International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 04 - Issue 03 || March 2019 || PP. 83-89

Smart Traffic Light Controller

Ram Nivas. D[1], Krishna Veni. V[2], Kalika Devi. K[3], Kokilavani. J[4]
[1]Assistant Professor, [2,3,4] Under Graduate Scholars
Department Electronics and Communication Engineering,
P. A. College of Engineering and Technology, Pollachi, Coimbatore 642 002, India

Abstract: The traffic lights are also known as traffic signals which are used to provide assistance in controlling city traffics and streamlining the current traffic situations. The traffic lights are used since 1868. They are used by traffic sergeant to avoid congestion and to maintain the proper flow of city traffic. As years passed, these lights are evolved with automatic controls, Pedestrian supporters and so on. There are several standards followed in implementation and design. The smart traffic light controller is designed to develop a traffic signal based on avoidance of traffic congestion and also innovative control to clear the traffic for emergency vehicle. The emergency vehicle would have a transmitter within it, which would transmit a signal to the receiver side, this will enable green signal in the corresponding pole. The light of the signal is controlled by automatic timers which are built in by discrete components. The automatic timers are controlled using Arduino boards. The implementation is made simplified by readily available components. The complexity of the control mechanism is also simpler. Simulation is performed with the help of Proteus 7.0 and the simulation result holds good for hardware implementation also. Accuracy of data transmission and reception are good in desired or specified range of operation.

Keywords: Arduino, Encryption & Decryption, Proteus, Radio Frequency Transmitter, Radio Frequency Receiver.

I. INTRODUCTION

The traffic signals are positioned at road junctions and Pedestrian crossings. In general, the traffic signals have two main lights red and green. To support people with red- green color blindness, red contains orange as hue and green contains blue. For our experimental considerations, we take red and green in to account. Red indicates the stop command, green indicates the go command and the yellow indicates to get prepared. There is a blinking yellow condition where the user needs to precede the signal with caution [1].

An Emergency vehicle is designed or authorized to respond during emergency or life threatening situations. We have considered an ambulance in our experimental procedure. The ambulances are permitted to break conventional road rules to reach their destinations in time. Their break points include violation of traffic junctions and violating road speed rules. The ambulances come under the category of emergency medical vehicles[2].

The ambulances are provided with various life savers, first aids and assist devices. As the above short comings or violations are to be rectified, the emergency vehicles have to establish a relation with the traffic junction. The communication between the fixed receiver and isolated movable transmitter has to be established wirelessly. The main objective of our work is to implement a smarter system for avoiding congestion of stagnating vehicles, to assist the emergency vehicles and to provide scope for improvement in smarter traffic systems.

II. LITERATURE SURVEY

Grindhar Balakrishna et.al (2017) proposed Traffic Signals based on Density with Innovative Clearance for Ambulance. During normal timings, the signal timing changes automatically by sensing the density at the junction. The movement of approaching an ambulance which is in emergency would have android device that would override the set timing prompting instantaneous green signal in the desired direction while blocking the other lanes by red signal for some time. Microcontroller AT89S52 is the brain of the project which initiates the traffic signal at a junction .The led are automatically on and off by making the corresponding port pin of the microcontroller high. At a particular instant only one green light holds and other lights hold at red. During transition from green to red, the present group yellow led and succeeding group led changes to green. This process continues as a cycle. IR sensors are used in line of sight configuration across the roads to detect density at the traffic signal. The density of vehicles is measured on which timings are controlled accordingly. Clearance to the emergency vehicle is activated by a Bluetooth operated by the android device from the emergency vehicle. [3]

Harshada Rajale, et al proposed a system Traffic Density Control (2017) to reduce the problem of traffic congestion which is a very severe problem now a days. A scheme using microcontroller, in which timings of green light and red light are assigned based on the density of the traffic present at that time .This can be done by using LASER diode and photo diode. [4]

