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Speed Control of Vehicle in Accident Zone

A Shabaz Khan¹, Chethan M N², Akash O³, Ch. Rakesh Singh⁴, Dr. D V Manjunatha⁵

UG Student, Department of ECE, AIET, Moodbidri, India.¹⁻⁴

Sr. Prof. & HOD, Department of ECE, AIET, Moodbidri, India.⁵

ABSTRACT: Every year the density of vehicles are increasing rapidly, which results in more traffic related problems and leading to accidents. The causes for the accidents are over speeding, negligent driving and ignoring the road rules etc. These problems can be solved by using a system which alarms the accident zone or speed limit area, in response to these alarms the speed of the vehicle can be controlled in order to, avoid the accidents. The system can be implemented by using two methods such as RF communication and Geo-fencing. The proposed system is an attempt to control the speed of the vehicles, which is designed with software and hardware to enable the driver to get the speed of the area in which the vehicle is currently moving. The main focus of this project is to provide safety and precaution to the driver as well as to the passengers and to avoid the accidents which can save many lives. The framework makes utilization of two methods which are mentioned earlier. In RF communication method RF transmitter placed at accident zones (such as school zones, hospital areas and speed limit areas etc.) and RF receiver placed in the vehicle will communicate using electromagnetic waves. The microcontroller that is the brain of the project activates the particular action corresponding to the received signal. The prototype is implemented using geo-fencing technology to overcome from the drawbacks which are encountered in RF technology. Geo-fencing is a feature in software /program that uses the global positioning system to define the geographical area with different radius. In geo-fencing method, the software application provides an alert or notification to the controlling part of the system when the vehicle enters an established geo-fenced area. The microcontroller in the controlling part will perform the necessary action based on the notification to control the speed of the vehicle.

KEYWORDS: RF transmitter and receiver, speed limits, sign boards, accident zones, Geo-fencing.

I. INTRODUCTION

The road accidents are major cause for premature death and disability over the world from the past decades. As per the survey held by World Health Organization (WHO), around 1.3 million people are losing their lives due to road accidents every year and more than 50 million people get injured. The numeral count of road accidents are increasing due to over speeding, negligent driving, drink and drive, poor vicinity of roads etc. Among these reasons, over speeding is the major cause for the accident. The problem of over speeding becomes more dangerous in the rainy, winter and spring season. Also the roads which has full of turns are more prone to accidents.

In order to reduce the count of accidents, the respective department of government has been deploying necessary steps like sign boards, speed humps etc., these steps need an individual riders attention which is not taking place effectively. So that it is necessary to design the smart system to alert the driver about the accident zone and to control the speed of the vehicle. Using the advancement of technology a new system is designed to prevent the road accidents. There are various methods available in real time to design the system. But this paper presents two methods such as RF technology and Geo-fencing to control the speed of vehicle. In RF technology the system has two sections, transmitter and receiver. The transmitter has to be installed on the road side in accident zones, which transmits the speed limit of the particular zone. The receiver is embedded in the vehicle, which receives the data and alerts the driver about the zone to control the speed of the vehicle. In Geo-fencing, different geo-fenced area can be created by using GPS tracking software application as per the requirement with different radius. The location based values like latitude and longitude of mobile devices are keeping on updated to the server. When the devices enter the geo-fenced area, the notifications are sending

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to the controlling part of the vehicle from the server. The Controlling part in the system activates the necessary action to control the speed of the vehicle based on the notifications.

