Advance Security System for Automobiles Using Flex Ray

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Abstract - Road safety is emerging as a major social concern around the world especially in India. The main objective of this paper is to bring down the number of accidents in real-time using Embedded System platform at a low cost. The system in the vehicle section consists of GPS receiver, GSM modem, Sensors, ARM7 Controller. This Vehicle Security System designed using FlexRay protocol aims in avoiding occurrence of road accidents and helps in detecting the location of accidents. Drinking and driving is a serious public health problem, which is likely to emerge as one of the most significant problems in the near future. Hence we have included Alcohol Detection which serves as a means of self detection for the alcoholic content in driver's breath. In case of occurrence of accident, the GSM modem sends a message to the concerned person about the same. Added to this the location of the accident could also be conveyed to the concerned person by the virtue of GPS receiver which gets the latitude and longitude values of the location from the satellite. Thereby the feature of Accident Detection is accomplished.

Keywords–GPS, GSM, FlexRay, ARM7 Controller, Vehicle Security System.

I. INTRODUCTION

In this fast moving world, new technologies are evolving for the betterment of human life style. There has been an enormous advancement in automobile technologies and the advancement is still taking place. These technological advancements have made our life more comfortable. Nowadays, the numbers of accidents have gone up in number. The accidents occur due to increased vehicle density, violation of rules and carelessness. Shockingly, India ranks 7 in the list of road accidents all over the world. Hence in our project we have proposed few concepts to minimize accidents that may happen due to the above mentioned reasons. A total of 3,94,982 accidental deaths were reported in the country during 2012(4,098 more than such deaths reported in 2011) showing an increase of 1.0% as compared to 2011. Correspondingly, 0.3% increase in the population and a marginal rise of 0.9% in rate of 'Accidental Deaths' were reported during this year as compared to2011.

Number of Accidents, persons killed & injured as per road classification (2009)

Road Classification	Total	National Highways	State Highways	Other Roads
No. of Accidents	486384	142511 (29.30)	115992(23.85)	227881(46.85)
No. of Persons Killed	125660	45222 (35.99)	34093(27.13)	46345(36.88)
No. of Persons Injured	515458	152816(29.65)	131517(25.51)	231125(44.84)

Source: Transport research wing

Fig.1.1 Number of accidents

The paper is organized as follows. Section 2 gives a brief working principle. Section 3 gives the module in the Vehicle Security System. Section 5 gives the simulation results, Section 6 presents the conclusion of our paper and section7 focuses on the future enhancements.

