Int. Conf. on Signal, Image Processing Communication & Automation, ICSIPCA

Density Based Traffic Control Signal with Emergency Override

Ranjan Sharma[1], Gaurav Kumar[2], Abhay Naik[3], Arjun Patil[4] and D Jayadevappa[5]
[1234] Final year students, Dept. of E&IE, JSSATE Bangalore
ranjan4985@gmail.com, gauravkumar21620@gmail.com, abhaynaik10@gmail.com, arjun5rocky@gamil.com
[5]Prof. Dept. of E&IE, JSSATE, Bangalore
devappa22@gmail.com

***Abstract*— With the increase in human population in cities and therefore number of vehicles, traffic control signals have been playing significant role in managing traffic flow in cities. It provides safety and convenience to both drivers and pedestrians. However, traditional traffic control signals fails in time management, as it allocates equal time slots to each road it is managing. This creates unnecessary waiting for drivers, which could not be endurable in every case, as being in time, is important to everyone. Therefore, here we proposed density based traffic control signal, which allocates different time slots to each road according to vehicle density on it and therefore doing time management function. This system also comes with RF signal override control in case of emergency vehicles such as fire brigade, ambulance, etc. So this is also a priority based system. This system, therefore, offers advantages over ordinary traffic control signal.**

***Index Terms*— Density Based Traffic, Traffic Control Signals, Microcontroller, IR Transmitter and Receiver.**

I. INTRODUCTION

Nowadays one of the major problems faced in any metro city is traffic congestion. Getting stranded in between heavy traffic is a headache for each and every person driving the vehicle and even to the traffic police controlling the traffic. One of the oldest ways of handling traffic was having a traffic police deployed at each junction and manually controls the inflow of traffic through hand signaling. However this was quite cumbersome and then came the need for a different type of control - using Traffic Control Signals. Conventional Traffic signal started playing important role in cities, but as time passed, with increase in population in cities, this system became less efficient in traffic management. This called the need of traffic control signal which works more efficiently. So density based traffic control signal is proposed which allocates time for each road depending on the density of traffic on it. And also the project aims to provide signal override for emergency vehicles through RF signal. It happens when there is an emergency situation like ambulance, fire brigade stuck in the traffic. This project therefore happens to be the perfect solution in high population cities. This circuit makes use of IR sensors to measure the density of traffic. These sensors are interfaced with microcontroller of 8051 family which in turn allocates time for each road according to the output of IR sensors through traffic signal. For the emergency override it uses RF transmitter and receiver.

Grenze ID: 02.ICSIPCA.2017.1.18

II. Literature Review

A green wave system which is used to provide the clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, for this reason providing a complete green wave to the desired vehicle. A “green wave” is the synchronization of the green phase of traffic signals. With a green wave setup [1], a vehicle passing through a green signal will continue to receive green signals as it travels down the road. Advantage of the system is that GPS inside the vehicle does not require additional power [2], [3]. The biggest disadvantage of green waves is that, when the wave is disturbed then the disturbance can cause traffic problems that can be exacerbated by the synchronization. In such cases, the line of vehicles in a green wave grows in size until it becomes too large and some of the vehicles cannot reach the green lights in time and vehicles must stop. This is called over-saturation [4].

III. Materials and Methods

This proposed techniques uses four important elements namely; Microcontroller unit, RF transmitter and receiver, IR transmitter and receivers and sensors. These elements are briefly discussed in the following sections.

A. Microcontroller Unit

The AT89S52 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel’s high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in -system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications.

Figure 1. AT89S52 Microcontroller

The AT89S52 provides for 4K EPROM/ROM, 128 byte RAM and 32 I/O lines. It also includes a universal asynchronous receive-transmit (URAT) device, two 16-bit timer/counter and elaborate interrupt logic. Lack of multiply and divide instructions which had been always felt in 8-bit microprocessor /micro controllers, has also been taken care of in the AT89S52.

B. RF Transmitter

The transmitter will generate the signal which is then encoded with the help of an encoder. This is done to increase the security. Since RF signal moves in every direction they need to be supported so that the loss of energy is reduced. The modulator is used to bind the RF signal with the carrier signal. Once the signal is bounded with a carrier signal it is then amplified and transmitted through the antenna. The signal travels in all direction and then will be caught by the receiver with the same crystal frequency. In this system, the matching crystal frequency of 433MHz is used. When the signal is transmitted by the RF TX of 433MHz it is caught by the receiver of 433MHz. Hence security is improved.

