Automated Traffic Violation Detection and Challan Generation System

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Abstract
Road traffic emerged as one of the major problems across the globe, results increasing road accidents. Road accidents result in human injury/loss of life and monetary. Traffic accidents can be controlled largely if traffic norms followed strictly. The presented system is embedded inside the vehicle to provide surveillance of traffic violation. Driver is penalized for his offences at nearest checkpoint, so system enforces people to obey traffic regulations. The designed system mainly focuses two parameters of four wheelers i.e. seat belt and over speed. Firstly, the detection of over speed, and location of vehicle has been determined via GPS, and the measured speed is then compared to the set speed limit. In seat belt detection, seat occupancy is detected first. If seat is occupied only then fastening of seat belt is detected. The system monitors both the conditions continually, if the driver violates either or both norms, a short warning will flash inside the vehicle. After prescribed warning, if the driver continues the offence, a challan for that offence is generated; details of the vehicle and type of offence is uploaded to police database.

Keywords
GPS; Over-speed; Database; Seat occupancy; Seat-belt

I. Introduction

The road traffic is increasing worldwide, due to huge traffic and violation of road safety at the road, rate of traffic clashes and death rate are increasing very rapidly. Road accidents are the wastage of human lives and money. According to world health organization (WHO), the rate of traffic injuries estimated in a single year 2010 was 1.25 million across the world [1]. In year 2012, the International Road Federation (IRF) surveyed that traffic clashes results in monetary loss of $20 billion (INR 1 trillion) in India [2]. According to the Times of India (TOI) survey in India, 1214 road collisions occurs every day and 16 people dies every hour [2]. In a single year 2014, total 1.41 lakh people killed in road accidents in India, which is greater than the total number people who killed in wars in India [2].

Table 1: Rate of Accidents and Death Rate in India [2].

In Year 2014, 37% Accidents Due To Over Speeding		
4.5 Lakh Road Accidents	1.4 Lakh Dead	4.8 Lakh Injuried

Road accidents can be reduced largely if traffic regulations are enforced properly. Road safety is the only solution to this problem; however, most people obey traffic regulations only at the places where they knew the probability of a police check is high or vice versa. People speed up their vehicles to fulfill the needs of their racing life but by this, they put their and other people life in danger.

This research developed an electronic system, which continually monitors the road safety regulations. The designed system is embedded inside the vehicle (four wheelers) to monitor the speed of vehicle and status of seat belt continuously from the starting of vehicle until it switched off.
In automated traffic violation detection system. We classified the research work into two sections; first is speed measurement and second is seat occupancy and seat belt detection. Fig. 2 showing the basic blocks of the designed system and connections describe the way how desired functionality is achieved.

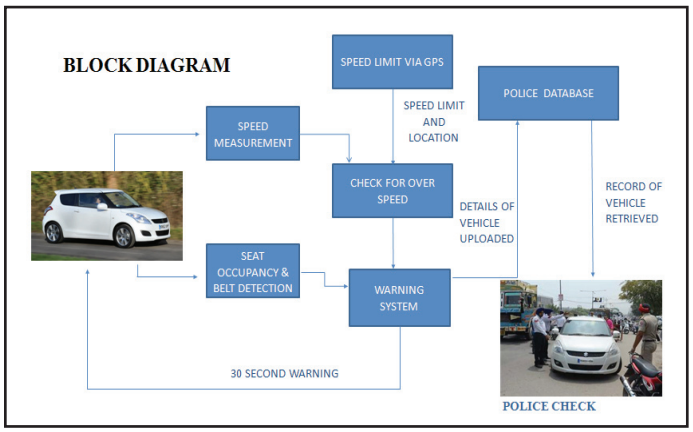

Fig. 1: Block Diagram

II. Work Methodology

The work methodology of the Automated traffic violating detection and challan generation is divided into various segments. To achieve desired functionality, we used various technologies i.e. Global positioning system (GPS), Global system for mobile (GSM), Liquid crystal display (LCD) and a Buzzer.

A. Speed Measurement

The designed system performs the continuous traffic violation detection, to achieve the motive, system continually measures vehicle speed and compare measured speed with the set speed limit of the location to detect over speed.

In this system, Global Positioning System (GPS) technology is used for speed measurement. GPS use satellites to measure the speed of the vehicle as in fig. 3. In GPS satellites accounts the distance traveled by the vehicle and corresponding speed is provided by the GPS. More the number of GPS satellites (fix) higher will be the accuracy.

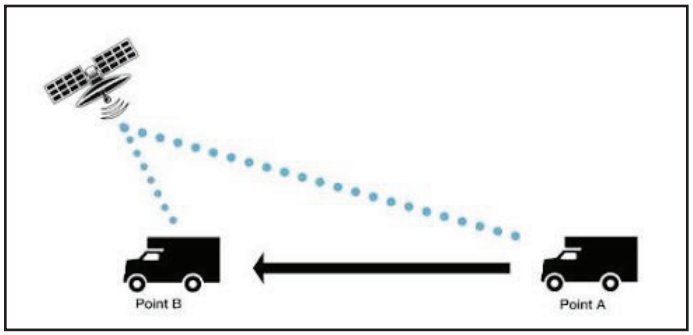

Fig. 2: GPS Speed Measurement

Speed is given by:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{Nautical miles (Knots)} \qquad (1)$$

Speed by GPS is provided in nautical mile (knots) per hour, whereas one nautical mile knots
Equals to 1.852 kmph.

