Intelligent RF-ID based Traffic Signal Control

Jayesh Meghani[1], Gaurav Gumbade[2], Komal A. Chaudhari[3]

[1]Department of Electrical Engineering SITRC, Nashik, India
Email: *jayeshmeghani35[at]gmail.com*

[2]Department of Electrical Engineering SITRC, Nashik, India
Email: *gauravdg2108[at]gmail.com*

Department of Electrical Engineering Mulana Mukhtar Ahmad Nadvi Technical campus, Nashik, India
Email: *chaudharika99[at]gmail.com*

Abstract: *This paper aims to reduce the accidents caused by breaking the traffic signal rule and to stop the breaking of the traffic signal rules. To reduce these things, we are using the RF- id sensor. The RF-ID sensor will be installed on the stop line before the zebra crossing on the traffic signal. Each vehicle will be installed with an RF-ID tag, each tag will be having its unique frequency. If any vehicle breaks the signal the RF-ID sensor will sense the frequency of that particular vehicle and will send the SMS through the GSM (Global System for Mobile communication) to the traffic control department and they will beagle to take further action.*

Keywords: RF-ID, traffic control system, traffic jam, Traffic rile violation, accident.

1. Introduction

Traffic lights were in development since 1912, traffic lights contain three colored lights. Nowadays, many countries suffer from traffic jam problems that affect transportation in cities and cause serious dilemmas. The rapid increase in the number of automobiles and therefore the constantly rising number of road users aren't accompanied by promoted infrastructures with sufficient resources. [1]

Vehicular traffic control at road crossings has always been a matter of concern for administrations in many modern cities. Several attempts have been made to design efficient automated systems to solve this problem.

To manage non-recurring jams some sensor-based systems were suggested for improvement over fixed timing-controlled ones. To solve these problems and to add further enhancements to the complex problem of vehicular traffic control at road crossings Traffic Control Systems are proposed using radio frequency identification (RFID). The key idea is based on the principle of RFID tracking of vehicles, a topic on which many organizations are doing extensive research. [1]

The major reasons that cause accidents in India are:

1) Crossing the speed limit:
Overspeeding is one of the major causes of road accidents in India. Many riders cross the speed limit in areas where it is dangerous to do so. It is important to maintain the distance between your vehicle and the vehicle in front of you so that if you need to apply the brakes immediately, you have the time and space to do so. Remember that overspeeding and reaching the destination a few minutes early is never more important than putting your own life at risk.

2) Not following rules and regulations on the road:
Being unaware of rules and regulations on the road or knowingly ignoring them is another major cause of road accidents in India. For instance, many drivers change lanes without giving a proper signal or without looking at the rear-view mirror. Being unaware of the road signs is another reason and driving ahead despite seeing a red light are some of the other reasons for road accidents in India. Many accidents occur at nighttime due to the riders not switching on their lights sufficiently while driving. Traffic signs have to be followed for accidents to be avoided.

3) Driving on the opposite side on a one-way:
Driving in the reverse direction on one-way causes a lot of road accidents. Due to a lack of education or road awareness, many people drive in the wrong direction which increases the chances of accidents.

Indicators of traffic rule violations recorded a decline in growth in 2020 compared to 2019. Road accidents attributable to various types of traffic rules violations reveal that 'over speeding' constitute the main violation associated with accidents, accident-related deaths, and injuries, for the third consecutive year in 2020 (Table 4.1). In 2020, 'overspeeding' accounted for 72.5 percent of road accidents, 69.3 percent of total deaths and 73.4 percent of total injuries. However, a smaller number of accidents, fatalities, and injuries due to overspeeding" is recorded in 2020 as compared to the same period last year. 'Driving on the wrong side/ Lane indiscipline' is the second most important cause accounting for 5.5 percent of road accidents, 5.6 percent of total deaths, and 5.6 percent of total injuries. 4.4 Violation of any traffic rule constitutes human error or driver's fault. But from the perspective of road safety strategy, violations such as overspeeding and driving on the wrong side do not constitute human error alone, but also possible fault in road design. The approach opens up the scope for road engineering measures to address problems that are, prima facie, considered to be human error and enforcement issues. Drunken driving/ consumption of alcohol & drugs, jumping off red lights, and use of mobile phones taken together accounted for 4.9 percent of total accidents and 5.4 percent of total deaths. The others category which would include reasons like road environment, vehicular condition, etc. accounted for almost 17.1 percent of the accidents, 19.8

