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Research Article

Highway Adaptation-Based Car Safety Application Based onGPS and GMS Technologies

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Abstract

The majority of collisions occur owing to a lack of prior knowledge aboutthe driver. Drivers are sometimes intrinsically distracted, which leads to serious highway speed limit zone accidents, particularly in universities, schools, hospitals, and workplaces. To avert crashes, preparatory information regarding the speed restriction zone is communicated with the motorist in this study paper. This study provides a highway adaptation-based car safety application based on GPS and GMS technologies. While crossing the speed limit zone, this system is designed with a low cost to figure outcollision avoidance in advance by properly informing the driver with a beep sound and showing the word "Go Slow" on the dashboard. On the roadway suited for real-time application, the suggested real-time system is tested and appraised. Furthermore, the suggested system considers that rapid braking causes mechanical stress, chassis damage,and low fuel usage, making passengers in the car unpleasant, and so provides a substantial benefit over vehicle safety systems.

Keywords: Accidents, Speed Limit Zone, GPS, GMS Automotive, SafetyApplication.

1 Introduction

Based on the current Association for Safe International Road Travel (ASIRT),—nearly 518 billion $ are spent yearly. As per ASIRT, the majority of accidents are affected by distracted driving and motive on the highway. Many research articles disclose automotive security systems using Global Positioning System (GPS) and Global System for Mobile communications (GSM) technology. As an initiation, the research paper [1] reveals the location of the automotive vehicle for anti-theft application using GPS and GSM Technology. Similarly, [2] fine-tune the accuracy of GPS for vehicle localization via INS-Assisted single RSU. The research paper [3] approaches the design model for Traffic alert and collision avoidance systems using GPS Technology. The Vehicle tracking systems [4] enhances the utilization of GPS Technology in real-world

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applications. Subsequently, the women's security system [5] is employed using GPS and GSM Technology.

Furthermore, the research [6] models an efficient, low-cost tracking system for real-time implementation. Many research techniques to wireless network security systems are described in detail [7, 8]. Following that, an adaptive speed strategy modelled in [9] determines the appropriate speed to prevent collisions in dynamic road circumstances. For the multi-mode application, the study [10] approaches the same adaptive speed. Finally, intelligent speed adaptation helps to the research [11] for intelligent Speed, which is more suited for real-time applications.

Furthermore, the technology suggested in this study contains a worldwide information database, as well as predetermined longitude and latitude values of the speed restriction zone. As a result, the offered analysis analyses both GPS data (i.e., the vehicle's actual location) on the road and predetermined values stored in the Microcontroller's memoryat the same time. When the vehicle reaches a certain speed limit zone, the driverreceives an alert.

2 Implementation

The suggested research's major purpose and goal are to inform about speed restriction zones by capturing latitude and longitude (i.e., current position) of the vehicle using a GPS receiver and comparing it to speed limit zone data. To put the suggested systeminto action, a combination of hardware components such as the SR-87 GPS receiver and the 8051 microcontroller is required.

Flash Kit, 5x7 Dot Matrix LCD, and RS232/Serial Port Connector are required for the inexperienced driver in a speed restriction zone. The programme is coded using the KEIL C Compiler (micro vision 2) and Flash Magic software. The Global Positioning System (GPS) is a satellite-based navigation system. This radar system actively delivers location, navigation, and timing services in all weather circumstances, including day andnight, and anywhere on or near the ground surface. The GPS system uses geometric trilateration to determine the vehicle's position on the planet [12].

Furthermore, the complete system provides 24 satellite vehicles, six orbital planes separated by 60°, inclined 55° with respect to the equator, and at an elevation of roughly 20,200 km above the Earth. GPS's principal job is to transmit time, almanack, and ephemeris data to the user segment, i.e., GPS receiver. The GPS receiver in the vehicle detects its location using digital signals transmitted by GPS satellites in orbit. There are two types of GPS receivers: non-self-contained receivers (on-screen) and self-contained receivers (off-screen). In the suggested systems, the Not-self-contained receive is utilized, which is often used in vehicle navigation systems [13].

