

DESIGNING A MODEL TO ENHANCE THE EFFICIENCY OF ROAD TRAFFIC ENFORCEMENT SYSTEM IN INDIAN CONTEXT

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Abstract - The traffic police issues challans for people who violate the traffic rules. The violators have the choice of either paying the prescribed fine on the spot or go to the court at the prescribed date and time. But now, there is a need to modify the working of traffic enforcement system. This paper presents a model for enhancing the efficiency of road traffic enforcement system. The proposed model uses three concepts viz. locating/identifying the violator, identifying the violation activity and violation enforcement (fine etc.). The violator's vehicle is identified by the traffic enforcement system and also classified based upon various characteristics like length, height, shape etc. After identification of violator's vehicle, it will take snapshot of driver's face and the vehicle's registration number plate, so that these can be used to issue fine ticket to the violator. The violator is informed for the fine ticket with the help of a customized message which will tell about the violation activity, fine amount and last date to deposit the fine. The proposed model is implemented using a simulator designed and developed on Java platform.

1. Introduction

India has a road network of 4.3 million kilometers. National highways constitute about 1.7 per cent of that. However, this 1.7 per cent carries approximately 40 per cent of India's vehicle traffic and is growing rapidly. With this expansion in the highway network, vehicle traffic has come with an equally large increase in road accidents. As per the report of Ministry of Road Transport and Highways, more than 1.25 lakh persons lost their lives in road accidents in India in 2009. Road accident deaths have consistently been on the rise since 2001 [1].

Initiated in 1995, IRTE (Institute of Road Traffic Education) developed the state of the art traffic enforcement technology vehicle called "Interceptor". This technology was recognized by the Government of India at the National Republic Day Parade in 1996 and implemented successfully in 2001. Designed for practical use by police in capturing video based moving violations including speeds of vehicles, the interceptor is a comprehensive enforcement and education system. The system comprises of suitably customized vehicle platform, enforcement equipment, software, hardware and a data analysis centre [3]. Various objectives of traffic enforcement vehicle are: (i) evidence based traffic law enforcement, (ii) enforcement on a mobile platform, (iii) road traffic education, (iv) primary first aid and rescue, (v) road and infrastructure surveys, (vi) road accident deterrence, and (vii) road safety audit.

The most important part of the interceptor vehicle is radar gun. Radar guns are, in their most simple form consists of radio transmitters and receivers. Radar Speed guns use Doppler radar to perform speed measurements. A radio transmitter is a device that oscillates an electrical current so the voltage goes up and down at a certain frequency. This electricity generates electromagnetic energy, and when the current is oscillated, the energy travels through the air as an electromagnetic wave. A transmitter also has an amplifier that increases the intensity of the electromagnetic energy and an antenna that broadcasts it into the air [11]. A radio receiver is just the reverse of the transmitter. It picks up electromagnetic waves with an antenna and converts them back into an electrical current. So, the process of radio gun includes transmission of electromagnetic waves through space. These radars works on the basis of phenomenon which is known as Doppler shift. They send out a radio signal in a narrow beam, and then receive the same signal back after it bounces off the target object. Due to phenomenon of Doppler Effect, if the object is moving

toward or away from the gun, the frequency of the reflected radio waves when they come back is different from the transmitted waves. From that difference, the radar speed gun can calculate the speed of the object from which the waves have been bounced [2].

2. Related Work

The primary role and objective of a traffic enforcement system should be the reduction of fatal and serious injury road crashes, while the secondary considerations would be to ensure the free flow of traffic. In developed countries the enforcement agencies are supported by the road authorities in order to efficiently perform their secondary role of road traffic engineering which forms the basis of efficiency and safety of the movement of traffic. In developing countries like India, the traffic police unfortunately have to play the primary role for traffic engineering, and enforcement for road safety as the secondary one. More researches related to traffic enforcement are:

Traffic Enforcement in Development

Cover of Traffic enforcement in development; an inventory of research questions in the field of enforcement of speed, alcohol and drugs. This report aims to make an inventory of the requirements for knowledge in relation with traffic enforcement, to link the information to knowledge that is already available, and to identify gaps in the knowledge that require further research, for instance in the SWOV research programme for 2011-2014 [5].

I.R.T.E. Traffic Enforcement Program

Every component of the road system which includes the vehicle, road infrastructure, traffic engineering, driver training, education and awareness programmes as well as the laws that govern the road, must have safety as an inherent virtue [4].