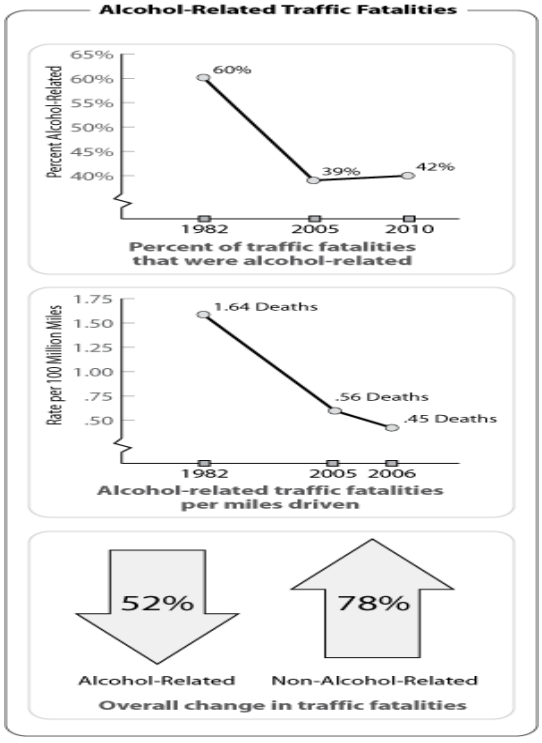

Fig 1.2 Alcohol-Related Traffic Fatalities

II. WORKING PRINCIPLE

In our prototype model which we have designed, we have included a brake checking mechanism and seat belt checking mechanism. The alcohol sensor checks if the driver is alcoholic or not. If there is excess pressure then it is an indication that accident has occurred. The LCD displays a message that the accident has occurred. Meanwhile the concerned person is informed of the accident occurrence by sending him a message using GSM network. GPS module helps to know the exact location of the accident. The temperature sensor displays the values of temperature that it senses which is displayed on the LCD display. The feature of obstacle detection is accomplished using IR sensors.

III. VEHICLE SECURITY SYSTEM

ARM architecture has evolved to include architectural features to meet the growing demand for new functionality, high performance and the needs of new and emerging markets. The LPC 2129 is a 16/32 bit ARM7TDMI-7 microcontroller in a tiny LQFP64 package. It has 16kB on-chip static RAM, 128/256 kB on-chip flash program memory, 128 bit wide interface with 60 MHz operational speed. The basic LPC 2129 chip includes a number of peripheral I/O devices including two 32-bit timers, PWM unit, Real time clock, WatchDog and 2 UARTs. It has **Harvard architecture**[1]. The ARM7 controller is connected to the GPS receiver and GSM modem using MAX232. **GSM SIM300**[2]is a module that connects to the specific application and the air interface. SIM300 can be integrated with a wide range of applications and functional components. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control.GPS is a satellite based **Global Positioning System** [3]. It mainly has 3 segments namely Space (24 satellites), Control and User segments. Working of GPS: Position of the Satellites is usually known. The satellite provides an "electronic almanac" to the receiver. The speed of the radio signal from each satellite is known. Timing allows the calculation of the distance from each satellite. Using triangulation, the position of the receiver is calculated. Measurements are possible when each satellite sends information on its location and the time code. It sends a code that allows the measurement of the distance to the satellite. If 4 satellites are visible, a single receiver can measure locations to within 100 meters and 95% of the time.GPS measurement yield only a position, and neither speed nor direction. **L293D IC** [4] is a dual H-bridge motor driver IC which can drive two motors simultaneously. One H-bridge is capable to drive a dc motor in bidirectional. L293D IC is a current enhancing IC as the output from the sensor is not able to drive motors itself so L293D is used for this purpose. L293D is a 16 pin IC having two enables pins which should always be remain high to enable both the H-bridges. GSM is connected to port pins of UART 0 i.e., P0^0 serves as transmitter and P0^1 serves as receiver.GPS is connected to port pins of UART 1 i.e., P0^8 serves as transmitter and P0^9 serves as receiver.

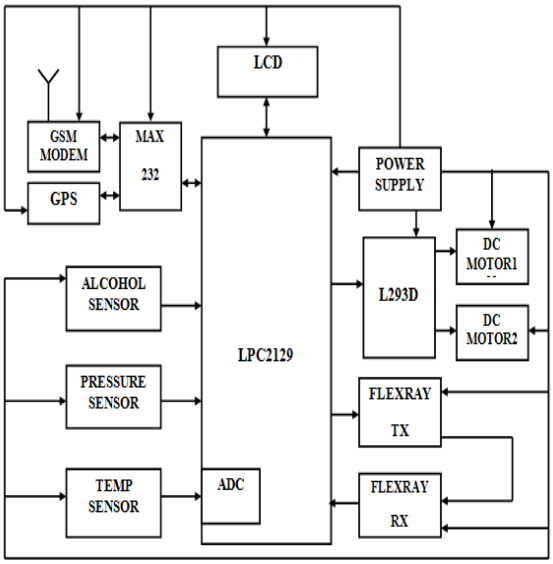

Fig.3.1 Block diagram of Vehicle Security System.

