

Wireless Accident Information System Using GSM and GPS

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Abstract: This study discusses about designing a Smart Display and Control (SDC) which will monitor the zone and maintains the specified speed in the zone levels, which runs on an embedded system. This system includes three modules; automatic speed control module, accident detection and information sending module and security enabling module. Automatic speed control module includes RF transmitter placed in specific location and RF receiver in the vehicle. Accident detection module includes GSM and GPS technology. Security enabling module includes sensory units which ensures the condition of seat belt and the driver. This module includes alcohol sensor and eye sensor. The smart display and control is composed of two separate units: Zone status Transmitter unit and Receiver (speed Display and Control) Unit.

Keywords: Alcohol sensor, eye sensor, GPS, GSM, PIC microcontroller, vibration sensor

INTRODUCTION

Nowadays accidents occur in all the places but major accidents occur in school zone and college zone. Because of high speeding of vehicle. The main objective of the system is to provide security for the vehicle user and also detects the accident if occurred and informs the respective authority through wireless technologies. If any accident occurs in highway or any other place. the accident information system will get activated and message will be transmitted to respective authority (Rajesh *et al.*, 2010). Statistical report says that the accident occur due to the following reasons; drunk driver not using the seat belt properly. This system will check all these things before the vehicle starts. This automatic accident detection system will overcome the above mentioned problems in an effective way. Present system checks only the seat belt condition and lacks much security constrains.

According to this system, whenever a person sits in driver seat of the vehicle, the system checks for the following parameters with the driver. The Alcohol sensor, which checks if the person has consumed alcohol or not. The eye sensor makes sure that the person in driver seat does not falls asleep. In case of any accident, the vibration in vibration sensor increases beyond the limit and information is sent to GSM module. The GSM can send message to respective authority. Thus this system ensures the life security.

Overview of the system frame work: In this design process three modules were used, automatic speed control module, accident detection module and security enabling module. In automatic speed control module the RF transmitter and RF receiver are to be used. The wireless Transmitter can send the data up to 100 feet away from

the vehicle. The RF module used here operates with a carrier frequency of 418 MHZ within the 260 MHZ to 430 MHZ RF Spectrum (unlicensed Spectrum) thus avoiding any FCC (Federal Communication commission) charges or regulations. The RF transmitter is placed in a specific location and RF receiver is placed in vehicle. When the vehicle reaches the zone like school zone or U turn, it will automatically reduce the speed and when it leaves the zone it will automatically regain its speed. From this the occurrence of accidents will get reduced. In information sending module GSM, GPS and vibration sensors are used. In this system, the vibration sensor, GPS and GSM is placed in the vehicle. If an accident occurred the vibration sensor senses the vibration level and if it exceeds the threshold limit, the system will consider that there is an occurrence of accident in that particular location. Then the system will activate the GPS to gather the location detail and sends the location of the vehicle through GSM to the control station. Security enabling module includes eye sensor and seat belt detector which will ensure the security condition of the driver.

Nowadays the accident occurs due to a drunken driver and improper use of belt. The main cause of accident is due to the driver drowsy and tired condition, which will be noticed by the help of eyes sensor which will not start and also informs the status of the driver to the base station along with the vehicle ID.

PROTOTYPE DESIGN

Transmitter design: Figure 1 shows the transmitter module. Transmitter module is placed in the specific zone. Transmitter and receiver both operate at a frequency of 430 MHZ. transmitter receives data serially and sends the data to the receiver continuously. The RF transmitter is

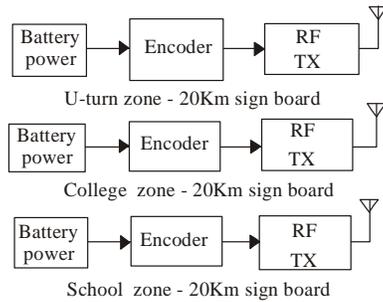


Fig. 1: Transmitting module

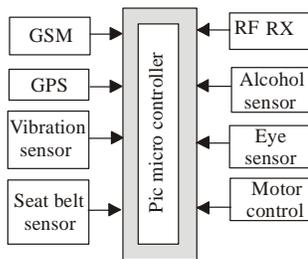


Fig. 2 : Prototypic design of accident detection, speed control and security module

placed in zones like school zone, college zone, U turn. When the vehicle reaches those zones, it will automatically reduce the speed (Ben Carroll *et al.*, 2010) to 20 KM. When the vehicle leaves the zone it will regain its speed. The receiver module is placed in the vehicle. When the signal from transmitter is received it will decode the encoded data and indicate the controller to reduce or limit the speed of the vehicle

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Receiver design: Figure 2 shows the receiver prototypic design. The RF module consists of RF transmitter and RF receiver. The RF module has an encoder in transmitter and decoder in the receiver. The encoder is used for encoding the parallel data for transmission while the reception is decoded by decoder in the receiver. The RF receiver is connected with PIC microcontroller. The RF receiver will be always in listening state, if it receives any signal of same frequency as of receiver, it will automatically indicate the controller which in turn reduces or limits the speed of the vehicle until the vehicle leaves that particular zone. From this, the accident in school and college zone will get reduced. The accelerometer is connected with microcontroller and placed in vehicle. If any accident occurs in the highways, the accelerometer

sensor (vibration sensor) will indicate the controller and controller will in turn transmit the message to the hospitals and police stations through GSM technology.

The message will contain the details of vehicle number, place of accident which was gathered using GPS. The function of Global Positioning System (GPS) is the most promising technology to acquire the position information in outdoor environments. In recent days most of the accident occurs due to drunken driver and improper use of seat belt. Before the vehicle starts the driver will be checked by the alcohol Sensor. Also if the driver is not wearing the seat belt it will also indicate it and also will not allow the driver to move the vehicle.