II. RELATED WORK

The chapter presents the literature review, which summarizes and interprets the existing work in the field of speed control of vehicle in accident zones. The survey of speed controlling of vehicle aims at reducing the accidents due to over speeding. The vehicle makes use of ultrasonic sensors to identify the potholes and humps by measuring depth and height of the road. The data sensed by the sensors contains the potholes depth and height of the hump of the roads respectively. The sensor works at frequency of 40 KHz [1]. Lidar sensor is used in the alternate of ultrasonic for the detection of slope shape and the camera for the detection of zebra-crossings. The Lidar sensor provides the measurements corresponding to four horizontal layers. The system has to satisfy the two conditions to detect the speed humps with zebra-crossings are; detection of slope shape and detection of zebra-crossings at the same time [2]. In order to establish the communication a RFID tags are used to read and controls the dynamics of the vehicle with gain adjustment. The RFID tags are embedded with roads, whenever the vehicle passes on it, the particular speed limit is displayed on the display plate. The speed of the vehicle is reduced according to the displayed message [3]. The range of RF communication is increased in the Zigbee devices which has better ability to operate for different frequency band (868MHz and 434MHz). The frequency band is selected on the basis Signal to Noise Ratio (SNR) for transmission [5]. The system gives a location identity with the help of on board processing unit (OBPU).

The three modules which help in controlling are the security enabling, speed control, accident detection and information sending to the module. The data regarding the location of the vehicle is acquired using GPS module and this is sent to the phone using GSM modem. Location of the place is achieved using GPS and the message is sent to police control room and ambulance services etc. [8]. The GPS unit and GSM modem, which clearly passes the information to responsible authorities by using control database server [4]. The driving support aid is an important factor presented for road safety has two phases. Phase1 includes a development of algorithm to detect hump from a single image capture from a camera. Phase2 to generate 3D view automatically to view2 the details on the road. The image has to be constantly capturing the idea behind to store memory rather than video. With the 3D view to know the details before reaching the speed hump [10]. The simple way to traffic authorities for monitoring of all the vehicles the system calculates the GPS co-ordinates to find out the area and the speed of the vehicle with respect to the area in which the vehicle has been present. In case, the speed of the vehicle exceeds the speed limit the driver is alerted through the buzzer. Also the SMS is sent to the traffic authorities, accordingly an over speed ticket is issued against the vehicles [11]. The framework of ARM microcontroller, GPS and GSM is to control the speed. The speed of the vehicle is controlled based on the obtained GPS values and GSM helps in sending and receiving the messages. The method proposed in this paper finally finds the simple way by limiting the speed of the vehicle with cost effective [13]. An attempt to control the vehicle designed with software, the system is designed in such a way that to enable the third party to get the location, speed and activity of the driver. The use of GSM/GPRS technologies allows the system to track the objects and provide the up to date information [14]. IR sensors are used to detect the speed and its output given to microcontroller which checks whether the speed is within limit the driver can switch off the alarm on the highways also in case of accidents the GPS and GSM will sent alert message to rescue team[15].

III. METHODS

The paper discuss about the two different technologies to implement the objectives. The technologies are RF communication and Geo-fencing, these are two different domains which are used to achieve the same goals. The RF technology deals with the transmitter and receiver section with an encryption and decryption to provide security to the information transmitted. The Geofencing technology consists of server and client. The server works with a principle of location based service and exchanges of information takes place with the push and pull method.

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Vol. 7, Issue 4, April 2018

A. RF Technology

- **RF Transmitter**

The Fig.1 represents the block diagram of the transmitter that consists of Arduino Uno and the RF transmitter, which has in-built encoder. The power supply for the transmitter is given from the Arduino Uno. The data from the arduino is fed to the transmitter through the encoder, where encoder encodes the data into the binary form. The encoded data is in terms of serial form. The RF transmitter, transfers the encoded data over the air medium using radio frequency signals.

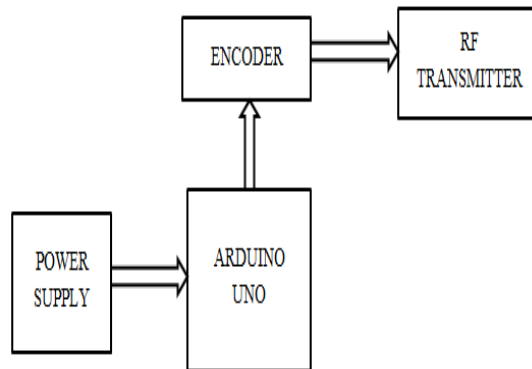


Fig 1: Block diagram of the transmitter

The RF transmitter part is installed at the road side, which transmits the encoded data in continuous manner. The transmitted data carries the information about the speed limit of the area in which the transmitter is installed. The signal is in the radio frequency range and it can reach up to the distance of 100mtrs. The transmitter has the address pins used to set the address for acknowledgement purpose.

