ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

Implementing Intelligent Traffic Control System for Congestion control, Ambulance Clearance and Stolen vehicle detection

Sagar G. Umale, Dr. S.D. Lokhande

Department of Electronics & Telecommunication, Sinhgad College of Engineering, Savitribai Phule Pune University, Pune, India

ABSTRACT: This project presents an intelligent traffic control system to pass emergency vehicles smoothly. Each individual vehicle is equipped with special radio frequency identification (RFID) tag (placed at a strategic location), which makes it impossible to remove or destroy. We use RFID reader and microcontroller based system-on-chip to read the RFID tags attached to the vehicle. It counts number of vehicles that passes on a particular path during a specified duration. It also determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using application to the police control room. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light. We used microcontroller based system on chip for wireless communications between the ambulance and traffic controller. The prototype was tested under different combinations of inputs in our wireless communication laboratory and experimental results were found as expected.

KEYWARD:-FPGA, RFID TAG, GSM MODULE

I. INTRODUCTION

India the second most populous Country in the World and is a fast growing economy. With globalization the problem of congestion on highways and in cities is becoming more and more acute. The goal of intelligent traffic management systems is to achieve improvements in mobility, safety and productivity of the transport system through integrated application of advanced monitoring.Intelligent management of traffic flows can reduce the negative impact of congestion. Technologies like ZigBee, RFID and GSM can be used in traffic control to provide cost effective solutions. RFID is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimeters, while others may work for 100 meters (300 feet) or more.

II. LITERATURE SURVEY

This paper presents an intelligent traffic control system to pass emergency vehicles smoothly. Each individual vehicle is equipped with special radio frequency identification (RFID) tag (placed at a strategic location), which makes it impossible to remove or destroy. D reader, NSK EDK-125–TTL, and PIC16F877A system-on-chip to read the RFID tags attached to the vehicle. It counts number of vehicles that passes on a particular path during a specified duration. It also determines the network congestion, and hence the green light duration for that path. If the RFID-tag-read belongs to the stolen vehicle, then a message is sent using GSM SIM300 to the police control room. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the green light. This module uses ZigBee modules on CC2500 and PIC16F877A system-on-chip for wireless communications between the ambulance and traffic controller. The prototype was tested under different combinations of inputs in our wireless communication laboratory and experimental results were found as expected.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

III. PROPOSED MODEL

- **Schematic Block diagram OF Model:**

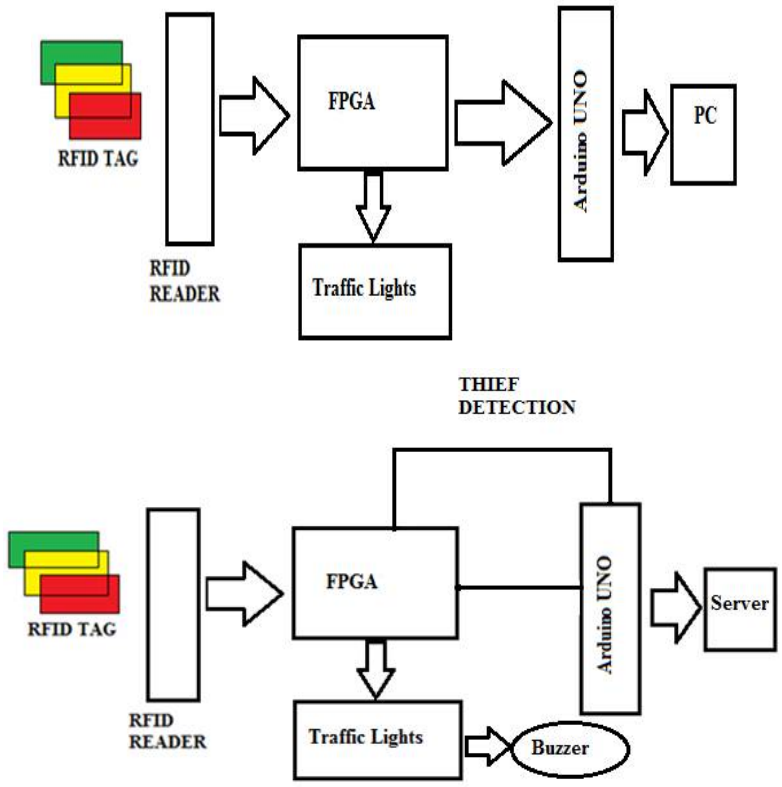

Fig.1: Schematic Block diagram

In this project we propose to implement our Intelligent Traffic Control System. It mainly consists of three parts.