Speed in kilometer per hour is given by:

$$\text{Speed in KMPH} = \text{Speed in Knots} \times 1.852 \qquad (2)$$

$$\text{Speed in KMPH} = \frac{\text{Distance}}{\text{Time}} \times 1.852 \qquad (3)$$

In speed measurement process, the system checks for the satellite fix (number of available satellites), more the number of fix, more will be the accuracy. If satellite fix is available. GPS receiver establishes its link with the satellites. GPS performs measurement and provide speed and coordinates of that location. The next step is to compare the measured speed with the set speed limit provided by the database of coordinates and their corresponding speed limit. If the vehicle's measured speed is lesser than the set speed limit fetched from database that means, driver is not violating speed norms but if he overrides the limit speed then a 30 second warning is flashed inside the vehicle via buzzer and LCD to alert the driver about the violated offence, after that challan initialized.

B. Seat Belt Detection

Seat occupation and seat belt detection unit works in coordination with the speed measurement unit. Belt detection unit works only if measured vehicle speed is more than 20kmph. This is done to check, whether vehicle is in motion or stationary, otherwise system may generate a challan for not fastening seatbelt at speed lesser than permissible speed (20kmph and can be set accordingly).
At present, various techniques for seat belt detection are available. To make the system cost effective, we used a very simple and cheap technique for the seat occupancy and belt detection purpose; the designed system uses a push button to detect seat occupancy and detects the wire connectivity to achieve the desired functionality. Firstly, seat occupancy is detected, for this purpose we placed a push button inside the vehicle seat. The placement of push button within the seat is an important issue because the placement of push button should be such that it should not be pressed by some luggage or smaller weight placed on the seat. If no person is seated at either of the seats then belt detection unit will not perform belt fastening detection. If seat occupancy occurs, then seat belt detection part begins. The system detects the circuit connectivity and transmits low DC voltage from one port of the controller board and read the corresponding voltage at other port, if the belt hook is inserted inside the belt clip means circuit connectivity is complete because clip hook is usually made up of a metal. If a small amount of voltage is detected at the controller port that shows seat belt is fastened otherwise a 30 second warning is flashed via buzzer and LCD to aware the driver about the violated offence, after that challan initialized.

C. Warning System and Challan Generation

If an offence is detected, then corresponding warning for that offence is generated and flashed inside the vehicle. In this system, a 20*4 graphic Liquid Crystal Display (LCD) and a buzzer is used for warning purpose. LCD displays the type of offence message along with a 30-second timer and buzzer start beeping inside the vehicle. Therefore, warning system alerts the driver about the offence. If the driver continues to violate traffic norms after the prescribed warning period, the system will take details of vehicle i.e. registration number (already feeded) and type of offence and uploads the details to police database whereas time of the offence is automatically taken from database server. For this purpose, we are using Global System for Mobile (GSM) technology, via GSM details vehicle is uploaded as text message to police database.
In challan generation, vehicles are challaned based on their offence history in the police database, whenever the vehicle is stopped at nearest check post, the history of that vehicle is retrieved from the database and a challan is done based on the offence history of vehicle.

III. Results

Road safety is the one of the biggest problems of the fast developing world, Road safety can be ensured, if traffics regulations are enforced strictly. The prime motive of the designed system is to reduce the number of road accidents by ensuring proper traffic regulation. Reduction in number of road accidents will result to the reduction in wastage of monetary, human injuries and death rate.

A. Vehicle's Dashboard Speed v/s GPS Measured Speed

In Automatic traffic violation monitoring system, speed of vehicle is measured via GPS device. The accuracy of the designed system depends on the accuracy of the measured speed. The selected GPS device is of very fine quality and provides the velocity accuracy of 10 m/s.
To verify accuracy of the designed system, various samples of the dashboard speed is taken the correspondingly compared to the speed given by GPS device. Table 1 represents speed comparison between vehicle's dashboard speeds, GPS measured vehicle speeds. The graph between the dashboard speed and GPS measured speed is shown in fig. 3.

Table 1: Comparison Between Dashboard and GPS Measured Speed

Vehicle speed an Dashboard Odometer	Vehicle Speed measured with GPS
0	0.39
10	9.25
20	18.53
40	38.03
60	57.33

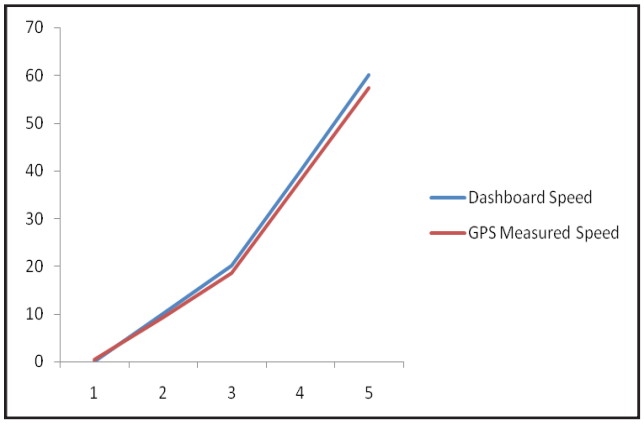

Fig. 3: Speed Comparison of Dashboard and GPS Measured Speed

IV. Conclusion

In this work, the designed Automatic Traffic Violation Detection and Challan Generation system is presented. The motive of this research is to develop a low cost, durable and compact system so it could be implemented to both old and new vehicles. The system is designed to provide continuous detection of traffic violation via vehicles on the road and ensures full road safety that enforces the people to obey the traffic norms. The system designed as a complete solution to all road traffic violations. The designed system can be further enhanced by adding some more offences to the system i.e. alcohol level detection, pollution emission of vehicle.

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