

# Automobile Black Box System for Accident and Crime Analysis

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**Abstract-** Automobiles and computing technologies are creating a new level of data services in vehicles. The Automobile Black Box has functions similar to an airplane black box. It is used to analyze the cause of vehicular accidents and prevent the loss of life and property arising from vehicle accidents. This paper proposes a prototype of an Automobile Black Box System that can be installed into vehicles. The system aims to achieve accident analysis by objectively tracking what occurs in vehicles. The system also involves enhancement of security by preventing tampering of the Black Box data. In addition, the Black Box sends an alert message to a pre-stored mobile number via Short Message Service (SMS) in the case of occurrence of an accident.

**Keywords-** Automobiles, Black Box data, Short Message Service etc.

## I. INTRODUCTION

Millions of people die due to accidents. The vehicle accident is a major public problem in many countries.

This problem is still increasing due to rider's rash driving and drunk and drive. This problem can be solved by using Black Box system analysis. Automobiles and computer technologies are creating a new level of data service in vehicles.

The automatic Black Box has functions similar to an airplane Black Box. It is used to analyse the cause of vehicular accident and prevent the loss of life and property arising from the vehicle accidents. This paper proposes a prototype of an automatic Black Box system that can be installed into vehicles

## II. LITERATURE REVIEW

**An Implementation of a Vehicular Digital Video Recorder System (Chien-ChuanLin; Ming-Shi Wang, 2010 IEEE/ACM Int'l Conference on Green Computing and Communications & Int'l Conference on Cyber, Physical and Social Computing)**

A vehicular digital video recorder system acts as the flight recorder of a vehicle which used to record the behavior of a running vehicle. In this paper, a designed vehicular digital video recorder system was reported. The hardware system was based on an embedded platform. The system also supports an online real-time navigator and an offline video data viewer. To consider data security, the recorded video data was water-marked to prevent tampered. The offline video data viewer is used to play the

Recorded video and display the recorded related vehicle's parameters accompanied with the video which represented the instant status of the running vehicle. With the viewer system, it can be used to analysis the recorded data and find the facts for the status of the vehicle when a traffic accident occurred

**The Design and Implementation of New Vehicle Black Box Using the OBD Information (Duy Le Nguyen; Myung-EuiLee, Artem Lensky, 2012 7th International Conference on Computing and Convergence Technology (ICCCT))**

In this paper, the new Vehicle Black Box, which is named E-Black Box (Enhanced Black Box), is designed and developed. The E-Black Box is the combination of all the advantages of previous Black Boxes and Event Data Recorders (EDRs). The E-Black Box communicates with Electronic Control Units (ECUs) to read the status of vehicle via OBD port. It is equipped with camera that records the video in front of the vehicle. As the common vehicle Black Box, the E-Black Box also has Global Positioning System (GPS) for reading the current latitude and longitude of the vehicle point.

The 9 Degrees of Freedom (DOF) of inertial sensor, which is incorporated triple-axis gyro sensor, triple-axis accelerometer sensor and triple-axis magnetometer sensor, is integrated with E-Black Box to read the velocity, acceleration and orientation of vehicle after which we analyze the stability of vehicle during the travel. After collecting and synchronizing all data, the E-Black Box saves them in Secure Digital (SD) Card.

**Wireless black box using MEMS accelerometer and GPS tracking for accidental monitoring of vehicles (N.Watthanawisuth; T.Lomas; A.Tuantranont,**

### Proceedings of 2012 IEEE-EMBS International Conference on Biomedical and Health Informatics)

In this work, wireless black box using MEMS accelerometer and GPS tracking system is developed for accidental monitoring. The system consists of cooperative components of an accelerometer, microcontroller unit, GPS device and GSM module. In the event of accident, this wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital.

### III. EXISTING SYSTEM

Investigating a traffic accident, the officers will try to reconstruct the event from indirect sources such as the information given by the road users involved, or by eye-witnesses, about the circumstances, the characteristics of the vehicles, the road and the drivers.

