

Designing a Model for Traffic Rule Violation at Railway Track Using Raspberry Pi in Indian Context

Anish Vahora, Bhargav Goradiya, Devansh Parikh, Akash Shah

Electronics & Communication Department, BVM Engineering College, Vallabh Vidyanagar, Gujarat, India

Abstract: In past few years, traffic accidents and violation of traffic rules have increased at great extent. Even in our daily life we come across many problems caused due to traffic rule violation by someone. Also when we check news and reports, we realize that accidents are one of the major problems in our country. These problem cause disturbance to entire system and also consumes our valuable time. Sometimes at railway crossing when train is at some distance railway crossing is closed and people are forced to stay at the both side of road, but some people violate the rule and try to go to other side of road by under passing railway crossing. It may results into harmful consequences of that. To prevent such incidence, in this paper we propose an idea of detecting such individual and their vehicle (particularly two wheeler) through smart electronic system. The system comprises of sensors, cameras and Raspberry Pi. When crossing is closed and someone tries to go underpass it sensors will be activated and cameras will capture the photo of that riders number plate and then after recognizing his number by OCR, we will send the number to appropriate department by text message using GSM module attached to processor of system.

Keywords: Raspberry Pi, Infrared (IR) Sensor, Camara, GSM, Optical Character Recognition (OCR), Traffic Rule Violation Detection and Monitoring.

I. INTRODUCTION

India has a largest railway network in the world. But mostly all the railway crossing areas operates manually, a railway employee gets the signal and on basis of that he closes railway crossing before 5 to 7 minutes of arrival of the train. At times vehicle riders have to wait for so long when subsequent trains are passing through the route, the crossing remains closed for 15 to 20 minutes. So people get frustrated and they try to go to other side by under passing the railway crossing and violet the law. Sometimes it can cause into some very serious accidents.

Year	Collisions	Derailments	Level Crossing Accidents	Fire in trains	Misc. accidents	Total*	Train accidents per million train Kms.
2009-10	09	80	70	02	04	165	0.17
2010-11	05	80	53	02	01	141	0.14
2011-12	09	55	61	04	02	131	0.12
2012-13	06	48	58	08	-	120	0.11
2013-14	04	52	51	07	03	117	0.10

*excludes Konkan Railway.

TABLE1. Accident in 2009-2014¹

The Table 1 shows us the no. of accidents per year causing with railway crossings. The proposed system greatly helps in identifying the violation and can reduce the accidents if strict actions taken against them.

II. LITERATURE SURVEY

Nowadays Traffic rules violation has become very common, and it is impossible to seize or track all such violations physically by the traffic police. Hence a variety of researchers and scientists have proposed system which can automatically detect the traffic rule violation to tackle the problem.

The authors in [2] have proposed and use the most modern “smart-card driving licenses” to scan the information of the driver, without that the driver will not be able to start the car. In case of any penalty, the driver is charged with the fine automatically and sends information wirelessly using GSM. The authors in [3] have proposed solution for detect traffic signal violations using IR transmitters and receivers. On violation, mobile equipment use to send message to the law enforcing agency which have information of the driver.

Different approaches like radar gun, Laser Camera, Optical Code Recognition and database query have been proposed by the authors in [4] to identify the traffic rule violation. On violation of rule take snapshots of the driver’s face and the vehicle’s registration plates and send message to driver about penalty. The authors in [5] have proposed an approach using RFID and road-side cameras for penalizing driver who violate rule at traffic signal. Authors in [6] have also proposed a traffic monitoring system using Active RFID tag and Roadside Active RFID Reader / Router units that would capture beacons from cars and send them to control station using routers. Control Station doing necessary computations based on pre-defined traffic-rules; send traffic-management messages to the relevant vehicles.

From above discussion we find out that none of research has proposed any mechanism for violation rule at rail-track. In India many death occurred because of violating rule at rail track. So, here we have proposed solution of rail track with Indian Context. We used latest low cost ARM based single board Computer (SBC) Raspberry-Pi. Raspberry-Pi has capability of taking image and process as required. After

taking image of number plate system will send message to law enforcement agency.

III. COMPONENTS

3.1. SBC (Raspberry pi):

The Raspberry-Pi 2 Model B is a low cost, credit-card sized computer that plugs into a computer monitor or television, and uses a USB keyboard and mouse. This little device capable of processing image locally and parse the useful information using python script. It has number of I/O pin for taking input via sensor and sends output to camera to turn on for taking image.



