

INTELLIGENT TRAFFIC CONTROL SYSTEM USING ARDUINO UNO

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Abstract: Most people in a metropolitan city will surely have faced the difficulty to reach home by a few minutes earlier than the usual timings, all thanks to the traffic. Many at times, the green light would be shown to empty roads when many other people would be waiting for a wink of it. To bring a change to this scenario, a new plan can be implemented by making the traffic lights a little intelligent. The lights must be able to know which side of the junction actually requires the green light. In order to enable our traffic lights with this capability, this paper proposes a way of training the traffic lights by positioning IR sensors and RFID chips to help detect the extent of the traffic. The RFID will be useful for assisting the fast movement of emergency vehicles and the IR sensors can check if the road is free or not.

Keywords Density, traffic control, RFID, IR (TX & RX), LCD display.

1. Introduction

Everybody is growing rich each day and owning a car, to every available family has turned out to be an obsession. Hardly few people realize that all this and more increases the stress put on traffic. Thickly congested roads are a daily sight in most metropolitan cities. Commuters, including children and employees, spend hours each day stuck in long and never ending traffic jams. The pity is that very often, one can find the green light shining on empty roads, wasting the precious time of many other people. The worst scenario is that of an ambulance, with a person battling death, stuck in a traffic jam and the red light shining on that road. This paper, taking this scenario as our motivation, is thus putting its humble, little effort to help this situation by making traffic lights sufficiently intelligent that it can detect which side of a junction consists of more traffic density and thus deserves a green signal. Eventually, it would help relieve suffocating streets of heavy bottlenecks, saving people their precious time.

The paper proposes to implement this intelligent traffic light via the deployment of sensors capable of detecting the side of the junction on which traffic density is maximum. Infra Red sensors (IR sensors) have been implemented on either sides of the road to

detect the limit till where the traffic extends. It also helps detect vehicular movement on that road. Thus, the roads are conceptually divide into two distinct zones, the high density and the low density zones to help the traffic lights detect which road to let go. In order to create an environment that is friendly to emergency vehicles, they would be requested to have an RFID chip beneath their vehicles for detecting them. The category of emergency vehicles would include ambulances, police vehicles, vehicles of ministers and other nobles. The system would implement an RFID reader below the surface of the road, tuned to detect emergency vehicles, i.e., it will be able to detect emergency vehicles moving towards the traffic lights. As a result, in case of ambulances, the side with the emergency vehicle will obtain their rightful share of LCD display & turn on buzzer, thus the people may give way with free of traffic. Through this, we can be sure that even if the ambulance doesn't reach the line – of – sight of the RFID reader, the lights will be turned LCD & Buzzer for sure. This is because an RFID reader doesn't require the chip to come to its line-of-sight to understand the presence of an RFID chip. When implemented near hospitals wherein the movement of ambulances is quite heavy, emergency vehicles can be sure that they can reach their destination without much ado.

Among the papers referred for this plan, the paper with the closest similarities with our paper is the "Intelligent Cross Road Traffic Management System (ICRTMS)" published in the second International Conference on Computer Technology and Development (ICCTD 2010). It proposes the same plan as of density based traffic control system along with a preference for ambulances, except that in the ICRTMS, they are counting number of vehicles that exist o each side. In this paper, we are reducing the processing overhead on the processor by taking an approximate number of vehicles that exist on each side. Also, the emergency vehicles of ICRTMS include only ambulances and our paper includes police vehicles, fire emergency vehicles, VIP vehicles and also ambulances. This work, if implemented in real world, is sure to prove itself as a great relief to stuffed roads, anxious pedestrians and patient drivers, in short, everybody who uses roads in general.

2. Literature Review

Mr. Raja Ghosh & his team speaks of “Auto Density Sensing Traffic Control System using At89s52” [1], it is proposed that dynamic time based coordination scheme were the green signal time of the traffic light is assigned based on the present condition of traffic by using IR sensor.

K. Vidhya, A. Bazila Banu speaks of “Density Based Traffic Signal System” [2], the image captured in traffic signal is proposed & converted into grayscale image then threshold is in order to

image.

The Intelligent Traffic Light and Density Control using IR Sensors and Microcontroller by First A MsPromilaSinhmar[3] proposes the use of IR sensors and microcontrollers, just as the name suggests, in an attempt to reduce the number of vehicles waiting for their chance to move out. The system gives equal preferences to all the vehicles plying, ignoring all the emergency vehicles.

3. Methodology

In order to measure the density of traffic on each side, IR sensors will be kept on either sides of the road at a specific distance. Each pair of IR sensors consists of an IR transmitter and an IR receiver. Just as the name suggests, the IR transmitter transmits the IR rays and the receiver is responsible to receive the rays. When an obstacle is kept between the two, the receiver will no longer be able to detect the rays transmitted by the IR transmitter. This indicates that traffic exists till the point of the corresponding IR sensors. The traffic signal will be tuned with a default timing of 5 seconds of green light. Should the road be cleared soon, by any chance, the lights will turn red after a short flash of yellow. Each road, however, will get access to its fair chance of 10 seconds of green light. Under conditions where the density is equal on all sides of the junction, the lights will work as usual, i.e., each side will get equal timing to move out. To support those who believe in walking their way to health, it has been decided to add a time slot for pedestrians to walk in order to ensure their safety. A gap of 5 seconds will be provided to pedestrians to cross the road in peace, during the transmission time of green lights from one road to the other. An RFID detector placed below the surface of the road will allow us to detect the movement of emergency vehicles. The manufacturers of emergency vehicles will have to install RFID chips below the vehicles for their smoother movement.

