International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 13
October 2017

Implementation of Efficient Traffic Management System and Detection of Emergency/Stolen Vehicle

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Abstract-This project introduces smart traffic management system which helps in smooth movement of traffic. The project deals with three major scenarios traffic congestion, theft detection and passage of emergency vehicle. It passes the emergency vehicle without any delay. Individual vehicle is equipped with the RFID tag which is made impossible to remove. The RFID reader EM18 which is placed at certain checkpoints counts the number of vehicles in that lane and if the congestion is found the duration of the green light is calculated by the Raspberry Pi 3. If the RFID tag belongs to the stolen vehicle then Raspberry Pi send the information to the nearby Police control room using GSM technology and thief is caught by giving red light in that lane. The emergency vehicle is monitored using the ZigBee communication which is wireless communication protocol ; if the ZigBee signal is in range then the passage of the emergency vehicle is made smooth by giving the Green signal by the Raspberry Pi in that lane.

I. INTRODUCTION

India is the world's second most populous country where there are heavy traffic congestion problems, due to the increased number of vehicles. The traffic management system is non lane based and the traffic congestion in some areas is terrible.The main aim of this project is to make the traffic management system smart by considering the three major scenarios in the real time which minimizes the traffic related problem. They are congestion control, theft detection and lane clearance for emergency vehicle. First and the most major issue in the present world is congestion in the lanes which leads to the delay in reaching our destination. The solutions to these three problems are being explained in the proposed model.

RFID, ZigBee technology and GSM technology are the wireless communication technologies are used which provide the cost effective solutions. Technology like RFID is being used in many real time applications which are used in monitoring. RFID uses radio frequency range electromagnetic signals to communicate between the reader and the tag. These are used in applications which are used to communicate in the range of few centimetres to some 100 meters. ZigBee is also widely used in the applications where the communication is restricted to small distance. ZigBee operates in the low power environment. The operating frequency range is the ISM band which ranges from 900MHz-2.4GHz. They also can communicate within a range of 10-100meters.

II. LITURETURE SURVEY

As discussed earlier traffic congestion is the major problem in the countries which are developing such as India. India is the second most populous country in the world where the number of vehicles in the country is increasing day by day. Due to the rapid increase in the vehicle count, traffic also increases which eventually increases the time of travel. The previous solutions which were given to overcome such traffic problems were cost ineffective. In [1] the implementation involved separate systems for congestion control and ambulance clearance. Four microcontrollers were involved in the implementation where two were used to monitor the congestion control and the other two for the lane clearance for emergency vehicle. The system proposed was costly and the complexity in implementation which was more where the communication must be correctly synchronized or else it leads to the inefficient outcomes.

Another solutionis system which was implemented for lane clearance for emergency vehicle in [5]. It suggests that all the lights should turn green on the path of emergency vehicle. As the entire path of the desired vehicle is given green it is named as green wave system. It is the synchronisation of the green light of the traffic signals. The main advantage of this system is lane can be cleared before the emergency vehicle comes near to the signal. The most biggest disadvantage of the green wave system is if the green wave is disturbed then the entire traffic gets disturbed and the synchronisation of the signals is the biggest challenge which when doesn't correctly be done leads to huge traffic problems, which is the over saturation of traffic in other lanes.

In another proposed solution for the traffic clearance for emergency vehicles, [6], uses RFID for passage of the emergency vehicle. In this solution, it proposes solution for multilane, multi road junction is dealt. It provides an impressive traffic management method in which time is scheduled dynamically in the real time for passage of vehicles. The main advantage of this work is, it provides the real time traffic congestion control by making the decision based on the number of RFID's in the particular lane. The disadvantage in this model is

that it doesn't propose any method to trace the stolen vehicle

In the work [7]the authors proposed, the RFID and GPS are used to clear lane for the ambulance where it reduces the delay in the arrival of the ambulance to the hospital. It clears the lane before the ambulance arrives near the signal. The RFID is used to distinguish the ambulance and the other vehicles. The disadvantage of this system is the starting point information is needed to decide the end point.

India is a developing country, traffic management should be made sophisticated so that the country's infrastructure increases and looks clean. It is estimated that population of the Hyderabad is around 77 lakhs, where the vehicle count is around 48,70,017 in November 2016 which also includes two wheelers as satted in [11]. It is expected that there might be increase in one lakh vehicles in the following 6 months. Hyderabad has only 6.06% portion of roads, in Chennai it is 8% and in Bangalore it is 15%. Everyday 800-1000 vehicles come on roads in India which leads to 1.5 – 2 lakh vehicles every year. On an average in Hyderabad vehicles used to ride at a rate of 30-40 KMph five years back which has been greatly reduced to 17-20 KMph as per now. To overcome the problems present in the already proposed work, the project gives a solution to the existing scenarios which are congestion control, theft detecting and the lane clearance for emergency vehicle. The implementation is cost effective, efficient and dynamic.

