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RESEARCH ARTICLE OPEN ACCESS

Smart Car Black Box System

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Abstract:

Each day there are immense number of car accidents take place. According to the World Health Organization, more than a million people in the world die each year because of car accidents. In order to solve this problem, the black box concept is used as stepping stone solution. In this paper we are trying to implement the concept of black box in the car. Car black box system has feature to record the information's such as alcohol content, speed of the car, engine temperature, seat belt information and exact location of the accident about the car using different sensors and GPS data. Along with the use of GSM module we could transfer this data to the emergency services. Use of accelerometer enables to detect the accident and transfer data to emergency services through GSM. Car black Box system provides compact solution for the before and after accident events.

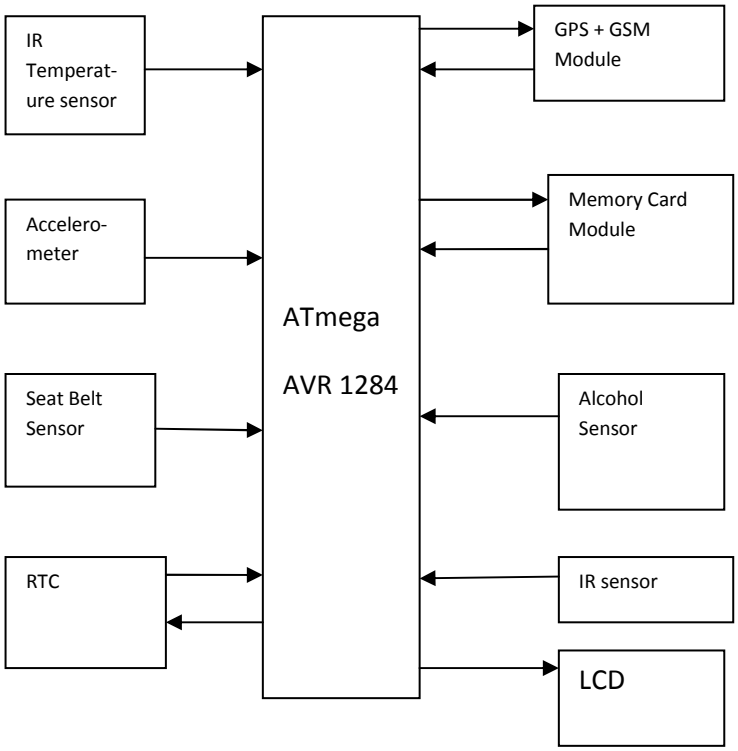
Keywords— black box, sensors, GPS, GSM, Accelerometer, record data.

1. INTRODUCTION

According to the WHO, more than a millions of people in the world die each year because of transportation-related accidents. To solve this problem, we have introduced the Smart Car Black Box System. The system deals with 3 situations, first is, driver safety and avoiding accident. Second is, calling out emergency services immediately at the exact location of accident. Third is, it helps in analyzing accident as it offers to record the information about various features that can be related to accident. It also serves as proof for the investigation teams or police for occurred accident. The system consist of features like detecting alcohol percentage inside the car, detecting speed of the car, Accident detection, engine temperature checking, seat belt information. There is use of different sensors. Such as MQ3 alcohol detector, IR sensor for keeping track of RPM of the car. Accelerometer for accident detection, Magnetic switch sensor for seat belt information. There is use of ATmega AVR1284 IC which drives all the sensors of the system.

Threshold value is set for every sensor over which, if any sensor goes then SMS is sent via GSM and GPS module. From the module GSM part enables to send message and GPS module gives live location of the car. All the programming done through embedded C programming. Embedded C programming not only helps in recording the data but also helps in retrieving the data from Microcontroller memory to an LCD which is used to display the output. GPS & GSM works together in ensuring vehicle safety. It is programmed in such away that whenever the collision occurs the location of vehicle is sent to registered telephone number through GSM & all the sent details can be used to locate the vehicle using google map.

1.1 BLOCK DIAGRAM



Block diagram in our proposed system is shown in Fig. Black box contains the alcohol sensor, temperature sensor, IR sensor, GSM and GPS Module, Real Time Control, Accelerometer, Memory Card Module & 16x2 LCD. The outputs of these parameters are displayed on the LCD. GPS tracking system developed in this paper helps to track the vehicle in case of accident and enables authorities to extend immediate emergency medical service after accident.

HARDWARE DESCRIPTION AND FUNCTION-

A. Atmega AVR 1284:

The system uses 8051 based ATmega AVR 1284 microcontroller as a master controller.