- First part contains automatic signal control system. Here, each vehicle is equipped with an RFID tag. When it comes in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track how many vehicles have passed through for a specific period and determine the congestion volume. Accordingly, it sets the green light duration for that path.

- Second part is for the emergency vehicle clearance. Here, each emergency vehicle contains RF transmitter module and the RF receiver will be implemented at the traffic junction. The buzzer will be switched ON when the vehicle is used for emergency purpose. This will send the signal through the RF transmitter to the ZigBee/RF module receiver. It will make the traffic light to change to green. Once the ambulance passes through, the receiver no longer receives the RF signal and the traffic light is turned to red.

- The third part is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs. If a match is found, it sends SMS to the police control room and

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

changes the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action.

- In the second module if the thief tries to steal the vehicle the detector will break down and the owner and police will get the location massage.

A. RFID MODULE:

- A high level comparison: RFID technology is similar to the bar code identification system that we see in the retail stores every day; however one big difference between RFID and barcode is that RFID does not rely on the line-of-sight reading that bar code scanning requires.

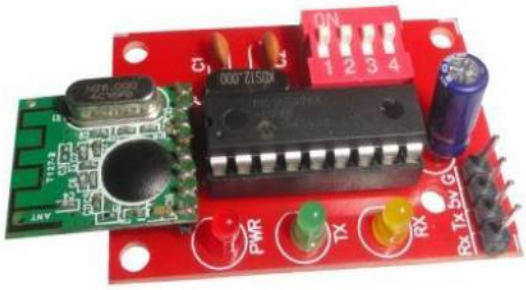

Fig.2: RF Module

1) RFID tags: RFID tags can be either passive, active or battery assisted passive. Passive RFID does not use a battery, while an active has an on-board battery that always broadcasts its signal. RFID technology is grouped under the term Automatic Identification (Auto ID). Auto ID technologies are a way of controlling information and material flow. The RFID technology is a means of gathering data about a certain item without the need of touching or seeing the data carrier through the use of electromagnetic waves.

2) RFID and Barcode : RFID eliminates the need for line-of-sight reading that bar coding depends on. Also, RFID scanning can be done at greater distances than bar code scanning. High frequency RFID systems (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) offer transmission ranges of more than 90 feet, although wavelengths in the 2.4 GHz range are absorbed by water (the human body) and therefore has limitations. RFID is used in the retail industry for product tags. The primary benefits of RFID technology over standard bar-coding are:

- Information stored on the tag can be updated on demand
- Huge data storage capacity
- Instantaneous data identification
- Data collection from multiple items (hundreds of tags per second)
- Small surface area requirement
- Longer read range; line-of-sight not required

It is believed that RFID technology will play two major roles. It will provide a means of unique object identification at low cost, which will enable it to transform supply chains and reduce their costs dramatically. Secondly, it will be used in combination with other sensing and network technologies to track objects and physical environments.

3) GSM: GSM (Global System for Mobile Communications) is a second-generation digital mobile telephone standard using a variation of Time Division Multiple Access (TDMA). It is the most widely used of the three digital wireless

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

telephone technologies - CDMA (Code Division Multiple Access), GSM and TDMA. GSM digitizes and compresses voice data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900, 1800 or 1,900MHz frequency bands. The GSM network can be divided into three broad parts

- The subscriber carries the mobile station
- The base station subsystem controls the radio link with the mobile station
- The network subsystem performs the switching of calls between the mobile users and other mobile and fixed network users.

IV. FLOW DIAGRAM

Fig.3: Flow diagram for Congestion control

Steps:

- Read ID
- Compare with ambulance ID
- If match TURN ON the green
- If not same to ambulance then COUNT =COUNT+!;
- COUNT>threshold
- IF yes turn ON green.

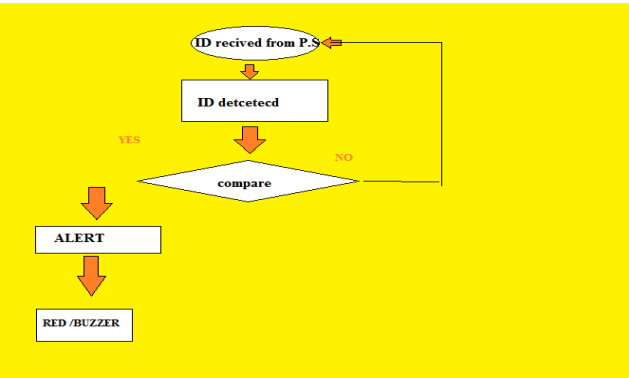

Fig.4: Flow diagram for detection of stolen vehicle

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

Steps:

- Read ID from police station from server
- Compare with car/bike ID
- If match TURN ON the ALERT TO POLICE.

