IoT based framework for Vehicle Over-speed detection

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Abstract – Automatic vehicle monitoring has turned out to be a very crucial scenario in the current years. It may develop into possibility by executing the following technologies. This project targets to propose a system, which detects speeding vehicles over a specific speed limit and immediately report to concerned authorities. At present, road accidents rates have raised so, there is a necessity for developing a system that detects an over speeding vehicle. The implementation of present Smart Vehicle Overspeeding Detector using Internet of Things determines all the road traffic information automatically with intelligence. The smart vehicles are suitable with overspeeding detector that has capability for recording, storing and information sharing about the vehicle's speed. The system contains GPS module, Radar, Google maps and IoT module. The safe regions are identified automatically using GPS and IoT technologies. Electronic tracking device runs in 12 V lithium batteries with network of GPS sensing and IoT implementation. The battery life of this device is range from 5-10 hours. A smart vehicle overspeeding sensor is employed and is combined with IoT in order to decrease the vehicle's speed at particular places like accident prone zones. If this smart sensor technology is used the safety parameters, then avoidance of accidents may be attained. The system sends the data wirelessly. If the overspeeding vehicle is detected, then the sensor alerts by sounding an alarm. The purpose of the proposed sensor is to decrease high death rates because of accidents in Middle East countries and in Oman.

Keywords – *IoT, Smart vehicle overspeeding sensor, accident prevention system in Oman, vehicle to vehicle interaction.*

I. INTRODUCTION

The major concern of vehicle accident is the part of continual disaster lists, which might happen anywhere anytime. In accordance with Association for Safe International Road Travel Report, around 1.24 million people die and 50 million people are getting wounded on the roads each year in the World. Statistically, they are assumed as the second important reasons for death. In order to overcome these problems, many automobile device industries and vehicle manufacturers have tried to propose speed control techniques in order to keep up a vehicle safe distance. In this direction, the effort is going on devising a security driving application for vehicles by new rising IoT-oriented technology, which is employed for devising a more effective solution [1].

The IoT (Internet of Things) is the interrelation of distinctly identifiable embedded computing appliances inside the existing infrastructure. IoT provides sophisticated connectivity of systems, services and devices, which goes beyond M2M (Machine to Machine Interactions) and covers different domains and applications. This interrelation of embedded appliances like smart objects is implemented in all automation enabling modern applications such as Smart Grid [2].

The target of this project is to propose and develop a new Smart Vehicle Overspeeding Detector using IoT technology for alerting information about overspeeding vehicles. The smart vehicle over speeding detector is very essential for the human life as there are so many accidents in road every day. This study gives a general idea about a smart vehicle over speeding detector and also concentrates on the functionality of the over speeding detector by use of IoT technologies. In addition, the current research concentrates on the various methods for controlling the over speeding radars using literature survey. Further this research explains the technical working of the speeding detector and benefits associated with

it. Thus, the proposed analysis will act as an eye opener for the future researches and it provides new insights about the particular topic for the researchers and academicians.

II. LITERATURE REVIEW

The authors have presented EBM (Eye Blink Monitoring) technique, which alerts the focus during drowsiness state. An embedded system depends on the psychological state of focus through monitoring head movements and eye movements are helpful in alerting drivers at the sleep cycle stage of drowsiness. An ordinary eye blink moment has no effect on the system results [1].

In [2], researchers have designed Automated Speed Detection System that may detect the vehicle's speed and if overspeeding happens, then remove the particular vehicle's license number and send it through mail to Toll Plaza in order to indict fine. Here, Doppler Effect observable fact is employed for measuring the speed. If overspeeding is identified, then a camera captures the image of a vehicle automatically; and DIP (Digital Image Processing) methods are used to remove the license number. The findings have revealed that the developed system detects overspeeding vehicle successfully, mines the license number, has great performance and may be used on roads to test out for overspeeding vehicles.

The researchers, in [3], have designed and developed a novel system, which may efficiently identify speed violations on roads and helps driver to respect traffic rules by maintaining speed along with the prescribed speed limit. The developed system contains RFID (Radio Frequency Identification), GSM (Global System for Mobile) and PIC (18F45K22). This system has provided reliable, low cost, effective results and real-time notification.

In [4], the authors have proposed a new Vibration Sensor Device that was set on the vehicle. If any accident happens, vibration is activated and then vehicle's location has been detected with the help of GPS locator. Immediately, the incident has been intimated to Patrol and Life support in order to recuperate the accident as well as suspect is to be tracked by means of GPS locator. The researchers have estimated the speed of vehicles by incorporating the accelerometer readings throughout the time and determine the acceleration faults. Widespread

experiments were carried out so that sensor speed is precise and strong on real driving atmospheres.

The authors [5] have presented a system to identify rash driving on the highways as well as to alert the traffic authorities if there is any violation. Many approaches need human focus and engage many attempts that is complex to execute. In this article, the researchers have aimed to propose a device for the early detection and provided alert of risky vehicle during patterns linked to rash driving. The whole implementation needs IR transmitter and receiver, a buzzer and a control circuit. If the vehicle exceeds the speed limits, then a buzzer signal sounds warning the police.

