Indian Journal of Science and Technology, *Vol 11(44), DOI: 10.17485/ijst/2018/v11i44/137642, November 2018*
ISSN (Print): 0974-6846
ISSN (Online): 0974-5645

Road and Traffic Enforcement System Using GPS Enabled Mobile Cloud Computing

Y. Mohana Roopa[1*], M. Ramesh Babu[2] and D. Kishore Babu[1]

[1]Department of Computer Science and Engineering, Institute of Aeronautical Engineering, Hyderabad – 500043, Telangana, India; ymohanaroopa@gmail.com, domalakishore@gmail.com
[2]Department of Electronics and Communication Engineering, Institute of Aeronautical Engineering, Dundigal, Hyderabad – 500043, Telangana, India; ramesh010777@gmail.com

Abstract

Objective: Traffic enforcement systems are very important implementations of different technologies used worldwide. Collecting data of violators by the traffic police is not always feasible in the current system of practice in India, as they are not connected to the online database. **Methods:** This study introduces android based camera phone and tablet with latest mobile data network facility as a technical field tool for the police to issue or check the traffic law enforcement status with cost effective and rapid operational solution for present scenario. **Findings:** The traffic policeman is given an android mobile working on Mobile data technology. When a violator is stopped, he/she is asked to produce his/her driving license and other registration details. On the basis of these details, the device will be able to retrieve data relating to previous offences committed by the driver or the vehicle from its database. The terminal prints the tickets and it is updated online. Each device is capable of acting as a payment receiving station for any notice generated by any other device and issue the receipt. **Application:** Moreover, this study introduced a system that will also enable the policemen to know whether the vehicle involved in the traffic rule violation is stolen, the previous history of the vehicle or driver in accidents, and whether any notice from the traffic police is pending against the vehicle.

Keywords: Advanced Video Graphics Array (AVGA), Mobile Cloud Computing, Road and Traffic Enforcement, Universal Mobile Telecommunications System (UMTS), GPS

1. Introduction

Traffic enforcement structures are very vital implementations of various technology used globally. However, there may be no single solution that entails a unified incorporated machine that able to put in force all site visitors under legal guidelines. Existing solution does not support quick violation identifications due to technology limitations. Vehicle number plates are not uniform and owners customized text format that leads to system failures to auto scanning for vehicle register number. Most of the vehicles are not RTA registered with owner's mobile numbers. Though, photographic evidences are being issued by the officials but are not geo enabled, hardly finding the place, where the place of violation is committed. Present E-POS systems being used at field, are outdated and very expensive with software customization very difficult to implement. Repetitive violators are increasing in numbers, and they are not paying the fine tickets due to non-availability of public interface to check their pending tickets. Still, the violation information is being sent to vehicle owners through snail mail (Postal), where vehicle owners get to know the violation information very late and they are being caught by police as non-fine payers.

Since 2012, a new automatic traffic enforcement camera project has been in operation in Israel. Several databases are included in this project, i.e. sensor data, traffic reports, and road accident records. In 2014 a business intelligence system was developed to obtain

*Author for correspondence

all the data from the sensors of the new project and to merge them with the existing data to run the project effectively and efficiently. In[1], the author demonstrated the importance of a business intelligence system for operating, engineering, researching and managing aspects of the project. But Traffic police currently have limited resources and they are assigned to tasks that cannot be automated[2–4].

Many countries have been using speed and red-light enforcement cameras[5]. However, the automatic enforcement camera technology, like any resource, is expensive and cannot be deployed everywhere at all times[6]. Almost three decades of use, automated traffic enforcement has mainly been applied to speed and red light violations. In the recent years, however, there has been an extension to other violations, e.g., following distance, lane keeping, and toll payment violations. The increased use of digital video and image processing technology, as well as the electronic identification of vehicles, has paved the way for extending the applications to a still wider spectrum of violations, as well as making the enforcement considerably more efficient in the future[7]. The ESRA (European Survey of Road users' safety Attitudes) was to develop a system for gathering reliable information about people's attitudes towards road safety in a number of European countries. This objective has been achieved and the initial expectations have even been exceeded. The outputs of the ESRA project can become building blocks of a road safety monitoring system in Europe that goes beyond monitoring road traffic casualties and also includes indicators for the underlying causal factors. The ESRA project has also demonstrated the feasibility and the added value of joint data collection on road safety attitudes and performance by partner organizations in a large number of European countries. The intention is to repeat this initiative on a biennial or triennial basis, retaining a core set of questions in every wave allowing the development of time series of road safety performance indicators. This would become a solid foundation for a joint European (or even global) monitoring system on road safety attitudes and behavior[8].