Features-

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 128KB ISP flash memory with read-while-write capabilities, 4KB EEPROM, 16KB SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a real time counter, three flexible timer/counters with compare modes and PWM, two USARTs, a byte oriented 2-wire serial interface, an 8-channel 10-bit A/D converter with optional differential input stage with programmable gain, programmable watchdog timer with internal oscillator, SPI serial port, a JTAG (IEEE 1149.1 compliant) test interface for on-chip debugging and programming, and six software selectable power saving modes. The device operates between 1.8-5.5 volts.

By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

B. Temperature Sensor

The engine temperature sensor is a type of sensor that changes its resistance with temperature. Many critical engine functions such as selection of air-fuel ratio, fuel injection timing, ignition timing etc. depend on the engine's temperature. Engine temperature is the important parameter in control unit, if this value goes to abnormal, some unwanted gases exhaust from vehicles due to improper combustion. In this paper, to obtain the vehicle engine temperature, we used LM35 as temperature sensor. It continuously senses the engine temperature and fed to the microcontroller. It converts temperature value into electrical signals. It is rated to operate over a -55 to +150°C temperature range.

C. Alcohol Sensor

In this paper, we use MQ-3 as alcohol sensor to detect the alcohol content. It is high sensitive to alcohol, simple drive circuit, stable and long life. If driver has drunk, then alcohol sensor sends signal to microcontroller. The output of MQ-3 is given to microcontroller and message is displayed on LCD.

D. GSM and GPS Module

GSM used in ensuring vehicle safety. It is programmed in such a way that whenever the collision occurs the location of vehicle is sent to registered telephone number through GSM & all the sent details can be used to locate the vehicle using Google map.

E. LCD Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology. It is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. In this paper we are using 16×2 LCD. It receives the collected information's which are stored in the microcontroller and displays these messages. It uses very small amounts of electric power.

E. RTC

The module based on DS1307, The DS1307 serial real-time clock (RTC) is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially through an I²C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power-sense circuit that detects power failures and automatically switches to the backup supply. Timekeeping operation continues while the part operates from the backup supply.

F. Memory Card Module

The micro- SD Card Module is a simple solution for transferring data to and from a standard SD card. This module has SPI interface which is compatible,with any SD card and it use 5V or 3.3V power supply which is compatible with Arduino UNO/Mega. SD module has various applications such as data logger, audio, video, graphics. This module will greatly expand the capability an Arduino can do with their poor limited memory.

G. Accelerometer

Accelerometers measure linear acceleration. They can be also used for specific purposes such as inclination and vibration measurement. MEMS accelerometers embed several useful features for motion and acceleration detection, including free-fall, wakeup, single/double-tap recognition, activity/inactivity detection and 6D/4D orientation.

H. Seat Belt Sensor

The seat belt buckle, SBB, is another area where Hall-effect technology has been used as a part of the safety system. The two-wire, unipolar switch is again a simple, yet reliable, solution common to many automobiles on the road today. The purpose of the Hall-effect device (HED) is to guarantee proper latching of the buckle whereby ensuring the occupant is properly restrained in the event of an accident or sudden stop.

FUNCTION DESCRIPTION-

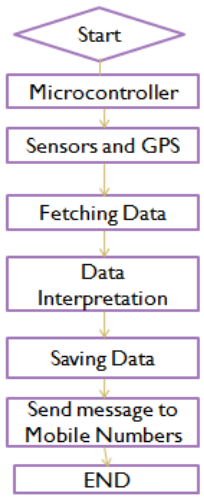


Fig 2: Functional description of proposed system

When accident occurs the microcontroller gets activated and starts collecting the information such as temperature, alcohol content respectively from the sensors. This collected information is displayed and is sent to the police through mobile number. By using this information police can easily know the accident spot and they get the correct proofs for the accident to provide justice.

CONCLUSION

This paper attempted to equip automobiles with "Black Box' kind of equipment which aids driver for safe driving, ensures vehicle safety, help in locating vehicle in case of accidents and useful information for post-crash analysis. This paper used different sensors like temperature sensor, alcohol sensor, slot sensor and IR sensor to ensure safety of the vehicle. The seat belt sensor detection mechanism enables and guides the driver for safe driving. The data collected using the above sensors are also useful in the post-accident analysis. The system developed also has data recording using memory card module which could be vital for post-crash analysis. GPS tracking system developed in this paper helps to track the vehicle in case of accident and enables authorities to extend immediate emergency medical service. Measuring tire pressure, Speed of the vehicle, improved break failure condition using multiple sensor, Sleep alarm indicator, Video processing for panic and accelerate. Options can be provided as a part of future enhancements.

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