V. EXPERIMENTAL SETUP

In this project, Implemented hardware consists of RFID Tags, FPGA (Spartan XC3S5000), EM-18 RFID Reader module, Buzzer, Arduino UNO along with the traffic light system. The Arduino UNO is connected to the PC via cable. On the other hand the Serial To USB converter is connected to the other terminal of PC via FPGA. According to the pin configuration the various traffic lights are connected to their specific slots on the FPGA. The Arduino UNO connected to PC, RFID Reader and FPGA is also associated with Local server(Police station's) which is used for the information in case of stolen vehicle. There is also a facility of getting the readings of swapped RFID Tags over the RFID Reader using Python software. The experimental setup of the project is shown in figure below.

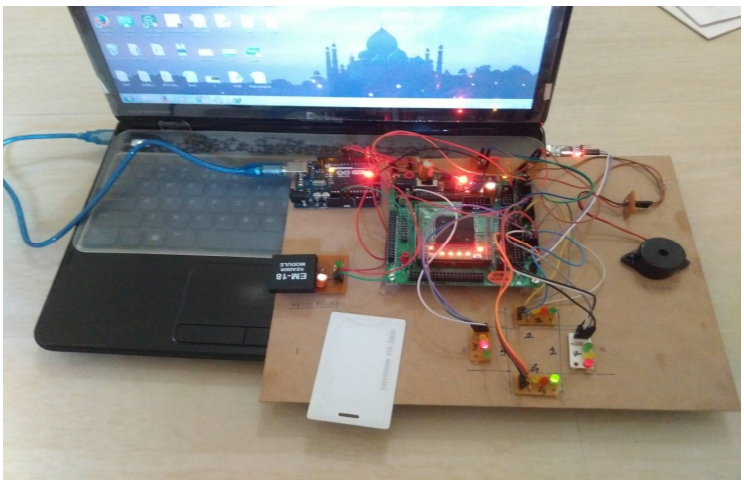

Fig.5. Experimental setup

Working

The function of the system is in such a way that when the RFID tag is detected and when the clock goes from 1 to 0 , 8-bit data serially gets transmitted and when the clock goes from 0 to 1, the same 8-bit data gets received serially. The swapped RFID Tags shows the readings on the Python software . The The traffic light system works under the state machine cycle thus allowing the LED light of a particular traffic lamp for certain amount of time. The Congestion control performance depends upon the no of readings of RFID Tags. In case of Emergency vehicle (Ambulance), when the RFID Tag indicating ambulance vehicle is swapped the associated junction will show the Green light and forcing the others LEDs to glow to Red for a certain amount of time.

On the other hand, when the RFID Tag (Stolen Vehicles) is swapped , this will causes every traffic Led light to glow to RED along with Buzzer for a long time. Correspondingly, there is also a sending of message as "stolen vehicle" to the serve of the Police station. Initially, the server consists of the list of RFID Tags of stolen vehicles as "not detected". When the swapped RFID Tag and tag in the list(Police server) is matched , the buzzer will make the sound and also sends message to the server.

Simultaneously the server list also gets updated automatically indicating the desired RFID Tag as "detected at junction". The buzzer is intended to make sound until the Police takes the proper action over the stolen vehicle. The

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

FPGA connected to the four Traffic lamps is programmed with the Verilog code using Xilinx ISE. The corresponding Behavioural simulation of the Traffic control system is shown below:

