An Analysis and Implementation of Vehicle Black-Box System

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Abstract- *The main purpose of this paper is to analyze and implement the prototype of Black-Box system in the vehicle of all kind. This prototype contains all the basic features which are essential to analyze the system and vehicle environment activities. This system helps to find exact cause of accident and helps to improve the vehicle safety, and also helps the owner of the vehicle and others during insurance claim.*

Key words- Black Box, Vehicle Safety, Arduino Chip, Camera, Microphone, Sensors.

1. INTRODUCTION

According to the survey of world health organization on road safety 2015, reflecting data of 180 countries shows that total number of road traffic deaths are more than 1.25 million per year [1]. In order to avoid this collisions the Black Box system can be the first step towards the solution. By using the same concept of black-box used in flights we can implement it into vehicles to investigate vehicle crash [2]. This system could be the ultimate solution for investigation and insurance claims and also to improve the vehicle designs and safety features for future.

A large number of vehicles currently on the roads have electronic systems that record information in the event of crash. That's why it is important to have a video recording system into your vehicle to record the on time vehicle environment activities. This system contains mainly three major units first one is the recording unit, second is storage unit, and third unit contains the recharging system.

To execute first unit's work black box have some sensors to record system activity and to record environment activity black box contains cameras and microphones. Second unit have different storage devices in which separately every data will get stored. And third unit have some regenerative system which helps to provide the energy to entire system, so the whole system can work for longer duration.

2. SYSTEM ARCHITECTURE

This system mainly contains two sub-systems which are listed below,

A. Vehicle Monitoring System

This system mainly used to record vehicle performance and functional activities.

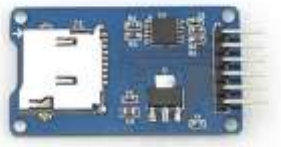
1.Temperature and Humidity Sensor - In this system we used DHT11 Temperature and humidity sensor to record the temperature and humidity. This sensor is fitted near the engine so that at the time of accident it can record temperature and humidity of the vehicle engine compartment. By using this sensor we could know the accident cause in case of engine catching fire or other causes.

Temperature and Humidity Sensor [3]

2.Speed measuring sensor- Here we have used LM393 speed measuring sensor which helps to calculate the speed by using photoelectric waves. By using this sensor we can get the speed and rpm of the flywheel.

Speed Measuring Sensor [4]

3.Micro SD Card Storage- For this system we have used KG072 micro SD card Storage Device which is directly connected to Arduino chip which controls all the functions of other sensors. This storage system is stores all the digital data which is get collected from all the sensors.



Micro SD Card Storage [5]

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4.Arduino Uno R3 Board- Arduino Uno is a microcontroller board which is based on ATmega 328. It consists of 14 digital I/O pins, 6 analog pins, a power jack, a reset button, a 16b MHZ crystal oscillator and an ICSP header.* Arduino boards designs uses a variety of microprocessors and controllers. This board act like a brain for the all sensors it collects all the data from sensors and send it to the micro SD card storage module.

Arduino Uno Board [6]

B. Driver Monitoring System

This system is created to monitor the driver activity and also to monitor the external environment activities.

1.Alcohol Detector Sensor- MQ3 Alcohol detector sensor senses the level of alcohol in the different levels like: Sober, Drunk, heavily drunk. This sensor is mainly used in breathalyzer. This sensor have low sensitivity to benzene and high sensitivity to alcohol. When the alcohol level increases above the set limit the buzzer present in circuit starts to warn by making a beep sound.

Alcohol Detector Sensor [7]

2.Digital Camera- Cameras are used to capture the surrounding activities of cabin as well as outside of the vehicle. Totally 3 cameras are equipped in this system. In this system we have used 720pixel and night vision camera for a video recording. This

camera also have night vision feature to record video clearly in the night also. CCTV cameras to reduce the cost but the user can install various types of cameras according to requirement.

