

Multi-Modes In Traffic Light Control System

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Abstract:

Modern world having the issue to controlling the traffic at major cities for rapid increase in automobiles and also large time delays between traffic lights. So, in order to rectify this problem, we will go for different modes of traffic light control system. In this article, we have three modes i.e., Normal mode, Density mode, Emergency mode. By interfacing these modes with PIC 16F877A using Embedded C language the switching of modes is performed.

Keywords: *Traffic Light, Multi-Mode, Embedded Systems, PIC Controller, RFID Tag.*

1. INTRODUCTION

The traffic light was first discovered in 1912 by a Detroit policeman named Lester Wire like two-colour, red- and- green light with a buzzer warn to pedestrians before the impending transition then, in 1920, this basic design was updated by William Potts to incorporate the Tri- coloured Red, Yellow and Green lights widely used today [2]. This easy three-colour icon has allowed for nearly a century with little change, using modern technologies like automatic times, diode lights and motion sensors [5].

Traffic signals are mainly developed to certify the right flow of traffic, provide a chance for pedestrians or vehicles to cross the junction and help to scale back the amount of collisions between vehicles entering intersections from opposite directions. Traffic signals should be considered once they're going to alleviate more problems than they create. A warranted signal results in properly operating which may provide for more orderly movement of traffic and reduce the occurrence of particular sorts of collisions. Unwarranted signals may result in increased crashes, delays and congestions [2].



Figure 1.1 Crossover between Side Road and Highway

The prevailing traffic signal system is implemented with delays where the signal transition time slots are fixed and don't depend on current traffic flow. The prevailing traffic system must be upgraded to unravel the severe traffic jam problems. Thus we've included extra modes called Density mode and Emergency mode which will be supported by the detection of IR sensors and detection of RFID readers respectively. These usual conditions, density based working and emergency activations are switched automatically through an interface with the PIC Microcontroller.

2. LITERATURE REVIEW

In recent years, surveillance systems and video monitoring are widely used for control [4]. Historically, there exist several vehicle detectors like radar, ultrasonic and microwave detector. But these sensors are expensive, with less capacity and difficult to take care of, difficult for installation and implementation and additional maintenance charges be there. Radar sensors are damaged by metal barriers near road [5].

In mathematical modeling parameters of a vehicle are designed mathematically using the geometric positions of camera, sunlight and vehicle are compared with values obtained using video [5,7]. The manual dependencies between intersections cause a sophisticated derivation with fault parameters. These parameters are hazardous and most of the issue is due to the variance of those parameters with time.

Several techniques are designed for traffic jam detection that's supported sensing. Another approach is that measure the traffic density depending on the number of occupied fraction of road with the help of RF signals which was placed on road side [1,6].

Traffic signals operating on fixed signal timing delays can't be used properly to regulate the traffic congestions. When the traffic density increases quite a limit on a specific road, it needs larger green light duration to scale back the traffic flow [3]. The main problem of the prevailing traffic signal system is that the transition timing slots are fixed in software and unnecessary waiting time when no vehicles are present on opposite route. So the vehicles had to stand in traffic junctions due to which many of the traffic jam occur.

3. MULTI-MODE TRAFFIC LIGHT SYSTEM

The waiting at traffic light signals is a major additional problem for people and government. This can be rectified with the switching of traffic control based on the situations. The most commonly required in routine life are summed in three different modes of action.

- Normal mode
- Density mode
- Emergency mode

3.1. Normal Mode

This mode has alternate switching of green and red signals wherein the signals are opposite on both sides for a fixed period. This mode will be suitable for non- peak hours as there will be moderate or low count of vehicles.

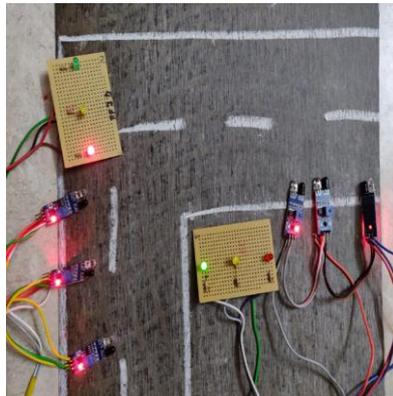


Figure 3.1.1 Normal Mode

3.2. Density Mode

The operation of this system consists of a PIC Microcontroller 16F877A, IR sensors and power supply.