Figure 1: Raspberry-Pi Board (Front Side) ⁷

3.2 IR Sensor:

An IR sensor detects IR waves falling on it. There are number of types of IR sensors that can be built depending on the application. Proximity sensors, contrast sensors and obstruction counters/sensors are some examples of which use IR sensors. An IR sensor is basically device which consists of a pair of an IR L.E.D and a photodiode which are collectively called a photo-coupler or an opto-coupler. The IR L.E.D emits IR radiation reception or intensity of reception of which by the photodiode dictates the output of the sensor. Now, there are so many ways by which the radiation can or cannot be able to reach the photo diode. The Basic Concept of IR Sensor Shown in Figure 2.

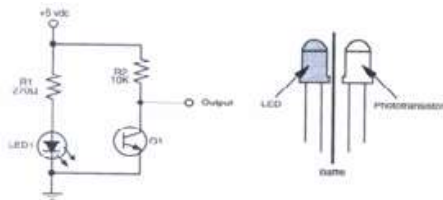


Figure 2. Basic Concept of IR Sensor

3.3 Camera:

In this system camera is one of essential component from all. Here we are interfacing it with our raspberry pi. We can use any HD cameras which have high resolution.

3.4 Display Device:

Monitor means any display device which can be used to see real time footage. And we can also measure traffic intensity at various places.

3.5 GSM Module:

We are connecting GSM module SIM 900 with raspberry pi and when sensor gets cut we will send SMS to law enforcement agency through GSM.

IV. FUNCTIONALITY AND DESIGN

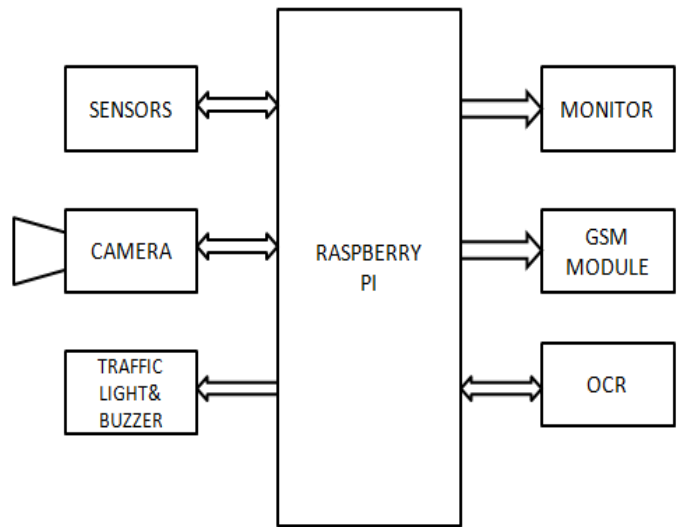


Figure 3. Block Diagram representation of the proposed traffic violation processing System.

The basic block diagram of system is shown in figure 3. It consists of Sensor, Camera GSM module, etc. Out of this different blocks Raspberry pi is brain of the system. As Shown in Figure 4 when the some train passes near to railway crossing signal is Red, at that time sensor gets active otherwise it will stay in normal condition.

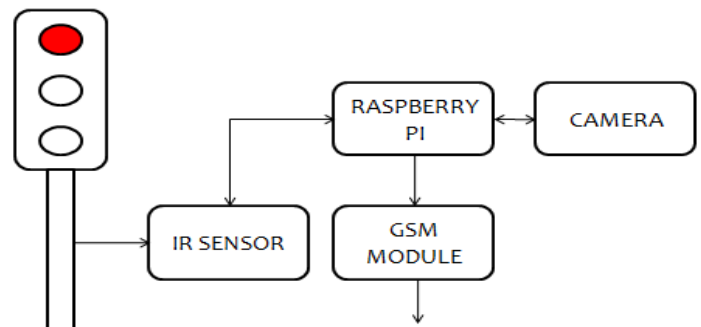


Figure 4. Representation of the proposed traffic violation processing System.

Same time As show in Figure 5 if any one cuts the sensor means violate rule and try to go other side of road by under passing railway crossing it will send a signal to Raspberry pi. Raspberry pi will activate camera module and camera will take a picture of number plate. We reorganize violator's vehicle number by performing OCR. After Getting number of violator vehicle system will Message to law enforcement agency via GSM Module.