III. PROPOSED SYSTEM (SYSTEM DESCRIPTION)

The proposed project deals with the traffic problems such as congestion control, theft identification and the clearing lane for the passage for emergency vehicles. Here the proposed project is implemented using the RFID for the congestion control and theft detection. The reader placed at check points where it reads the RFID cards present in the each vehicle and if the number of vehicles in the particular lane is more than the expected the delay in the signalling of the green signal is done. For instance if the count crosses greater than 20 vehicles then the signal is given for 8 seconds. This is implemented only for the single lane.

The theft detection is also done using the RFID technology only. The stolen vehicle RFID tag which has a specific ID number is compared at the check point and if found then the immediate action is taken by turning the signal to Red. Immediate SMS is sent to the nearby Police control room, so that they can catch the thief without any delay.

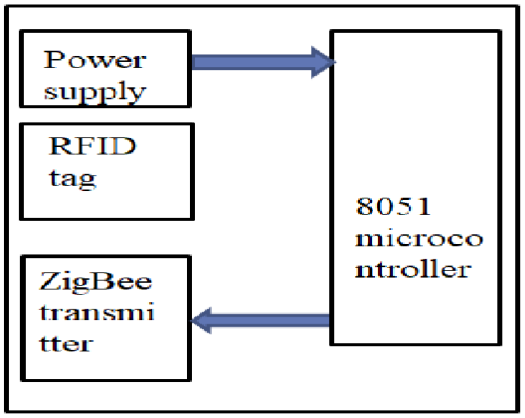
Here the ZigBee is used to communicate with the emergency vehicle where the raspberry pi is connected with the ZigBee receiver which receives the data from the ZigBee transmitter if the emergency vehicle is in the range then the ZigBee receiver connected to the Raspberry Pi turns the green light on for the easy movement of the emergency vehicle. The ZigBee transmitter is interfaced to the 8051 microcontroller so that it can serially communicate using ZigBee wireless communication.

The proposed project handles the three major situations where the traffic can be managed in the cities. Two major wireless communication technologies are used to implement the project; they are RFID and ZigBee technologies.

The transmitter section consists of microcontroller AT89S52 and ZigBee module cc2510.The emergency vehicle is equipped with this arrangement for the continuous sending of data when it is in the range of the receiver ZigBee module which will be connected to raspberry pi 3 where the signalling is interfaced, the signal turns to green until the ZigBee signal is lost. This mechanism helps in the easy movement of the emergency vehicle without any delay. The RFID tags of the range 125 KHz is used in the project. The RFID reader named EM18 reader is the module used for the reading the tags which will be inserted in every vehicle. The reader counts the number of vehicles passing through checkpoint and according to the congestion the green signal duration is varied. The EM18 reader module is interfaced with the Raspberry Pi # which makes the decision for altering the green signal based on the traffic congestion. In the similar way the stolen vehicle RFID tag is compared with all the tags scanned and is the tag is detected, and then automatically the signal is turned to Red as immediate action, where a SMS is sent to the nearby Police station to catch the thief using the GSM-SIM 800.

