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Position Matching Based Autonomous Speed Regulation System for Vehicles

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Abstract: **A novel approach for creating an advisory/regulatory environment to limit the maximum running speed of the vehicle is presented. This paper deals with creating an onboard speed regulation module for vehicles which can monitor as well as control their instantaneous speed in comparison with the maximum permissible speed of that location. The location is obtained using position tracking technology of GPS system. The work discusses the unique position matching algorithm developed and design details of the proposed on- board module for limiting vehicle's speed. The algorithm continuously compares the actual speed of the vehicle with its corresponding location based limits obtained through the developed database and thus provides: a) an advisory signal to the driver about the need for a reduction in speed. b) An automatic restriction of the speed below the prescribed limits. The algorithm matches the position with the geographical zone already defined in the database and compares the actual speed with the limit of the corresponding zone on an intermittent basis, depending on the execution time of the processing cycle. The algorithm developed tracks the vehicle position using data acquired from GPS receivers which lead to increased efficiency, reduced complexity and processing time in contrast to the conventional methods.**

Keywords: **Speed Regulation System, Position matching, Vehicle Automation, GPS Tracking.**

1. INTRODUCTION

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called ―firm ware . The desktop/laptop computer is a general purpose computer. You can use it for a variety of applications such as playing games, *word* processing, accounting, software development and so on. In contrast, the software in the embedded systems is always fixed listed below:

Embedded systems do a very specific task; they cannot be programmed to do different things. Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property. Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low.
Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity.

2. EXISTING SYSTEM

India holds the distinction of registering the highest number of road accidents in the world. Of all the causes, exceeding the posted limit or driving too fast is one of the most prevalent factors contributing to traffic crashes therefore actions are required to properly monitor and regulate the vehicle speeds. We introducing new technique in this application and cost are less to prevent using this.

3. PROPOSED SYSTEM

In this project, we are discussing position matching based autonomous speed regulation system for vehicle, we using ARM processor, GPS Modem, LCD, relay to operate device. In this vehicle section we get a GPS value from satellite continuously and display in LCD Modules if vehicle meet the Pedestrian zone having a fixed GPS modem and transmit the value to the vehicle help of zigbee wireless and we compared and check its same zone means microcontroller automatically reduce the speed of vehicle and if the vehicle has passed Pedestrian zone means that should be increase previous speed limit Because of we are avoiding the accident in zonal limits

The proposed system uses both GPS and GSM for retrieving the position of a moving vehicle without involving any additional infrastructural requirements except the receiver module:
i) GPS (Global Positioning System): It is the only fully functional Global Navigation Satellite System that uses a constellation of at least 24 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS

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receivers to determine their location, speed, direction, and time.

ii) GSM: Position is retrieved using the Mobile positioning Technology (used by telecommunication companies to approximate where a mobile phone, and thereby also its user, temporarily resides). Considering an ideal GSM hexagonal cell structure system which operates by dividing the complete area of operation into hexagonal cells and a unique group of cells (variable in number) is called a Location Area and is identified by a Location Area Code (LAC). Each cell has a transmitting tower at the centre which further has 3 antennae mounted on it, aligned at 120° to each other and having a unique cell id. In urban areas, constructions such as high buildings, ramps and tunnels obscure the line of sight to the satellites, which may result in signal multipath or even a loss of signal. This increases the positioning error or might lead to a complete blackout where no position is provided [2]. To avoid a total loss of positioning, in our system GPS is coupled with a GSM receiver because of the following considerations. Firstly, the position accuracy which is required for the kind of an application mentioned is provided with a combination of GPS and GSM with far less complexities as compared to using only GPS. As speed limits are uniform for a region (i.e. a set of co-ordinates) the application would be unnecessarily forced to group a set of co- ordinates falling in the same speed zone, whereas the GSM straight away provides a region (cell) of presence of vehicle which can be in itself considered as a speed zone. Although, GSM alone is also not sufficient enough due to a large number of speed zones falling inside a cell due to its large span. Secondly, GPS unit performance highly depends on the positions of the satellites in the sky and their visibility from the vehicle location. GPS accuracy is expressed in a few attributes available from GPS receiver (SAT – number of satellites visible, HDOP – Horizontal Dilution of Precision, and FOM – Figure Of Merit). If any of these parameters exceeds a certain threshold value, the probability of correct position matching is very low.