Lella Sai Krishna, et al implemented an Advanced Automation in an Ambulance under Emergency Condition (2017) mainly in urban areas most of the people are using cars as transport when they go out .The ambulance is implemented with embedded system units which finds the accident spot and delivers the spot to close by ambulance through GPS. It depends upon the driver alertness and his skill. Furthermore, these advanced intelligent techniques have complex programs to determine accident insecurity. [5]

Charak Bhardwaj et al invented New Era Smart Traffic System(2016) improvised concept for a better operation and controlling of the traffic light system. This system uses an RFID technology to track the entire details of very vehicle on the road and a ZIGBEE module for emergency situations in case of ambulance .It reduces a cost of installation and the cost of maintenance .It reduces the cost and efforts of manpower involved in the present traffic system. [6]

The proposed system is implemented by using RF transmitter receiver and arduino boards.

III. HARDWARE AND SOFTWARE REQUIREMENTS

This hybrid RF Transceiver Module provides a complete RF transmitter and receiver module solution which can be used to transmit data at up to 3KHz from any standard CMOS/TTL source.

The transmitter module is very simple to operate and offers low current consumption (typical 11mA). Data can be supplied directly from a microprocessor or encoding device, thus keeping the component count down and ensuring a low hardware cost.

The RX – ASK is an ASK Hybrid receiver module. The RF Transmitter Receiver Module is an effective low-cost solution for using 433 MHz. The TX-ASK is an ASK hybrid transmitter module. TX-ASK is designed by the saw resonator, with an effective low cost, small size and simple to use for designing [7].

3.1 A Smart Traffic Light Controller

At present, traffic congestion is a major problem. The smart traffic controller controls the signal based on the path of emergency vehicle. If the emergency vehicle is sensed, then the traffic signals are enabled according to the path of the ambulance. If the road consists of four junctions and when the emergency vehicle arrives at first junction then the signal 1 is enabled, automatically consecutive signals are enabled one by one. In case if the emergency vehicle arrives at second junction, the signal 2 is enabled by resetting S2 and then signal 3 and 4 also gets enabled after a particular time, where signal 1 is disabled at this case. After the emergency vehicle crossed, the signals are reset to start from the first iteration to avoid traffic congestion. When normal vehicles move with a constant speed, then there is no delay in crossing poles.

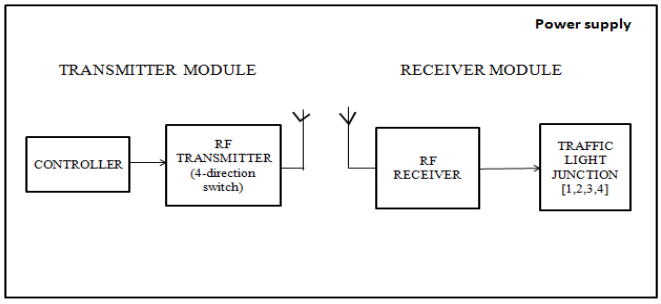
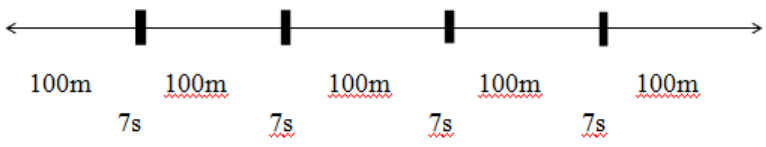


Figure 3.1 Block Diagram of Traffic Light Controller

3.1.1 Assumption



CONDITIONS:

80kmph – 2 seconds(Emergency vehicle).

40kmph – 6 seconds.

Consider the assumptions for implementation. The junctions are placed at a distance of 100 meters. Let us consider the source be A and Destination be B. The Emergency vehicle which moves with a speed of 80 kilometers per hour can reach the destination within 10 – 15 seconds where as the normal vehicle takes 28-35 seconds, which is approximately 7 seconds per junction.

3.2 Implementation

The Smart 4-way Traffic Light Controller comprises of transmitter and receiver module. The RF Transmitter continuously transmits the position of Ambulance within the range of 1km with the help of 4-way controller module found in the Emergency vehicle. If a vehicle meets the junction, the timer is enabled, the speed limit constrain for the driver is intimated for the clearance of the forth coming junctions.