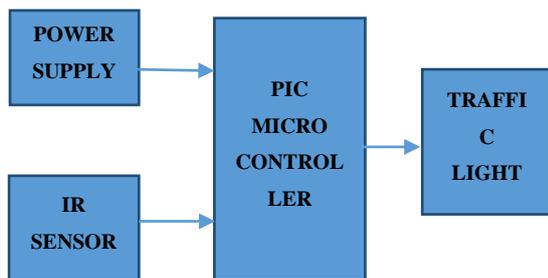


Fig 3.2.1 Block Diagram of Density Mode

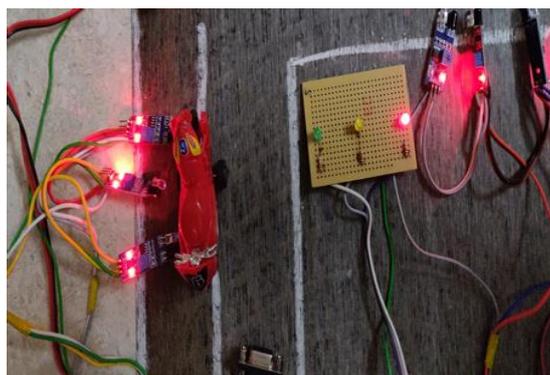


Figure 3.2.2 IR Sensor Detecting Vehicle

IR sensor detects the vehicle and the information is passed to the PIC Microcontroller.

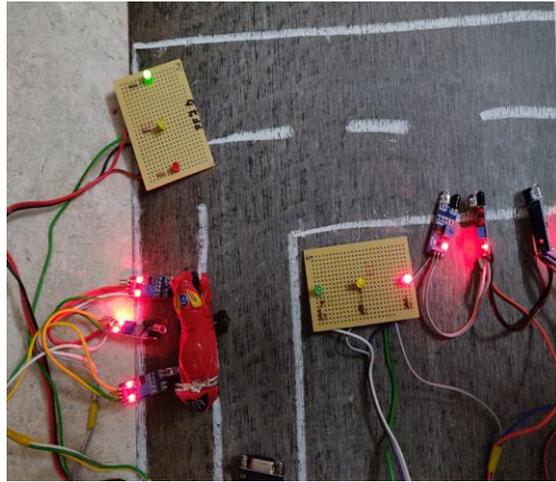


Figure 3.2.3 Change in Signal Due to High Density of Vehicles

After detection of vehicle by the IR sensor, the signal turns green and opposite side becomes red. Thus when there are increase in vehicles along a particular direction will not lead to waiting and it is highly beneficial during peak hours.

3.3. Emergency Mode

Traffic Congestion is a root cause of various problems including traffic jams, traffic rules violations and accidents. This has adverse effect on human lives. The rescue vehicles are also facing such crisis due to these congestions that had already occurred on a road as there is no alternate in the existing TLC.

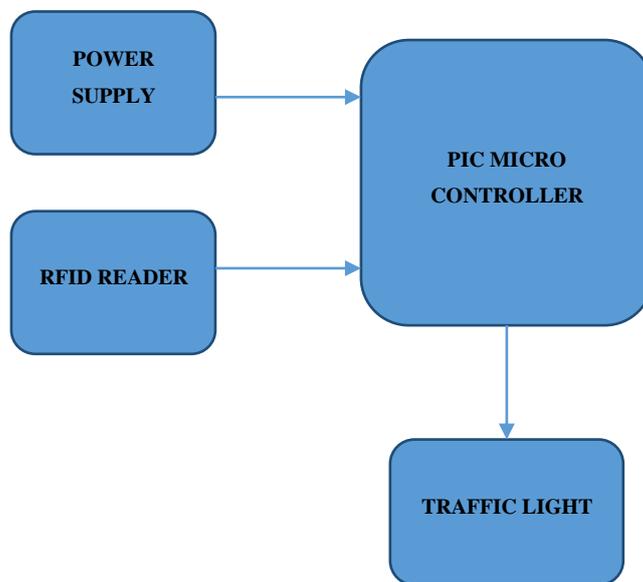


Fig 3.3.1 Block Diagram of Emergency Mode

This mode rectifies these issues with the help of Radio Frequency Identification (RFID) and a power supply whose data is passed on to the controller and that changes the colour of the signal.