Traffic Management Streamlining Technologies

The report highlights all the available technologies for traffic management in India and abroad like demand and supply side management, supply management techniques, signaling technologies, incident reduction techniques, techniques for better passenger driver information system, technologies for overcoming parking problems and improved road safety related technologies [6].

Intelligent Highway Traffic System and Surveillance in Indian Scenario

The construction, extension, maintenance and operating costs of highways, roads, bridges and tunnels were collected directly or indirectly. In the older indirect method, the expenses are compensated either by tax payment on fuel or by budget allocation from the national income. The shortcoming of this method is that a number of tax payers, who do not use some of the roads and carriageways, have to pay extra money. However, in the other system, called direct method, the tolls are taken directly from the drivers passing that road or street. One of the biggest complaints of motorists using toll roads is the congestion and delay caused by stopping to pay at the tollbooths [7].

Traffic Safety and City Public Transport System: Case Study of Bangalore, India

Vehicle crashes are a major concern in rapidly growing urban agglomerations. They also have attracted the attention of researchers, academicians, and policy makers. A large body of research literature exists that throws light on the magnitude of this problem and also indicates the interventions required. In a vast majority of Indian cities, buses are the main mode of public transport. This research has attempted to find patterns in the crashes involving public buses. While some of the findings fortify the existing understanding of the causes of crashes, the study has, nonetheless, provided empirical evidence for it [8].

Law Enforcement Record Management System (RMSs)

A records management system (RMS) is "an agency-wide system that provides for the storage, retrieval, retention, manipulation, archiving, and viewing of information, records, documents, or files pertaining to law enforcement operations. RMS covers the entire life span of records development from the initial generation to its completion [9]

Recommendations for Driver Licensing and Traffic Law Enforcement in India Aiming to Improve Road Safety.

During the last decade, developing countries such as India have been exhibiting rapid increase in human population and vehicles, and increase in road accidents. Inappropriate driving behavior is considered one of the major causes of road accidents in India as compared to defective geometric design of pavement or mechanical defects in vehicles. It can result in conditions such as lack of lane discipline, disregard to traffic laws, frequent traffic violations, increase in crashes due to self-centered driving, etc [10].

3. Proposed Approach

Today's traffic enforcement system has many challenges. One of the major challenges of using the paper-pen process is payment of the fine. There is no mechanism to find out information about the previous offences committed by the driver. Also, there is no proper procedure for collecting fine and for finding information of some pending notices.

The existing traffic enforcement system include stopping of violator and then the speeding ticket is issued i.e. you are knocked down by the interceptor. This problem can be solved by fully automating the system. Major components of the proposed model are:

Radar Gun

Speed radar and laser guns are primarily used in law enforcement to detect the speed of a passing vehicle. With the introduction of video recording systems in police vehicles it has been natural requirement to interface the speed gun with the video system. This will produce an indisputable video recording of the actual vehicle along with the speed of the vehicle overlaid in the video simultaneously.

Laser Camera

A traffic enforcement camera (also red light camera, road safety camera, road rule camera, photo radar, photo enforcement, speed camera, safety camera, bus lane camera, Safe-T-Cam) may be mounted besides or over a road or installed in an enforcement vehicle to detect traffic regulation violations, including speeding, vehicles going through a red traffic light, unauthorized use of a bus lane, or for recording vehicles inside a congestion charge area.

Optical Code Recognition

Optical Code Recognition (OCR) system is used to extract text from the JPEG format. Video frame (photo/ image) of the violation activity is given as input to the OCR system. It identifies the registration number plate of the vehicle through segmentation and converts the number on the plate into text format i.e. we get alphanumeric value for the registration number which is used to search the database to extract the contact details of the violator. For experiments purposes, Free-OCR.com is a free online OCR (Optical Character Recognition) tool. You can use this service to extract text from any image you supply. This service is free, no registration necessary. This also does not need your email address. Just upload your image files. Free-OCR takes either a JPG, GIF, TIFF BMP or PDF.

Database and Query

A database query is a piece of code (a query) that is sent to a database in order to get information back from the database. It is used as the way of retrieving the information from database. The term 'query' means to search, to question, or to find. When you query a database, you are searching for information in the database.

