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Cloud Assisted Event Data Recorder for Four Wheelers

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***Abstract*—**Over speeding is one of the major causes of road accidents all over the world. Road accidents account for more deaths than those related to different diseases put together. It has now become a necessity that we take preventive measures towards this problem. Cloud Assisted Event Data Recorder for Four Wheelers keeps check on all registered vehicles for their speed and if the vehicle is found to be over speeding an e-challan is sent to the defaulter via an email. This will considerably bring down the over speeding cases, eventually leading to lesser road accidents hence leading to safer roads. This work consists of an Event Data Recorder which is an inherent part of a vehicle sending real time data to the cloud wherein it is processed. It is a 24X7 regulating process and therefore the vehicle is monitored even in the absence of human intervention.

***Keywords*—**road accidents, Event Data Recorder, cloud, speed monitoring

I. INTRODUCTION

Over speeding is one of the major causes of road accidents all over the world. Road accidents account for more deaths than those related to different diseases put together, and India is no exception. According to the National Crime Records Bureau (NCRB), 48,654 persons died in 2014 in road accidents due to over-speeding. This means that almost 33% of over speeding cases result in fatalities. Incidentally, over-speeding also remains the single biggest cause of road accident deaths in India with over 36% of all road traffic accident deaths occurring solely due to this reason. The accidents may be due to carelessness of the driver, driving vehicles in a hurry, driving with insufficient sleep or driving with alcohol intake which could eventually lead to over speeding. These are some of the reasons for careless driving. This work is an initiative to prevent this.

In this paper, cloud technology is used to track vehicles. Tracking consists of continuously updating the cloud with the longitude, latitude and vehicle ID of the four wheeler. This work is an implementation of one vehicle scalable at a later phase. Event Data Recorder (EDR) sometimes also referred to as "black box" was introduced in American open-wheel championship CART in the 1933 season, and the Formula One World Championship in 1997. The information from the EDR is obtained only if the device is physically removed from the automobile and connected to the PC which helps to read the data. In order to make the data dynamically available we are using the cloud technology. EDR is a small unit consisting of a GPS module and an ESP 8266 module. GPS is used to continuously send the location information to the Node MCU which later sends it to the cloud. Thus, the speed is monitored in real time at regular intervals. An e-challan is issued to the owner of the four wheeler every time he over speeds

The rest of the paper is organized as follows. Section II describes related work in this area. Section III describes approaches to the project. Section IV and V discuss the methodology used and implementation details. Experimental results and conclusions are discussed in section VI.

II. RELATED WORK

A lot of research work has been carried out to solve the problem of injuries and deaths caused by road accidents.
In [2], researchers have designed Automated Speed Detection System that may detect the vehicle's speed and if over speeding happens, then capture the particular vehicle's license number and send it through mail to Toll Plaza in order to indict fine. Here, Doppler Effect is employed for measuring the speed. If over speeding is identified, then a camera captures the image of a vehicle automatically; and Digital Image Processing (DIP) methods are used to capture the license number. The findings have revealed that the developed system detects over speeding vehicle successfully, mines the license number, has great performance and may be used on roads to test out for over speeding 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 is detected with the help of GPS locator. The incident is immediately intimated to Patrol and Life support in order to recover from the accident and the suspect is also tracked by means of GPS locator. The researchers have estimated the speed of vehicles by incorporating the accelerometer readings throughout the time and determining the acceleration faults. Wide spread experiments were carried out so that sensor speed is precise and strong on real driving atmospheres.

The authors in [5] have presented a Smart Vehicle Overspeeding Detector using Internet of Things(IoT). The smart vehicles are fitted with an overspeeding detector that has the capability of recording, storing and sharing information about the vehicle's speed. The system contains GPS module, radar, Google maps and IoT technologies. In the smart vehicle an overspeeding sensor together with IoT is used to decrease the vehicle's speed at particular places like accident prone zones. If overspeeeding is detected, then the sensor alerts by sounding an alarm

III. APPROCHES TO THE PROJECT

On evaluating the problem of over speeding we came up with different approaches. One of them being the use of Image Processing. Its basic idea is to detect the speed of the vehicle and capture an image of the speeding vehicle. But on studying it further the approach was dropped as it was expensive to implement and the scope was limited. The second approach that was considered was an inbuilt Event Data Recorder which would alert the drivers themselves when they over speed. This idea was later dropped as it was inefficient as no stringent actions were taken against the defaulter. Finally, the approach that was taken up was Cloud Assisted Event Data Recorder. Its aim is to develop a device which will keep track of the speed of a vehicle and if over speeding occurs on zones with prescribed speed limit, it will take immediate action by informing the concerned authorities about it. All this will happen without the need of human intervention. This work will overcome the limitations of many currently available speed tracking systems. We will make use of GPS module to get the exact location where the over speeding occurred. If this system is implemented there will be no scope for drivers to disobey the traffic rules.