Eventually, we can be sure that even if the emergency vehicle doesn't reach the line – of – sight

of the RFID reader, the lights will be turned green for sure. This is because an RFID reader doesn't require the chip to come to its line-of-sight to understand the presence of an RFID chip.

The block diagram of the system is as follows:

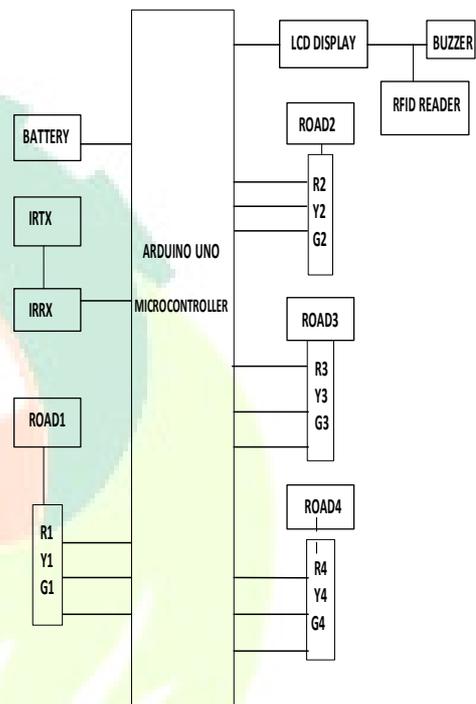


Figure 1 Block Diagram
The circuit diagram of the same is as follows

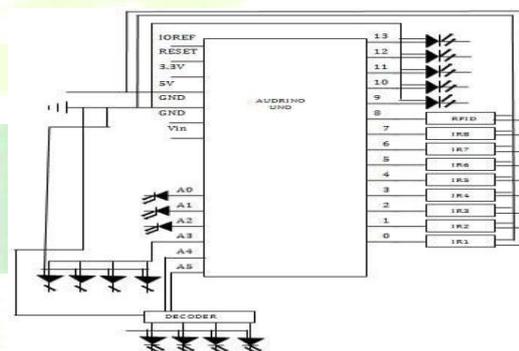


Figure 2 Circuit Diagram

The components used for this project includes:

- Arduino Uno microcontroller

The microcontroller chosen to program the system is the Arduino Uno microcontroller.

LED lights

We require LED lights in the colors red, yellow and green, 4 each, to mimic the traffic lights. An additional 4 LED lights in the color red could help depict the signal for pedestrian crossing. Connecting wires help us to connect all the components of the entire system.

IR sensors

IR sensors are required to sense the limit up to where the traffic persists. The white one is the IR transmitter and the black one is the IR sensor.

RFID chips

An RFID chip attached to the bottom of emergency vehicles will facilitate their faster movement as the RFID readers kept beneath the surface of the road will detect the emergency vehicles with the chips beneath them and will eventually ask the traffic lights to turn LCD & buzzer.

RFID reader

Placed beneath the surface of the road, this reader will detect any emergency vehicles and will request the microcontroller to turn the LCD display & buzzer for that particular road. The result of this paper is as following:

4. Results and Discussions

Though this paper concentrates only on a two - way junction, the idea can be enhanced to support even multi lane systems by implementing Infrared (IR) sensor pairs on either sides of the road on each lane. Another change that could be enhanced in the future is the classification of emergency vehicles. Each type of emergency vehicles could be given a set priority so that in situations where in an ambulance comes on one road and at the same time a fire engine comes on the other road, the traffic lights should be in a position to prioritize as to which vehicle should move first. GSM technology is used to give a free way to the ambulance.



Figure 8 Proposed System

5. Conclusion

This paper proposes a much more practical approach that can be implemented in junctions with high density of traffic. The IR sensors placed on either

sides of the road will help detect the density of traffic on the particular side if the road and thus can be assured that each side gets a green signal only for the required quantity of time. Conceptually, the road is divided into a low-density zone and a high-density zone. If a road has heavy density, the road is given an additional 10 seconds, making the overall time given as 15 seconds. If the density of a road stays in the low density zone, the road gets 5 seconds to move out. In case absolutely no density is detected, that side of the junction is skipped. This help save time. A gap of a few seconds after each green signal for pedestrians to cross will provide a safe environment for people to cross roads as well. The RFID detector placed beneath the surface of the road will detect the emergency vehicles with an RFID chip placed beneath them. This model involves the cooperation of both the government and the manufacturers of emergency vehicles. Together, India can be made a vehicle - friendly country.

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