percent of accident-related deaths, and 16.3 percent of injuries. State-wise details on various types of traffic rules violations for the year 2020 are presented in

Table 1.1: Accidents due to violation of traffic rules

Traffic Rules Violation	Accidents	Persons Killed	Person Injured
Over-speeding	41,540	9,003	36,235
% share of total	70.72	66.48	71.73
Drunken driving/ consumption of alcohol & drug	1,477	390	1,244
% share of total	2.51	2.88	2.46
Driving on the wrong side/ Lane indiscipline	2,272	659	1,900
% share of total	3.87	4.87	3.76
Jumping red light	1,099	288	1,000
% share of total	1.87	2.13	1.98
Use of mobile phone	1,101	369	879
% share of total	1.87	2.72	1.74
Others	11,247	2,833	9,257
% share of total	19.15	20.92	18.33
Total	58,736	13,542	50,515

2. Existing System

As the population of modern cities is increasing, vehicular travel is also increasing leading to jams on roads. The average number of vehicles in India is growing at the rate of 35.9% annually, over the last few years. Spending hours in traffic jams have become part and parcel of the metropolitan lifestyle.

3. Proposed System

From the current problem section, it can be seen that being technologies are inadequate to handle the problems of jam control, exigency vehicle clearance, stolen vehicle detection, etc. To solve these problems, we propose to implement our Traffic Control System using RF-ID. It mainly consists of three parts. The first part contains an automatic signal
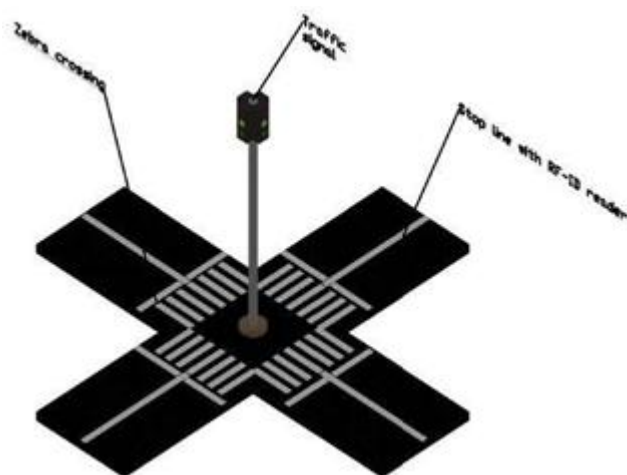

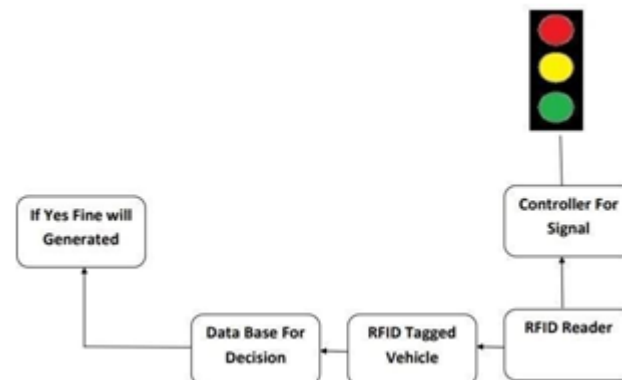**Figure 4.1:** Block diagram of the system

Figure 3.1: Schematic view of the project

control system. Then, each vehicle is equipped with an RFID tag. When it comes in the range of an RFID reader, it will send the signal to the RFID reader. The RFID reader will track how numerous vehicles have passed through for a specific period and determines the jam volume. Consequently, it sets the green light duration for that path. The alternate part is for emergency vehicle clearance.