IV. METHODOLOGY

The data from the system (containing GPS module, Wi-Fi module, Storage unit) will be sent through the internet onto a Cloud storage from where it will be retrieved and accessed by the administrator's local server who will route it to the web app as well as a database. The web app will analyze the data, to correlate the speed zones with GPS coordinates and speed of the vehicle and display the number plate as well as driver details on the screen. Analysis of time and speed will aid us in gathering evidence for where exactly the vehicle was over speeding. The internal memory card of the device will store all parameter values and can be accessed at any given time.

The Event Data Recorder consists of the following:

1. Assembling the Arduino: this will be an inherent part of the vehicle which will continuously record the vehicle location and speed.
2. Sending the data to the cloud: The data acquired by the GPS module is sent to the cloud at regular intervals as the vehicle moves
3. Retrieving data from the cloud : For the purpose of accessing data in real time we can use the cloud technology for instant location.
4. Display the obtained data in a user interactive format: The data stored on the cloud herein is retrieved and displayed to the user in an user friendly manner.

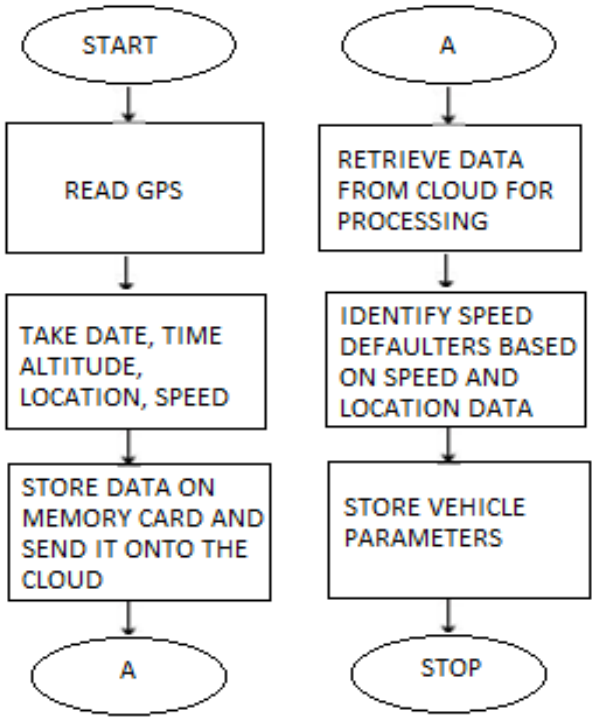

Figure 1: Dataflow Diagram

V. IMPLEMENTATION

1. Analysis of Hardware

The ESP8266 is a low cost WIFI microchip with full TCP/IP stack and microcontroller capability. This microcontroller is used to connect to WIFI network and make simple TCP/IP connections using Hayes-style commands. The NEO-6M GPS module is a well-performing complete GPS receiver with a built- in 25x25x4 mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. With the data backup battery, the module can save the data when the main power is shut down accidentally.

2. Assembling the hardware

The connections are as follows:

- VCC connected to 3V3pin
- TX toD2
- RX toD1
- GND to GND

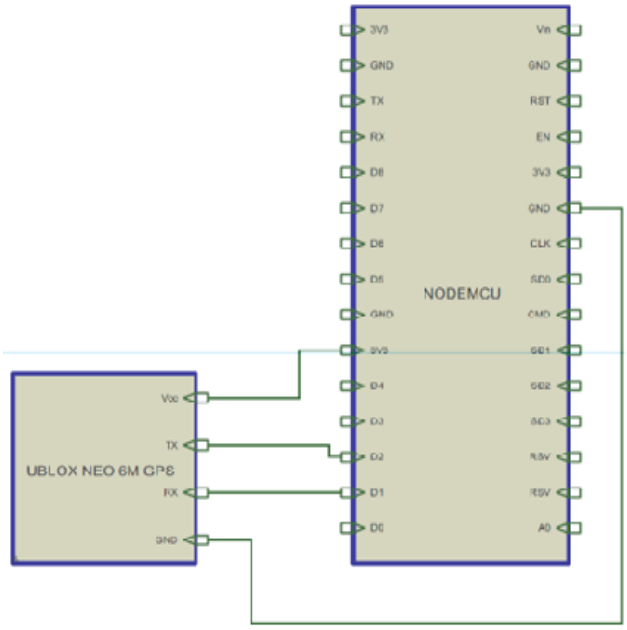

Figure 2: Pin diagram of ESP and GPS module

3. Retrieving the data from GPS module.

We obtain the longitudinal and latitudinal positions of the GPS module and speed which is zero since the device is static. We vary the position of the module to see the accuracy of the data retrieved.