Figure 2. RF Transmitter

C. RF Receiver

The RF receiver will perform the reverse operation as of RF transmitter. First the receiver will capture the signal of matching crystal frequency. It is then amplified since the signal loses energy due to interference. This amplified signal is demodulated to remove the carrier signal. Here also once again amplitude shift key is used. Once the original signal is regained, it is processed through decoder which decodes the fragments from the signal.

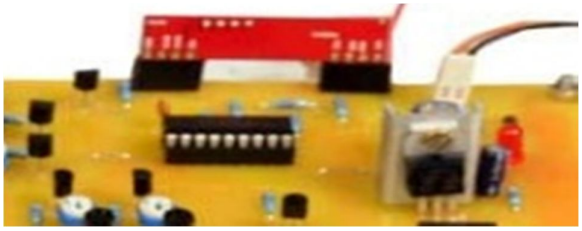

Figure 3. RF Receiver

D. IR Transmitter

Symbol and operation of IR transmitter is very similar to ordinary LED IR Transmitter generates infrared. It is made up of gallium arsenide. If we pass the current to gallium arsenide it produces IR rays. Current applied to the sensor is directly proportional to the rays emitted through IR Transmitter can withstand up to 35MA, we have used 5MA, due to shortest distance. If the distance is more we have to increase the current flow to the transmitter.

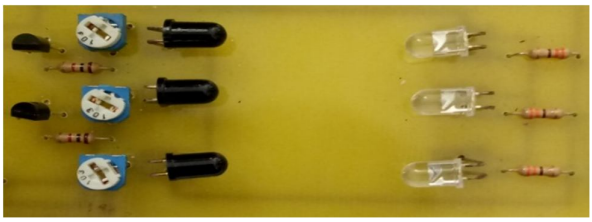

Figure 4. IR Transmitter and Receiver

E. IR Receiver

This circuit is mainly used to for counting application since IR can be used only during proper alignment position IR Receiver is having reverse characteristics of the IR Transmitter. IR Receiver will conduct as long as the rays fall on it.

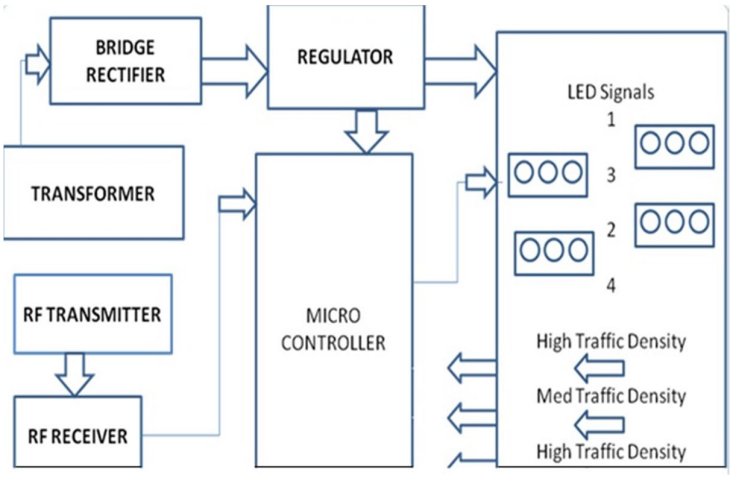

Figure. 5 Block Diagram of the proposed system

IV. Software Implementation

Software used to design, program and configure the hardware. Keil an ARM Company makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators for ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251, and 8051 MCU families.
Compilers are programs used to convert a High Level Language to object code. Desktop compilers produce an output object code for the underlying microprocessor, but not for other microprocessors. i.e the programs written in one of the HLL like 'C' will compile the code to run on the system for a particular processor like x86 (underlying microprocessor in the computer).