3.2.1 Isolated Transmitter Module

The transmitter module consists of a RF transmitter for transmitting the signal through antenna. The input of RF transmitter is through OR gate. One of the input of OR gate is given from ambulance and the other is in ON state. The figure 3.2 shows the isolated Transmitter module.

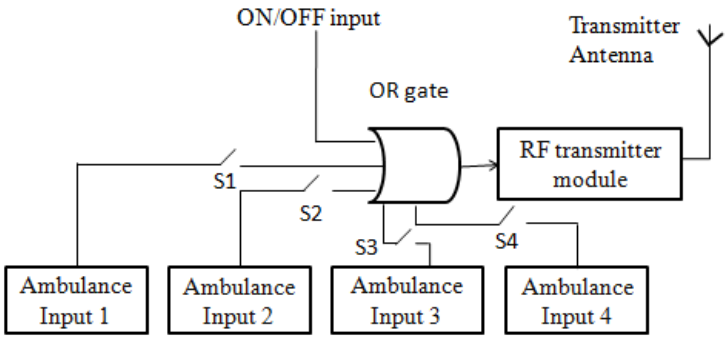


Figure 3.2 Isolated Transmitter module

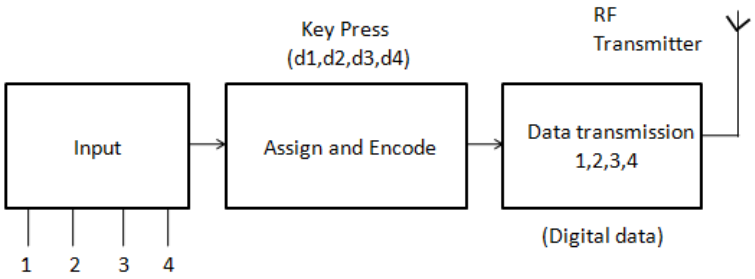


Figure 3.3 Flow diagram - Transmitter

The RF transmitter is enabled if and only if the signal from any one of the ambulance unit is received in the OR gate pin. Then the signal from transmitter module is transferred to receiver module.

3.2.2 Receiver Module

In receiver module, RF receiver receives the signal from transmitter antenna and provides the signal to controller module.

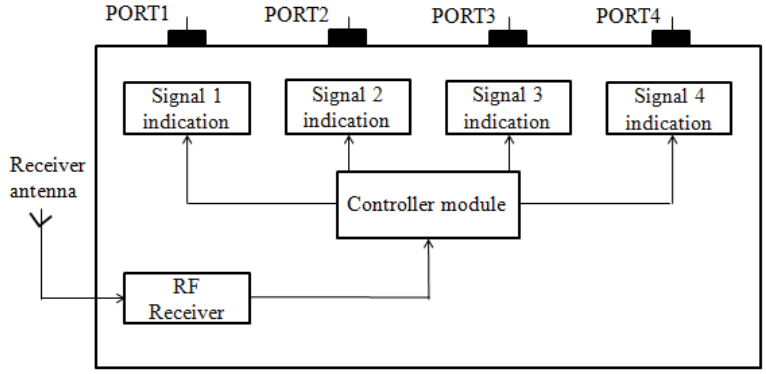


Figure 3.4 Receiver Module

This controller module controls the different signal indicator. Signal indictor is enabled based on the signal from the transmitter side (i.e) Ambulance unit.