Block Diagram

Transmitter



Receiver

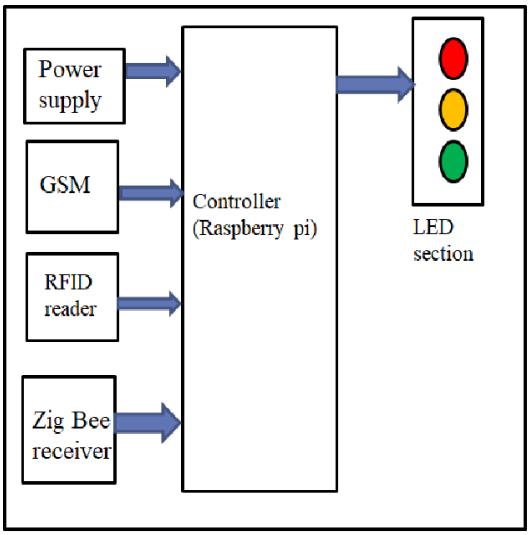


Fig 1: Block Diagram of the proposed system

Working Principle

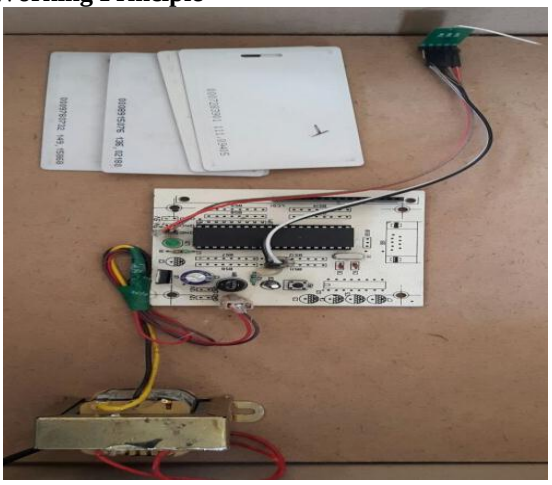


Fig 2: Transmission section hardware kit

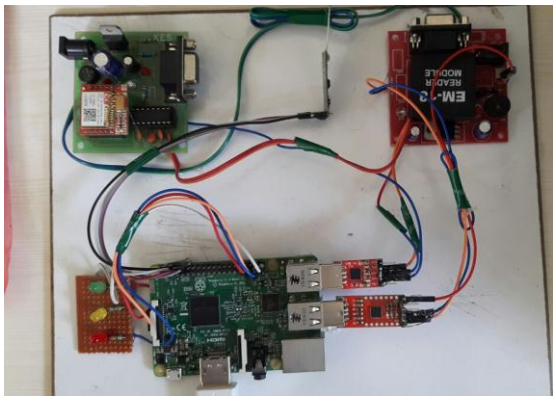
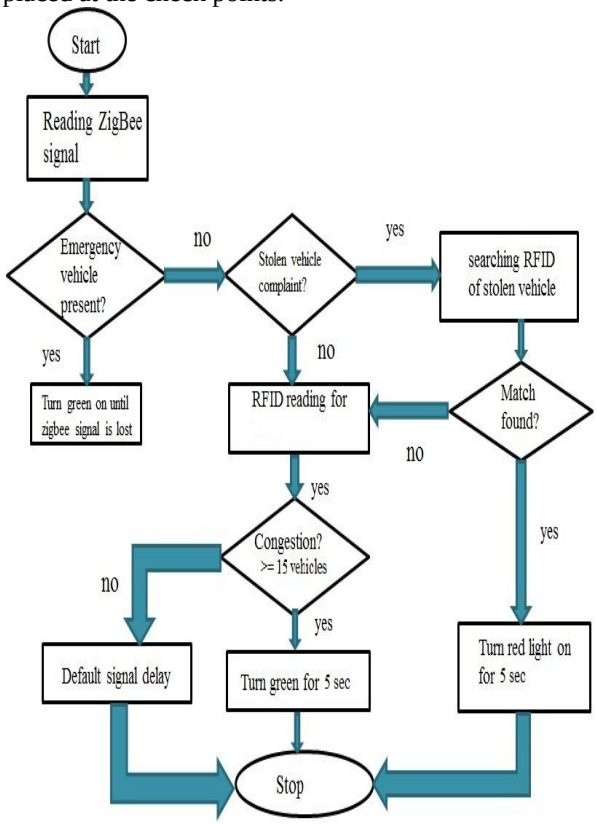


Fig 3: Receiver section hardware kit

The implemented project contains the ZigBee module connected to At89S52 which act as transmitter in the emergency vehicle. Here the transmitter and receiver which are in Port 3 as P3.1 and P3.0 are connected to the ZigBee module. This transmits the data continuously. RFID cards of 125 KHz will be placed in every vehicle where it cannot be destroyed. The RFID cards get scanned at every check point by the EM 18 RFID reader and depending upon congestion green signal is given.

The receiver section has Raspberry Pi where the EM 18 reader, GSM module and LED section which is to be placed at the signal is interfaced. The RFID reader and GSM module are connected using the USB ports present on Raspberry Pi board. The ZigBee module is connected to the 8th and 10th pin of the GPIO pins which is RX and TX pin. The led section is connected to the 33, 35 and 37 pins and 39 pin is connected as common ground.

When the emergency vehicle is in the range the ZigBee transmitter sends the character 'A' continuously to the ZigBee receiver, which when receives data turns on green signal until ZigBee signal is lost. If the stolen vehicle compliant is registered then the RFID tag of the respective tag is read and if found then the signal at the respective lane is turned to RED. If no compliant is registered, then the congestion control is done. The green signal duration is varied depending upon the traffic congestion which is calculated by the RFID reader placed at the check points.



Advantages

This proposed project has many advantages in the real time. Some of them are listed below:

It allows the passage of emergency vehicle without any delay.

Traffic management becomes easy if this is implemented to multilane.

Less man power is used if this is implemented in real time.