The parts of interceptor vehicle and the messaging system are incorporated with simulator T.E.S. in order to meet the objectives. In this model, a scene of a roundabout is presented as shown in Figure 3.1. When the violator's vehicle crosses the red light, he is knocked down by the interceptor vehicle. Laser camera is used to take photo of violation activity as a proof along with photo of number plate of the vehicle. Radar guns are used to measure speed of the vehicle. Optical Code Recognition is used to extract text from image. After this, the registration number is compared with database entries and contact number is taken as output. This contact number is given as input to the messaging system and a customized message is generated showing the registration number, violation activity and

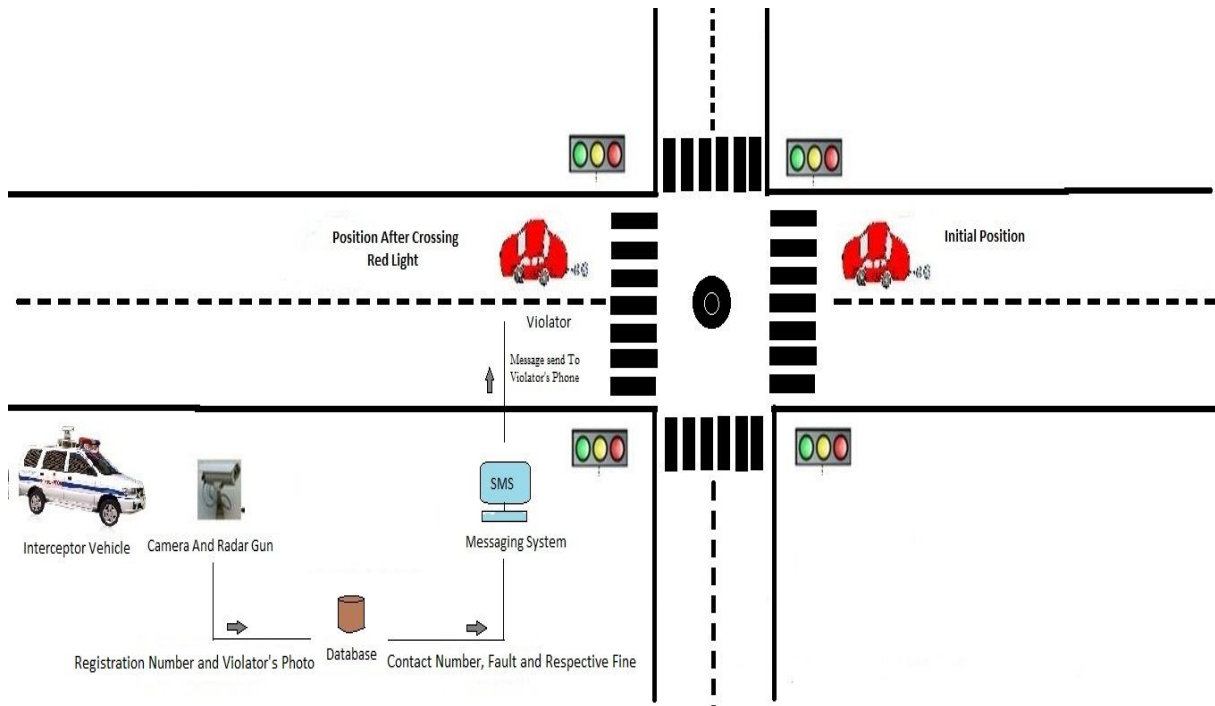


Figure 3.1 Proposed Model for Traffic Enforcement System

respective fine. This message is sent to the violator's mobile phone as a notification and the record containing list of violators who have been fined, is updated on both local (local city) and central (head quarter) level as shown in Figure 3.2. The violator is supposed to submit the fine on time.