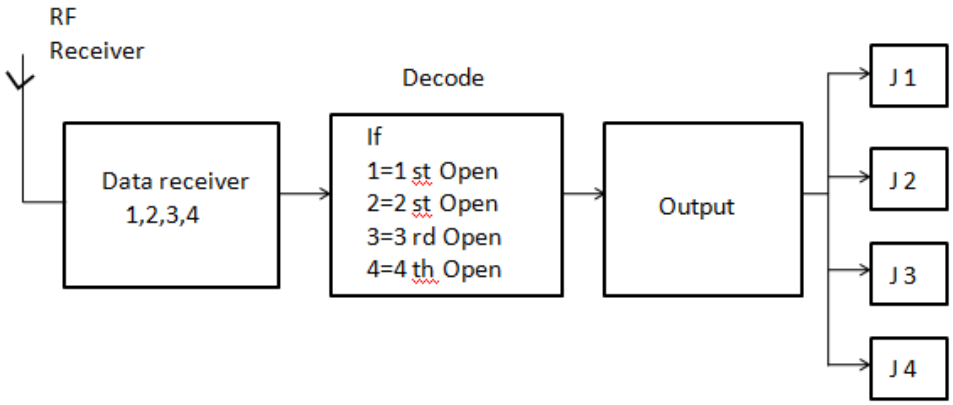


Figure 3.5 Flow diagram -Receiver Module

The power is supplied to the module through power supply unit. Figure 3.5 represents the flow of receiver module.

IV. RESULT AND DISCUSSION

4.1 Simulation results

The figure 4.1 shows the circuit connection to test the RF transmitter and receiver module. Here we have four switches to encode and transmit 4 input data to perform 2 operations in receiver side. The key 1,2 in the transmitter controls LED 1 and key 3,4 controls the LED2.The operation table is mentioned below

S. No / Key No.	Encoded Data	Decoded Data	Operation
1.	@ABC$	ABC	LED 1: ON
2.	@BOFF$	BOFF	LED 1: OFF
3.	@FON$	FON	LED 1: ON
4.	@FOFF$	FOFF	LED 1: OFF

Table 4.1 Operation table

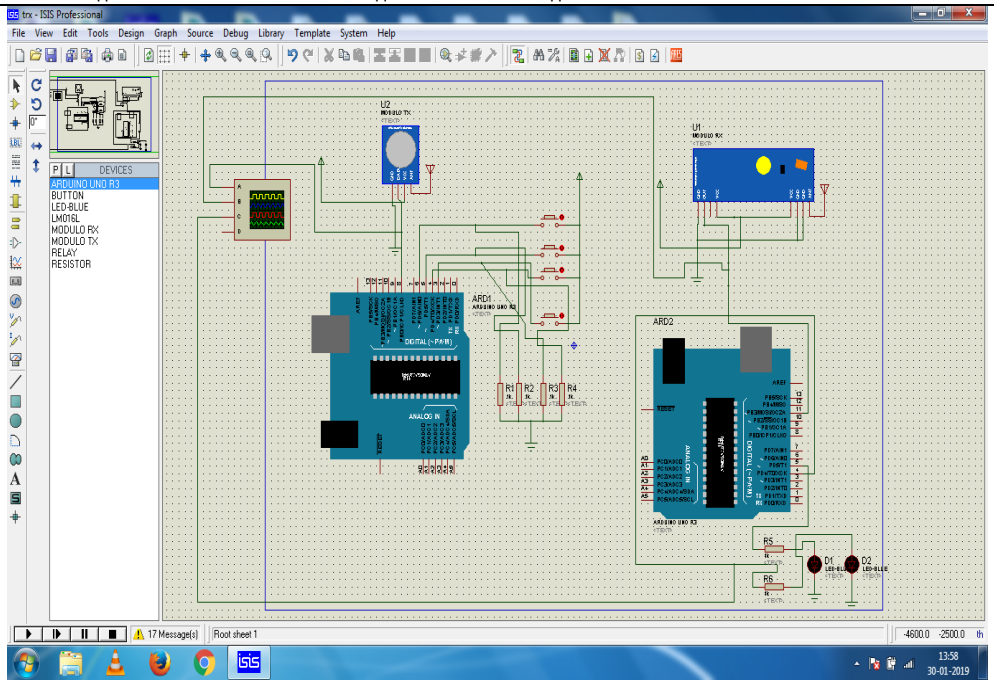


Figure 4.1Connection of RF Transmitter and Receiver

.

