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# Analysis of Accident and Safety system using Black Box

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**ABSTRACT**

This paper has proposed scheme of black box for the examination of accident. In this work details related to accident are stored. The work focuses on analysis of accident and a safety system with two features have been installed in the system. The information gathered is guaranteed that it is reliable as it is gathered only minutes prior accident, while the safety system aims to reduce the accident to some degree. The safety system detects drowsiness and brake failure, it alerts the driver.

**Keywords—Raspberry Pi 3 Model B , Black Box, Accelerometer, Load cell**

## I. INTRODUCTION

Black Box is the most interesting word, when it comes to air crash. Since the reason behind air crashes were not easy to determine causing heavy damage to life and company, hence black box was implemented in all aero planes. Black Box basically means being opaque only the given input and output are known, its internal working is not known. It is common knowledge among people once an air crash occurs black box is required for investigation. Hence an idea has been proposed to implement a similar kind of black box in vehicles especially cars to determine the cause of accidents.

Here, proposed work plans to do an Analysis of accident based on black box. With respect to earlier works few changes have been proposed. It has been proposed to replace ARM XScale with Raspberry Pi 3 Model B. Various advantages can be achieved by replacing the previous processor ARM XScale with Raspberry Pi 3 model B like the size of black box can be reduced to a great extent, memory storage is high and usage of CAN bus is eliminated due to in-built interfaces present in Raspberry pi 3. Hence overall decreasing the size of black box to a great extent and reducing the overall dependence on cameras. The previous work heavily relied on camera and microphones while in this work complete reliance on camera has been avoided instead some sensor has been added. The physical parameters like position of steering wheel angle, press applied on brake pedal, air bag state, vehicle light state, road inclination and vehicle speed were considered in previous works. In 2016 Australia installed black box in their vehicles but it was not meant for accident detection, the black box here records the speed of driving so that it becomes easy for their police to determine whether the vehicle was speeding or not.

## II. LITERATURE SURVEY

In WIRELESS IN-VEHICLE COMPLAINT BLACK BOX [1], virtual co driver software had been built for analyzing the cause of accident. While in this proposed work, virtual co driver is not needed as the results are directly obtained from sensors. The physical parameters like lights condition of vehicle, road, press on brake pedal, vehicle speed. The previous

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work was totally image processed. The former work considered vehicle, driver and road as the important aspect for building the black box.

In [2] and [3] the work is thoroughly different. Here a different aspect of black box is considered, it is mostly related to electromagnetic field. It does not focus a building a black box for the sake of determining the reason behind accident. In this work a black box and white box method has been proposed for the identifying and reducing the abnormal noise present in hub permanent magnet synchronous motors. The work is carried out in three steps. In first step sources of abnormal noise irrespective of the internal parameters are recognized and then a white box method is used to verify the sources of abnormal noise. In last step after identifying the source of abnormal noise, the noise reduction takes place.

In ROBUST VEHICLE-TO-INFRASTRUCTURE VIDEO TRANSMISSION [4], paper portrays work on video transmission system kind of road surveillance. Based on three dimensional discrete wavelet transform, an idea has been proposed on scalable video coding by introducing algorithms and unequal packet loss protection. The system has been tested in real environment. It has been observed even when vehicle are moving a good quality video can be transmitted but at a distance of 600-800 meters. Since the complexity is low it can be used in surveillance. When it comes to surveillance, China is considered to be the undeniable lead as it is the country consisting large number of surveillance camera in world. Due to this reason China is often tagged as security state. While in India only few cities are under surveillance cameras, like New Delhi, Chennai and Pune. Since Raspberry pi can be used for multipurpose, one of the work focuses on using Raspberry Pi for road traffic surveillance in [8]. In this work, in this work constant checking and recording of traffic takes place. The traffic updates can be displayed on the digital board with the help of advertising agency. In this way the driver can avoid crowded regions and opt for any other route.