2.1 SR87 GPS Receiver

The SR87 GPS receiver serially acquires and records the vehicle's latitude, longitude, and speed, as shown in Fig. 1. This module communicates with the system application through RS232 using the NMEA-0183 protocol (TTL level). As a general rule, the SR- 87 GPS receiver is applicable to a wide range of applications, including handhelds, PDAs, PPCs, and GPS. To improve organizational performance while minimizing dimension and energy utilization, the SR-87 design employs cutting-edge surface mount technology and high-level circuit implementation. The SR87 GPS Receiver sends information in the form of NMEA phrases [14].

Fig. 1. SR87 GPS Receiver

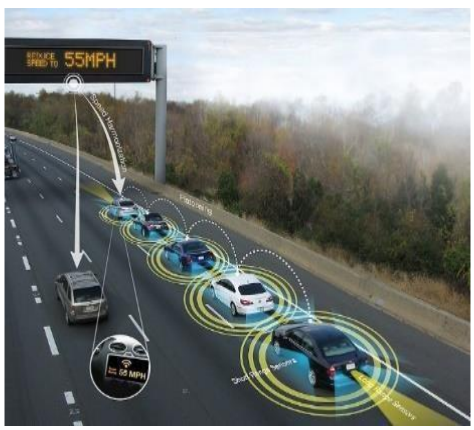


Fig. 2. GPS data

2.1.1 NMEA Standards

The National Marine Electronics Association (NMEA) has created a piece of marine electronic equipment that provides a line of data with the sentence type $GP for GPS receivers, as shown in Table 1. Figure 2 depicts some of the data lines provided by GPS devices.

Table 1. NMEA-0183 Message format

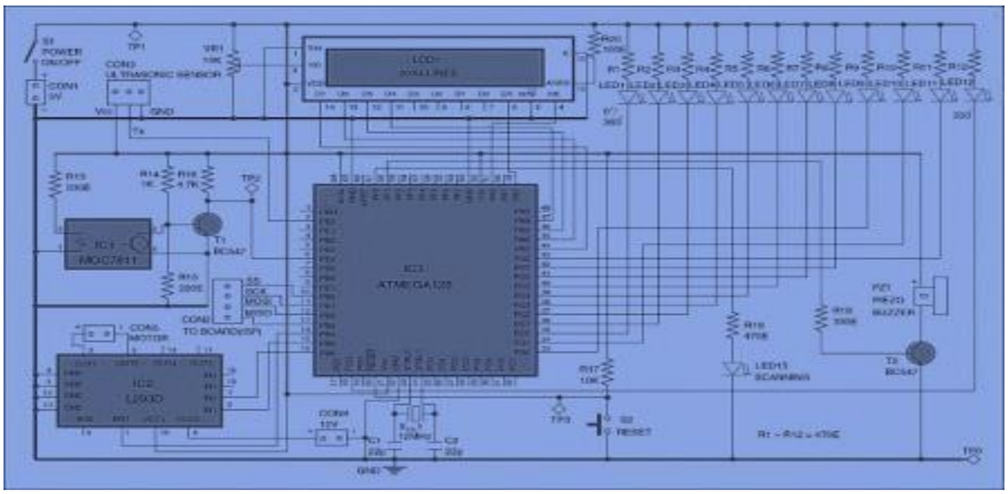
NMEA	Format
$GPGGA	Data on historical, location, and solve type
$GPGSV	Display satellite systems
$GPRMC	Lowest binding GNSS data requested
$GPVTG	Acceleration, airspeed indicator, and course over the ground are allfactors to consider

2.2 UE-FMC51

The UE-FMC51 is a digital circuit that provides a wide range of integrated 8-bit 8051 (with on-chip ROM) circuits. The UE-FMC51 is intended for R&D laboratories in industries and is powered by a PHILIPS P89V51RD2/ED2 microcontroller with 64 Kb of on-chip programme memory for developing real-time applications (Fig. 3 and Fig. 4). The step-by-step algorithm for driver alert system,

1. GPS receiver transmits serial data to the controller, which incorporates the vehicle's current position (i.e., latitude and longitude).
2. The controller has to grab out exact latitude and longitude values.
3. Compare the actual GPS of the vehicle with predefined values (dumped into Microcontroller).
4. Warning information must be given to the driver if the Actual value is within therange of predefined values.

