Secured Vehicle Access System with Enhanced Accident Detection and Signboard Recognition

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Abstract - **In critical situations many vehicles face accidents, due to this lot of persons lose their lives. Some can be saved if the victim is given medical care as soon as possible. But this has not been the case in real time since no information is provided to rescue sectors regarding the location if accident occurs. This paper provides an optimum solution to the drawback shown above. This system identifies the accident and intimates the information to the emergency care unit. If the accident is diminutive, then the victim needs to press the emergency switch so that the emergency care unit will skip the rescue process. The impact of the accident is detected using the vibration sensor. Here the image comparison technique is introduced to protect vehicle from theft. Speed limiters on the roads have become very common nowadays due to the increase in the speed of the vehicles. These speed limiters that are meant to reduce accidents sometimes act as a cause for it. Especially at night, speeding vehicles tend to overturn and heavy vehicles with loads find it difficult to stop at speed breakers. This even leads to traffic jam at such places. This paper proposes a solution to these problems by attaching an automated speed reduction unit on the vehicles. These units reduce the speed of the vehicle at critical junctions automatically without the consent of the driver. The RF transmitter is placed at sign Boards along the roads and the RF receiver in vehicle communicates with the transmitter and helps in reducing the speed of the vehicle. Alcohol sensor is used to detect whether the driver is drunk or not. If it senses the consumption of alcohol then it denies the ignition of vehicle. Temperature sensor is used to measure the temperature of the engine and displays it in the mounted LCD display. Heartbeat sensor is used to monitor the heartbeat of the driver, if the heart beat becomes abnormal, then the vehicle speed is reduced and an alert message is sent to the emergency unit via the GSM module, and the location of the vehicle is shared with the help of GPS module mounted alongside. GAS sensor is used to monitor the emission level in the vehicle which helps in avoiding air pollution.**

IndexTerms - **Accident detection, RF Module, Image Processing, Signboard recognition, CAN controller, speed sensor, GSM/GPS system.**
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I. INTRODUCTION

As the population rate in country like India elevate to a higher rate and due to this the usage of vehicles also been increased in the society which leads to increase in rate of accident. So researchers have being working on this area to develop a system which helps to reduce the accident rate. The incidence of accidental deaths has shown an increasing trend during the period 2003 -2012 with an increase of 51.8% in the year 2012 as compared to 2002 [5], [6], however 0.2% decrease was observed in 2003 over previous year 2002. The population growth during the period 2003-2012 was 13.6% [5] whereas the increase in the rate of accidental deaths during the same period was 34.2%.

Sensor based approach can be defined as an application of engineering and science for developing resources, methods or devices that supports to save the life of the victim met with an accident. It is a wide field for Research and Development.

In the previous decades the accident occurrence has been intimated to the emergency unit by the persons who are in the location of accident by making a call or by taking the victim to the hospital using some other vehicles, etc. In some critical situations like where there is no facility to communicate the emergency unit, and the location where no one is present in the place of accident occurred will definitely leads to the loss of life. Due to this delay in providing medical care many life has been lost and it can be reduced by using the proposed system.The main objective of this paper is to develop an Enhanced accident detection system and to provide a secured access to the vehicle by Image processing, to monitor many aspects of the vehicle using sensors and to control the speed of the vehicle automatically in several zones by signboard recognition.

II. EXISTING SYSTEM

From the literature it was found that, N. Watthanawisuth, T. Lomas and A. Tuantranont , [1] proposed a system which was based on MEMS Accelerometer for accident detection. It has been designed for motorcycles to detect the accidents using MEMS accelerometer [2], [3]. It detects the accident using 3axis accelerometer and indicates it to the emergency care unit. The limitation of the system is that even when the vehicle falls it will alert the emergency care unit. The model failed to overcome the limitation

III. PROPOSED METHODOLOGY

A. Accident Detection System

This paper proposes an enhanced accident detection system using vibration sensor. The vibration sensors are placed in four corners of the vehicle. Whenever the vehicle met with an accident the vibration sensor detects the vibration level. If it is more than the threshold value then it transfers the data to the microcontroller. The microcontroller makes the switch which is present in the dash board to glow with a beep sound. If the person inside the vehicle presses the switch the intimation message will not be sent to the emergency care unit. If the person is unconscious and fails to press the switch for the particular period of time then the microcontroller sends the message alert to the stored emergency care unit number with the location where the accident occurred with the help of GPS and GSM module [1]. This helps to rescue the person's life who met with an accident.

B. Theft Avoidance System

This paper proposes an advanced security system to the vehicle which helps in reducing the theft of the vehicle. In the existing system only key is used to access the vehicle. But in this system the Image processing system using MATLAB has been used to access the vehicle [9]. The face recognition system proposed here captures the faces of the owner's family members using camera which has been installed in the vehicle and stores it in the database. The face of the person who going to access the vehicle is captured, the comparison of this captured face with the existing database is carried out by WEBER's algorithm.