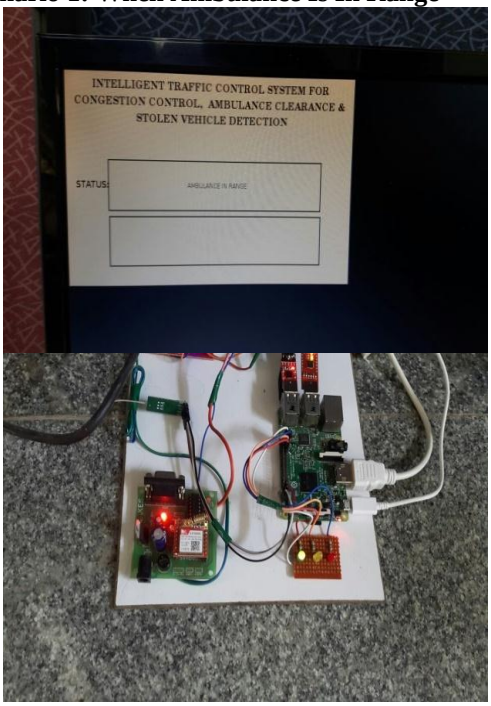
The recovery of the stolen vehicles is very easy.

Limitations

If the emergency vehicle is passing through the lane and stolen vehicle is also passing through the same lane then the red signal will not be given because the emergency vehicle has the high priority. The stolen vehicle which was not able to catch at that signal can be caught in the following traffic signal where the interference with the ambulance will not be there.

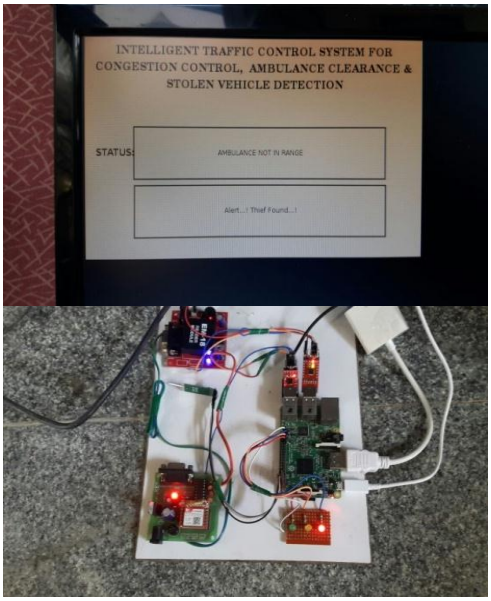
IV. RESULTS

Scenario 1: When Ambulance Is In Range



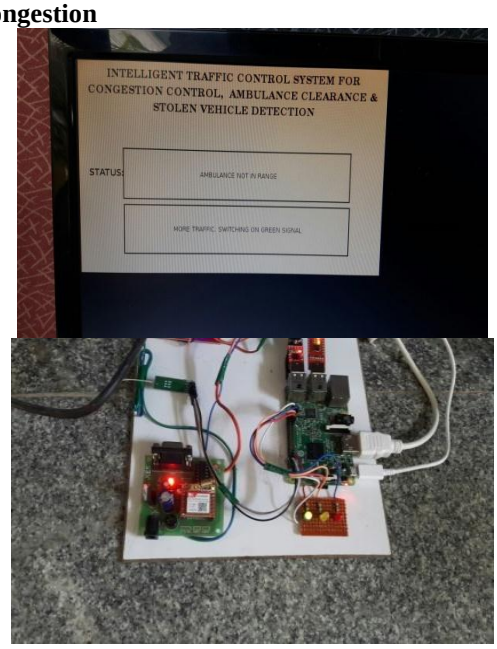
When the ambulance is in range then the zigbee sends the signal continuously . Immediately the signal is turned to green so that the emergency vehicle such as ambulance is passed without any delay.

Scenario 2: When Stolen Vehicle Is Detected



When the RFID reader reads the stolen vehicle's RFID tag, if the tag is found then the signal is turned to red immediately. Immediately a SMS is sending to nearby Police station for catching the vehicle at the respective signal.

Scenario 3: When There Is Heavy Traffic Congestion



Depending upon the traffic congestion, the signal is turned to green if there is heavy traffic then the duration of green signal is increased accordingly.

V. CONCLUSION

The project "Detection of Emergency Vehicle, Stolen vehicle and Traffic Density based Smart Traffic Management System" has been designed successfully. This project was tested in various scenarios and found to be working efficiently. Theft detection was effectively implemented with the congestion controlled monitoring of the traffic. Lane clearance for emergency vehicle is also implemented without any delay.

Future Scope

The usage of IOT in the project, we can update the database to cloud for analytics to make decision for traffic diversions in busy routes at peak times. This can suggest the locations where hospitals are not present and need to be constructed.

The future development that can be done to this project is this project can be implemented to multilane.

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