A design centered on black box method had been proposed to tackle the issues of electromagnetic and thermal problem in [7]. Till date Intelligent Transportation Systems (ITS) have created different frameworks like Antilock Brake System, Active City Stop System, Attention Assistant System and they have been incorporated by different vehicles because of phenomenal execution. The greater part of the frameworks has been incorporated into high standard vehicles.

The objective of this work is to determine the exact reason behind accident so that it will be helpful during forensic investigation as well as while claiming insurance from company. What's more it has been proposed to introduce a safety system which is utilized to caution the driver and other traveler's if driver's drowsiness is recognized and Brake fail system to identify brake failure.

## III. BLOCK DIAGRAM

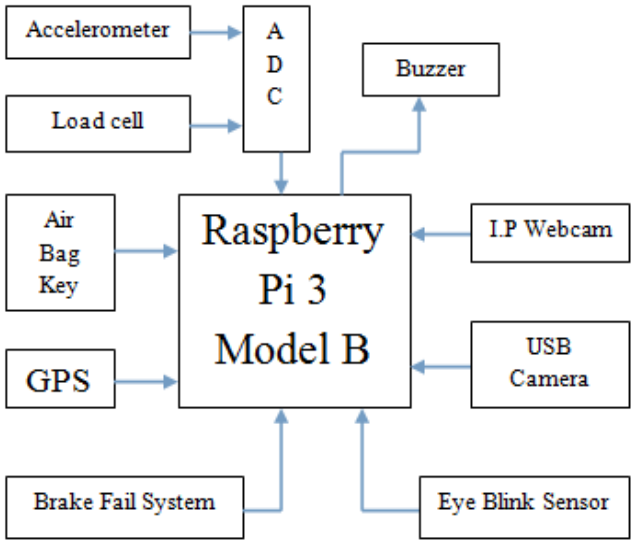


Figure 1 Block Diagram of Black Box

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This work has utilized two cameras one is I.P camera and other one is USB Camera, Air Bag Keys, Accelerometer, Load cell, Analog to Digital Convertor (ADC), Buzzer, Brake Fail System, Eye Blink Sensor. Since the raspberry pi contains inbuilt interfaces, no CAN bus is required. This work has utilized ADC in order to interface Accelerometer and Load cell to the Raspberry Pi 3 Model B due to their analog output.

## IV. HARDWARE DESCRIPTION

### *A. Raspberry pi 3 model B*

It is the third era of Raspberry Pi. It is speedier than past ages of Raspberry Pi. It's shape is like debit or identity card. It has remote LAN and Bluetooth network making it more noteworthy than past ages. It's processor is Broadcom BCM 2837 chipset, 1.2 GHz quad-core with 1 GB RAM memory. Raspberry Pi has demonstrated it's productivity in Traffic observation where movement has been persistently checked and recorded in [8]. With such a high interior memory it is not needed generally to stress over outer memory establishment., a memory card of 16 GB has been used so it stores the information and it help the forensic team or insurance team in getting the information put in another PC (Personal Computer) moreover. In this proposed work Raspberry Pi is the core of this framework, a pivotal processor which will help in acquiring and storing information. All the processing is done in RAM but the data is stored in SD card of 8 GB. Since the booting takes place from secondary storage, a memory card is of utmost necessity.

When at any point, a mishap or accident happens, it triggers the air bag and afterward black box consequently stops the information gathering and the information is put away in the memory of raspberry pi. Information gathered is supportable as it is gathered seconds before accident. It will store the last GPS address, the amount of pressure applied on brake pedal, position of steering wheel and the data gathered from both the cameras regarding any time.