The Weber's Law can be expressed as [4],

$$\frac{\Delta I}{I} = k,$$

Where ΔI represents the increment threshold (just noticeable difference for discrimination); 'I' represents the initial stimulus intensity and k signifies that the proportion on the left side of the equation remains constant despite variations in the 'I' term. The fraction '$\Delta I/I$' is known as the Weber fraction.

If the person is authenticated then he/she will have an access to the vehicle, otherwise the ignition system of the vehicle fails which leads to avoidance of theft of the vehicle.

C. Monitoring Various Aspects of the Vehicle Using Sensors

This paper provides a system which helps to monitor many aspects of the vehicle using sensors and to control the speed of the vehicle automatically in several zones by using signboard recognition system. In the existing system the vehicle monitoring is carried out manually. This proposed method helps in monitoring the vehicle in automatic manner in low cost. Heartbeat sensor is used to monitor the heartbeat of the driver. If it gets abnormal then the vehicles speed is automatically gets reduced and the alert message will be sent to the emergency care unit along with the location with the help of GPS and GSM module. Temperature sensor is used to monitor the temperature of the engine [7]. If it overshoots than the threshold level then it is intimated to the driver by displaying it using the LCD display. Alcohol sensor is used to detect whether the driver is drunk or not. If it senses the consumption of alcohol then it denies the ignition of vehicle [3]. Gas sensor is used to monitor the emission level of the vehicle which helps to avoid the air pollution.

The signboard recognition system is used to reduce the speed of the vehicle according to the particular zones in the road using RF transmission [8]. RF transmitter with particular frequency has been placed in the signboard with predefined speed level, when the vehicle with RF receiver enters into that region receives the signal from the transmitter ant it is fed into microcontroller which reduces the speed of the vehicle to the predefined speed. By this, the accident rate will be drastically reduced.

IV. OVERALL MODULE OF THE SYSTEM

The figure which is given below represents the overall system. It consolidates the accident detection system, theft avoidance system and vehicle monitoring system. The system consists of two ARM processor which has been interfaced using CAN bus through CAN controller and transceiver. The ARM (LPC 2148) Microcontroller is used which gets the information from all other units through CAN bus, processes it and controls the whole unit. The CAN BUS has high speed rate for transmitting data which has been specially designed for automation industry [7]. The sensors used for monitoring the aspects of the vehicle has been interfaced with one ARM processor and the camera which is used for theft avoidance, GPS and GSM module which has been used to identify the location of the vehicle has been interfaced with the other ARM processor. Due to this the efficiency of the overall system gets increased. In the prototype the DC motor is used in the place of vehicle which is controlled using relay unit.
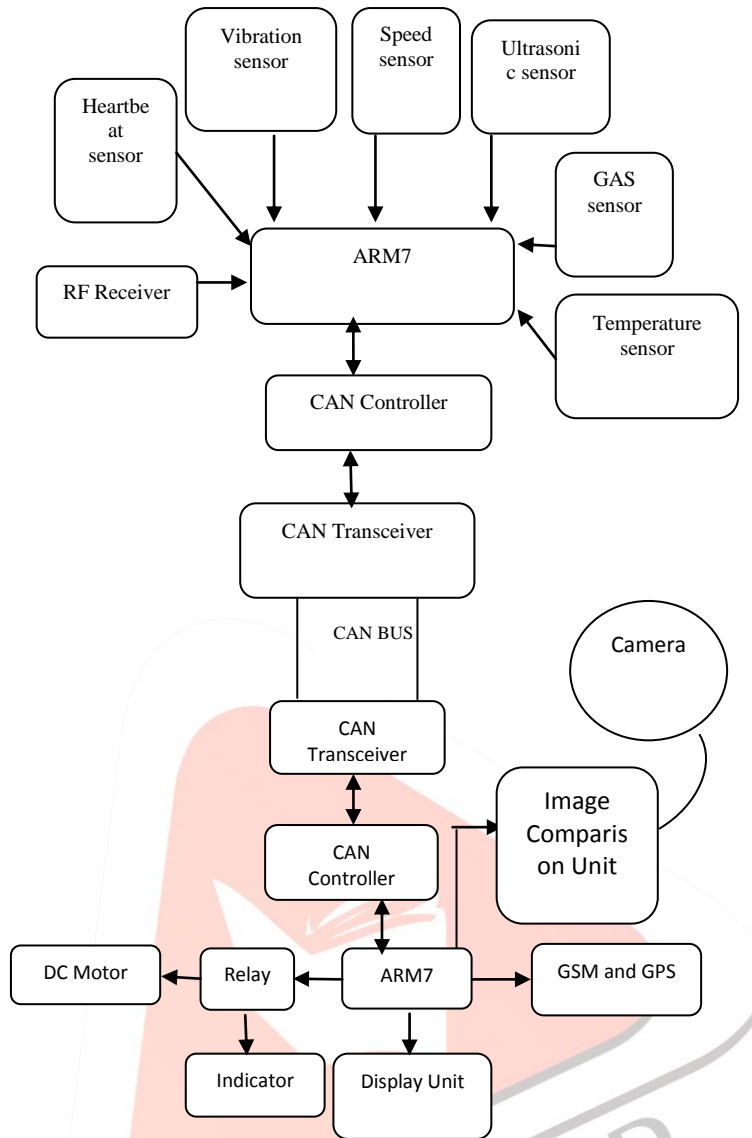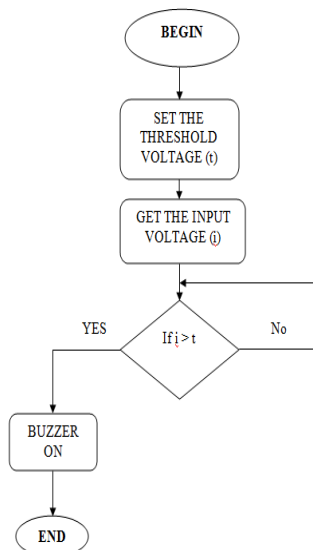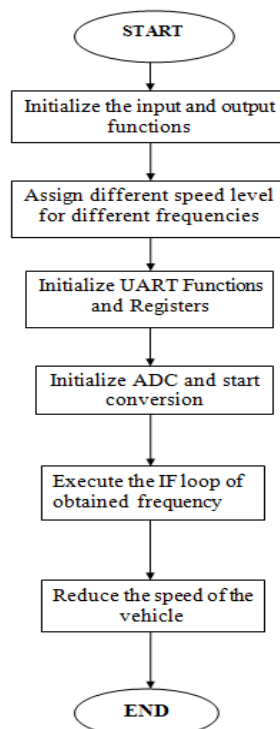
Figure 1Block Diagram of the Overall System