Today, Indian Metros like New Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad have nearly 20 million vehicles. As a consequence, there are too many vehicles occupying disproportionately inadequate quantum of roads. Therefore, the greatest challenge for city police managers is traffic management at par with maintenance of order and prevention of crime. Apart from enormous growth of vehicles, poor traffic enforcement is one of the major causes for traffic congestion and poor discipline on roads. Road users do not follow traffic rules and violation of these rules has become norm rather than an exception. Existing manual monitoring and ticketing system prevalent in most of the cities is not effective, as deterrence level is minimum. In manual monitoring and ticketing system, there is no mechanism to punish repeat offenders. The system is also not transparent as manual booking system breeds corruption and harassment[9].

The traffic management system provides a real-time data detection and notification mechanism to detect traffic speed violation, also to notify the police and the car owner of the committed violation in order to be able to take the right procedure at the right time, resulting in an increasing rate of saved lives. There are systems to identify whether the driver is alcoholic, or not. The speed of vehicle is measured and checked if vehicle is in over speed then shutdown signal is send to the vehicle then vehicle gets slow down and stopped. There are some mechanisms to check the vehicle parameters and document (Vehicle Reg. no, Seat belt status, alcohol status, insurance, tax etc.) status if anything finds improper then the car gets arrested and stopped. Usage of Radio Frequency Identification (RFID) technology can detect the theft vehicle when a vehicle gets theft[10]. The idea is to design a framework that can be utilized to design happening on the road and afterward sends SMS to both the owner of the vehicle and the police additionally take a picture. The proposed framework comprises of microcontroller, RFID and Global System for Mobile communications (GSM). The framework is having two RFID readers alongside a tag that is joined to the vehicle and GSM is used to notify the vehicle's owner and police through SMS. Moreover, a photo of a vehicle is taken by means of the camera and a fine is charged when the speed limit is exceeded[11]. The point of the examination is to fabricate a sensor framework for foundation to vehicle, which can transmit the data gave by active signs put making progress toward adjust the vehicle's velocity and prevent impacts. By active signs we mean normal activity signals that includes long-extend active RFID labels with data put away into them. This data is gathered progressively by RFID sensors set on board of the vehicle, which will convert to consequently change its rate to adjust to the circumstances of the street. Specifically, it included a fuzzy logic control algorithm to calculate the longitudinal velocity of the vehicle, with actuators which control the vehicle's throttle and brake to reach and keep up

a given target speed[12]. Wi-Fi Traffic Enforcement (WiTE) is placing a Wi-Fi card on-board of all vehicles. This card is able to communicate with various Wi-Fi Access Points (APs) in an infrastructure along the roads of a city, where APs will be available at all intersections. These APs can either be an existing infrastructure or a specifically built infrastructure for the WiTE system. When simulating the system on OPNET Network Modeler, a Free Space Wi-Fi environment is used[13].

Existing solutions include Radio Frequency Identification (RFID) used for tolling[13], Camera-based used for red light crossing violations[14]. Also, Radars[15], Wireless Magnetic Sensors[16] and Induction Loops are used for speeding violations[17]. There are also Global Positioning System (GPS)-based traffic monitoring technologies; however, such solutions are mainly used for congestion reporting rather than traffic enforcement.

Each of the currently available solutions addresses mainly a single violation, requiring a combination of several solutions to address them all. The lack of a single comprehensive system is the motivation for this study.

2. A New Geo-based Traffic Enforcement

New Geo-based Traffic Enforcement is recommended with many advanced features to the existing application like GPS based smart camera phones, UMTS/ LTE latest mobile internet technology, An Android application, Mobile multimodal communication.