Figure 2 Raspberry Pi 3 model B

### *B. I.P. Webcam and USB camera*

Internet Protocol (I.P.) Camera is for the most utilized device used for inspection. Through the I.P address of the camera the team can get the information. I. P. Camera has discovered its application in Day care to monitor the developments of children around one year in [9]. It has been even used in homes to keep track of maids or nanny taking care of small children. Since the

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I.P camera is very expensive it has been replaced with similar working equipment or it can be rather classified as mobile application that is I.P Webcam. The I.P. Webcam is connected to the raspberry pi via Wi-Fi by using its I.P. address. Also, with the help of I.P address the specific video can be recorded.

USB camera utilized here has VGA resolution and it has a scope of 40 cm. Because of wide scope of length and determination, it's ensured that it's nature of video of video will be great and clear. Both the cameras have built-in microphone. Hence usage of separate microphone has been eliminated. Also both the cameras allow capturing video at rate of 20 frame per seconds and 640 X 480 pixels.

*C. Eye Blink Sensor*

It is an I.R. based sensor. This sensor helps in recognition driver's drowsiness. It relies upon the nearness of cornea. The sensor will be available close to the territory of eye so it won't generally make obstruction for the driver. In an on and of chance it is considered that blinking of eyes within 4 seconds is not good. Hence 4 seconds has been set as the limit of eye blink.

At the point when the driver shuts his/her eyes, if the nearness of cornea isn't distinguished for a nonstop length of 4 s. At that point buzzer makes sound which thusly cautions the driver. This should be possible even by utilizing third camera straightforwardly by introducing a camera close to the driver, yet again preparing consumes more memory for functioning. Hence eye blink sensor has been introduced to keep track of driver’s fatigue.

*D. Accelerometer*

Accelerometer is utilized to ascertain the steering wheel position at the time of accident. It is placed at the midpoint of steering wheel. Data transmissions of the accelerometers are chosen at X, Y, Z axes. It expends less power, has each great temperature steadiness. Transmission capacity of the co-ordinates can be balanced at all 3 co-ordinates. It utilizes serial correspondence. In some works the 3 axes accelerometer has been used for transportation purpose [6].

*E. GPS*

GPS is Global positioning system, it is route framework that gives data about the area of the required GPS transmitter by the auto any place on earth. Web isn't required for getting to the scopes and longitude, yet in the event that it is specifically needed to distinguish the place of accident then web is required. After the information gathering stops, it stores the last GPS area of the vehicles. It will be generally helpful in deciding the correct area of accident by legal labs.

*F. Load cell and Brake Fail System*

Load cell is utilized to gauge the measure of press connected to the brake pedal. The power connected on brake pedal is straightforwardly relative to the electrical signal delivered. It's fundamentally a strain guage which has a setup of Wheatstone connect. A potential distinction is made because of contrasts in Tension and pressure when drive is connected at brake pedal. This potential difference is only the electrical signal in millivolts. It is exceedingly precise. They have for the most part discovered their utilization in Industries and by researchers. In this work we have utilized a fake brake which is associated with stack cell and the heap cell thus is associated with ADC at that point thusly it is associated with Raspberry Pi.

In brake fail system, failure of brake is identified, if in on and off situation by pressing brakes vehicle does not acts while driving, the bell makes commotion which thus not just alarms the driver but also the different vehicles close by with the goal that they can remain away and take their own decisions and act according to it, in order to stay away from any harm.

## V. SOFTWARE DESCRIPTION

Python is the language used here. It is a very high level state programming language. Space required for the language structure is very lower than C++. In this manner it has less memory utilization when contrasted with C++. It is thought to be more beneficial than customary dialects. Today python is popular to the point that it is utilized by numerous enormous associations like Google, Yahoo, Wikipedia, NASA, Reddit.

It can be effectively executed in programming items. It is open source programming. In this manner it has been tried and execution trials are continuing for constant speaker acknowledgment in [5]. Every one of the orders have been given through

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python just to all the equipment show in the work whether they have been associated specifically or in a roundabout way associated with raspberry pi. To associate with Raspberry Pi a USB interface is required. It is very simpler. It is question situated, in this way developer can utilize distinctive sorts of classes. It has broad help for Boolean articulations. The best working framework for Python is Linux. Nowadays businesses are utilizing python to secure data.