The combination of indirect observation and lack of systematic control make it very difficult for the investigator to detect which factors, under what circumstances cause an accident. Although the researcher is primarily interested in the process leading to accidents, he has almost exclusively information about the consequences, the product of it, and the accident.

### IV. PROPOSED SYSTEM

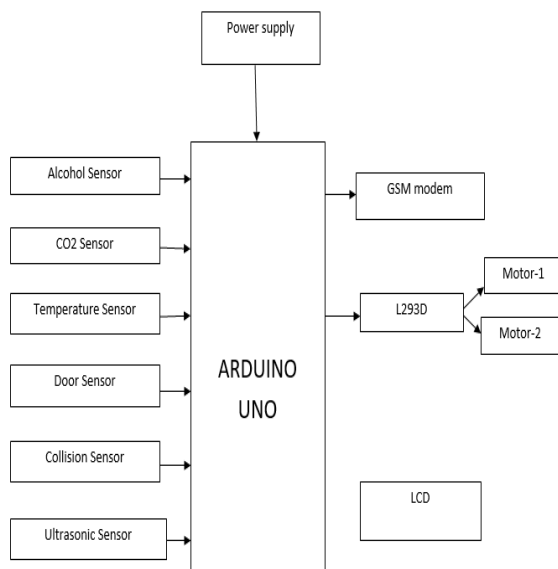


Fig 1. Block diagram.

This paper proposes a prototype of an automatic Black Box system that can be installed into vehicles. The system aims to achieve accident analysis by objectively tracking the vehicle. The system also involves enhancement of

security by preventing tampering of the Black Box data [1].

The message will be send to the pre-stored number in the case of detection of an accident. This system consists of Alcohol sensor, door sensor, Ultrasonic sensor, Meamory Unit, co2 sensor and temperature sensor and GSM modem. Whenever an abnormal value is detected it will send ansms to the prestored number.

### V. HARDWARE REQUIREMENTS

#### 1. Aurdino Controller:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.



Fig 2. Arduino Uno is a microcontroller.

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 Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

#### 2. Alcohol Sensor:

This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple; all it needs is one resistor. A simple interface could be a 0-3.3V ADC.



Fig 3. Alcohol Sensor.

### 3. GSM Module:

GSM stands for Global System for Mobiles communications.

It is a digital cellular technology used for transmitting mobile voice and data services.

GSM is the most widely accepted standard in telecommunications and it is implemented globally.

GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world.

The GSM network is divided into three major systems,

- The Switching system (SS)
- The Base station system (BSS)
- The Operation and support system (OSS)

### 4. Temperature Sensor:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centi-grade scaling.

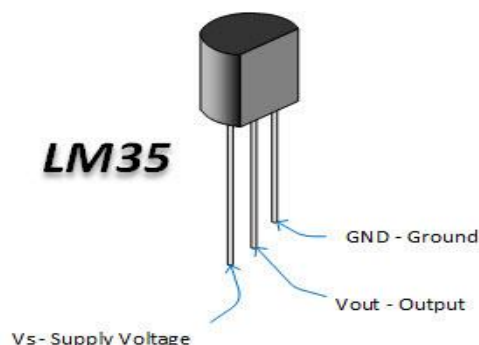


Fig 4. Temperature Sensor.

### 5. LCD:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to a controller is an LCD display.

## VI. EXPERIMENTAL RESULTS

The values from Arduino are communicated to Raspberry Pi over USB. The Raspberry Pi virtual desktop output is

shown in Figure 6. Figure 6: Raspberry pi virtual desktop output The alcohol value is 167; this is a digital value indicating the presence of low alcohol, which gives the information that the driver was not drunk. The alcohol sensor gives an analog output, which is connected to the ADC on the Arduino board.

