Automobile Speed Control Using Geo-fencing

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Abstract – Speeding is currently one of the trending topics when it comes to the automobile and road safety sector. Today's youth enjoy driving at high speed for the adrenaline rush of it, this may lead to accidents. This also causes sound pollution and creates an uncomfortable situation for everyone. Geo-fencing can eliminate these issues. It's a virtual perimeter for a real world geographic area, with the help of which, the automobiles are set to a desired speed limit depending on the location.

Keywords—Speed governors, Virtual perimeters, JSON format, GPS, RFID, WiFi

I. INTRODUCTION

Driving automobiles at a speed over the limit can cause damage of two kinds. Firstly, it can lead to accidents and tragic loss of life. According to a survey conducted by the research wing under the Ministry of Road Transport and Highways, Government of India, in 2016, driving at a speed over the limit was declared as one of the major causes of road accidents. 66.5% percent of all road accidents occur due to speeding, and 61% of the overall fatalities are caused by it. It was also reported that one death occurs in every four minutes due to road accidents. Hence, it's quite evident that there is desperate need for a solution when it comes to speeding. Secondly, driving at a speed over limit causes an unhealthy amount of noise, this ends up disturbing people and is also not favorable for patients suffering from heart disorders etc. It can also lead to bad traffic situations and can create dangerous problems if the road is not up-to safe standards.

If we can control the speed of the vehicle irrespective of the user choice who is driving in a specified location, we can save lives and ensure peace and security in the society. This will minimize all traffic related fatalities considerably. A Geo-fence is a virtual perimeter for real world geographic area which can be dynamically generated around a point location. This virtual radius can be constructed at specific locations which are traffic prone and accident prone, such as junctions, schools and colleges, areas under construction etc. The speed can be controlled by setting up a device inside the automobile with the help of a location based service like GPS, RFID, Wi-Fi or cellular data to trigger a predefined program to receive the speed limit of a particular area and then set the boundaries to reduce the speed of the automobile.

Speed of an automobile is usually controlled by obstacles like speed breaker and by traffic interceptors like sign boards that are placed alongside roads. These traditional methods of control aren't always a 100% effective. They may harm the automobile in cases where the ground clearance is low, thereby damaging the lower part of the vehicle. When it comes to sign boards, the drivers don't always pay attention to them and may be invisible due to heavy traffic, and hence they fail to give the necessary information to the drivers, so that they can control the speed. If a particular road isn't suitable for driving, for reasons like damage of path and construction work, it's difficult to communicate the information to the drivers as soon as an issue occurs, but with the help of Geo-fencing, the speed will be automatically controlled and hence, there will be no inconvenience to the driver.

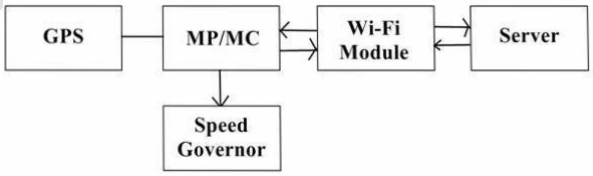
II. FUNCTIONING

Device – The device is fixed onto the vehicle and it tracks the locations of the vehicle. It continuously makes requests to the cloud to know if the vehicle is in Geo-fencing area or not. Next, it receives the response from the server, and if the vehicle is in Geo-fencing area, speed is slowed down and set by speed governors which are attached to the microcontrollers as accurators .

Server/Cloud – It processes the request sent by the device and sends back the signal containing the answer of the request i.e it tells if the vehicle is in Geo-fencing area or not. If it is, it sends the signals that contain the speed limit and sets it on the vehicle. If the vehicle is not in the Geo-fencing area, it sends null signals.

III. METHODOLOGY

In this system, the GPS plays a major role in controlling the speed of the car, as the latitude and longitude values are recorded from the module with the help of the controller, and then it makes a request to the server which in turn sends a response. It sends "null" if there is no speed limit or sends the speed limit value to be maintained by the automobile if it is present in the geo-fence area. The response contains the value of speed which the automobile cannot cross.