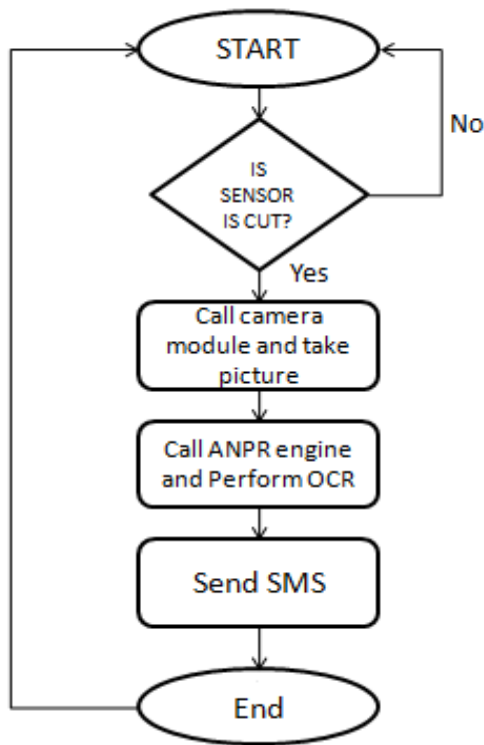


Figure 5. Flow Chart of the proposed traffic violation processing System.

V. RESULT

To simulate our proposed Concept we have prepare small model of railway track as show in Figure 6.



Figure 6. Simulation model of the proposed traffic violation processing System.



Figure 7. Two wheeler traffic violation

As shown in Figure 7 when some user trans-passing railway crossing IR sensor will detect the movement which is connected to Raspberry-pi. IR sensor will give input of detection to Raspberry-Pi and Raspberry-pi will activate camera module for capturing the image as show in Figure 8.



Figure 8. Picture of user Vehicle number Plate

as show in Figure 9 After taking Image using Camera module from raspberry-pi, Raspberry-pi will use ARPN module for recognition of user Vehicle number plate. ARPN module will extract the number plate image from taken image. ARPN also use OCR method for detecting the number of user vehicle. Figure 10 shows the number plate is detected. After extracting information of number of user vehicle Raspberry-pi will send signal to GSM module for activate.

```

--- Opening /dev/video0...
Trying source module v4l2...
/dev/video0 opened.
No input was specified, using the first.
Adjusting resolution from 1280x720 to 640x480.
--- Capturing frame...
Captured frame in 0.00 seconds.
--- Processing captured image...
Disabling banner.
Writing JPEG image to '/home/pi/webcam/0519_0647.jpg'.
    
```

Figure 9. Screenshot of Raspberry-Pi

```
plate0: 10 results
- BO2W6886 confidence: 87.4361
- WBO26886 confidence: 86.8337
- BO26886 confidence: 84.3851
- BO2H6886 confidence: 83.6753
- HBO26886 confidence: 82.9081
- UBO26886 confidence: 82.6424
- WBO2W686 confidence: 82.323
- BO2WG886 confidence: 82.1256
- WBO2W688 confidence: 81.8833
- BO2N6886 confidence: 81.6141
pi@raspberrypi:~$
```

Figure 10. Detecting user vehicle Number on Raspberry-Pi

As show in below Figure 11, GSM module which is connected with Raspberry-pi send message. Law enforcement agency will receive the message when user violate rule near railway crossing.



Figure 11. Message received on mobile from GSM module

VI. CONCLUSION AND FUTURE WORK

By taking this initiative we could ensure that in future there would be a reduction in rate of violation of traffic rules near to railway crossing. And also the probabilities of accidents or death caused due to braking of rules are also decrease. Proposed idea will help grate extend for smart city concept. And future direction this system can integrate with automatic railway crossing system where railway crossing will open or close automatically before train will come. Also in future extension on can integrate timer circuit in proposed system so user can estimate waiting time for opening railway crossing.

REFERENCE

- [1] http://www.indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/IRSP_2013-14/pdf/Year_Book_Eng/8.pdf
- [2] Nikita Prabhu, Ameya Vedpathak, Nikita Vedpathak, Smita Kulkarni, "Automatic Penalty Charging for Traffic Regulation", International Journal on Recent and Innovation Trends in Computing and Communication, Volume 1, Issue 3, pages 164-169
- [3] M. R. T. Hossain, M. M. K. Bhuiya, J. U. Ahamed, T. H. Bhuiyan, S. Bhowmik, "Monitoring and Reporting of Traffic Rules Violation Using Microcontroller through Wireless Communication System", Electronic Journal of University Malaya, Volume 5, Number 2, pages 117-121.
- [4] Ashok, Manju, Dr. Harish Rohil, "Designing a Model to Enhance the Efficiency of Road Traffic Enforcement System in Indian Context", International Journal of Latest Trends in Engineering and Technology, 2014.
- [5] Shiv Kumar Goel, Manoj Shukla, "Electronic Penalty an Initiative for E-Governance using RFID and Camera-based Hybrid approach", International Journal of Computer Applications (0975-8887), International Conference on Communication Technology 2013.
- [6] Sathish Nagarajan, P Kavitha, "Efficient Road Traffic Policing With Coordinators and Routers Using Radio Frequency", International Journal of Advanced Research in Computer Engineering & Technology, Volume 2, Issue 3.
- [7] www.raspberrypi.org