Camera [8]

3.Microphones- In this system we have used small microphones along with the cameras. Which has noise cancellation feature. This microphone records all the voices inside the cabin from different places.

Microphone [8]

4.Digital Video Recorder-The DVR is used to record the video and audio from cameras and microphones and sends it to the hard drive for storage. DVR is also available in different qualities so user can choose as per requirement.

Digital Video Recorder [9]

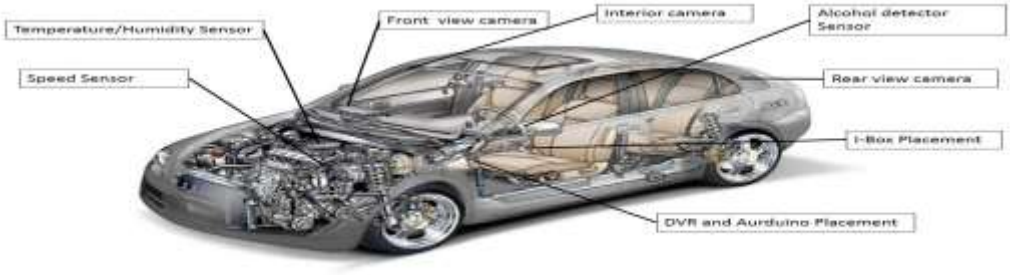
5.Hard Disk Drive- In this system we have used 1TB hard disk to store specifically all the video and audio data.

Hard Drives [10]

6.Battery- To run the whole second system we have used 12v DC, 35 Ah Lithium ion rechargeable battery. This battery have capacity to run the complete system continuously for more than a week.

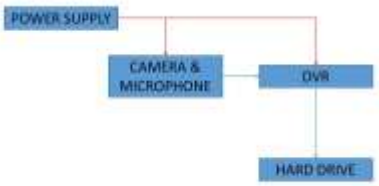
Battery [11]

3. SYSTEM OVERVIEW-

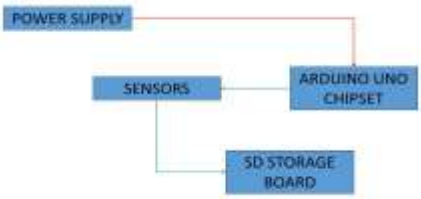


Basic layout of car BLACK-BOX implementation [12]

A. Driver Monitoring System Path Flow-

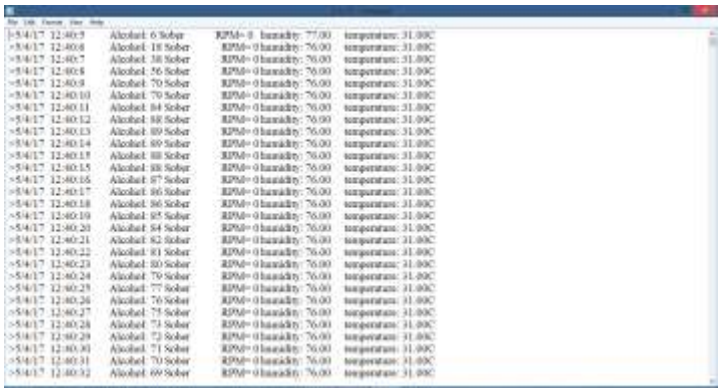


B. Vehicle Monitoring System Path Flow-



4. EXPERIMENTAL RESULTS-

A. Recorded Data File-



5. Conclusions and Future Work - This Paper presents a new and useful invention to the automotive industry, which is the black box system used for any vehicle. This paper also shows a detailed information and structure of the black box. Whenever the driver drives the vehicle or the vehicle is parked, the system will continuously save the data in the separate chamber where hard drives are kept. This chamber will be made out of tough material (ex-steel) which will make it unbreakable, fire proof, and water proof, so the data will be completely safe in any condition. As a future development we can also attach one regenerative system to recharge the batteries.

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