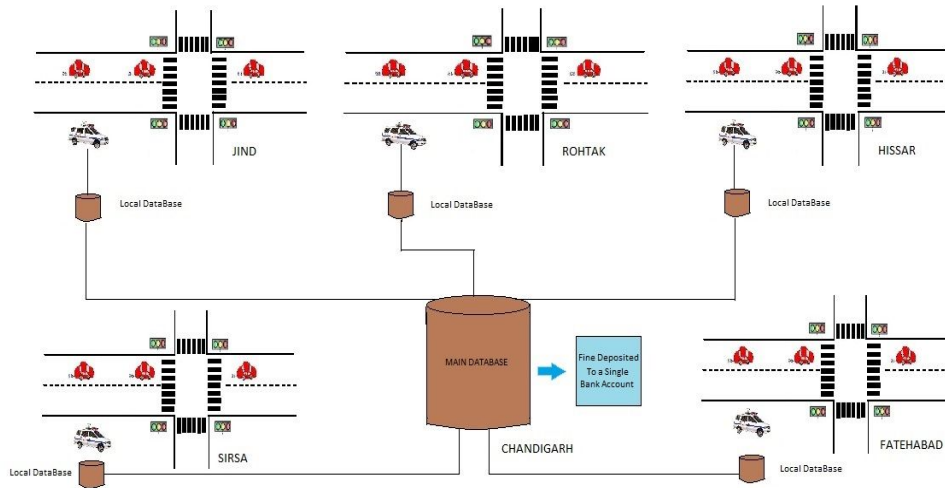


Figure 9 Fine Collection Procedure From Various Cities From Haryana State.

Figure 3.2 Fine Collected from violators from Different Cities.

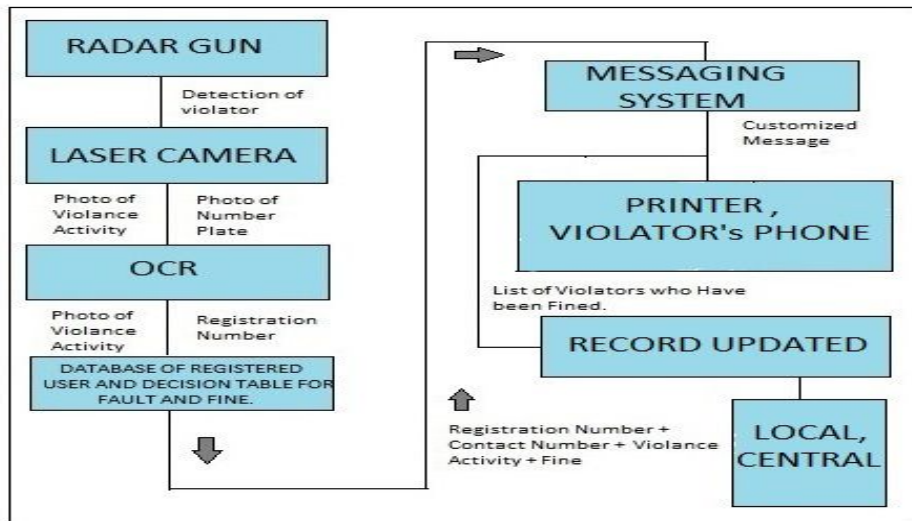


Figure 3.3 Detailed Process Of Traffic Enforcement System.

As shown in Figure 3.3, the record of fine collected from different violators from different cities is stored at local databases present at district level and also its copy is stored at main database present at headquarters and fine collected is stored in a single bank account assigned by the government. In this way, fine can be submitted from any place irrespective of the place of issue of challan.

4. Implementation

Java Platform Standard Edition is used to create a simulator for traffic enforcement system. After successful login, you will see a registration page as shown in Figure 4.1. This form is used for registration of a new vehicle. Here four attributes are provided and entries are inserted in the data base.

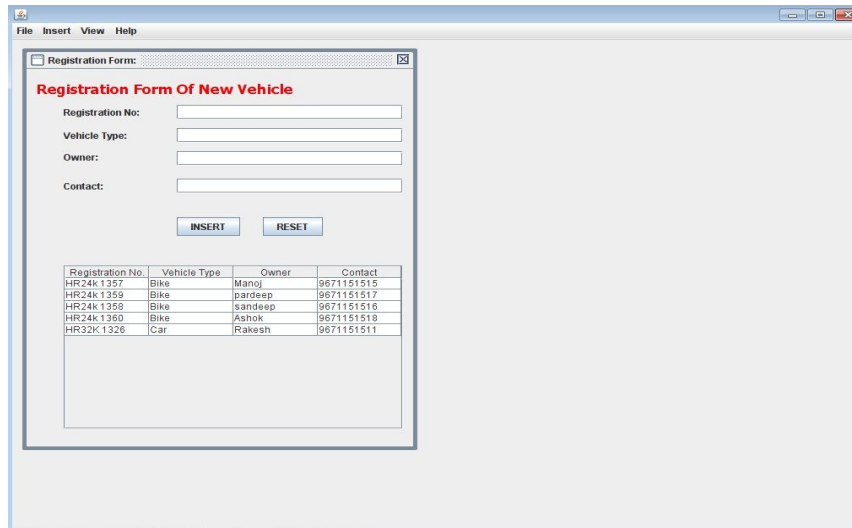


Figure 4.1 Registration Form for New Vehicle.

