A RESEARCH PAPER ON UPGRADED BLACK BOX FOR AUTOMOBILES

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Abstract:
The main purpose of the paper is to develop a prototype of Black Box for vehicle diagnosis that can be installed into any vehicle. Like flight data recorders in aircraft, "Black Box" technology plays a key role in vehicle crash investigations. This prototype can be designed with minimum number of circuits. This can contribute to construct safer vehicles, improving the treatment for crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate. The prototype provides complete information about the car along with Navigation system in collaboration with Google Earth. The prototype can provide Artificial Intelligence Support by having a communication channel between the user and the car. Car-To-Car Communication for analyzing abruptness in the forthcoming vehicle before it intends to collide is a major field studied in the paper along with live analysis through experiments.
Keywords: Black Box; Google Earth; Artificial Intelligence; Global Positioning Society.

I. INTRODUCTION

Have you ever wondered what really goes on under the hood of your car? Do you wish you could peek inside the engine-management system and read values from it? Are you annoyed that your dashboard displays a cryptic "check engine" light but gives absolutely no explanation what the problem might be? You don't need a $10,000 specialist diagnostic console or even a laptop computer to get access to useful data from your car.

According to the World Health Organization, more than a million people in the world die each year because of transportation-related accidents [1]. In order to react to this situation, the black box system draws the first step to solve problem. Like flight data recorders in aircraft, "Black Box" technology can now play a key role in motor vehicle crash investigations [1]. A significant number of vehicles currently on the roads contain electronic systems that record in the event of a crash [1]. That is why it is so important to have recorders that objectively track what goes on in vehicles before, during and after a crash as a complement to the was used. Subjective input that is taken usually from victims, eye witnesses and police reports. This system is mainly committed to three sections. The first one is how to detect and collect the information from the vehicle. The second is how to present the data to the user in a simplified way. The most important is the third one, where the information related to abruptness and rashness in the driving skills of the driver are transmitted from one vehicle to another using Radio Frequency and suitable Transceivers. To measure the inclination of vehicle as well as measuring the tilting and analysing the speed of the vehicle, basically a Vehicle Dynamics Control Unit there are G-Sensors used in the vehicle which are connected to the

microcontroller. C programming is being used to interface all the sensors on the Arduino Board as it provides great efficiency to the microcontroller. This programming helps in not only recording the data but also retrieving the data from microcontroller memory to an LCD to display it.

In this project, the traditional version of Black Box is replaced by a newer technology i.e. the traditional black box used a OBD-II cable for diagnostics of the vehicle whereas the current version of Black Box uses sensors connected to the Microcontroller giving you better and more information about the vehicle along with the On-Board Diagnostics cable.

The applications of Car Black-box include:

1. Better crash research that may produce improved driver education programs, safer road designs and improve highway safety.
2. Collision data for research, data to improve vehicle design internally and externally.
3. To not only record the relevant data, but also try and prevent a possible collision by limiting the speed of the vehicle in accident-prone areas.
4. Wireless communication by transmission of alert message in the event of a collision along with the time and location co-ordinates through GSM.

II. HARDWARE AND SOFTWARE RESOURCES

The hardware part consists of the components and the sensors used in the black box system. This part mainly collects the status of the sensors and stores it into the micro controller‘s EEPROM.

A. Sensors

1) Proximity Sensor: A proximity sensor is used to detect the lanes in which the vehicle is travelling.

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic or electrostatic field, or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal.

2) Ultrasonic sensor: The ultrasonic sensor is to measure the minimum distance in front of the vehicle Ultrasonic sensors work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor.

3) Pressure Sensor: A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. This pressure sensor is mainly used to find whether an accident has occurred or not.

4) Temperature Sensor: This sensor is mainly used to detect the temperature of the engine of vehicle. It detects two types of temperatures one is abnormal temperature and other is engine temperature.

5) Leakage Sensors: This sensor is used to detect mainly the leakage in CNG or LPG vehicles and alarming the vehicle user about it through a buzzer or indication on the dash board.

6) OBD-II Reader: The On-Board Diagnostics cable v2.0 is connected to the vehicle to acquire information from the vehicle regarding the coolant temperature, internal combustion engine pressure and temperature, fuel level etc. The information which is not fetched through the OBD-II cable is acquired through the sensors and the modules connected to the programmable board.

B. Digital Processing

In order to control all these sensors and their inputs, a digital process can be used. As prototype a Arduino micro controller is selected to control the black box.