- **RF Receiver**

The Fig.2 represents the block diagram of the receiver which consists of RF receiver, which has the in-built decoder, Arduino Uno and pair of DC motors.

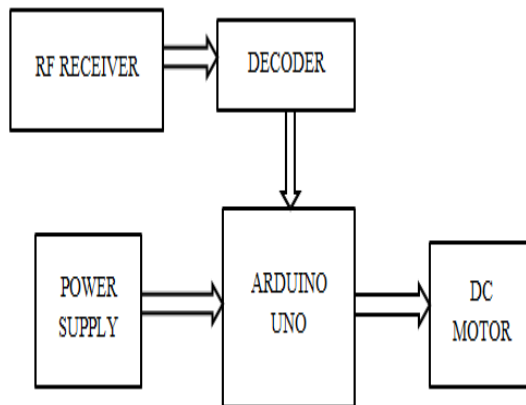


Fig 2: Block diagram of the receiver

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Vol. 7, Issue 4, April 2018

When the vehicle approaches the transmitter, the receiver kept in vehicle receives the signal. The received signal is in terms of serial is converted to parallel only when the address bits of the decoder and encoder are matched. The decoded signal is fed to the microcontroller which is in the arduino Uno. The microcontroller takes the necessary action to control the speed of the DC motors to the speed limit of that particular area.

- **Data Transmission and Reception**

The RF transmission system uses Amplitude Shift Keying (ASK) with transmitter/receiver pair operating at 433 MHz. The transmitter module takes serial input and transmits these signals through RF signals. The transmitted signals are received by the receiver module placed in the vehicle. The transmission of data takes place between the two systems through the free space, so the air acts as a medium to transfer the data. The free space is physical connection existing between transmitter and receiver. The first action is that the data in parallel form is converted to serial data form to transmit in free space in forms of serial manner. In the receiver part these data is converted to a parallel form. These conversions of data take place from one form to another in encoder and decoder. In this region where the signals are transmitted is marked as a danger zone or accidental zone, so the drivers should be careful in these regions. The particular speed limit of the vehicle is displayed on the LCD.

The system allows one way communication between the two nodes, namely transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder IC's. The encoder and decoder are HT12E and HT12D have been used respectively. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used, once the RF receiver receives the signal and decodes the serial data and retrieves the original signals as outputs. These outputs can be observed on corresponding LED. The received data of speed limit is displayed in the vehicle.

The RF technology has better prospective in other communication systems but in speed control system it has few drawbacks like one way communication, transmission range, installation and maintenance. The drawbacks of the system can be overcome by the Geo-fencing technology which is explained in the below section.

B. Geo-fencing

The implementation of Geofencing is to track, monitor and control the speed of vehicles. Firstly, the particular area has to be created as a geo-fenced area where the speed of the vehicle is to be controlled. The areas which are taken into consideration are school zone, accident zone, hospitals.

Traccar software is open and secure software used for GPS tracking. It has multiplatform and functions like server, adding devices, giving alerts, interfacing and live tracking. The traccar includes a modern fully-featured web interface with both desktop and mobile-friendly layouts, native mobile apps for android and iOS platforms. Traccar supports more protocols and device models for GPS tracking system and also it can host for many devices. An instant web notifications along with support for email and SMS, this allows for external alerting in cases of harsh driving behavior like speeding, fuel and maintenance events, geo-fencing and many other types of alerts. A vehicle embedded with a GPS can view in real time with no delay. The mapping techniques include road map which has the details of all the necessary requirements while driving like hospitals, forestations etc. and satellite imagery.

The Fig. 3 shows the block diagram of the proposed system using geo-fencing. The inclusion of a microcontroller makes the system to be a stand-alone, which has capability to take decisions to keep the system functioning properly. The system consists of GPS and GSM modules.

