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Black Box Technology used in Automobile

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Abstract: Automobiles and computing innovations are creating a new standard of vehicle data services. The automobile black box has similar functions to a black box used in an airplane.It is used to determine the cause of vehicle accidents and to avoid loss of life and property arising from injuries in vehicles.The system aims to achieve an analysis of accidents by tracking vehicles.The system also involves enhancing security by preventing the black box data from being tampered. In case of an accident, the black box sends a warning message to a pre-stored mobile number via short message service (SMS).This device is an advanced version of the system for speed detection, seat belt warnings, and it is placed in vehicle.A speed sensor, seat belt sensor and various sensors that sense different parameters of the vehicle are connected to a microcontroller that detects hazardous conditions or injuries and then sends text messages to a police ambulance and driver relatives using GSM technology.The text which is sent to different authorities contains the vehicle details and its position.The main objective of this project is to develop a smart vehicle system that minimizes the imitations of existing methods and also improves the protection of vehicles and people, and also reduces accidental injuries.

Keywords: Accident, Black Box,Microcontroller, Sensor,Tampering,Vehicle.

INTRODUCTION

Accidents in the world is increasing rapidly so there must be good and efficient regulation over the protection of human life in violation of drunk driving traffic rules, careless driving are some causes of road accidents cannot stop the accidents but reduce the accidents by some precautionary measures[1].Most of the fatal accidents happen because of over-speed.A vehicle is moving on high speed have greater impact during the crash and hence will cause more injuries. The lack of immediate first aid also causes several deaths. Another problem is the lack of information regarding the location of the vehicle.Many solutions have been introduced as a major problem but most are largely ineffective or manually controlled and rely on the ability of the user to be alert when using them.A smart human security alert and reporting system is needed to inform the driver if any parameters are wrong, as well as to inform the police to violations of the law[2].

The automobile black box partially exists as event data recorders (EDRs) and black boxes. The exact cause of an incident from these is hard to determine. An automobile black box device, which incorporates both of these factors, is proposed to resolve this shortcoming.In addition to the accident report by tracking what occurs in vehicles, the proposed system sends a short message indicating the vehicle's location via GPS system to family member, emergency medical service (EMS) and nearest hospital, so that first aid can be received as soon as possible.The proposed system also features a security module, which uses data encryption to protect the data stored on the SD card. The system aims at achieving accident analysis through strategically positioned sensors, inside and around the vehicle[3].

OVERVIEW OF THE SYSTEM

The automobile black box system is shown in figure 1.The sensor data is read out from Controller 1 and transmitted to Controller 2.The data will be transferred to the SD card. The encryption algorithm is used to avoid falsification of the data and the data is recovered using the decryption algorithm[4].

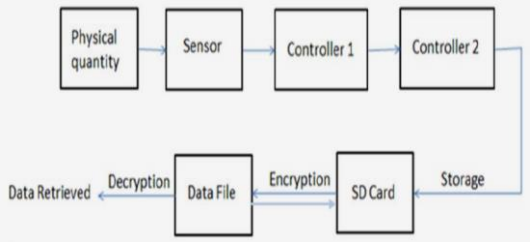

Fig.1: Automobile Black Box System

The automobile black box block diagram is shown in Figure 2. The main components of the software include Raspberry Pi and Arduino controllers. They regulate the different sensors which interface with them[5].

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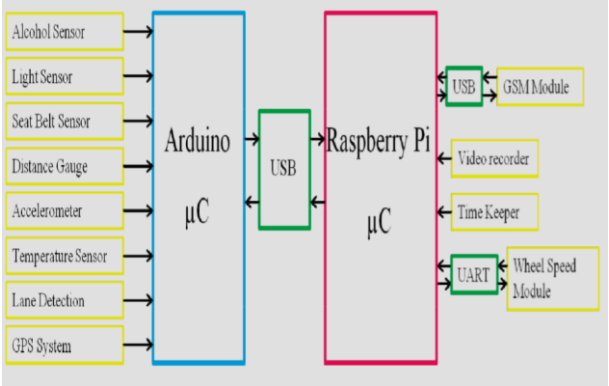

Fig.2: Block Diagram of the Automobile Black Box

Arduino Uno controller uses the analog to digital convertor (ADC) to convert analog sensor values into digital values.Alcohol sensor, accelerometer, LDRs are the analog sensors.The output from Arduino's digital pins interfaced with the different sensor readings is communicated via USB to Raspberry Pi controller[6].Raspberry Pi stores these values and saves them in a Secured Digital (SD) card as .txt file, which can be read after the accident to determine the cause of the accident. Using USB communication, the GSM module is interfaced with the Raspberry Pi controller.It is used in the subscriber identity number (SIM) card to send the GPS data and an alarm message to pre-stored numbers. The wheel speed module is connected to the Raspberry Pi to record the rpm (rotations per minute) using the universal asynchronous receiver and transmitter (UART) module.Using the Inter-Integrated Circuit (I2C) protocol, a Real Time Clock is interfaced to the Raspberry Pi controller. Real Time Clock is used to monitor the time when incident occurs.A Raspberry Pi Camera is interfaced to the Raspberry Pi by plugging into the camera serial interface slot in Raspberry Pi. It is used for taking video inside the vehicle and storing it on an SD card. To determine the cause of an incident, it can be recovered later.Using a substitution cipher the stored sensor data on the SD card are secured. The cipher is used to decrypt stored data. Similar to the one used in airbag deployment, the crash sensor is used to sense an accident occurring[7].