V. FLOW CHART

A. For Temperature Sensor

B. For Signboard Recognition

VI. HARDWARE IMPLEMENTATION

A. ARM LPC2148

    The microcontroller used here is ARM LPC2148, which has 512 KB program Flash and 32+8 KB SRAM. The microcontroller crystal frequency is 12 MHZ. This frequency has been selected in order to allow maximum execution speed. It has inbuilt A to D and D to A converter. ARM has Von Neumann architecture (Program and RAM in the same space).

B. CANBUS

    Controller Area Network (CAN) is an advanced serial bus system that efficiently supports distributed control system. The CAN protocol handles bus accesses according to the concept called "carrier sense multiple access with Arbitration on message priority".

C. CAN Controller (MCP2510)

    CAN controller with SPI interface (MCP2510) implements full CAN V2.0A and V2.0B at 1Mb/s. It has 0-8 byte message length. The programmable bit rate is 1Mb/s. It has a Look-back mode for self test operation.

D. CAN Transceiver (MCP2551)

    The High speed CAN transceiver (MCP2551) supports upto 1Mb/s. Upto 112 nodes can be connected to the CAN transceiver. The MCP2551 provides differential transmit and receive capability for the CAN protocol controller and is fully compatible with ISO-11898 standard, including 24v requirements.

E. Temperature Sensor (LM35)

    LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (centigrade) temperature. Calibrated directly in °Celsius and rated for full -55°C to +150°C range. It operates from 4 to 30 volts.

F. Ultrasonic Sensor (LM358)

    It is used to detect the nearest vehicle which helps to reduce the speed of the vehicle. It measures and detects the distance of moving vehicles. It is impervious to target materials, surface and colour.

G. RF Module

The 10 KHZ to 300 GHZ frequency range can be used for wireless communication. It is used to refer to the radio signal generated by the system transmitter, or to energy present from other sources that may be picked by the wireless receiver.

H. RF Transmitter (TWS434)

The transmitter output is upto 8mW at 433.92 MHZ with a range of approximately 400 Feet (outdoors) which is required in zones like school zones, etc. The TWS434 transmitter accepts both linear and digital inputs that can operate from 1.5 to 12 volts-DC. Its size is approximately 1/3 the size of a standard postage stamp.

I. RF Receiver (RWS434)

The RWS434 receiver also operates at 433.92 MHZ and has a sensitivity of 3uV. The RWS434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs.