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Visit: www.ijirset.com

Vol. 7, Issue 4, April 2018

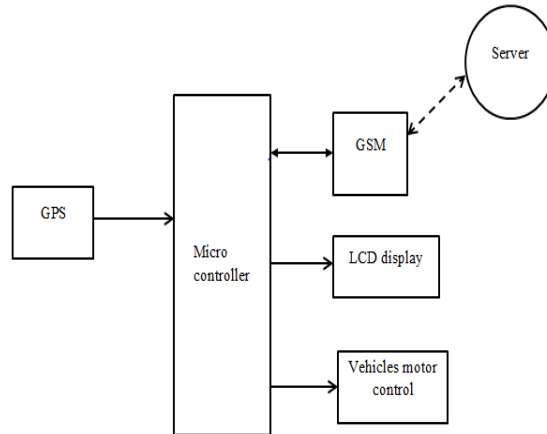


Fig 3: Block diagram of the proposed system

GPS used to keep a track on location of the vehicle, in order to get the latitude and longitude values of the location. The GPS values (latitude and longitude) of the vehicle are fed to the GSM through the microcontroller. The GSM is used to establish the communication between the system and the server and transmit the GPS values of a position to the server. The server is created to maintain the database. The database contains GPS values of the geo-fenced locations and the corresponding speed limits of those locations and the unique identity of the vehicles. When the vehicle enters the geo-fenced area the server compares GPS values of the location to which vehicle entered with the values which already stored in the server. The server sends a particular speed limit of that area only when the compared values are matched. The speed limit of the particular area is fed to microcontroller through GSM. Then the microcontroller takes necessary action to control the speed of the vehicle. LCD display is used to display the particular speed limit of that area.

Traccar software which runs on local host: 8082, it is used to map roads and satellite images. When the local host runs then it displays a satellite image of an earth surface to map. Additional features are included like devices, state, events and reports.

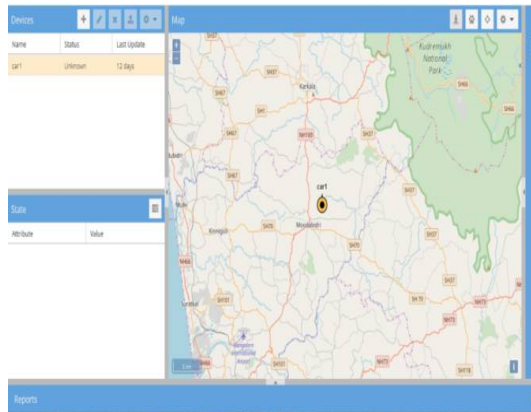


Fig 4: Image showing the geographical map.

The device can be added by giving the name with a unique identity to it. The status of the device is updated when the vehicle is moving or turned on. The device also includes some additional information which will help the driver while driving in the new place such as Devices, Geofence, Notifications, Computed attributes, Saved commands and device

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Vol. 7, Issue 4, April 2018

distance. Once the device is created it displayed on the screen. The required helplines like hospitals, fuel stations are displayed.

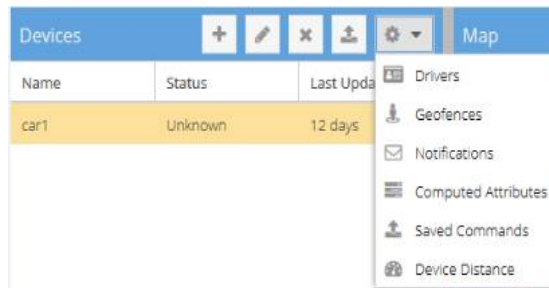


Fig 5: Creation of devices

The state is a function of open software which shows an attributes and its corresponding value. The attributes are Time, Latitude, Longitude, Valid, Accuracy, Altitude, Speed, Course, Address, Protocol, Distance; Motion and Total distance the device is covered.

Attribute	Value
Time	2018-02-13 13:08:58
Latitude	13.090000°
Longitude	75.020000°
Valid	Yes
Accuracy	0.00 km
Altitude	0

Fig 6: State of the device.