In urban areas, the GPS signal can be blocked by tall buildings, in that case the location obtained from GSM can be utilized as in no scenario can a GSM signal be blocked. Moreover, if GPS alone is used a digital road network [2][4][5], comprehensive speed limit information is required which in turn needs to be frequently updated, whereas using both GSM and GPS eliminates the need of digital road network (explained in subsequent sections) which in turn leads to a reduction in memory requirements for maintaining the database. A rewritable and replaceable storage device is integrated with the module in which a unique structure of database developed is stored and can also be updated when required as shown in Fig 2. The database comprises of set of LACs which further consists of some finite number of cells each identified by a set of three cell id's representing the sectoral distribution of the cell. Each hexagonal cell is further divided into six similar and equilateral triangles referred as the speed zones. Every speed zone is identified by the GPS co-ordinates (latitude and longitude) of its geometrical centroid. Each speed zone is assigned a speed limit value which is the most favorable for that respective speed zone.

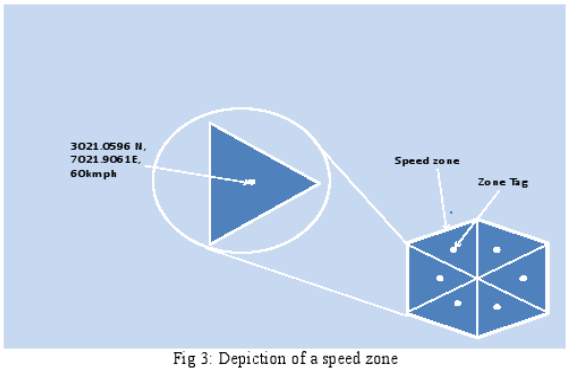
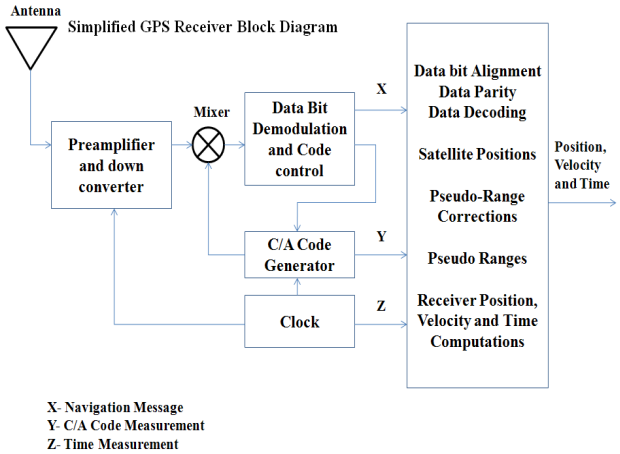


Fig 3: Depiction of a speed zone



4. RESULT

If the acquired GPS data is non-reliable , time since the data remains non-reliable is computed (t) and it is further compared with predefined threshold value (t th) . If the non-reliable time (t) is less than the threshold time, then reacquisition of location data is done and the process starts from beginning else minimum speed limit value out of the different available values from speed zones of the corresponding cell is obtained and considered as end product of the position tracking algorithm. Critical Speed Point (CSP): A functionality for maintaining an extra vigil on vehicle speeds at some critical locations such as schools, hospitals etc. is added in the algorithm. For this purpose the database would include additionally (below the speed zone (in which it lies) in hierarchy) the co-ordinates of the critical point and a range along with it. Thus, if vehicle is in a speed zone which also has a CSP in it, the algorithm will further check if the vehicle is within the stored range of the CSP or not and will accordingly define the allowed speed.

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Fig. 7. Actual GSM tower position and zone tags marked on the road map of the region.

5. CONCLUSION

India is the worst hit country in terms of the number of road accidents occurring annually and mostly they are caused due to over speeding of vehicles. There is an urgent need to put a system in place which can automatically restrict the top vehicle speed according to the speed limit regulation of a particular speed zone, thereby minimizing accidents due to over speeding. The system proposed in the paper is a fully functional automatic speed regulation system which is a step ahead of presently available speed controllers in terms of efficiency accuracy and simplicity. The algorithm used for position matching and subsequent speed limit extraction is the first of its kind relying on both GSM and GPS input signals, complementing each other and thus avoiding limitations of using them individually for position tracking. The algorithm also takes special steps to validate the inputs before actually using them and also makes sure that it does not halt its output in case of inputs not being reliable. A self assessment check is also done by the algorithm and in case of dispute, restricts itself from proceeding and starts processing with new inputs. It also has a special provision for limiting the speed in sensitive areas without affecting the speed limits of the complete speed zone in which the place of concern lies. If this system is made compulsory for all vehicles, a noticeable decrease in the number of road accidents would be seen and thus reducing a heavy loss of life and property in the country.

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