4. Block diagram of the system

The problem of traffic light control can be answered by RF-ID grounded system. With this system, we can consider the precedence of different types of vehicles and also consider the density of traffic on the roads by installing an RF-ID reader on the stop line positioned near the traffic signal. Radiofrequency identification is a technique that uses radio waves to identify an object uniquely. Each vehicle is equipped with different Radio Frequency Identification markers, RF-ID reader is used to reading the tags attached to the vehicle. The use of RF-ID compares emergency and non-emergency cases, thus preventing unnecessary traffic jams. We are going to make a prototype model for this system using RFID and other components. Firstly, we discussed this topic and then we will start thinking about that then we decided to work on this topic. The RF-ID sensor will be installed on the stop line before the zebra crossing on the traffic signal. Each vehicle will be installed with an RF-ID tag; each tag will be having its unique frequency. If any vehicle breaks the signal the RF-ID sensor will sense the frequency of that particular vehicle and will send the SMS through the GSM (Global System for Mobile communication) to the traffic control department and they will be able to take further action.

5. Working

A. Automatic Signal Control System
In this module, for experimental purposes, we have used RFID tags and an RFID reader, when the vehicle comes in the range of the receiver will transmit the unique RFID to the reader. Vehicles during RTO registrations are required to have an RF-ID tag embedded into them, which can later be used to authenticate a vehicle and its owner's information. While the RF-ID reader will be attached to the stop line at the traffic signal and will capture the smart tag id every time a vehicle passes in front of it and even during the case of a red light run, the system can now easily identify the correct vehicle on crime and it will issue the fine challan, would provide 24-

hour feedback to the Traffic Management Centre for maintenance of records on all vehicles passing through a given area. If the police just want to check on a vehicle for security reasons, they will just need to key in its registration RF-ID tag id in the main system to get all its information. If any vehicle skips the red light, its details are obtained through the RFID tag attached to the vehicle, and automatically a fine challan is raised and posted to the vehicle owner's address and its details are sent as a message on the registered mobile number. With details of the offense available, then traffic police take further action as per law.
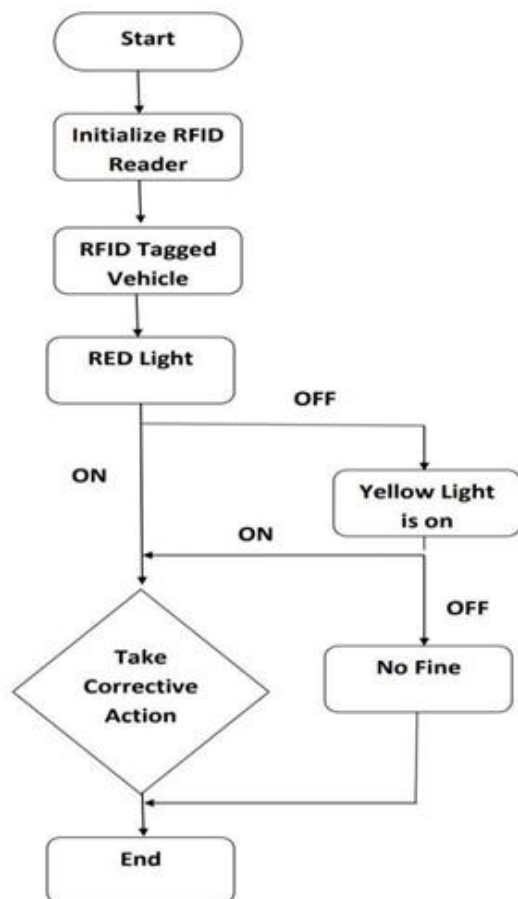