An event is a small window with information's like device, event and time. The report window also has some information like Configure, Show, Export and Clear. At first when adding a device a pop up window appear and asks for a name with a unique identity number (known as identifier). It also includes an attributes of web report colour and its value represented in hexadecimal value. If all the information has entered, cross mark is clicked to create a device. The process is continues when another device has to be added.

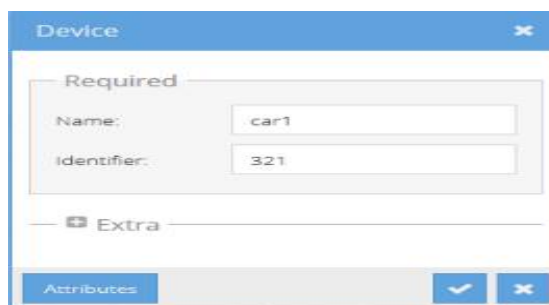


Fig7: Device identifier.

Geofencing is a feature in software application that is used to define geo-fenced area with different geometrical shapes. In Fig.8 it is shown that geo-fenced area can created using the polygonal, circle, pentagonal and polyline shapes. The circle and pentagonal shapes are used when it is required to cover more area. The polyline shape is used to map small

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Vol. 7, Issue 4, April 2018

areas. The covered area can be named with a value, which represents the colour of the boundary in web page. The three different shapes can be mapped in a single image and two methods can be drawn in same place. The covered area can be named with a suitable function. The shapes used to mapping can be representing with different attributes such as colors. Each colors having a unique color code to define or map the area. The whole area covered with a color line is considered as the geo-fenced area or mapped area.

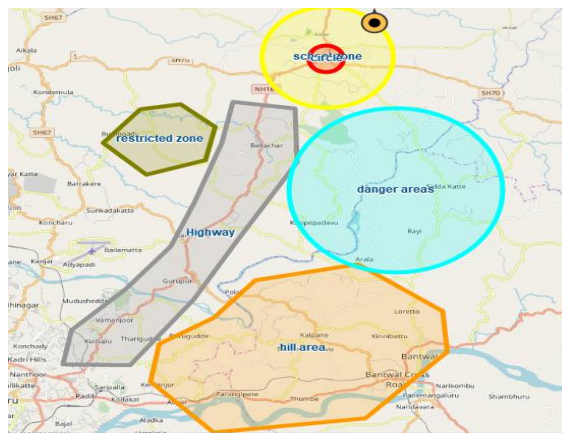


Fig 8: Mapping of an area with different shapes

The notification window shows the type of notification for the user and through which via it sends. The type of notification includes whether text message received or not, device has entered geofence and device has exited geofence. The information is sent to the selected devices through web, mail and via SMS. These specifications are selected in the notification window.

Notifications				
Type of Notification	All Devices	Send via Web	Send via Mail	Send via SMS
Text message received	Yes	Yes	No	No
Device has entered geofence	Yes	Yes	No	No
Device has exited geofence	Yes	Yes	No	No
Device is moving	Yes	Yes	Yes	Yes

Fig 9: Notification to devices

When the device is on, status of the device turns to online and the exact position of the vehicle is displayed on map with the help of latitude and longitude value. Even more number of devices can be mapped in a single layer. When the vehicle is moving the corresponding address, protocol and distance it has covered is displayed on webpage.

IV. CONCLUSION

The paper has discussed the RF communication and Geo-fencing used to alert the driver and to control the speed of the vehicle in accident zone. The speed of the vehicle is controlled according to the speed limit of the accidental zones, which is done through RF communication. The RF system is one way communication in which transmitter only sends the required signals. There are few drawbacks in the RF communication are range of system is less, transmitter

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 7, Issue 4, April 2018

maintenance and more installation cost. In order to overcome from these drawbacks, another method called Geo-fencing is employed to implement to proposed system which is discussed in this paper. The Geo-fencing system is more accurate, secure and also has extra features. The RF transmitter is been replaced with software application, which provides two way communication between server and vehicle.

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