Initially the module is required to carry out two preliminary tests namely the brake test and the seat belt test. Once these tests are satisfied the driver has to undergo alcohol test. The driver has to wear a mask and blow into the **MQ7**[5] alcohol sensor placed in the mask which senses the presence of alcohol content in the driver's breath. If any traces of alcohol are sensed, then the motor doesn't allow the ignition system of the vehicle to turn ON. If the driver is not alcoholic, then the motor turns ON the vehicle. The module also helps in detecting the objects which are very close to the vehicle by distributing the IR sensors over a number of locations on the car. These sensors are capable of detecting any object present near the car at a distance of 10 cm. There are 2 LEDs one for transmission and the other for reception. Whenever the sensor detects a nearby object/vehicle then the LED emits light. If the radiation is reflected back it implies that an object is there at a distance of 10 cm. The driver can take necessary action which helps in avoiding accidents. This task is accomplished in the real-time by means of Ultrasonic sensors which are available with many sophisticated features. The pressure sensor comes into picture when accident occurs. We have designed our prototype model such that if there is excess pressure then it is an indication that the accident has occurred. The LCD display displays a message that the accident has occurred. Meanwhile the concerned person is informed of the accident occurrence by sending him a message using GSM network. The message not only informs the

concerned person about the occurrence of accident but also the exact location of the accident by virtue of GPS module. At a time the message could be sent to more than one person. In our prototype model the temperature sensor displays the values of temperature that it senses which is displayed on the LCD display but has no role in indicating that the accident has occurred.

IV. FLEX RAY Protocol

FlexRay[6]is an automotive network communications protocol developed by the FlexRay consortium to govern on-board automotive computing. It is designed to be faster and more reliable than CAN and TTP. FlexRay is a set of ISO standards. The prominent features of FlexRay are High data rates upto 10Mbps, Time and Event triggered behavior, Redundancy, Fault–tolerance, Deterministic. **FlexRay frames**[7] are divided into three segments, the header segment, payload segment, and the trailer segment. The header segment consist of 5 bytes and contains information such as: Some information about the purpose and the content of the frame, like if it should be used for clock synchronization, if the payload section contains any valid data, if the frame should be used as a startup message to some node, or if it contain network management information. The frame ID which determines in what slot the frame should be transmitted. The length of the payload segment. A cyclic redundancy check for the header, which is a type of hash function used to detect accidental data changes. The payload frame segment consist of 0 to 254 bytes of data depending of the size of the message a node wishes to send, the payload segment may contain a network management vector. The FlexRay frame trailer segment is a 24 bit cyclic redundancy check that is calculated over the two previous segments, the header and the payload parts of the frame in an attempt to find errors in these fields.

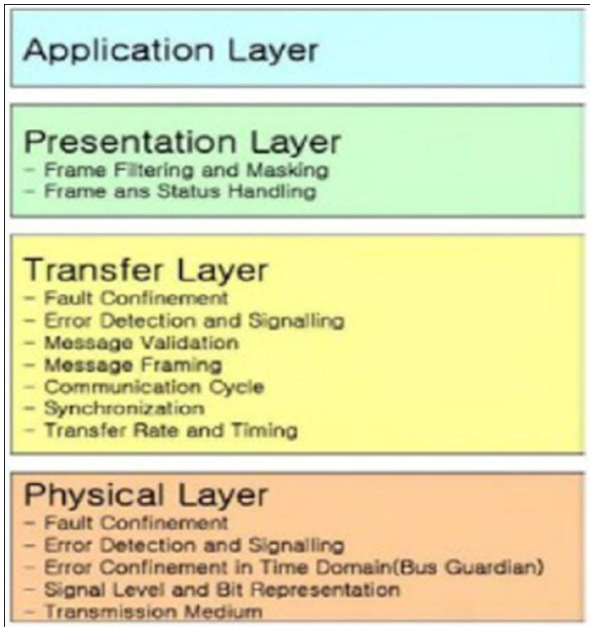

Fig. 4.1 FlexRay layer structure

V. SIMULATION RESULTS

Fig. 5.1Display of results.

