CAR BLACK BOX SYSTEM

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Abstract – *Most of the time, whenever we read or hear any news related to travelling, it is an accident. Millions of peoples are losing their lives because of accidents that occur every year. In recent years, the accident rate has been increased, and in some cases, false accidents are shown. The main cause of death was recorded due to the unavailability of medical services at the time of accident, and also the reason for the cause of accident is also not known. So to overcome these problems, a car black box system came into existence. The main objective of the system is to develop a hardware system which can monitor image and video, motion detection, humidity & temperature with real time continuously on SD card. Monitoring various environmental parameters such as temperature & humidity along with other factors can be of significance in various fields. It can be secured, easy & fast for accessing. So any signals can be logged into memory so that any authenticated person can observe the data from any place (here from same place too). The information is collected by Raspberry Pi on SD card and through camera module and other sensors which are connected to the raspberry pi which is based on Linux operating system. The language used by the raspberry pi is Python. The monitoring system will display the data (if needed and wanted) in real time which help the investigation to find out the scenario of accident occurred. Here, for demo purpose monitor is used to display output.*

1. INTRODUCTION

Nowadays, most of the vehicles (mainly car), which are highly automated are using black box system. The car black box system is one of the promising solution for public safety. The car black box system is nothing but a vehicle-based CCTV (Closed Circuit Television) which records video, images, sound, time and many more parameters if included. The Black Box concept is derived from the aviation industry, a flight recorder, known as a black box also known as EDR. Although it is now orange colored for easy search, is an electronic recording device placed in an aircraft for the purpose of the investigation of aviation accidents and incidents. With the advancement in technology and cost coming down, in our project we attempt to build similar device for cars. According to the results of a newly published study, more and more car black boxes are installed for accident evidence. More recently, car black box systems are used to prevent some crimes. So, with minimum number of hardware to build a strong evidence collection which can later be implemented in any vehicle is main aim of the system.

1.1 Background

According to the WHO (World Health Organization), more than a million people in the world die each year because of transportation-related accidents. In order to react to this situation, the black box system took 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. In an Army Transportation Vehicle too, black box technique used with help of different recorders. Mainly, it consists of three different recorders. First is Cockpit voice recorder, which records cockpit conversations, ambient sounds, radio communications, front/rear video recording, and passenger seating. Second is Operating data recorder, which records engine performance, speed, direction of travel, distance, normal operations, and impact acceleration from sensors. These two are mainly known as data recorder which receives data from both recorder and saves the data to a disk. Provides data protection by erasing memory if the box is tampered. Recorded data is rotated every 24 hours. And, the third recorder used is quick access recorder which records fuel flow and level, temperature. Data easily available but not impact resistant.

A significant number of vehicles currently on the roads contain electronic systems that record in the event of a crash. That is why it is so important to have recorders that objectively track what goes on in vehicles before and during a crash. Subjective input that is taken usually from victims, eye witnesses and police reports. This system is mainly committed to two 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 basic functions of a black box system should include continuous audio/visual recording for both the front and rear of the vehicle. This will be part of the voice and visual recorder. The next part of the

black box system is the vehicle data recorder including the status of the vehicle (ex. vehicle speed, engine health, inside temperature), environmental status (ex. outside temperature, climate), and passenger seating arrangement, etc.

To implement the first section, various types of sensors and python language are used. While the second section was implementing by using the softwares like putty, VNC server. This programming helps in not only recording the data but also retrieving the data from memory to any GUI display like monitor, mobile, or directly to LCD connected to raspberry pi (or RPi). In order to know which type of sensors to be installed into the vehicle various types of research are done and following ones are considered as the most important data that is needed after the accident. Here to make it simple and easy to access, we used Camera sensor, PIR Motion sensor, DHT11 humidity and temperature sensor, and RTC.