It is assumed that no person shall drive any motor vehicle and no owner of motor vehicle shall cause or permit the vehicle to be driven in any public place or any other place, unless the vehicle is registered in accordance with Chapter 4 of IMV (Motor Vehicle) Act 1988. Every owner of Motor Vehicle shall cause the vehicle to be registered by a Registration Authority in whose jurisdiction he has residence or place of business where the vehicle is normally kept.

The current format of the registration number consists of 3 parts, these are:

- i. The first two letters indicate the state to which the vehicle is registered.
- ii. The next two digit numbers are the sequential number of a district. Due to heavy volume of vehicle registration, the numbers were given to the RTO (Regional transport office) of registration as well.
- iii. The third part is a 4 digit number unique to each plate. A letter(s) is prefixed when the 4 digit number runs out and then two letters and so on.

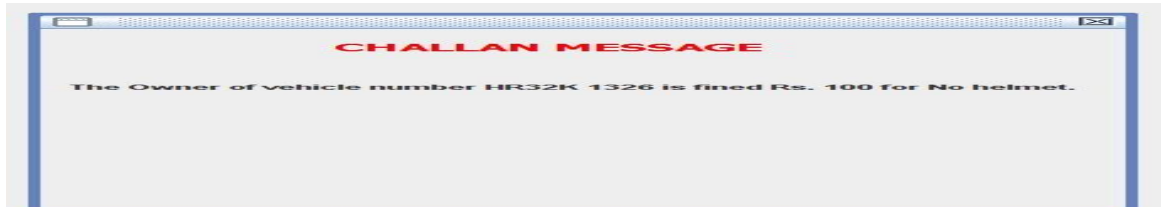


Figure 4.2 Challan Message to be sent to Violator's Mobile Phone.

After deciding about registration number and violation activity, challan message as shown in Figure 4.2, is sent to the violator's mobile phone. Violator's contact number is taken as input from "Registration Database." Also, we have to keep records of the violators who has been fined, for this another form is created which will keep record of those owner names and registration numbers who have been issued challan message, as shown in Figure 4.3.

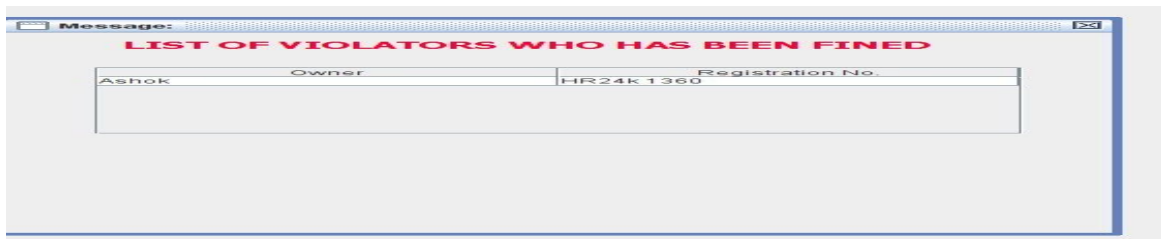


Figure 4.3 List of Violators Who have been Fined.

5. Conclusion

The purpose of this research paper is to provide solution to traffic enforcement problems and provide a better way to exchange information between the traffic police and the user. A high resolution camera is mounted at a suitable height to grab the front portion of the vehicle. Thus the characters of the number plate are extracted through OCR recognition process. This information is transferred to a road side monitoring unit and the legal action is duly taken. Improvement of accident registration and evaluation of traffic enforcement should be considered top priorities for the improvement of traffic enforcement. Without target setting and agreement on respective responsibilities between parties involved in the traffic law enforcement process, evaluation of enforcement activities makes little sense. National targets for traffic enforcement should be broken down into regional targets. There was no proper mechanism to find out information about the previous offences committed by the drivers. Also, it was difficult to find out about the vehicle, whether it is stolen, involved in crime or whether it had a previous history in accident, a previous prosecution, or some pending notices. The proposed model of traffic enforcement system addresses these issues.

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