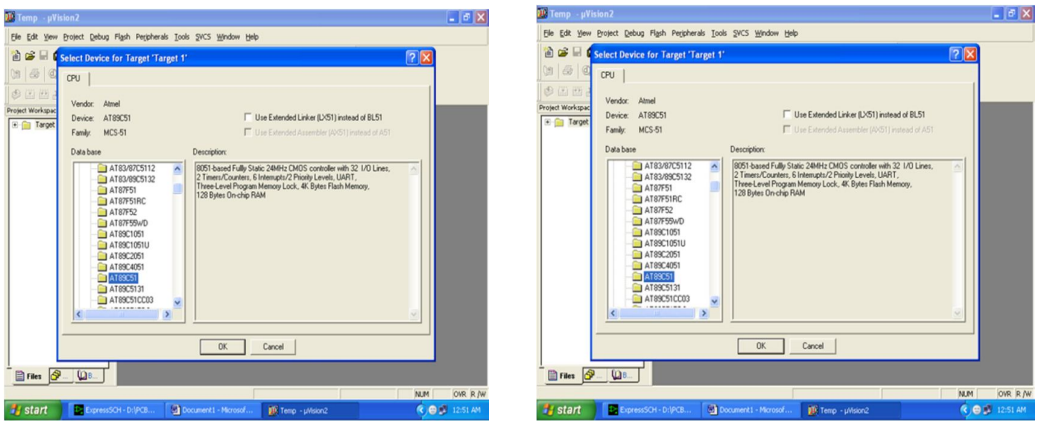

Figure 6. Kiel Software Implementation.

V. Experimental Results

The range of transmitter has been analyzed in outdoor and indoor places as to study the effectiveness of using RF in our study. From the table 1 the transmit data only can receive until the range of 20 m, the range that beyond than 20 m the receiver cannot receive data from transmitter. From the Table 2 the transmit data only can receive until the range of 30 m and the range beyond than that the receiver will not receive the data from transmitter. From the observation of the result, regular radio frequency modular is quite disturbed at outdoor places different from indoor places.

TABLE I. Outdoor Range Measurement

Range	Data transmit
5 m	Yes
10 m	Yes
15 m	Yes
20 m	Yes
25 m	No
30 m	No
35 m	No
40 m	No

TABLE II. Indoor Range Measurement

Range	Data transmit
5 m	Yes
10 m	Yes
15 m	Yes
20 m	Yes
25 m	Yes
30 m	Yes
35 m	No
40 m	No

VI. Conclusion

In this proposed system, we have studied the optimization of traffic light controller in a city using IR sensors, RFID tag, RFID reader and PIC 16F877A microcontroller Fig.1 shows the basic block diagram of the system and fig. 4 shows the complete circuit diagram of microcontroller board. This proposed system reduces the possibilities of traffic jams, caused by high red light delays and provides the clearance to the emergency vehicle, to an extent and successfully . Here we designed the system with the purpose to clear the traffic in

accordance with priority .In this system, we use IR sensor to find the traffic density. When the IR cut in any one of the roads, that road is considered
the higher traffic density road. So the road with the highest priority is cleared first. The proposed system also gives importance to the ambulance and also VIP vehicles. If any ambulance or VIP vehicle is waiting in a signal then the particular lane is given a higher priority and the traffic in that lane is cleared. Emergency vehicle is detected by using RFID technology. RFID tag is inserted in the emergency vehicle and RFID reader is interfaced with the PIC microcontroller. Whenever the emergency vehicle enters the lane, RFID reader reads the unique identification code of the tag and sends it to microcontroller. Microcontroller gives the high priority to the lane with the emergency vehicle and clears that particular lane..The program was successfully burned on the micro-controller using USB programmer. This proposed system is used to build a smart city with less traffic jams and it also helps the emergency vehicle to reach in time to the destination. The proposed system finds applications at toll gates. Further the project may be extended to the synchronization of all the traffic lights in the city.
This proposed system provides time efficient system by avoiding unnecessary waiting at traffic signal junction due to use of density based controlling. It is priority based system as it provides Emergency override and therefore avoiding any possible damage.

REFERENCES

[1] G.Monika, N.Kalpana, Dr.P.Gnanasundari, “An Intelligent Automatic Traffic Light Controller using Embedded Systems”, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, no. 4, April 2015.

[2] K.Vidhya, A.Bazila Banu, “Density Based Traffic Signal System”, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, no. 3, April 2014.

[3] Koushik Mandal, Arindam Sen, Abhijnan Chakraborty, Siuli Roy,Suvadip Batabyal, Somprakash Bandyopadhyay ,“Road Traffic Congestion Monitoring and Measurement using Active RFID and GSM Technology” ,14th International IEEE Conference,October 2011.

[4] Philip Kelly and Noel E. O’Connor, “Vision-Based Analysis Of Pedestrian Traffic Data”,IEEE, 2008.