Fig. 3. UE-FMC51 Microcontroller Circuit Board



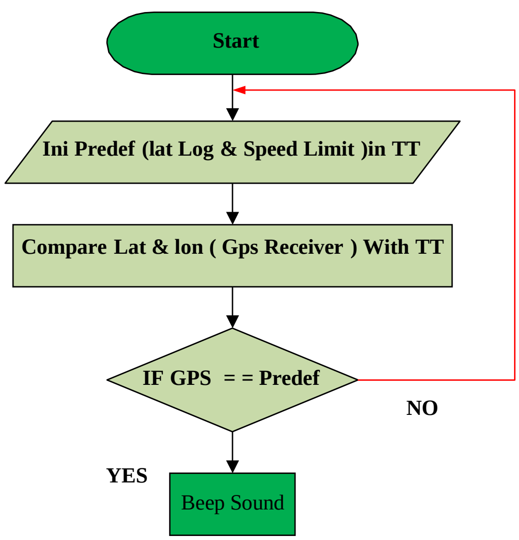


Fig. 4. Flow Chart for driver alert system

Fig 5. Oriole's Display Module

2.3 Oriole's Display Module (ODM)

The Oriole's Display Module (ODM), a dot-matrix LCD that displays alphanumeric and symbol data, is seen in Fig. 5. The board incorporates the HD44780U LCD controller and driver LSI alphanumeric, Japanese kana characters, and symbols. The display takes the vehicle's GPS coordinates from the serial data transmitted by the GPS Received.

3 Functional and Hardware Interfacing

The GPS receiver delivers serial data (NMEA) to the 8051 microprocessors via RS232, according to the automated system. As illustrated in Fig. 6, the controller is linked to mobile-related data and uses it to set the starting settings, displaying results on the LCD with a buzzer sound if predetermined longitude and latitude variables are fulfilled.

The hardware interface in Fig. 7 connects a GPS receiver, a microcontroller, and a display unit to provide a driver alert when approaching a speed restriction zone.