S. No	Author and Year	Techniques	Benefits
1.	Aishwarya et al. (2015)	Eye Blink Monitoring using IoT technology	• Fast response to take fast action • User friendly interface • Easily implementable
2.	Malik et al. (2014)	Automated Speed Detection System with DIP	• Involves manpower with a gun to inform a Toll Plaza
3.	Shabibi, Jayaraman and Vrindavanam (2014)	Automobile Speed Violation Detector using GSM & RFID technologies	• Reliable, low cost and efficient results • It provides real time notification
4.	Prasanth and Karthikeyan (2016)	Vibration Sensor Devise	• Find out acceleration faults • Estimated speed is accurate and vigorous on driving atmosphere
5.	Rangan (2017)	MQ 9 Gas sensor device using IoT, GSM and GPS	• Green city concept • Reduce speed and control air pollution

Table: 1 Different Vehicle Overspeeding detection techniques

III. PROPOSED SYSTEM

The proposed new Smart Vehicle Overspeeding Detector using IoT technology is used for alerting information about vehicle's over speed limit. This system doesn't require any manpower and records information about vehicle speed and wirelessly informs to overspeeding detection authorities.
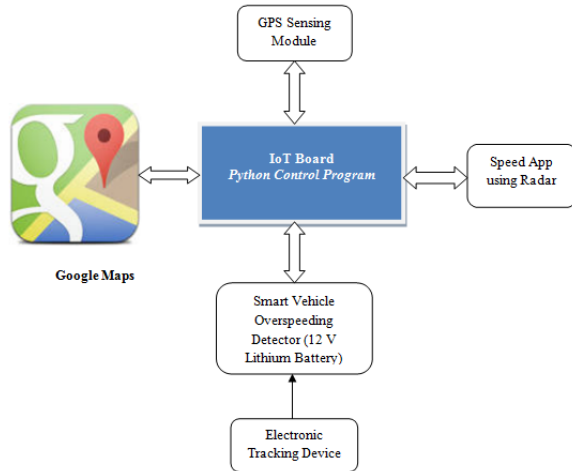

Figure 1: IoT-based Smart Vehicle Overspeeding Detector System

Source: Author

The above figure illustrates system architecture for vehicle speed detection technique. In this proposed system, the speed tracking accuracy can be calculated with Speed App using Radar. The road recognition accuracy based on the road names inserted in Google maps and this device records the vehicle speed in real timing. It also Cross validates with the allocated speed limits of the particular route in that road. Electronic tracking device runs in 12 V lithium batteries with network of GPS sensing and IoT implementation. The battery life of this device is range from 5-10 hours. Server details will be host in windows server for 6 months and then uploaded for later use. Tracking app tracks the vehicle with android application and it sends message to the designated number and the speed limits can be fed online application with separate login on that site. The login shows the speed of vehicle with server time on which the over speeding occurs.

A. Internet of Things:

IoT is internetworking of vehicles, physical devices and other items such as actuators, software, electronics, network connectivity and sensors, which allow these objects to gather and exchange data. The IoT permits objects to be controlled and/or sensed remotely across the network infrastructure, generating opportunities for more direct incorporation of the physical world into computer oriented systems and ensuing in enhanced accuracy, effectiveness and financial benefit.

It is obvious that IoT will contain very huge volume of devices that being linked to the Internet. The capability to network embedded tools with limited memory, CPU and power resources signifies that IoT detects applications in almost every field. Such kind of systems might be used for gathering information in settings that sorting from natural environments to factories and buildings, thereby identifying applications in urban planning and environmental sensing fields.

B. GPS Module:

A GPS (Global Positioning System) navigation tool or GPS receiver is used for vehicle navigation. It is competent of receiving information from the GPS satellites and after that send to precisely estimate its geographical position. This device may retrieve from GPS time information and system locations in all weather situations, near or anywhere on the Earth. A GPS response needs an unblocked line of sight (LOS) to four or many GPS satellites.

Nowadays, many detached GPS receivers are employed in vehicles. The GPS capacity of Smart Phones can use A-GPS (Assisted GPS) technology that may employ the cell towers or base station to give the device position tracking capacity, particularly when GPS signals are unavailable or poor. Though, A-GPS wouldn't be obtainable when the Smart Phone is external to the degree of mobile reception system.

C. Google Maps:

The Google Maps Road Apps permits to plot GPS coordinates to geometry of the road; and also to identify the vehicle's speed limits on the road segments. The following are services exposed for Google Maps Apps:

i. *Snap to Roads*: It returns the best-fit geometry of the road for a provided GPS coordinates set.

ii. *Nearest Roads*: It returns individual road divisions for a provided GPS coordinates set.

iii. *Speed Limits*: It returns the positioned speed limit for the road segment.

IV. METHODOLOGY

The system initially estimates the time needed by particular vehicle for moving from starting point to the destination. Depending on this data, the Smart Vehicle Overspeeding Detector estimates the vehicle's speed by Speed App using Radar. This data is collected and after that send through the IoT technology wirelessly to the concerned authorities at a remote position. The device contains GPS sensing module with Transmitter and Receiver that operate in combination with electronic tracking device for vehicle's speed detection purpose. The road identification accuracy is based on the name of the roads that inserted in Google maps and this system records the vehicle speed in real timing. The system calculates vehicle speed and displays it on a LCD display. If a vehicle with overspeed is detected, then the proposed device sounds a buzzer signal to authorities. Speed tracking accuracy is predicted by Speed App using Radar shows between 40 to 80 % accuracy based on the factor of internet speed as well as connectivity.

V. CONCLUSION

In this research, the problem of conducting accurate vehicle overspeed detection using IoT technology in urban atmosphere to support developing vehicular applications are addressed. Smart Vehicle Overspeeding Detector is used to sense the driving conditions to attain great detection accuracy. Especially, the proposed system is used to detect overspeeding vehicles and reports to concerned authorities to avoid frequent accidents.

The following are the future enhancement that may be done into the proposed system through developing hardware implantations, interfacing sensors and software algorithms:

i. Elucidation for drunk and drive cases;

ii. Solution for emergency vehicle's speed control;

iii. Solution for wheel grasp by gravity detector;

iv. Solution for identifying accidents with the help of Impact Detectors; and

v. Solution for Rash-Driving by hindering Spark Plug.

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