1.2 Problem Statement

Whenever an accident happens, the people nearby call the ambulance and relatives of victims through their mobile if available. The problem with this is that the victims depend on the mercy and help of nearby people. Sometimes you get help, sometimes you not. There are chances where no people nearby the accident spot or people who are around neglects the accident. Most of the time it happens in this way. This is the flaw in the manual system. There are many solutions proposed for the concerned problem and each one have some advantage over others. Presently tracking system and adding multiple sensors is introduced in vehicles to avoid accidents and save people's life. They have used microcontroller for this purpose. But the existing systems are available only in high-end vehicles, because the monitoring system is expensive. The Black Box system will give us easy solution. We need black box system which will give us instant feedback for any physical activity, and will also give access to the data on the Black Box system. If an accident were to occur, a Data Analyst can use the Black Box to determine the cause of the accident, and provide ways to prevent a future accident and new idea to improve the box. Potential benefits of this project are Vehicle monitoring (on the spot too if anyone can), Remotely monitoring vehicle sensor status, Evidence collection. Factors are likely to drive the economics of development as Safety and accident prevention, Vehicle maintenance, Cost of black-box maintenance, Hardware and software costs. System Boundary can be Vehicle, Climate conditions and Vibrations, Black Box RPi, Sufficient Power, Theft or loss of the box due to threats or accident.

The main problem that I have faced not just once but three times is of hardware that is SD card and sensors compatibility. I have and had to face the problem because of the memory problem and that caused SD card damaged which made me do the same process 3 times which was so time consuming and took too much time to complete the project and paper.

2. LITERATURE REVIEW

Sr.no	Author name	Paper name	Year
1	P. Ajay Kumar Reddy, P.Dileep Kumar, K. Bhaskar reddy, E.Venkataramana, M.Chandra sekhar Reddy	BLACK BOX FOR VEHICLES	2012
2	Abdallah Kassem, Rabih Jabr, Ghady Salamouni, Ziad Khairallah Maalouf	Vehicle Black Box System	2008
3	Monisha J Prasad, Arundathi S, Nayana Anil, Harshikha, Kariyappa B.S	Automobile Black Box System for Accident Analysis	2014
4	Rajashri R. Lokhande, Sachin P. Gawate	Design & Implementation of Vehicle Black Box For Driver Assistance And Alert	2014
5	Ranjitha S L, Ristha A S, Shilpashree M P , Aravind R	A Black Box with SMS Alert for Road Vehicles	2018
6	Chetan Patil, Yashwant Marathe, Kiran Amoghimath, Sumam David S	Low Cost Black Box for Cars	2013
7	Shiva Kumar N R, Venkatesh Murthy N K	Design and Implementation of Novel Video Compression Technique Using Raspberry Pi	2016
8	Ahmad Asi, Benjimin Chang, Mehdi Dadfarnia, Serge Kamta, and Ifzalul Khan	Black Box System Design	2010
9	Sasikala Guruswamy and K. Siddappanaidu	Real Time Video Black Box in Air Craft for an Intelligent Surveillance System	2015