At the transmitter section, the Arduino continuously monitors the status of the switches Whenever a switch is pressed, a logic HIGH is detected at that particular I/O pin. As a result, the Arduino transmits a suitable message corresponding to the switch pressed. For example, if LOAD1_ON switch, which is connected to pin 6, is pressed, Arduino detects a logic HIGH at pin 6. Hence, Arduino sends a message as "@ABC$" via the RF transmitter. At the receiver end, the RF receiver receives this message and transmits the same to Arduino for decoding. When the Arduino at the receiver end decodes the message and understands that the transmitter characters are "@ABC$", it then writes a HIGH signal on the digital I/O pin 4. As a result, the load is turned on. Similar actions are performed when other switches are pushed. If there is any error in the data transmission i.e. the desired data is not transmitted, the Arduino at the receiver section lights up the error LED which is connected to the 13th pin. A data transmission successful LED and an error buzzer can also be implemented to indicate those actions more efficiently.

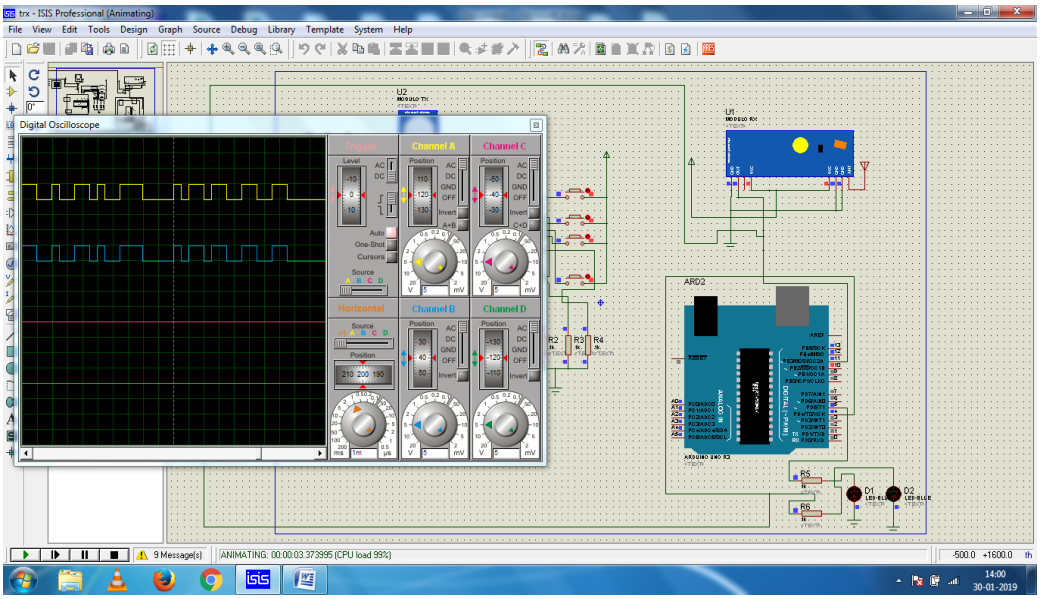


Figure 4.2 Testing of RF transmitter and Receiver

The figures 4.3 and 4.4 indicate the oscilloscope connected to the RF Transmitter and Receiver. The transmitted signal varies for different key presses are noted.