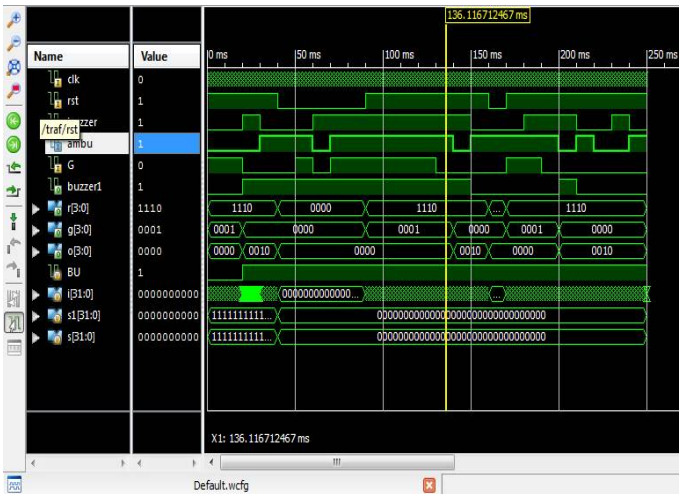

Fig.6. Behavioural simulation on Xilinx ISE

The behavioural simulation consists of all the input and output parameters declared in the code. The clock is meant to be performed for every 20ns from 1 to 0 and vice versa. When rst is low, then there is no change of states among the Traffic lights irrespective of the conditions. When rst is High , depending on the random condition as G, ambulance or Stolen there is a change of a states between the Traffic Lights.

VI. RESULTS

5.1Traffic Control System performance

The main aspect of Traffic Control System is RFID Tags which differs in the vehicles like in case of Emergency purposes(Ambulance) or stolen vehicles. When RFID Tags comes in the range of RFID Reader module it detects and read the RFID Tag . When a clock goes from 1 to 0 , the vehicles in the range of RFID Reader sends 8-bit data to the Reader module. Simultaneously 8-bit data also gets receiver by the Reader module which helps in the glowing of Traffic lights depending on the conditions over the junction.

The function of Traffic Control System performs in mainly into three categories as follows:

1. Congestion Control
2. Amulance Clearance
3. Stolen vehicle

5.1.1 Working of Congestion Control

In the Traffic Control system, the RFID Reader starts detecting RFID Tags placed on the vehicle at a strategic location. Initially, when reset is kept at '0' there is no change of states in the traffic lights but when RFID tag comes in the range of RFID reader the vehicle will send data to Reader module and it will be received by RFID reader. When the reset is made High, The RFID Reader counts the number of vehicles over the junction and compares with the Threshold value

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

and if the counts gets exceeded then the particular junction will allow the vehicles for a certain amount of time by showing Green light and indicating the change of states of traffic lights.

The Behavioural simulation of Congestion Control at reset '0' and '1' of Traffic control system are given in the below figure as follows:

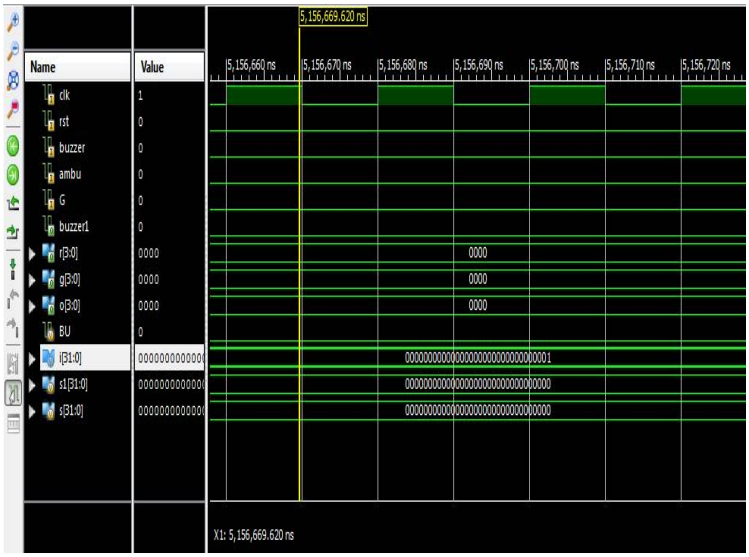

Fig.7 Behavioural simulation at reset= '0'

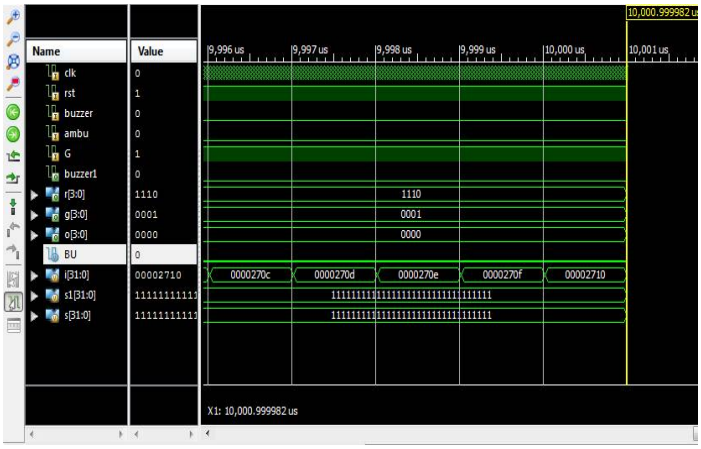

Fig. 8 Behavioural Simulation at reset='1' and at congestion with G

The above simulation indicates the presence of congestion over a particular junction when reset='1' and G='1' there is change of states and the junction keeps on counting the vehicles for the next cycle.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