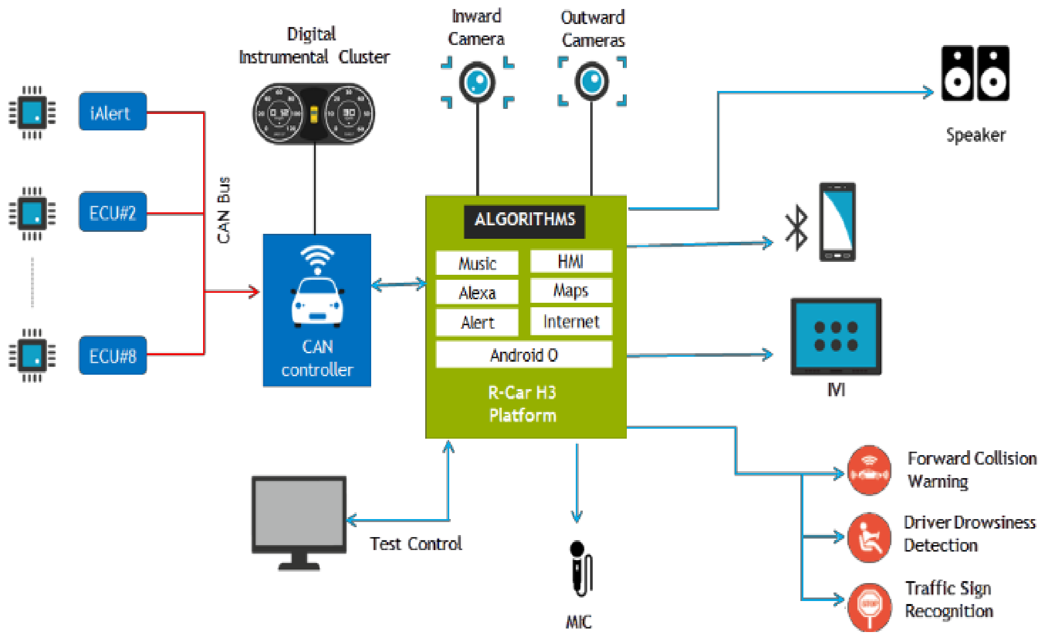


Fig. 6. Functional Block Diagram of Proposed System

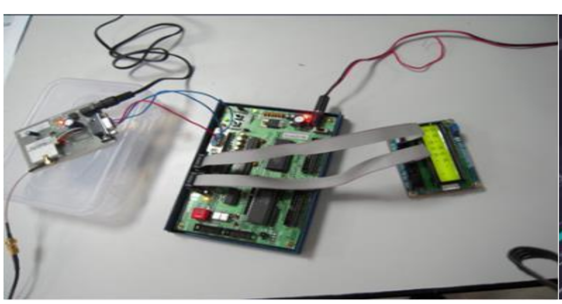


Fig. 7. Hardware Interface

Fig 8. Actual data on highway road

4 Analysis of Speed Limit Zone

The real data collection assists us in determining the speed restriction zone by highlighting the range of values required to reach preset values, i.e. (min. latitude valueof 1258.07 to the max. latitude value of 1258.09 min. longitude value 07909.0 to the max. longitude value of 07909.03). The college zone was specified as preset latitude and longitude values at the speed restriction zone, and an algorithm was proposed in this study, as illustrated in Fig. 8. Fig. 9 depicts GO SLOW when the actual value is within predetermined limits at the speed restriction zone. The study of driver information in the speed limit zone is provided in Table 2.

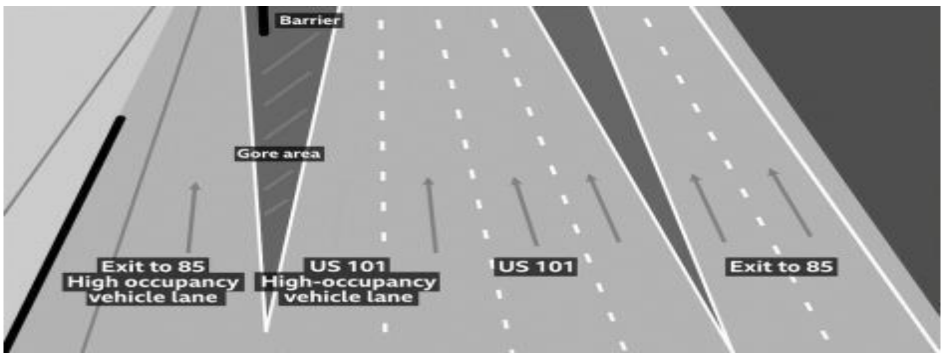


Fig 9. Speed Limit Zone

Table 2. Different zones and their relative information to the driver

Zone	Location	Predefined Range	Driver Dashboard
Non-speed limit zone	Latitude = 1258.07 Longitude = 07909.8	Latitude=(1258.07-1258.09) Longitude=(07909.0-07909.3)	Go
Speed limit zone	Latitude = 1258.07 Longitude =07909.2	Latitude=(1258.07-1258.09) Longitude=(07909.0-07909.3)	Go Slow (Below 20 *km/h*) Speed limit Zone
Non-speed limit zone	Latitude = 1258.10 Longitude = 07909.9	Latitude=(1258.07-1258.09) Longitude=(07909.0-07909.3)	None

5 Conclusion

Motorist alert in speed restriction zone using GPS and GMS Technology informs the driver about the speed limit zone in advance using GPS and GMS Technology. The suggested system is a low-cost, high-performance algorithm for vehicle safety applications. As a result, the suggested system prevents exceeding the speed restriction zone by providing the driver with alarm information. When a motorist is new on the road and does not know where the speed brake is located, this method will come in handy. Sudden braking causes mechanical stress, chassis damage, and low fuel usage; uncomfortable passengers in the car may be barred from utilizing the suggested system to ensure a safe driving.

6 References

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