4. Uploading GPS data to the cloud in real time

In this stage live data from the GPS module was gathered and sent to the cloud as vehicle changed its position. The data was refreshed at constant intervals.

5. Retrieving data from the cloud on frontend.

Data retrieved from the module needs to be displayed to the user in order to perform future operations. The data has to be presented in a user friendly manner for the user to read and understand it.

6. Improving the user interface

Addition features were added to the frontend such as maps and live display of latitudinal longitudinal positions, speed, vehicle registration number and status (Normal/Email Sent to Defaulter).

7. Sending e-challan via email.

After retrieving the data from the cloud, the data is analyzed and if any vehicle has exceeded the speed limit an e-challan is sent to the registered driver's email address. The e-challan includes vehicle's registered number along with the fine, location and speed where the over speeding took place

VI. RESULTS AND DISCUSSION

Sending data to the cloud

In order to conduct this experiment, the device was taken to an area with high internet connection speed and the data flow was observed. We varied the position of the Black box to different locations and observed the results obtained. Following screenshot shows the data obtained on the cloud The live data obtained from the Blackbox contains attributes such as flag, latitude, longitude, speed and the vehicle registration number. All this data is sent in the Jason format.

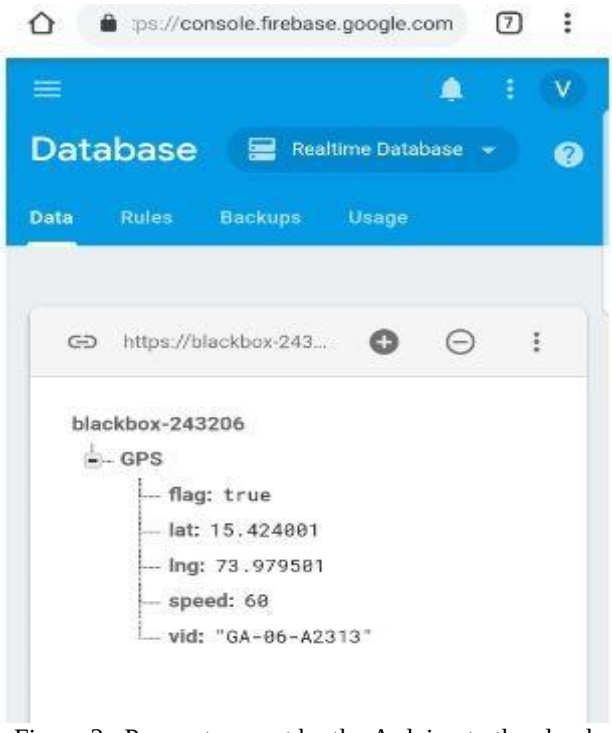

Figure 3: Parameters sent by the Arduino to the cloud.

Detecting speed defaulters

For this, we selected a road and assigned it a significantly small speed limit (initially started with 20) and tried speeding over the limit, this caused a change in the color of the car from green to red on the webpage and an e-challan was instantly sent.

Also tests were conducted in which the driver didn't go beyond 20 kms/h. This test gave satisfactory results as no flag was raised and no E-challan was sent. Both the experiments conducted gave desired results.