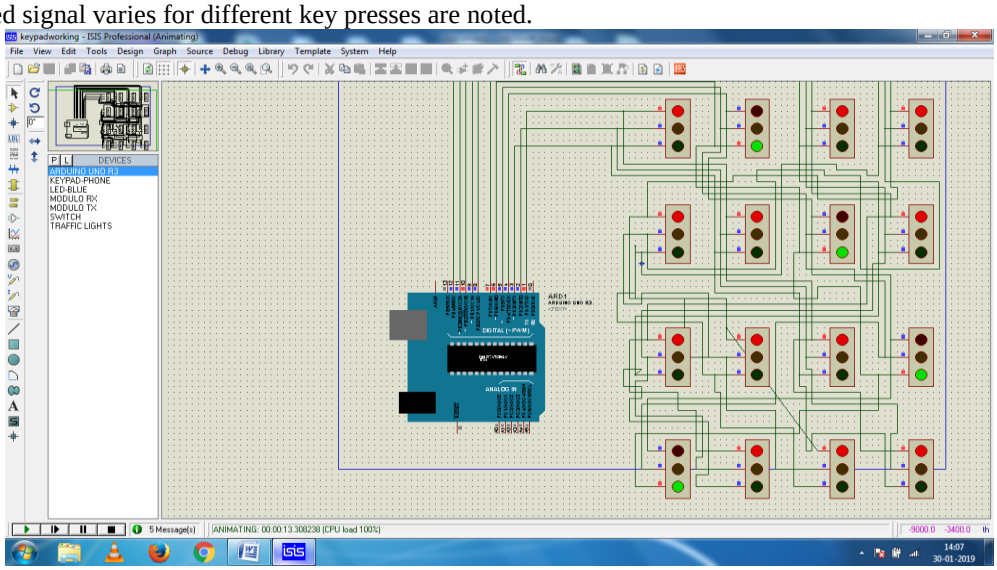


Figure 4.3 Different key press

It is evident from the above figure every one signal in a junction is synchronized with all the other signals in other junctions. So a driver could cover all the check points, if he meets the first junction at starting instance and he would successfully meet the destination junction but cope up with speed constrains.

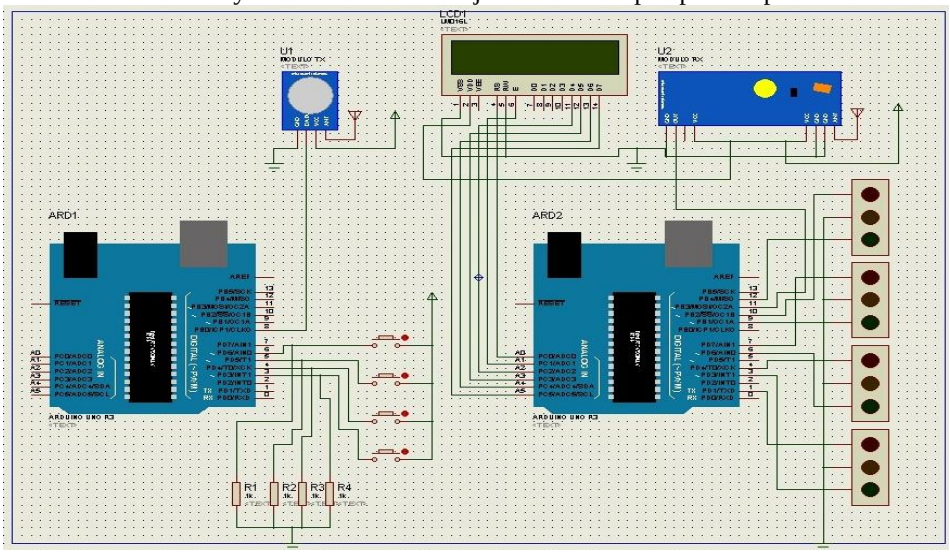


Figure 4.4The final experimental set up.

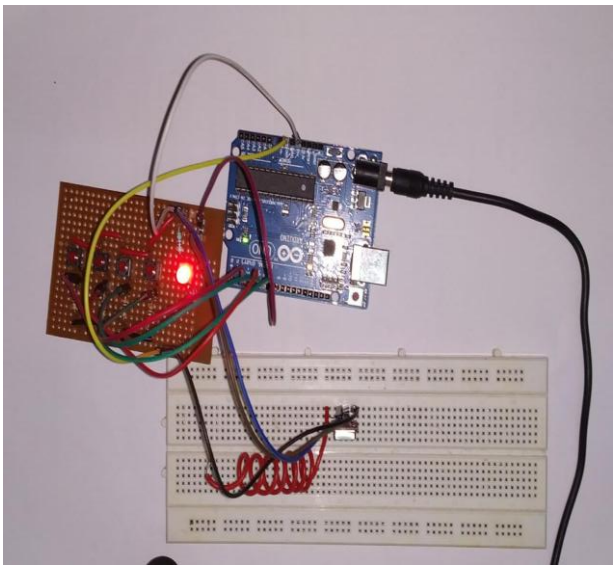
.