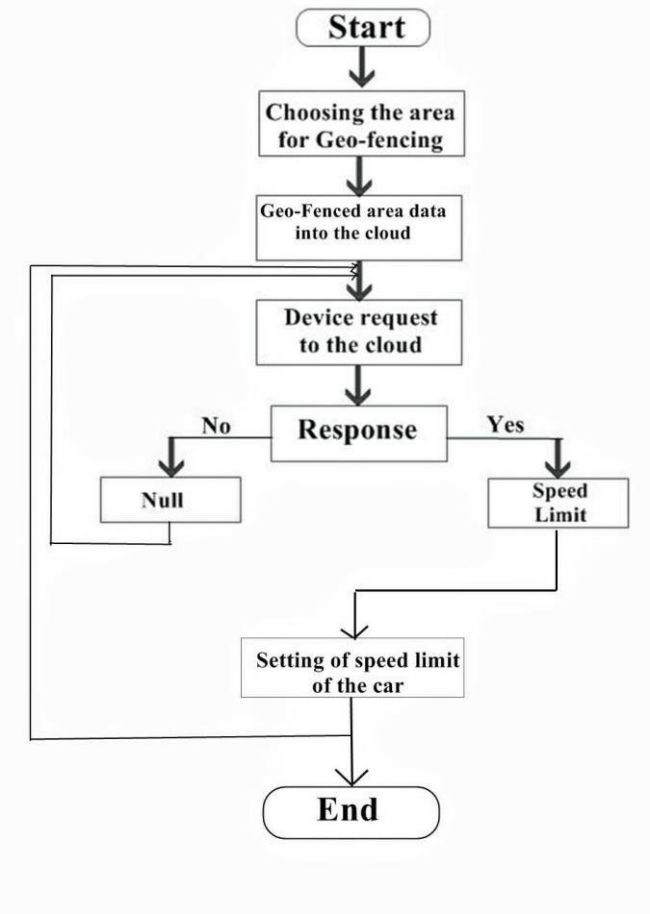
(Figure 1 -- Block Diagram)

The response outcome of the server will be passed on to the microcontroller/microprocessor, then the controller will convert the analog data to digital so that the speed governors can comprehend the information and subsequently limit the fuel flow which controls the speed of the automobile.
The automobile makes continuous requests to the server and whenever it gets the response "null", it implies that the

automobile is out of the Geo-fence area and hence the driver can drive at the speed of their choice.

IV. FLOW CHART

As soon as the automobile will be turned on, the Geo-fence system will also get activated. The first step in the execution of this process is, from Google Maps, we choose an area where the Geo-fence has to be set up. The areas where the road sensitivity is very high have to be selected first, for example, areas with schools and colleges, high accident prone areas and areas where the quality of roads isn't up to mark. The speed limit for the area is then set according to the road sensitivity. Next, the co-ordinates of the Geo-fence are loaded in to the server.



(Figure 2 – Flow Chart)

The device set in the automobile makes a continuous request to the server which has information related to the Geo-fence areas and their speed limits, the server returns back with a response that can be of two types, the first being "null", if there is no presence of a Geo-fence in the particular area, and the second type of response is given when there is a Geo-fence situated. When the second type of situation arises, the server returns the exact value of the speed limit of the area. The received speed limit value will be converted by the controller and will be passed on to the speed governor which controls the fuel flow and hence controls the speed of the automobile and prevents the occurrence ofany kind of damage to the driver of the vehicle. The device will hence be in the state of requesting and receiving the response until the automobile will be turned off.

V. ALGORITHM

DEVICE

Step 1: Initialization of all the modules the moment the automobile is switched on.
Step2 : The location of the vehicle is tracked by the GPS.
Step 3: The tracked location by the GPS is sent to the server.
Step 4: The device waits for the response from the server.
Step 5: The device receives the response.
Step 6: The device verifies for the value.
Step7: If the value is "null" no speed limit is set.
Step 8: If the value is not "null" ,the analog value is converted into digital pulse.
Step 9: Digital pulse are sent to the speed governor.
Step 10: Depending on the clock pulse the speed governor either increments or decrements the fuel supply.

SERVER

Step1: Waiting for the request from the device.
Step 2: If the request is received from the device, it extracts the latitude and longitude from the request.
Step 3: It verifies the latitude and longitude of the request.
Step 4: If the latitude and longitude is in the desired range it confirms that the automobile is in the geo-fencing area.
Step 5: It sends the response to set the value of speed limit.
Step 6: If the confirmation is wrong then it indicates that it is not in the geo-fencing area.
Step 7: Then no speed limit is set.
Step 8: Waits till the next request.