3. CAR BLACK BOX SYSTEM

The proposed system consists of the Raspberry pi as the main processing unit for the entire system and all the sensor and devices are connected to it as shown in Fig- 1. The components are connected to the RPi through GPIO and CSI. The Camera and PIR motion sensor module repeatedly sends the data to the RPi and simultaneously DHT11 humidity and temperature sensor module and RTC too. The implemented design consists of Raspberry pi, camera module, PIR motion sensor module, DHT11 humidity and temperature sensor module. RTC (real time clock) is also added to get the real timing and date of the evidence.
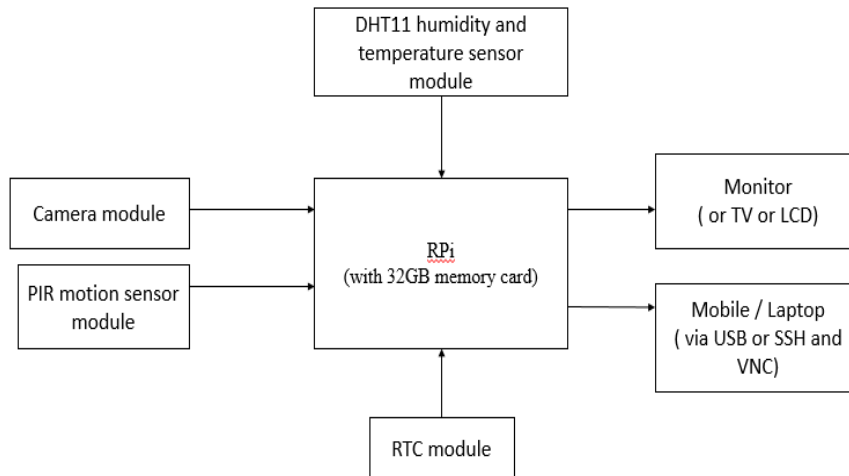
Fig- 1: Block Diagram of System
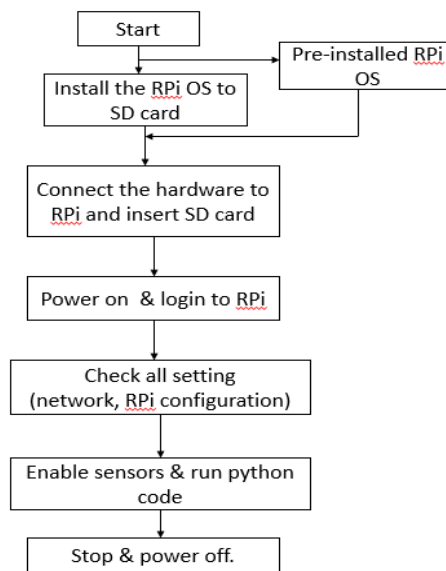
Fig- 2: flowchart diagram

As shown in Fig- 2, Initially raspberry pi OS is installed into the SD card and all the required hardware and sensors are connected to the RPi. Switch on the power supply and connect the raspberry pi to internet. Enable the sensors and write code for overall sensors. After that run the code in python. Finally check the output. For the demo purpose, initial working shown on monitor and also tried the proposed system via different softwares like putty shell, VNC server and viewer on mobile and laptop or PC and tried the headless setup of Raspberry pi too.

4. RESULT AND CONCLUSION

Whenever the motion is detected, the PIR sensor will detect it and the camera module will take down the pictures and will record the video. At the same time, DHT11 will record the humidity and temperature while, RTC will record time of motion detection. The system is really time consuming. Basically, for first time, all the sensors have to get setup done manually. Then only on the 2nd time on boot the modules will work properly. Some previously recorded data is also shown. To get started with Raspberry Pi computer we need the following accessories: A computer monitor, or television. Most should work as a display for the Raspberry Pi, but for best results, you should use a display with HDMI input. We will also need an appropriate HDMI cable, to connect monitor to your Raspberry Pi.

Fig- 3: Hardware setup

As a result of the project after running the code, we get the desired output as:
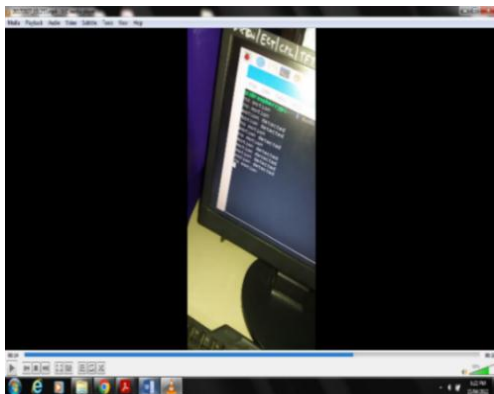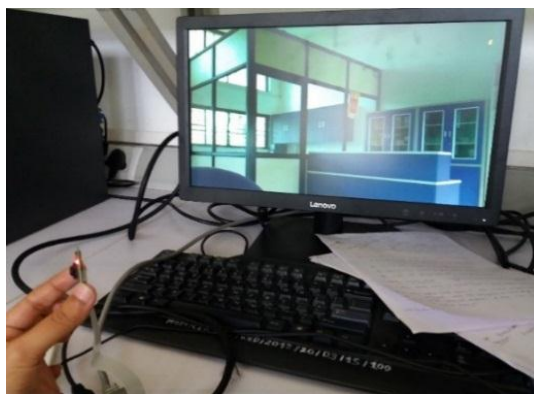