5.1.2 Working of Ambulance Clearance

In this case, there is same RFID Tag assigned to Amulance vehicles used for emergency purposes. When RFID reader detects the RFID tag of ambulance vehicle it will show the Green signal to the associated junction having presence of Ambulance vehicle. The remaining traffic lights will now turn to Red until the emergency vehicle passes. The behavioural simulation of Ambulance clearance is shown below:

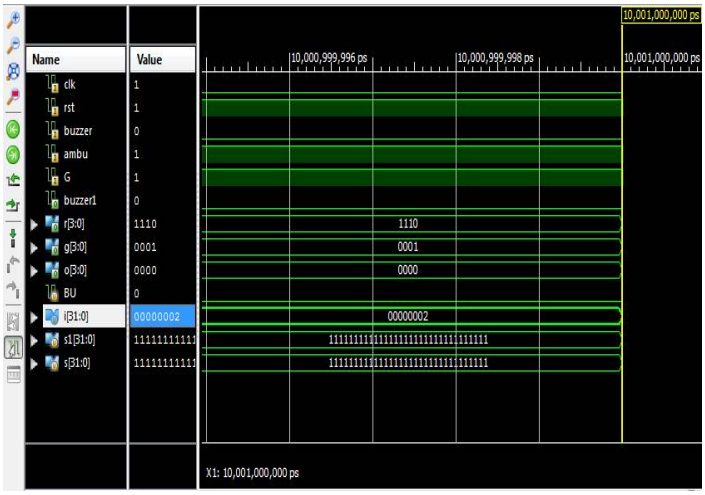

Fig.9 Behavioural simulation of Ambulance Clearance

In this case, when reset='1' and if there is presence of ambulance in the junction then it will show the Green light to the vehicle by turning to Red for other junctions. In this the variable i shows the value as per the detection of Ambulance vehicle.

5.1.3 Working of Stolen vehicle detection

In this case, the RFID Tag ID of stolen vehicle is already stored in the server of the police control room indicating the message as 'not detected'. The Police control room server initialize the slot as 'not detected' with respect to RFID Tag Id of stolen vehicle. When the RFID Tag of stolen vehicle comes in the range of RFID reader there will be the matching of desired RFID Tag, then the meassage is sent to the server as 'stolennn'. In this situation, all the Traffic light goes Red along with alertness on the buzzer.

Simultaneously, the information of the stolen vehicle passed to the server gets updated on it showing the message as 'detected at junction'. The message sending and the buzzer will keeps on working until the action taken by the Police control room. The Behavioural simulation of stolen vehicle is given below:

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

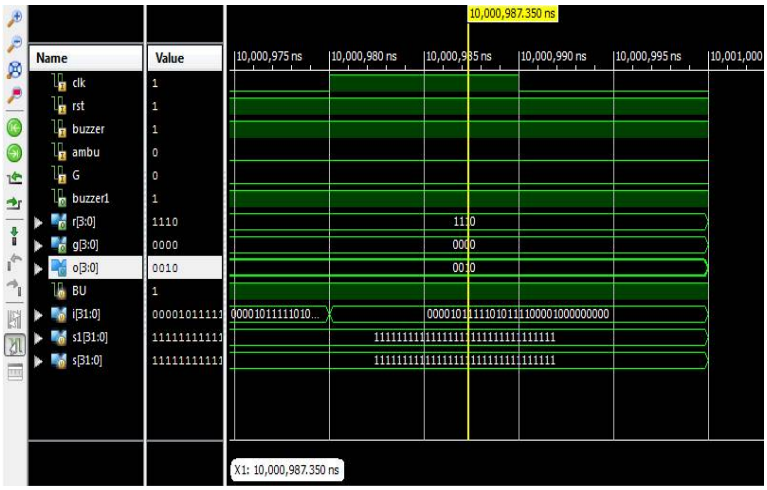

Fig.10 Behavioural simulation of stolen vehicle with buzzer.