VI. SURVEY OF STANDARDSPEED LIMITS

If we consider the case of Kerala, the standard speed limits for different regions in km/h according to the Ministry of Road Transport are as follows.

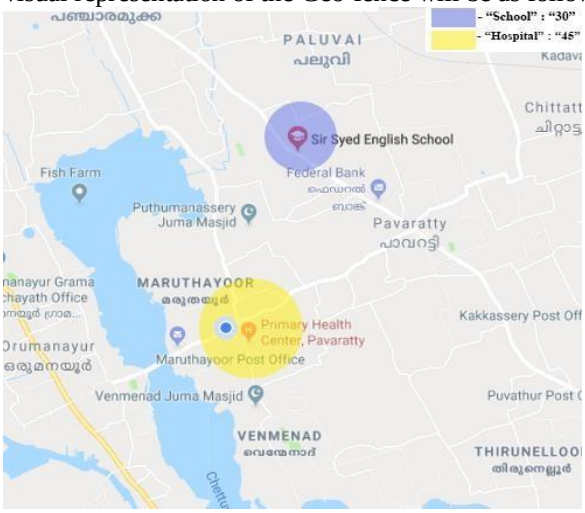
State	Light Motorcycle (Cars)	Passenger Vehicles
Kerala	30-40 (Near Schools & in Ghat Roads) 45 (Hospitals) 50 (City) 70 (All other places) 80 (State Highways) 85 (National Highways) 90 (4-Lane Highways)	30-40 (Near Schools, in Ghat Roads & in cities) 50-65 (All other places, State Highways & National Highways) 70 (4-Lane Highways)

(Table – Standard Speed Limits in Kerala)

VII. RESULTS

After choosing Kerala as the area for a demo experiment and setting up two Geo-Fences around a school & a hospital

respectively and selecting their appropriate speed limits, the visual representation of the Geo-fence will be as follows.



(Figure 3 – Appearance of the Geo-Fence)

Whenever a vehicle enters a Geo-Fence area, the device makes a request to the server and receives a response that contains the speed limit in the JSON format as shown below.

REQUEST FROM DEVICE

```
[
  {
    "city":"Kerala",
    "county":"india",
    "location":{
      "latitude": 10.558493,
      "longitude": 76.051334
    }
]
```

RESPONSE FROM SERVER

```
{
  "geo-fence":"true",
  "speed-limit":45
}
```

(Figure 4 – JSON format of the speed limit)

VIII. CONCLUSION & FUTURE WORK

In the present world situation, where thousands of lives are being lost every single day due to driving over the speed limit, this system can considerably minimize the possibilities of the occurrence of accidents.

The tracking aspect of Geo-Fencing can be used for different applications as follows

1. In the case of an accident if the vehicle lands into a water body, this system can be used to accurately track its location.
2. In case of the existence of damaged roads due to natural or any other reasons, the roads cannot be used. Hence the same information has to be notified to the driver.

IX. REFERENCES

[1] Trish Dirgahayu & Feri Wijayanto, "Location based request forwarding in Geo-fencing Application with Multiple Providers", 2015 International Conference on Technology, North Sumatra, Indonesia, September 2015.

[2] Aditi Gupta & Vibhor Harit, "Child Safety & Tracking Management System by using GPS, Geo-fencing & Android Application : An Analysis", 2016 International Conference on Computational Intelligence & Communication Technology.

[3] Tejas Thaker, "ESP8266 based Implementation of Wireless Sensor Network with Linux Based Web-Server", 2016 Symposium on Colossal Data Analysis and Networking.

[4] S. Spiekermann, "General aspects of location-based services", in J. Schiller and A. Voisard, Location based Services, Elsevier, Inc., 2004.

[5] Ying Bailey, "Practical Microcontroller Engineering with ARM", First Edition, 2016.

[6] Ravi Kishore Kodali & Kopulwar Shishir Mahesh, "A Low Cost Implementation of MQIT using ESP8266", National Institute of technology, Warangal.

[7] P. Szcytowski, "Geo-Fencing based Disaster Management Service", Agent Technology for Intelligent Mobile Service", Springer, pp, 11-21, 2015.

[8] F. Reclus and K. Drouard, "Geo-Fencing for Fleet & Freight management", Proc. 9th International Conference on Intelligent Transport Systems Telecommunications, pp. 353-356, 2009.