1) Arduino Uno Board: The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

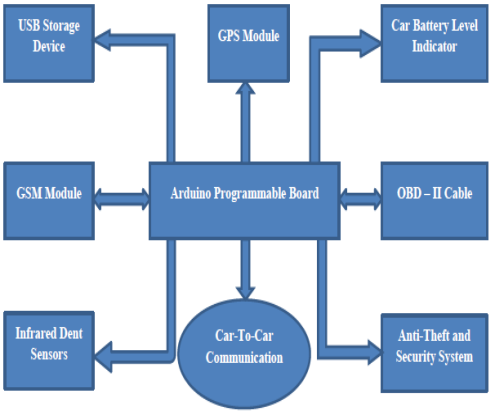
2) Arduino Mega 2560: The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs),

16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

3) Microcontroller's Program: The main function of the microcontroller program is to take input samples from different ports. These samples are taken from the sensors installed in the vehicle. After that, each sensor sample is saved into the microcontroller's EEPROM. After the accident all the data from the sensors is received by the microcontroller before it goes into the sleep mode. This data is used to analyzing the accident. The choice of the microcontroller's transmission protocol was the standard asynchronous format using 8 data bits, no parity bit and one stop bit with a 9600 baud rate. Since the complexity is in the interpretation of the data and not in the transmission, the need was for a format that guarantees minimum simplicity with maximum reliability. In addition, a MAX232 is used as an intermediary station, to connect the microcontroller to the serial port of the computer.

III. Vehicle Black Box Architecture

The In Vehicle based Car Black-box consists of an Arduino Microcontroller. The GSM/GPS module is also connected to the processor [2]. Different sensors are interfaced with the programmable circuit board as shown in the figure.



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ig 1. Architecture of Black Box

IV. Function and Design of The Proposed Prototype

The proposed system is an upgraded version of the Black Box designed earlier. The earlier box consisted diagnostics elements like Microphone and Camera for detection of any failure in the vehicle.

The upgraded version has sensor based activation with the programmable board along with the Diagnostics Cable put inside a single box allowing the user to configure and detect the malfunctioning in the vehicle system and navigate through roads and paths by tracking through a mass platform Google Earth. The newer version of Black Box offers a user friendly program with safe navigation by letting the driver know the details of the vehicle approaching the driver by communication through Transceivers which are sending and receiving the signals as soon as a threshold is crossed. This ensures safety to the user.

The basic and main purpose of the upgraded version of black box is to provide complete data analysis along with fleet management to the user by giving detailed list of the parts working within the automobile and the functions in a simplified non-technical language where the driver can identify and diagnose the wrong doings in the vehicle without him having the need to go to a mechanic where he is charged a huge amount for a simple malfunctioning.

Table 1. Function and Feature of Black Box Mining System Designed

Function	*Existing system*	*Proposed system*	*Function & Feature*
Function of detecting collision	Yes	Yes	Function of detecting external shock to car
Audio/video encoding	Yes	Yes	Function of encoding video & audio signal
Function of saving data	Yes	Yes	Encoding & storing information data of car
GPS function	Yes	Yes	Function of receiving current location information of car
Communication function	No	Yes	Function of transmitting car information to distant place using WCDMA modem
Function of transmitting video	No	Yes	Function of transmitting video of current load status to control center at distant place
Function of analyzing location information	No	Yes	Function of minimizing the load of network by analyzing current moving path of car and minimizing the transmission of data to distant place using moving path & pattern of car collected from mining system at distant place

Fig 2. Design of the Proposed System [3]

V. Conclusion

This paper has presented a new vision for the automobile industry. The use of Black Box system for vehicle diagnosis is a pitch capable to revolutionarize the way a layman visualizes his particular vehicle. A full and detailed

description was made for every part of this system. This paper also offers a user friendly embedded program to analyze the data of the accident. The Black Box system built can be implemented in any vehicle. As soon as the driver runs the motor, this system will begin saving the events and displaying the required details on the LCD screen of the corresponding vehicle. In case of an accident, an additional 10 seconds of events before and after this accident will be saved for complete analysis of the scene. The data saved can be retrieved only after the accident for privacy purposes. In addition, a detailed report will be given to the user containing the recorded data in the memory through the txt. File. The highlight of the prototype is the ability to communicate with another vehicle approaching it by transmitting the values of speed and RPM of the automobile for safety purposes and alarming the user for abruptness in the driving system of the approaching vehicle.

VII. FUTURE ENHANCEMENTS

We can enhance the present system to check other parameters like fuel level, tire pressure and working of headlights before starting the vehicle .Many other critical parameters can be read and stored in the memory. Another useful add-on to the present system could be cameras on front and backsides which keep recording live images and storing them in memory. This video data would be much useful for accident investigation.

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