2.1 Methodology

The system should allow the visible violations and captures the image of the violations for the evidence scope. The captured information along with the image should be stored in the remote centralized server. The captured information and image should be transferred through UMTS (3G) (Through Mobile cloud) LTE (4G) from the smart phone to the control room. Smart Phone should have a wide range display unit for better view preferably (Video Graphics Array) VGA display or Advanced Video Graphics Array (AVGA) technology. Police official uses the Smart Phone for new traffic challan tickets based on the vehicle registration number or using the finger prints from the fingerprint scanner of the smart phone. Traffic police are able to find the multiple violators based on the finger print technology using the smart phone, finger-print scanner. Traffic police can catch the pending ticket defaulters, theft vehicles, fake addressed vehicles, address changed vehicle owners, wanted vehicles, watched vehicles, crime involved vehicles, vehicle numbers containing multiple owners and vehicle transferred through brokers who are not reflected in the RTA registers on the road. Traffic cops can also make e-Tickets on traffic violators without stopping the vehicle on the roads can be sent the traffic violation tickets to their concerned address of the owner of the vehicle.

2.1.1 Android Smart Phone Module

Terminal with GSM modem along with the UMTS technology for the data transmission as communication network device. An alternative terminal should support the UMTS/LTE system for communicating between the Unit and the e-Challan data control room. Data transmission should not exceed more than a second for 1KB data transmission from the unit to the Centralized Data Base Server at e-Challan control room. Connectivity should be established from unit to the server within 2 to 4 secs for each unit power start-up.

2.1.2 Printer Module

Handheld terminal must contain the built in printer containing thermal printing technology. Printer contains and supports e-inches printer rolls. All the printouts should work based on the thermal print technology should be able to print the violations list for the continuous for the period of 8hrs as minimum requirement. Printer should print at least a minimum of 28 to 32 characters per line. Printer should print a line within a time of 0.01 sec per line.

2.1.3 GPS Module

Global Position System should be able to integrate later on upgrade the handheld terminal to retrieve the information of the coordinates for finding out the geo location of camera sent photograph.

2.1.4 Incident Records Module

Visible traffic violations. Images for the traffic violation evidences. The primary violations can be noted down using the handheld terminal. The primary traffic violation

image should be in color. An incident record should have at least two images with at least one image clarity shown in the number plate and the traffic violation including the red-light on the traffic signal. Images must clearly enable the make and the model of the offending vehicle to be identified. Images forming part of an incident record must be sufficient quality to prove the offence in the court of law.

Incident data block: Each incident record must have the following records, Site identification, name and location. Traffic police station jurisdiction. Nearest junction. Date and time of traffic violation/offence.

Booking officers name, cadre, and traffic police station/department. Vehicle registration code and vehicle number.

2.1.5 Device Communication and Processing Module

Electronics of processing module, communication module should be maintained at server side management using UMTS/LTE mobile technology.

Data will be passing through the handheld terminal to the server and the data will be stored in the centralized server. Handheld terminal should not contain and store the data except handheld protocol.

2.1.6 User Interface Facility Module

The User Interface to be designed to have simple operation as required. The interface should be updated during the period of warranty/AMC as per new suggestions and operational requirements. The User Interface broadly should fall into the categories of viewing violations and system configuration. The violation viewer should provide a means of listing the invalid violations along with the reasons of invalidation without deleting the records. Software should provide interface for taking prints of the violations (including image and other details preferred). A read only log of user actions to be maintained in the server at the back office for each instance. There should be a password access system along with the user type (admin, user).

All challans should have an image along with the violation details including the classification of the offence, place of offence, police station jurisdiction, speed, dangerous driving etc. The software should also be capable of generating query based statistical reports on the violation data. Necessary software for matching the violation data including vehicle registration number with the existing RTA database and for generation of challans has to be provided by the vender. In case the customer has any legacy system with required database, the vendor has to provide necessary software and technical support for matching, retrieving and generation of challans from the existing database.

2.1.7 Control Room Communication Module

The system should have appropriate means of communication between the control room (in station) and controllers (out station) installed at various junctions. It should have the facility to transfer violation data capture on the hard disk to the control room either on demand or automatically through PTS/broadband/fibre optic/wireless etc. The interface software should support transmission of data irrespective of communication network that is PSTN/broadband/fibre optic/wireless etc, necessary hardware and software interface for this purpose should be provided by the bidder.