The ADC is 10-bit with reference voltage 5V. Hence an output of 167 corresponds to voltage level of 0.82V. The distance of the obstacle in front of the vehicle, given by the ultrasonic sensor is 8cm indicating the vehicle is too close. The seat belt status indicates that the driver did not wear the seat belt.

The LDR value is a digital output of ADC to which it is connected. The corresponding voltage is 4.44V indicating high resistance and that the light is off. The accelerometer is kept flat on the table, the values from the pins X, Y correspond to 0g values for the X and Y direction and the value from the Z pin gives the 1g value for the Z direction.

The process is repeated in different orientations to get the values of 0g along Z direction, 1g along X and Y directions. The 0g value and 1g value is subtracted for each direction and suitable scale is selected. The sensor values from the pins X, Y, Z are read. These values are subtracted from the corresponding 0g values and divided by the scale to get the acceleration values. The GPS coordinates give the location of the vehicle. The GSM module communicated the coordinates of the location and a help message to the pre-stored mobile number as shown in Figure 7. Figure 7: Text message received through GSM the wheel speed sensor module calculated the rpm of the rear wheels was shown in Figure 8.

Figure 8: Wheel speed sensor module output in an effort to incapacitate any manhandling or tampering of black box data in a crash event, all information stored in the memory will be encrypted by the Raspberry Pi as soon as a crash is detected. The encrypted file output is collected.

## REFERENCES

- [1] Abdallah Kassem, Rabih Jabr, Ghady Salamouni, Ziad Khairallah Maalouf, "Vehicle Black Box System", Proceedings of the 2nd Annual IEEE System Conference, IEEE 2008, pp. 1-6.
- [2] Byung Yun Lee, Yong Yoon Shin, Hyun Joo Bae, "Development of Insurance Server System based on Vehicle Driving Information", Proceedings of 7th IEEE International Conference on Computing and Convergence Technology (ICCCT), 2012, pp. 156 - 159.
- [3] Sung-Hyun Baek, Hwa-Sun Kim, Da-Woon Jeong, MiJin Kim, You-Sin Park, Jong-Wook Jang, "Implementation Vehicle Driving State System with OBD-II, MOST networks", Proceedings of the 17th

- Asia-Pacific Conference on Communications (APCC), IEEE 2011, pp. 709 – 714.
- [4] Chien-Chuan Lin and Ming-Shi Wang, Department of Engineering Science, National Cheng Kung University, Tainan, Taiwan, “An Implementation of a Vehicular Digital Video Recorder System”, Proceedings of 2010 IEEE/ACM International Conference on Green Computing and Communications & 2010 IEEE/ACM International Conference on Cyber, Physical and Social Computing, pp. 907 – 91.
- [5] Milind Khanapurkar, Dr.Preeti Bajaj, Dakshata Gharode, “A Design Approach for Intelligent Vehicle Black Box System with Intra-vehicular communication using LIN/Flex-ray Protocols”, Proceedings of 2008 IEEE International Conference on Industrial Technology IEEE 2008, pp. 1 – 6.
- [6] Duy Le Nguyen, Myung-Eui Lee, and Artem Lensky,” The Design and Implementation of New Vehicle Black Box Using The OBD Information”, Proceedings of the 7th IEEE International Conference on Computing and Convergence Technology (ICCCT), IEEE 2012, pp. 1281 – 1284.
- [7] XuHui, Li Jing-zhao and Yin Zhi-Xiang, Sun Xia, “Design of Vehicle Black Box based on Dual-core System and 3C/OS-II “, Proceedings of the International Conference on Industrial Control and Electronics Engineering, IEEE 2012, pp. 763 – 766.
- [8] Watthanawisuth, N., Lomas, T., and Tuantranont, A., “Wireless Black Box Using MEMS Accelerometer and GPS Tracking for Accidental Monitoring of Vehicles”, Proceedings of IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), IEEE 2012, pp. 847 – 850.