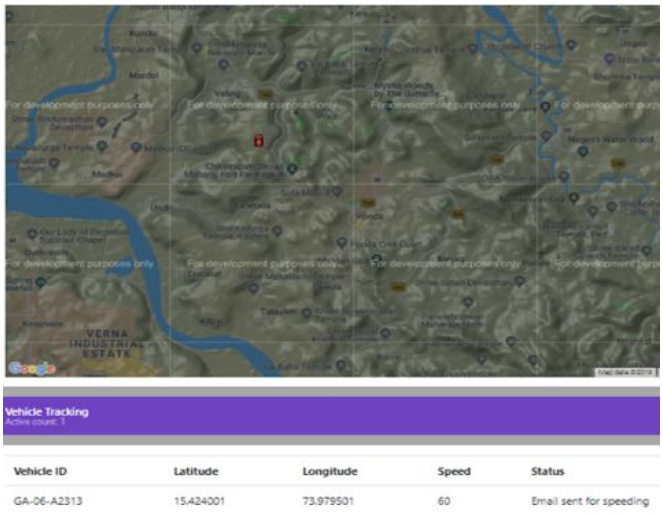

Figure 4: Red vehicle denotes it is a speed defaulter

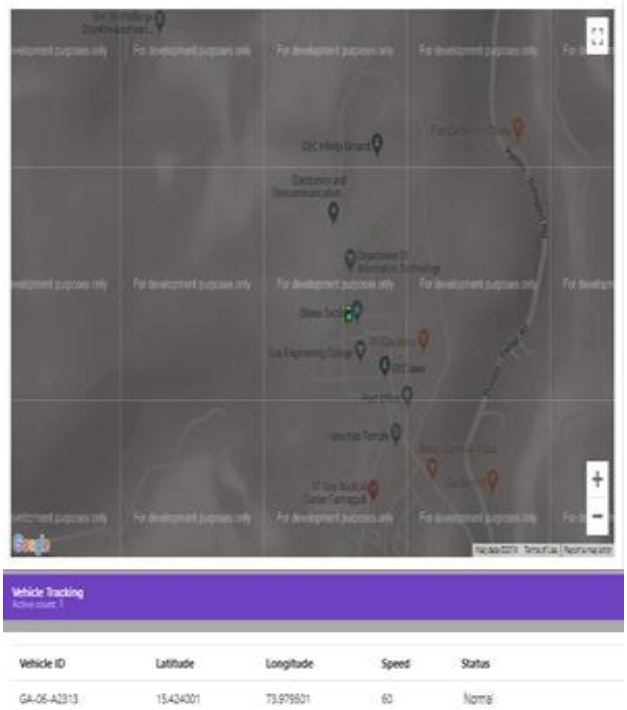

Figure 5: Green vehicle denotes it is within speed limits

Sending e-challan via email

In this project, challan for over speeding is sent via email. It is necessary that the email sent has accurate information of the location, data and time where over speeding took place and the vehicle registration number.

We created multiple users and sent an e-challan via email when over speeding occurred. Screenshots of an email generated is shown below:

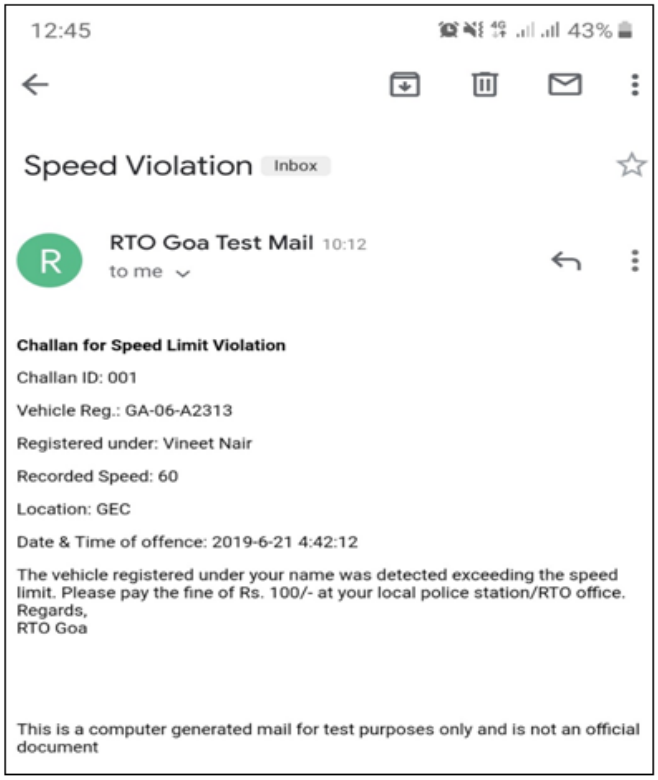

Figure 6: E-challan generated

VII. CONCLUSION AND FUTURE SCOPE

This work can be used to detect over speeding vehicles. No such system is currently available in the country. The system calculates the speed of four wheelers and then automatically sends an e-challan containing details of when and where the violation took place, to the defaulter's email address in case there's a speed limit violation. A copy of the e-challan is also made on the authority's system.

With irrefutable evidence in hand, regular defaulters can have their license suspended. Additional sensors can be added to the onboard device to detect vehicle parameters like acceleration, deceleration, impact sensors, camera, steering degree and other sensors for any kind of unexpected behavior by the vehicle. This will give us the ability to recreate the accident scene and help ascertain the culprit faster in case a mishap takes place. The law enforcement authorities will no

longer have to be de- pendent on eye witness accounts as they can be biased. We believe that such a system, if integrated in all 4-wheelers during manufacturing, can be a great leap forward towards a well-connected IOT based system of cars with tremendous scope in terms of what improvements and enhancements can be made to make the roads a safer place and to make transport more efficient.

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