Fig- 4: Motion detection
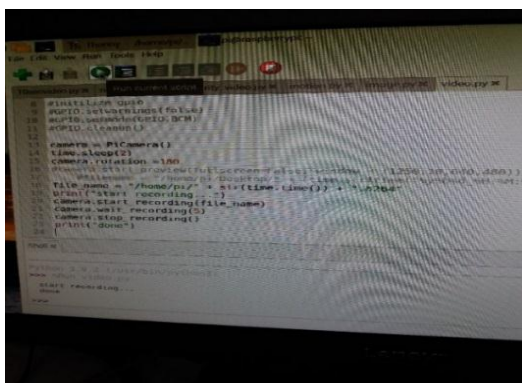

Fig- 5: captured image
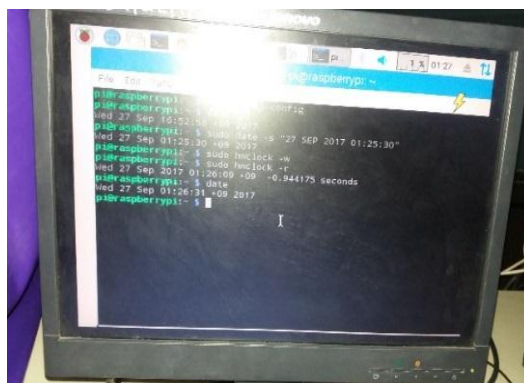

Fig- 6: checking and recording video

Fig- 7: RTC output

This project present the design of a Car Black Box System. We have successfully implemented the embedded system which is small and gave good results and expected functioning. The data can be retrieved as required with great ease. The initial testing is done with connection to a monitor instead of an LCD display or mobile for simplicity on trial purposes and later on the actual platform.

TROUBLESHOOTING

Basically it is easy to run the system with preinstalled OS, but when it get corrupted you have to reinstall the system and do all the setup and package installation. It is literally very time taking process. And within this process, as the raspberry pi is continuous technology, it is getting updated every day. So, it is hard to get new hardware because of the cost. (I have faced this problem and had to reinstall the system and network and other setup 3 times.)

Here is the list and some images of errors and problems caused during project working:

1. Port binding error: caused on opening python 3 in raspberry pi. Solved adding auto lo to network interface i.e. sudo nano /etc/network/interfaces which is needed to loop back interface to run idle.

2. Broken installs: unable to fix install. So used sudo apt-get -f install for fixing broken installs.

3. /etc/resolv.conf: empty file which means you are not online yet. It should get filled in automatically or automagically when you connect to router (wifi or otherwise) via DHCP.

4. Network error problem: unable to connect to internet. So have to add configuration setup to config file of Ethernet and wifi mode.

5. Other problems like unable to boot system, lack of stable power supply, due to that unable to stay raspberry pi active caused, but step by step resolved.

6. Due to connect and reconnect accessories, going to use IR sensor module got damaged, laptop, mobile and hard disk drive also got corrupted which made to format everything. That lost everything twice.

FUTURE SCOPE

Raspberry Pi is an innovative product. The Raspberry Pi is an amazing piece of hardware because it is a combination of the features of a traditional computer and an embedded device. For extra evidence, can use quad camera setup through USB port. Also, for better and easy access voice activation can and must get added. And, can add fingerprint or facial recognition system to make system and data secure. Make system with in-built app like Whatsapp to send recorded data to specific group of people for safe side and make system with voice command and voice recognition of driver or family, for theft and intruder. One can add an alarm which will alarm automatically when car is over speed and mainly system can be used for any vehicle not just for car.

ACKNOWLEDGMENT

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