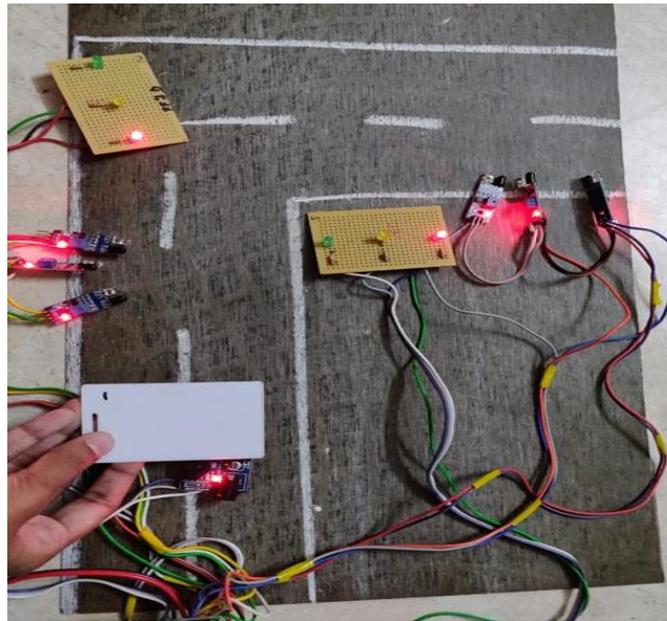


Figure 3.3.2 RFID Reader Scans the RFID Tag

The RFID reader detects the RFID tag in a direction where the signal shows red signal.

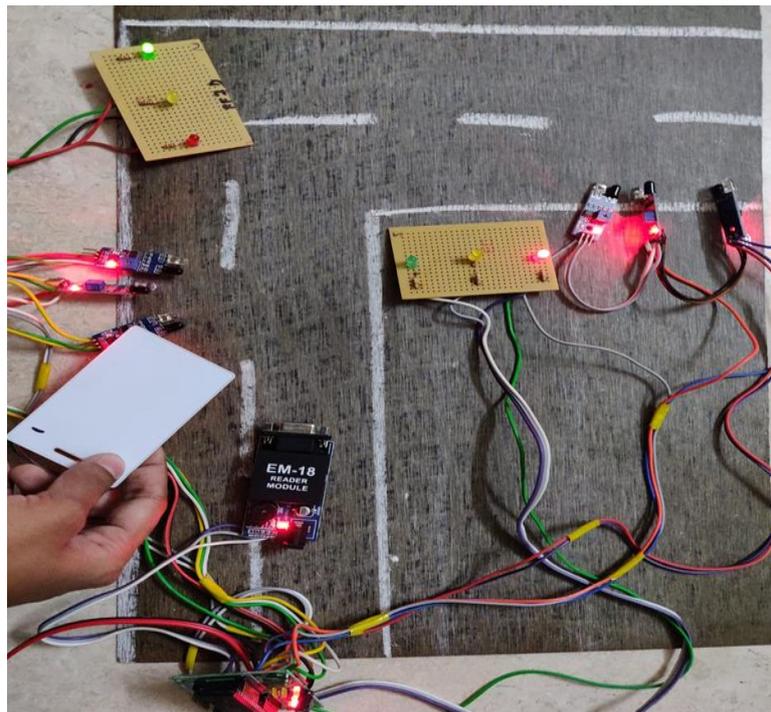


Figure 3.3.3 Signal Changes after Scanning the Tag

After the tag number matches with the registered numbers in the reader, the signal changes to green and others turn to red. The green on this side has a elongated time so that it allows the passage of emergency vehicles as a priority.

3.4. PIC Microcontroller 16F877A

The PIC 16F877A, is an integrated circuit(IC).

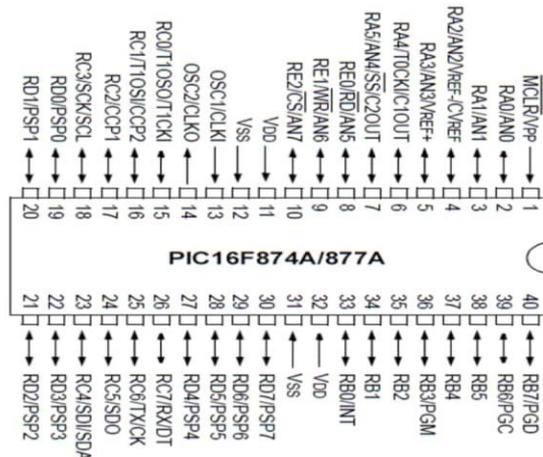


Fig 3.4.1: Pin Diagram of PIC 16F877A

3.5. LCD Display

Liquid Crystal Display (LCD): 16x2 LCD used in the implemented to display data over 2 lines, each of 16 characters. Actually, two types of registers are used to configure the LCD; the command registers and control registers. Other aspects are LCD initialization, clearing the screen, setting the cursor position, and controlling display. While the data register holds the ASCII code of the characters that are appeared on the display.

3.6. IR Sensors AND LEDs

An infrared sensor is an electronic device used to detect the objects.