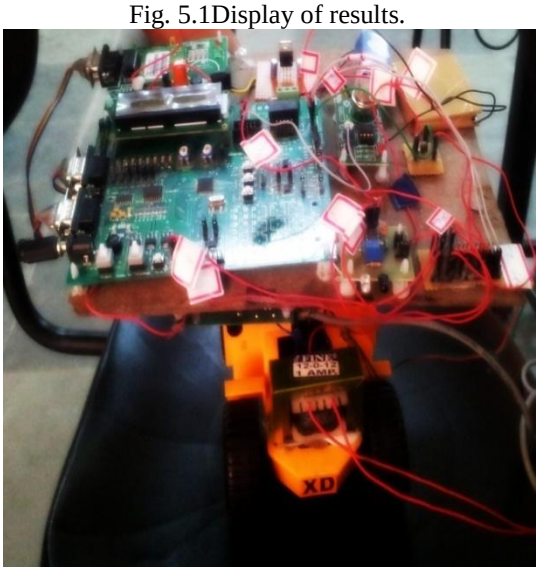

Fig.5.2 Working model of the Vehicle Security System

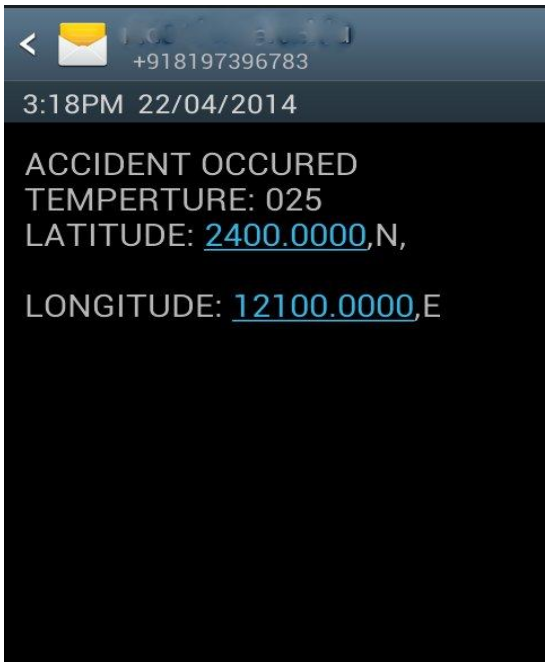

Fig.5.3 Display of the message

VI. CONCLUSION

The proposed model of Advance Security System Using FlexRay ensures safety of the vehicle. The Brake checking mechanism, Seat belt checking mechanism and Alcohol detection serve to be preventive measures in avoiding accidents. When accidents occur in remote areas, most of the times they remain unnoticed but in the model we have designed the concerned person is informed of the location of accident by the virtue of GSM network and GPS module. The implementation and testing results were good, the process of sending and receiving messages through GSM was successful. The GPS helps in locating the vehicle and tracing its path at a higher pace which increases the certainty of the vehicle's current position. The additional feature of Obstacle detection provides even more security to the vehicle. Thus the proposed model not only takes measures in preventing accidents but also helps in generating suitable action when accidents occur in remote places.

VII. FUTURE ENHANCEMENTS

The following modifications can be made to the present Vehicle Security System which still leads to a smarter system.

MOBILE SNIFFING[8]: If a person is talking on cell phone while driving, then accidents may occur. Hence if the driver is on phone with the duration exceeding 15 seconds then the car should automatically slow down and stop which could be developed as an android based application.

BIOMETRIC IDENTIFICATION[9]**:** If one person would undergo alcohol detection and allow another person to drive the car then there would be a miscarriage of the alcohol test. To avoid this we can include a biometric identification system which would allow only that person who has undergone the alcohol detection to drive the car by keeping track of his fingerprint.

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