 2018 International Conference on Emerging Trends and Innovations in Engineering and Technological Research.
2. Ashish Jain, Manisha Mittal, Harish Verma, Amrita rai. (2014)Traffic Density Measurement based Onroad Traffic Control using Ultrasonic Sensors and GSM Technology, Proc. of Int. Conf. on Emerging Trends in Engineering and Technology, ACEEE, Volume: 03 Issue: 03.
3. Ashwini Basavaraju, Senhalata Doddigarla, Navitha Naidu, Shruti Malgatti (2014). Vehicle Density Sensor System to Manage Traffic, International Journal of Research in Engineering and Technology, Volume: 03
4. Sarpong Kwadwo Asare, Robert A. Sowah. Design and development of a Microcontroller Based Traffic Light Control System Using Image Processing Techniques, A case study prototype for LegonOkponglo Junction, University of Ghana, IEEE 2012.
5. Mohammad Shahab Uddin Ayon Kumar Das, Md. Abu Taleb. Real-time Area Based Traffic Density Estimation by Image Processing for Traffic Signal Control System, Bangladesh Perspective, IEEE 21-23 May 2015.
6. M. Naveen, S. Raghavendra, D. Imran Basha, P. Kiran Kumar. Density based Traffic Signals Controlling Using ARDUINO and IR Sensors, International Journal of Electronics Engineering, ISSN: 0973-7383 Volume 11 Issue 1 pp. 348-351 Jan - June 2019.
7. Saiba P A, Afeefa M U, Aruna T S, Clincy Jose, Radhika V M. Density Based Traffic Signal System using PIC Microcontroller, International Journal of Computer Trends and Technology (IJCTT) – Volume 47 Number 1 May 2017.
8. S. Sundara Mahalingam, S. Arockiaraj(2018). Density Based Traffic Light Control Using Arduino, IJARIII, Vol-4 Issue-5.
9. Akindele Ayoola E, Awodeyi Afolabi I, Matthews Victor O, Alashiri Olaitan A, Idowu Oriyomi K, Olaloye Folarin J. Development of an Electronic Weighing Indicator for Digital Measurement International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 09, Sep 2018.
10. Vadrevu S. V. S. R. Pavan Kumar, Dr. M. Kamala kumara. A Novel Application of Adaptive Traffic Control System for India, International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 7, July 2016.