VI. RESULTS

After the mishap occurs we get the data in following manner. We get two videos which are evidences as actually what had happened just before the mishap. Two video files generated after accident as output.avi and output1.avi.

At the same time we also find what was the steering wheel position in X.Y,Z axes. Then the amount of pressure applied on the brake pedal, drowsiness state of the driver, date, time and the gps.

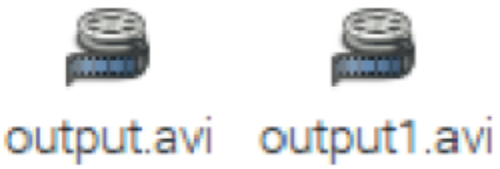


Figure 3 Video of two cameras

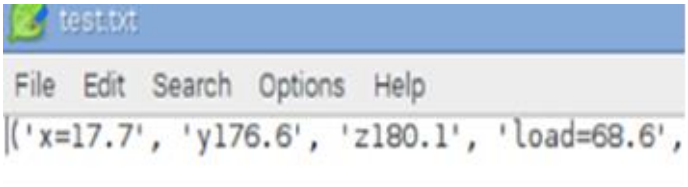


Figure 4 (part 1) Text output indicating Accelerometer's output, load cell output, eye blink sensor output, GPS output

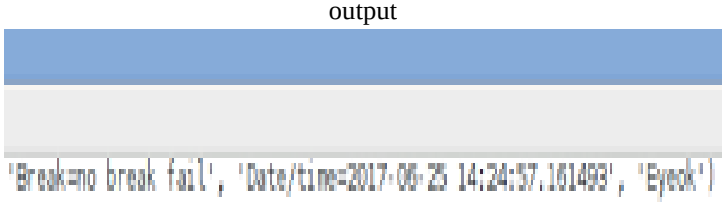


Figure 5 (part 2) Text indicating output result

The safety system cautions the driver as well as co passengers if any about brake failure by displaying the message as well as by making the continuous beep sound with the help of buzzer. The same goes for driver's drowsiness also in case it is detected the message as well as beep sound is displayed.

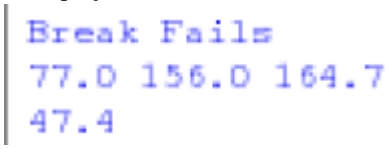


Figure 6 The message of brake failure while driving

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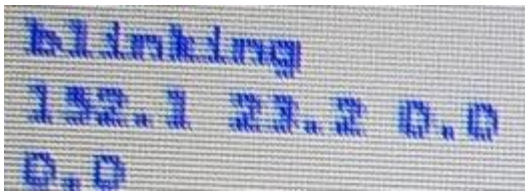


Figure 7 Eye blinking message when driver drowsiness is detected

## VII. **CONCLUSION**

This work does not require CAN bus. The idea of black box using Raspberry Pi 3 Model B has been successfully implemented. With respect to previous work, this work has avoided reliance on camera instead sensors have been used. But still there are two cameras at front of car and top of driver. The cameras will give top and front view of vehicle in order to find the actual state of vehicle and driver during accident. The prototype can help the forensic team to find the actual position of steering wheel, state of driver and the amount of pressure applied on brake pedal. Since the Raspberry Pi 3 model B has higher memory as compared to previous generations of raspberry pi and the ARM processor which was used in previous work, the need to set a video size is not required. But if the work demands a time limit be set, then 15 seconds is worth the time in order to know the real cause of accident. It was observed while using 3-pin SPDT switch as air bag keys in order to detect accident, needed to use pull up resistors in order to avoid short circuit. In safety system, if a driver's drowsiness is detected it alerts the driver as well as co-passengers if any and when the brake failure is detected it alerts the driver of vehicle as well as other vehicle passing by the road.

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