2.1.8 Access Control Security Module

The violation data will be transmitted using the GSM and UMTS/LTE technology from the handheld terminals to the centralized server using the HTTPS (Hyper Text Transfer Protocol secure) server. Appropriate encryption keys must be used for the encryption process and application should maintain the digital signature facilities and important key loggers. The operator/user should be able to download the violator's violations and images from the public gateway. Administrator/Supervisor– access the system status, change configuration settings, change access codes and passwords, delete records.

User/operator- access to download incident records, log files and challan payment status. They cannot change the configuration settings or mode of operation.

2.1.9 MIS Reporting Module

The system must be able to give statistical information based on the e-challans and e-ticket system.

Number of Challans booked Number of violations Number of challan defaulters, Number of challan payments. Flow Diagram of proposed Android based solution for Road safety and Traffic Enforcement System as shown in Figure 1(a). The extension of contact, MIS/View in Figure 1(a) as shown in Figure 1(b) respectively.

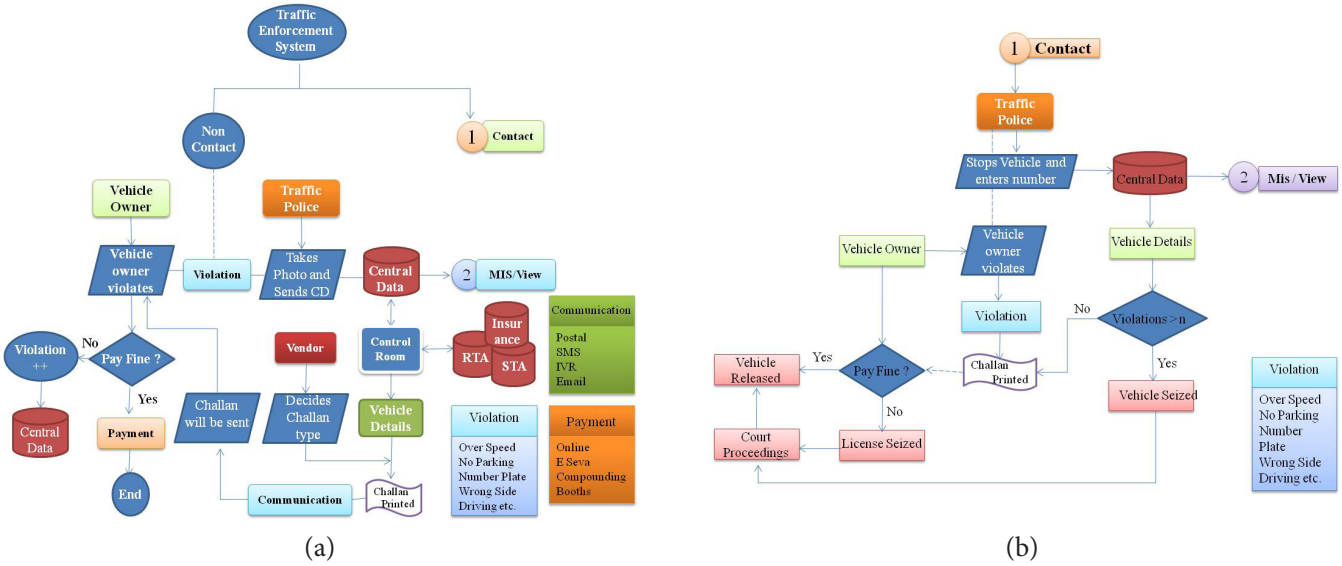

Figure 1. (a) Flow diagram of proposed android based solution for road safety and traffic enforcement system, (b) Flow Diagram of contract.

3. Proposed Solution

A complete administrative facts protection policy ought to be advanced which defines the records belongings that this paper needs to defend, and defines the importance of each computer users and computer operators to make certain protection of these property. This approach encouraged that supervisory computing servers be protected with the aid of a firewall. This will allow crew to higher control how they're accessed and used. The Kerberos/some other network authentication provider turned into recommended for users of the data, Violation related applications. Its miles additionally endorsed that users will be needed to supplement their Kerberos authentication with token authentication.