S. No / Key No.	Encoded Data	Decoded Data	Operation
1.	@ABC$	ABC	Restart at signal 2 (Ambulance Way 1)
2.	@BOFF$	BOFF	Restart at signal 3 (Ambulance Way 2)
3.	@FON$	FON	Restart at signal 4 (Ambulance Way 3)
4.	@FOFF$	FOFF	Reset / Restart at signal 1

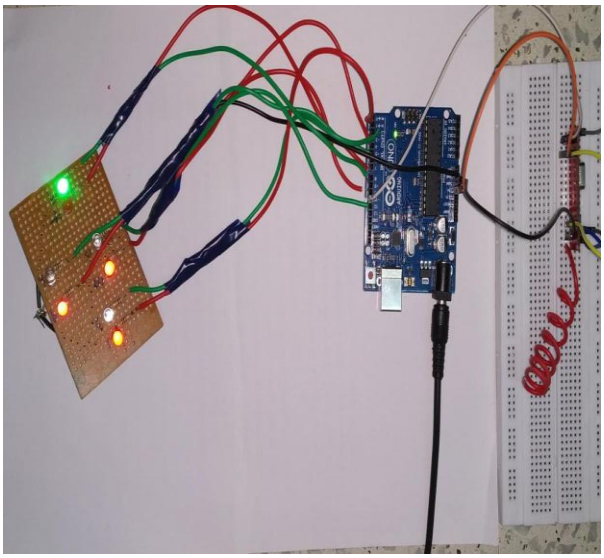
Table 4.2 Working of the setup

4.2 Hardware implementation:

The Hardware implementation is successfully done. It comprises of isolated transmitter module which is present in ambulance and the receiver module which is in junction. The ambulance operator takes the control over the receiver by enabling the transmitter. The implementation is simpler as it makes use of readily available components and complexity of conventional system is reduced.



Transmitter module (Isolated at ambulance)



Receiver Module

Figure 4.5 Hardware setup

V. CONCLUSION AND FUTURE WORK

It is evident from the implementation that the system works well in the desired range of operation. The range is improved by introducing antenna to RF Transmitter and Receiver. The simulation result synchronizes hundred percent in hardware implementation. The cost of implementation is also lesser when compared with conventional proposed systems. The transmitted operations are exactly received and the desired action of traffic control is established with one hundred percentage accuracy.

The improvement in the system can be made by introducing authentication systems for the isolated transmitter module. The smartness of the proposed system could be improved by providing mobile access and density analysis by image processing techniques.

REFERENCES

[1]. https://www.surfindia.com/automobile/traffic-lights.html
[2]. https://en.wikipedia.org/wiki/Emergency_vehicle
[3]. Giridhar Balakrishna R, (2016), "Traffic signals based on density with innovative clearance for ambulance", *International Journal of Innovations in Engineering and Technology, volume-7*
[4]. Harshada rajale, Tejas Baing, Akshay Varekar, Ketan Jogadhankar, Mihir Mhatre, (2017), "Traffic density control", *Imperial Journal of Interdisciplinary Research, volume-3, Issue-4,* ISSN:2454-1362
[5]. Lella Sai Krishna, Samineni Vijay, Pushpavalli M, Sivagami P, (2017), "Advanced automation control in an ambulance under emergency condition", *Third International Conference on Science Technology Engineering and Management ,volume 2, issue 4*
[6]. Charak Bhardwaj , Aishwarya Savithha. , Lokesh Kumar Rawat,(2016), *"New Era Smart Traffic System", International Journal of Engineering Science and Computing, volume 6,issue 10.*
[7]. https://www.engineersgarage.com/electronic-components/rf-module-transmitter-receiver