J. Global System for Mobile Communication (SIM900A)

This modem is designed with RS232 level converter circuitry, which allows you to directly interface PC serial port. It works on frequency 850 MHZ, 900 MHZ, 1800 MHZ, 1900 MHZ. It needs only 3 wires (Tx, Rx, GND) except power supply to interface with microcontroller. It has built in SIM card holder.

K. Global Positioning System (QUECTEL L10)

It has 210 PRN channels, with 66 search channels and 22 simultaneous tracking channel with low tracking power consumption (38mA). Its position accuracy is about 3.0m 2D-RMS 2.5m.
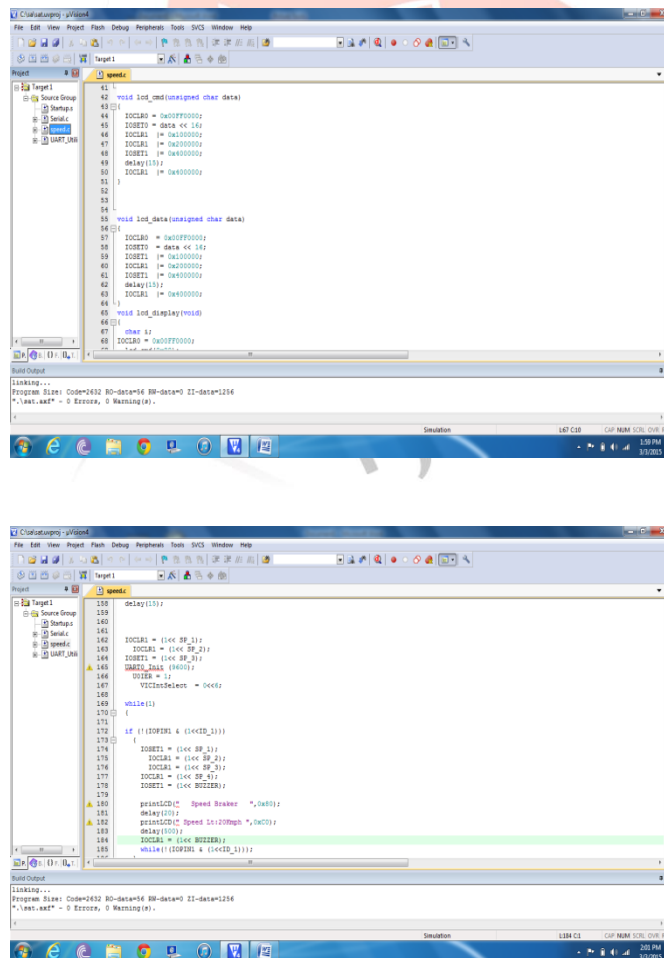
VII. SIMULATION OUTPUT

Figure 2 Snapshots of simulation program for signboard recognition system

The figure shown above is the simulated output of the embedded 'C' code using KEIL IDE software, for the RF module which helps to control the speed of the vehicle according to the zones like School zone, etc. By dumping this code into the controller unit the speed of the vehicle is controlled.
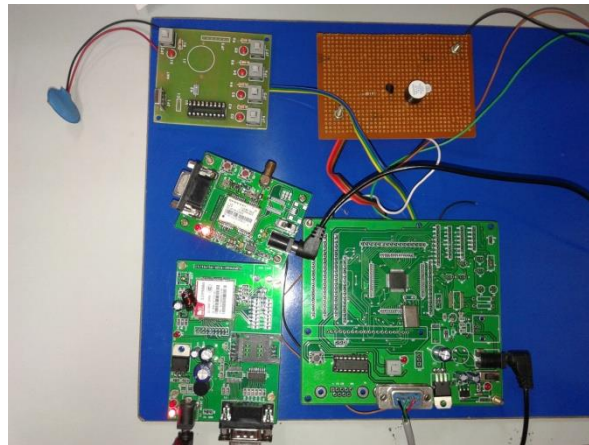

Figure 3 Photograph showing the interface of GPS, GSM, RF Transmitter, Temperature sensor with ARM LPC2148

VIII. CONCLUSION

This paper provides an optimum solution to detect the accident and intimates the information to the emergency care unit by which the many life can be saved. Here the image comparison is used to provide an authorized access of the vehicle by which the theft of the vehicles will be reduced. The speed limiting technique in this paper helps in reduction of accidents in the zones like schools, etc. By implementing this paper in the real automation world there will be a technical improvement in the automotive industry which helps in carrying it to the next level of secured and safety designs of the vehicles. In future the vehicle monitoring system can be extended to monitor the internal operations of the ABS, ECU unit of the vehicle which helps to rectify the problems by the user itself without the experts (mechanics) advice.

IX. ACKNOWLEDGMENT

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