1. *Wireless Black Box and GPS Tracking for Accidental Monitoring of Vehicles:*

The main objective of this project is to incorporate a wireless box system that uses MEMS to control the movement of vehicles and track the vehicle using GPS when an accident occurs (Figure 3). The project aims to monitor vehicle parameters. Detect and track the vehicle when an accident occurs, and use GSM to intimate about it[8]. The main advantage of this project is that it will automatically send out an immediate first aid message to the ambulance service.

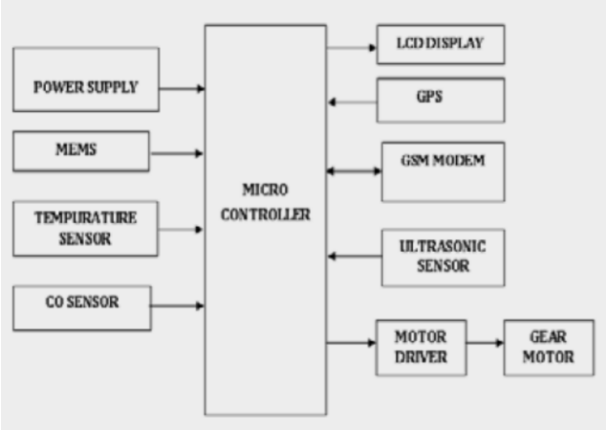

Fig.3: Black Box and GPS Tracking for Accidental Monitoring

2. *Vehicle Accident Prevention using Eye Blink Sensor:*

The eye blink sensor to sense the blink count is mounted near the eye and this information is transmitted in the form of pulses and given to the microcontroller.The Microcontroller uses this information to compare with the normal eye blink (Figure 4) programmed in the chip and, if an irregular situation arises, this process is activated by the driver circuit connected to the vehicle motor indication[9].

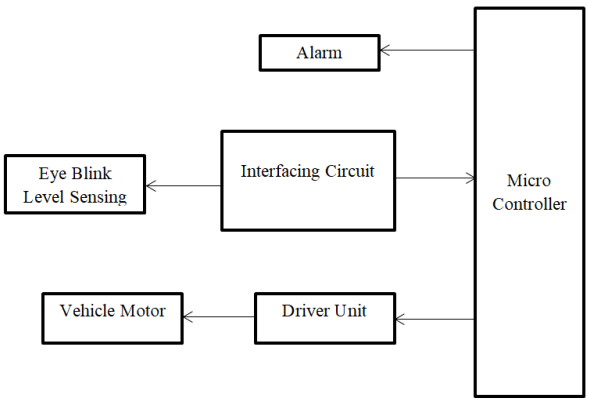

Fig.4: Eye Blink Sensor

3. *Seat Belt Controlled Ignition System:*

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A device which controls the vehicle's ignition system, the vehicle must only start when the vehicle's seat belt is clipped (Figure 5).Hall Effect principle for project seat belt controlled ignition system.The working model shows a Hall Effect sensor that is mounted on the seatbelt's belt clipping assembly.When the tongue comes close to the sensor the seat belt is tightened, the seat belt is close to the sensor and the sensor produces a pulse and the pulse gives the input to the microcontroller and the microcontroller controls the vehicle's ignition switch. Simple concept leads to many applications in automotive and safety systems implementations.The advantage of this system is that there is no direct contact between the contactless sensor and the magnet so that any electrical disturbances occur[10].

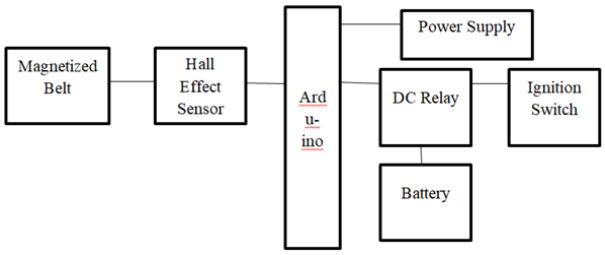

Figure 5: Seat Belt Controlled Ignition System

METHODOLOGY ADOPTED

The Arduino integrated development environment (IDE) is used for Arduino machine programming. During program initialization, the setup function is used to initialize settings such as digital pin mode, serial baud rate.The loop function runs indefinitely and it has the functions to track the different sensors including temperature sensor, light sensor, accelerometer, ultrasonic sensor, seat belt, IR sensor, alcohol sensor, and GPS.For transport, the serial port is used to communicate the sensor readings to Raspberry Pi.

CONCLUSTON

An efficient network of smart vehicles has been proposed which provides good driving safety.The advantages of the proposed system over other methods include preventing accidental injuries, helping to control traffic violation through an adaptable simple method of low cost, and improving driving safety to discourage careless driving.The system includes sensors that are mounted in and around the vehicle. Every sensor has been tested and found to provide desired performance. Such outputs had been transmitted to the controller at Arduino.The controllers Raspberry Pi and Arduino communicate with each other, and successfully regulate the sensors. The data collected from the sensors are successfully stored on the SD card and can be fully retrieved when necessary.The data from the video camera is successfully recorded and stored on the SD card as a file. The designed system also contains an emergency assistance module that automatically alerts the incident along with the GPS coordinates to the medical services, police and relatives.It also has a security module that encrypts the stored data to avoid tampering. Once a crash is detected a help SMS is sent to the pre-stored number. The encryption is performed successfully, and the encrypted file is decrypted to retrieve the original file.

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