Design process: In automatic speed control module RF nodes are used, the RF module consists of RF transmitter and RF receiver. The RF transmitter is used for the transmission of data the a rate of 1 to 10 kbps it will operate at a frequency range of 430 MHZ. RF transmitter is placed in specific zone and RF receiver is placed in the vehicle. The RF receiver also works with same frequency. The transmitted data which is sent by RF transmitter is received by the receiver and is validated. Accelerometer sensor (vibration sensor) is connected to the port A, which will provide analog value to the ADC port of controller. The GSM is interfaced to PIC microcontroller.

PIC controller used here is PIC16f877A. It has got five ports namely PORTA, PORTB, PORTC, PORTD and PORTE. PORTA and PORTE are meant for analog input data. PORTS B, C and D are used for input and output purpose. The purpose of GSM is for sending the message to police, ambulance and relatives. The GSM will communicate via the UART communication through RS232 standard. The GPS suits best for vehicle location or tracking. To know the location of vehicle GIS software can be used. Alcohol sensor is connected to port A which will indicate if the driver is in drunken state and will not allow the vehicle to move. Seat belt detector is also used to detect whether the driver is wearing the seat belt or not and an eye sensor will monitor the drivers cautiousness constantly.

LCD is connected to port B of the controller to which all data pins of LCD are connected. The alcohol sensor is connected to port pin RA0. The eye sensor is connected to RA1. Vibration sensor is connected to RA2. RA0, in that 1, 3 pins take as the analog inputs from sensors and convert them to digital values. The alarm circuit is connected to port D. GSM, GPS and RF modules are connected to TX and RX of PIC microcontroller.

The Fig. 3 shows the flow diagram of the overall system. First step in that process is alcohol detection and seat belt detection. The alcohol sensor and seat belt

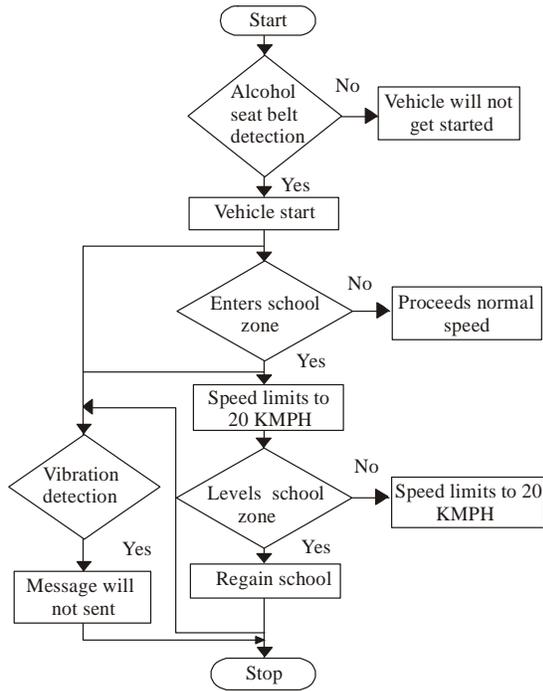


Fig. 3: Flow diagram of overall system



Fig. 4: Vehicle speed control module

detectors are used to find out the status. If these sensors find any abnormality, it will immediately alert the driver and will also not allow the vehicle to start. Next step after successful validation of the status of driver, the vibration detection and RF reception module will get initiated.

When the vehicle enters the school zone or any public zones where the vehicle has to maintain a particular speed, the RF transmitter will send the signal indicating that there is a school or college in that zone. The transmitted signal will be received by the RF receiver and alert the controller immediately, which will in turn reduce or limit the vehicle speed to 20 Km/h in that particular zone. After the vehicle leaves the particular speed limit zone it will automatically regain its speed. If the moving vehicle meets with an accident the vibration sensor interfaced with the micro controller will detect the vibration and indicate the

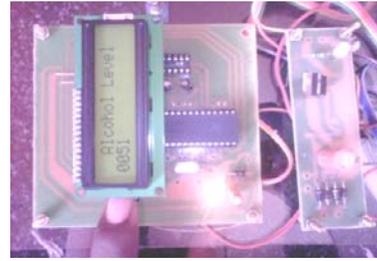


Fig. 5: Sensory unit

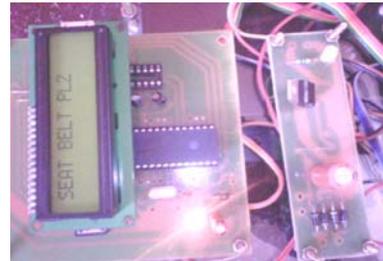


Fig. 6: Seat belt detection

controller which will immediately activate the GPS (Wu and Shenzhangyi, 2011) and collects the location detail and sends the message to the respective numbers stored in that controller (the number may be hospital or police stations number).

EXPERIMENTATIONS AND RESULTS

Figure 4 shows the prototypic model of the vehicle enabled with RF module, Alcohol sensor, GSM, GPS and Seat belt detector. Figure 5 and 6 shows the alcohol level indication and the seat belt off indication.

CONCLUSION

This study solves the issues like automatic speed control mechanism, accident detection and information sending. From this we conclude that this system will reduce the accidents and save the human lives. On the whole this system proves to be very cost effective and efficient. The experimentations and results prove that the system is easily implementable in real time. This system can also be extended by inducing automation concepts like automatic driverless vehicle system, inter vehicular communication etc.

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