The simulation of stolen vehicle works in such a way that when there is a match of stolen vehicle ID it will send send the message to the server with updated information, also the traffic light goes to Red by making the buzzer ON. When this condition happens all the light goes to RED and the buzzer1 is ON which is assigned to the BU keeping it ON state until the action taken by the police control room.

VII. CONCLUSION

The Traffic control system is proved to be efficient in such way that based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention. If the stolen vehicle is detected at the junction then the signal automatically turns to red, so that the police officer can take appropriate action. Correspondingly message will be sent to the server so that they can prepare to catch the stolen vehicle at the next possible junctions. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes through. The Traffic control system takes minimum period of about 9.214ns for proper functioning of the system. In this the minimum input arrival time before clock is 6.982ns and the maximum output required time after clock is 4.283ns. The cost of the system varies depending on the availability of long range RFID Reader. This project considers the four junctions at a time and also does not need comparison of images from video feed in the traffic.

The intelligent traffic control system is proved to be efficient because of lower time delay, parallel processing and execution speed. There is a greater accuracy in this traffic system which is associated with the RFID Tag placed on each vehicle. This system is used when there is a need of mass production. Intelligent Traffic control system using FPGA is proved to be one time solution as it handles data with good accuracy and high execution speed.

VIII. FUTURE SCOPE

In this project, there are conditions of Congestion Control, Ambulance Clearance and Stolen vehicle detection. It will perform as per presence of either of these conditions. It also can be extended to the level that when there is a presence of Ambulance in a particular junction wants to go either of the ways in case of halt condition so here the control system should already know the movement and willing direction of ambulance vehicle in case of emergency purposes.

Also the control system should know the priority to be given in presence of all these conditions at the junction. This also can be extended using GSM which helps in identification of proper location of the vehicles. Further enhancements can be done to the prototype by testing it with longer range RFID readers. Also GPS can be placed into

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An UGC Approved Journal)

Website: www.ijareeie.com

Vol. 6, Issue 8, August 2017

the stolen vehicle detection module, so that the exact location of stolen vehicle is known. Currently, we have implemented system by considering one road of the traffic junction. It can be improved by extending to all the roads in a multi- road junction.

REFERENCES

[1] Varaprasad G., Wahidabanu R.S.D., "Flexible Routing Algorithm for Vehicular Area Networks", in Proc. IEEE Conference on Intelligent Transport Systems Telecommunications, Osaka, Japan, pp.30-38, 2010.
[2] Gokulan B.P., Srinivasan D., "Distributed Geometric Fuzzy Multi-agent Urban Traffic Signal Control", IEEE Transactions on Intelligent Transportation Systems, vol.11, no.3, pp.714-727, 2010.
[3] Kumar S., Abhilash P.G., Jyothi D.G., Varaprasad G., "Violation Detection Method for Vehicular Ad Hoc Networking", ACM/Wiley Security and Communication Networks, 2014, DOI:10.1002/sec.427.
[4] Abdoos M., Mozayani N and Bazzan A.L.C., "Traffic Light Control in Non- Stationary Environments based on Multi agent Q-learning", in Proc. IEEE Conference on Intelligent Transportation Systems, pp.580-1585, 2011.
[5] ZigBee Alliance, "ZigBee Specifications", IEEE Standards 802.15.4k2013, http://www.zigbee.org/Specifications.aspx
[6] "Traffic Congestion in Bangalore-A Rising Concern", http://www.commonfloor.com/guide/traffic-congestion-in-bangalore-a-rising-concern-27238.html.
[7] Ayush K.R. Mittal, DeepikaBhandari, "A Novel Approach to Implement Green Wave system and Detection of Stolen Vehicles", in Proc. IEEE Conference on Advance Computing, pp.1055-1059, 2013.
[8] Suresh Sharma, AlokPithora, Gaurav Gupta, MohitGoel, MohitSinha, "Traffic Light Priority Control For Emergency Vehicle Using RFID", International Journal of Innovations in Engineering and Technology, vol.2, no.2, pp.363-366, 2013.
[9] Rashmi Hegde, Rohith R. Sali, Indira M.S., "RFID and GPS based Automatic Lane Clearance System for Ambulance", International Journal of Advanced Electrical and Electronics Engineering, vol.2, no.3, pp.102-107, 2013.