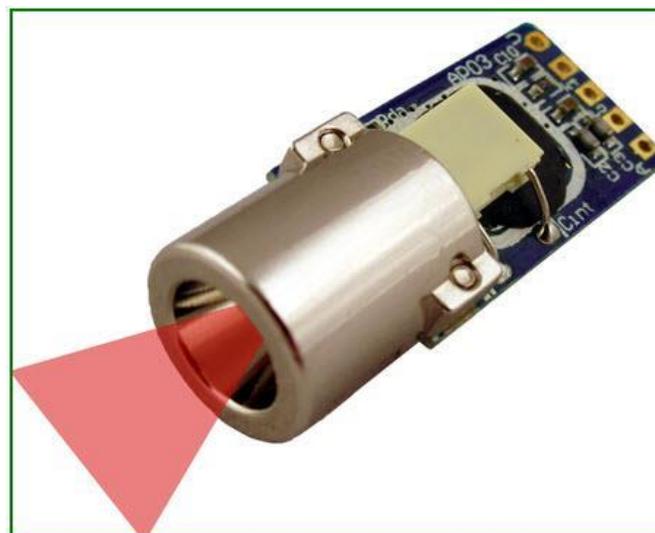


Figure 3.6.1 IR Sensor

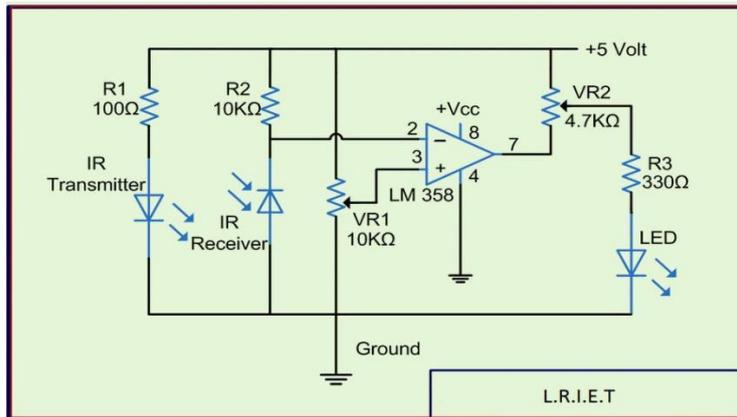


Figure 3.6.2 IR Sensor

3.7. RFID Tags

Radio Frequency Identification System uses electromagnetic fields for automatic identification. It is a modern technology that is actually based identification system.



Figure 3.7 Radio Frequency Identification

4. METHODOLOGY

In NORMAL mode, the PIC Microcontroller allows the LED to glow on normal time basis. In DENSITY mode, the PIC Microcontroller does all the functions according to code.

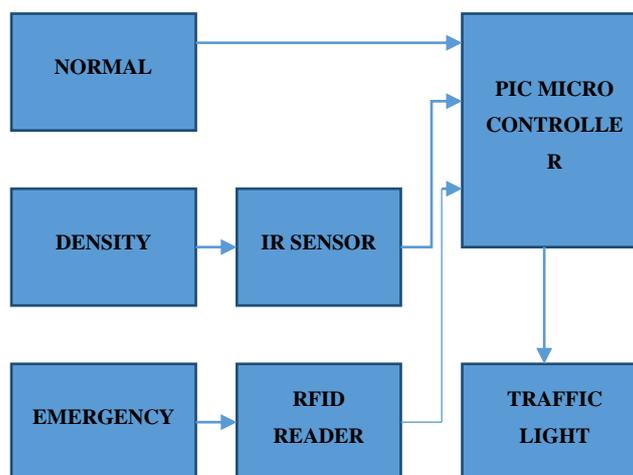


Fig. 4.1 Interfacing of Modes with PIC Microcontroller

Traffic light remaining time to be displayed in LCD. In EMERGENCY mode, the RFID with transmitter and receiver implemented at the traffic junction and in ambulance unit. This passes the information to the traffic junction, in order to maintain the traffic normally.

5. CONCLUSION

With the help of these multi – modes in traffic light, the need of policemen is decremented. As of now, major places have policemen at traffic junctions all over India. And so places have automatic changing of signals at particular period of time. But these go helpless at the time of emergencies. Also based on the commerciality of roads, the constant timing has to be changed to an alternate for effective living.

Thus the design of this system is only based on the automation of different modes based on the requirement of public, which has less human interaction at dangerous roads.

Ambulance, Fire engines have no prior notification in reaching their destinations. In such case being struck in traffic will lead to loss of lives or property. Thus the emergency mode comes into action and the side where this vehicle waits turn to green and all other sides will have red signal. The signal comes back to its normal mode only after it ensures the passage of these vehicles.

The density mode gets implemented when the count of vehicles increases on a particular road than a marked distance on a traffic junction which decreases the time consumption.

Thus the proposed system can be implemented in India which has a larger population where wastage of time at traffics can occur.

6. REFERENCES

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