Similarly, a few customers unable to use Kerberos authentication (generally because of insufficient desktop assets) will rather be need to apply a token to authenticate them. A token usually uses either a task/reaction set of rules, or a clock-driven set of rules to create one-time passwords, which cannot be re-used later, although they're disclosed with the aid of network sniffing. A token verification server gives token authentication offerings for the server. Customers storing sensitive statistics on their computing device computer systems might be required to guard the information the usage of computer get entry to manage and encryption software program until the computer systems are in any other case bodily secured. Policy should be evolved to outline the phrases and situations.

4. Conclusion

The present method is designed in such a way, that it makes more comfortable to use the application with providing the electronic field devices/gadgets with readymade solution installed. The study highlights the key benefits to the department and public as well. Consequently, gaining the local success will generate the market awareness and improve the sales.

5. References

1. Sher M, Shifrin G. Automatic traffic enforcement camera operation, based on a business intelligence system. Springer International Publishing AG, LNBIP. 2017; 282:16 –31. https://doi.org/10.1007/978-3-319-57487-5_2
2. Elvik R. Speed limits, enforcement, and health consequences. Annual Review of Public Health. 2012; 33:225–38. https://doi.org/10.1146/annurev-publhealth-031811-124634. PMid:22224882
3. Elvik R. Speed enforcement in Norway: Testing a game-theoretic model of the interaction between drivers and the police. Accident Analysis and Prevention. 2015; 84:128–33. https://doi.org/10.1016/j.aap.2015.08.017. PMid:26342893

4. Wijers PJ. Automated enforcement, get it right, make it safe. 16th Road Safety on Four Continents Conference Beijing, China; 2013. p. 1–15.
5. Automated Traffic Monitoring System [Internet]. [cited 2014 May 11]. Available from: https://ieeexplore.ieee.org/document/6887618.
6. SriRam G, Mohana Roopa Y. A threshold multi authority CP_ ABE access control scheme to verify attribute set in public cloud storage. International Journal of Creative Research Thoughts. 2018; 6(1):1310–15.
7. Buttler I. Enforcement and support for road safety policy measures. ESRA thematic report no. 6. ESRA project (European Survey of Road users' safety Attitudes; 2016. p. 1–50.
8. Angel Mariya TP. Traffic enforcement system. International Research Journal of Engineering and Technology. 2016; 3(9):1222–6.
9. Lujaina Al S. Automobile speed violation detection system using RFID and GSM technologies. International Journal of Applied Information Systems Foundation of Computer Science. 2014; 7(6).
10. Mishra A. Design of RF based speed control system for vehicles. International Journal of Advanced Research in Computer and Communication Engineering. 2012; 1(8): 1–4.
11. Gendi FW. Wi-Fi Traffic Enforcement System (WiTE). Journal of Transportation Technologies. 2013; 3:142–8. https://doi.org/10.4236/jtts.2013.32014
12. Kathawala YA, Tueck B. The use of RFID for traffic management. International Journal of Technology, Policy and Management. 2008; 8(2). https://doi.org/10.1504/IJTPM.2008.017215
13. Ramesh Babu M, Mohana Roopa Y. Component-based self-adaptive middleware architecture for networked embedded systems. International Journal of Applied Engineering Research. 2017; 12(12):3029–34.
14. TIPMRA. How Speed Trap Radar Works [Internet]. [cited 2011]. Available from: http://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=782536.
15. Sifuentes E. Wireless magnetic sensor node for vehicle detection with optical wake-up. IEEE Sensors Journal. 2011; 11(8):1669–76. https://doi.org/10.1109/JSEN.2010.2103937
16. Praveena A, Mohana Roopa Y. Resource allocation using entropy based FIFO method in mobile cloud computing. International Journal of Engineering Sciences Review. 2013; 4(1):1–4.
17. Byon Y, Shalaby A, Abdulhai B. Travel Time Collection and Traffic Monitoring via GPS Technologies. Proceedings of the IEEE Intelligent Transportation Systems Conference ITSC, Toronto; 2006. p. 677–82. https://doi.org/10.1109/ITSC.2006.1706820