Figure 5.1: Flow chart of working

B. Stolen Vehicle Detection System

In this module, for testing purposes, we compare the unique RF-ID label read by the RF-ID reader to the stolen RF-IDs stored in the system. However, also the traffic signal is incontinently turned red for 30 seconds, if match is found. The locating agency should also communicate the entering agency to advise them of the recovery and determine whether the entering agency wishes to interview the arrested persons or take any other investigative steps (i.e., process the vehicle, conduct additional follow-up, etc.). If the entering agency determines there is no need for them to respond, the locating agency may process the vehicle on their own. The locating agency should contact the entering agency and advise them of the recovery so that the vehicle can be removed from NCIC/CIB as stolen. The locating agency should obtain the vehicle owner's information from the entering agency and contact the owner to advise him/her of the vehicle's recovery.

Advantages
1) Simultaneous multi-tag automatic reading.
2) Item level assists tracking.
3) Reduce losses and theft.
4) Multi-options traffic control.
5) Simple operation.
6) Low cost.

Application
1) To reduce accidents due to violation of traffic rules.
2) To track the stolen vehicles.
3) It can also act as a GPS.
4) It will help to maintain discipline regarding traffic rules.
5) Our proposed plan with this application is expected to go a long way in reducing the number of accidents.
6) Keeping the application always active can be more advantageous for tracking the movements of vehicles in different areas.
7) E.g., If any vehicle is been stolen, using the current application we can easily track every movement of that vehicle when it passes through traffic junctions.
8) The creation of this application makes it even surpass the expected

6. Future Scope

- Extending the idea by implanting the shortest location and way to the hospital.
- Alerting the respective doctor in that hospital by providing initial medical details of patients.
- Facility to store details of several patients over a long period. The ambulance and the web applications should be interfaced so that he needs to give input to start the ambulance.

7. Conclusion

In this system, RFID technologies are used to monitor real-time traffic information. This system is good enough to track the information about vehicles that break the traffic rules and help to collect the passing vehicle data that break the traffic rules. A warning message can be sent to a registered number with a penalty receipt.

References

[1] 'Automatic Accident Detection and Ambulance Rescue with Intelligent Traffic Light System' by S.Iyyappan, V.Nandagopalat International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol.2, Issue4-April 2013.

[2] 'Automatic Street Light Control, Fault Detection and Traffic Density Control' by KM Harshitha, Lakhitha, LubnaTaranum, MamathaG, Divya KV at 8th One Day National Conference on Innovation and Research in Information Technology, June 2017.

[3] 'Intelligent Traffic Light and Automatic Street Intelligent Traffic Light and Automatic Street and Automatic Street Lighting System According To Traffic Density' by Solanke Digamber, Jogdand Maruti, Jadhav Amol, Mandlik Sachinat IJREAT International Journal of Research in engineering and advanced

technology.

[4] 'Smart Traffic Light Control System for Emergency Ambulance by Asmaa Shaalan Abdul Munem, Muayad Sadik Croockat International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5, Issue 8-August 2016.

[5] 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.

[6] 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.

[7] Arduino Uno Datasheet: http://arduino.cc/en/Main/arduinoBoardUno

[8] H. Lehpamer, "RFID Design Principles," Norwood, MA: Artech House, 2008.

[9] AyoubFikri, El Mehdi Zrihni, and YassineSalihAlj, "A Smartphone-based System for Traffic Congestion Control using RFID Tags", 1st International Conference on Electrical and Information Technologies ICEIT'2015

[10] https://www.elprocus.com/infrared-ir-sensor-circuit-and-working/

[11] A. Chattaraj, S. Chakrabarti, S. Bansal, S.Halder and A. Chandra "An Intelligent Traffic Control System Using RFID", IEEE Potentials.

[12] Roy Want "An introduction to RFID Technology", Journal IE