International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

BLACK BOX ANALYSIS SYSTEM FOR VEHICLES

P. Akshaya[1], L. Aparna[2], J. Mary Suji Mol[3]

[1,2]ECE Department, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India
[3]Assistant Professor, ECE Department, Jeppiaar SRR Engineering College, Chennai, Tamil Nadu, India

---

Abstract - *In modern World accident occurs everyday due to carelessness. The objective of this paper is to prevent accident by the use of Black Box Analysis System. It is a prototype model which monitors the speed level, distance and alcohol consumption level by using Speed sensor, Ultrasonic sensor and Alcohol sensor. When an accident occurs a mail is immediately send to a pre-stored mail id using MQTT cloud. The mail contains the location and image of the vehicle which undergoes with accident using IOT technology, so that first aid can be given immediately. Thus a person life can be saved. This prototype uses Raspberry Pi as an Microprocessor which functions as a Heart of the system. The several sensors are connected with the Raspberry Pi. The mobile GPS and IP Webcam are used to trace the accident occurred area.*

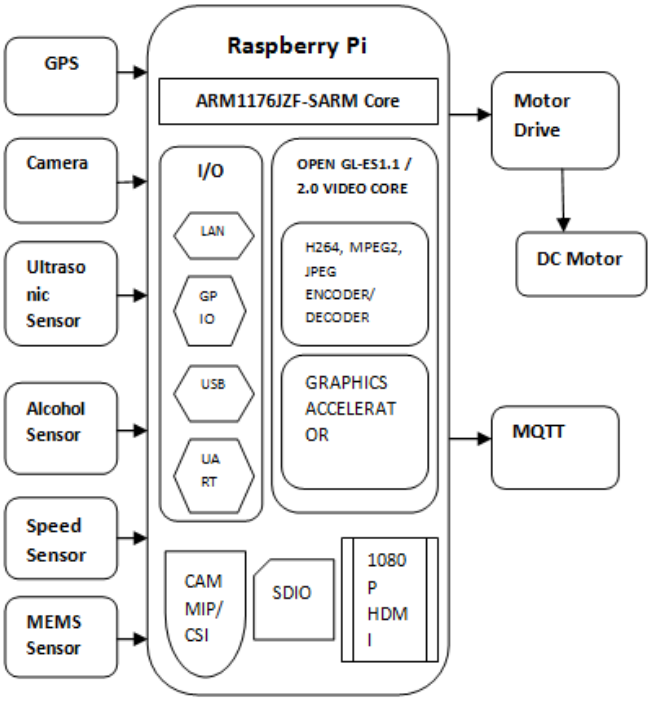
***Key Words*: Black Box, Raspberry Pi, Sensors, IOT technology, MQTT cloud.**

1. 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. 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 mail will be send to the pre-stored mail id in the case of detection of an accident. This system consists of Alcohol sensor, Speed measurement sensor, Ultrasonic sensor, MEMS sensor, IP Webcam and Mobile GPS. Whenever an abnormal value is detected it will be created in the form of log and send to the MQTT cloud it contain location and image.

1.1 Proposed Block Diagram

Raspberry Pi is interfaced with Alcohol sensor, Speed sensor, MEMS sensor, Ultrasonic sensor, camera and Mobile GPS. If any abnormal condition occurs it will send the total information to MQTT cloud. User can visualize the information anywhere in the world by using Mobile phone or PC.



2. HARDWARE DESCRIPTION

2.1 Raspberry Pi

In this project the latest version of Raspberry Pi i.e, Raspberry Pi 3 is used. The processor at the Heart of the Raspberry Pi 3 is a Broadcom BCM2837. This processor uses ARM Cortex A53 (ARMv8) cluster. The ARM cores run at 1.2GHz, making the device about 50% faster than the Raspberry Pi 2. The video core IV runs at 400MHz.

Features:

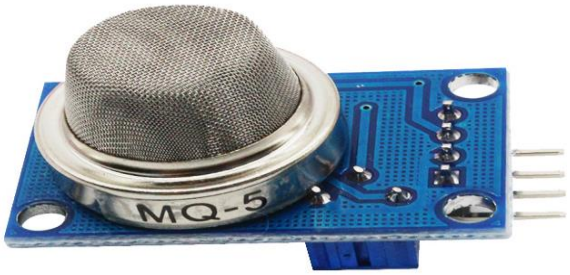
- One powerful feature of Raspberry Pi is the row of GPIO (General Purpose Input/Output) Pins.
- These Pins are physical interface between the processor and the outside world.
- Of the 40 Pins 26 are GPIO Pins and other are power or ground Pins.
- 1GB Memory LPDDR2-900 SDRAM.

2.2 Ultrasonic sensor

Ultrasonic sensor is used to measure the minimum distance of the nearby vehicle. It measures distance by sending out the sound waves at particular frequency and listening for that sound waves bounce back. It intimates the driver in case of any obstacle detected to avoid the crash of the vehicle.

2.3 Alcohol sensor

Alcohol sensor is used for finding the alcohol level while breathing. It has high sensitivity and response time. Alcohol sensor used here is MQ135 gas sensor which senses the gas like ammonia, nitrogen, oxygen, alcohols and smoke. Operating voltage is 2.5V-5V.

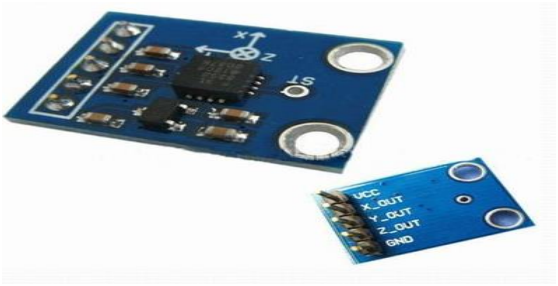


2.4 Speed sensor

Vehicle speed sensor is a type of Tachometer. It is a sender device used for reading the speed of the vehicle's wheel rotation. It is placed in the wheel of the vehicle and sense the speed by revolution produced by the wheel per minute. It indicates the speed value while driving. So that rash driving can be avoided by the driver.

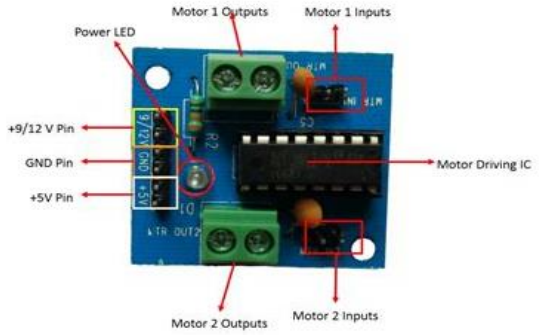
2.5 MEMS Sensor

MEMS stands for Micro-Electro-Mechanical Systems. Micro-Electro-Mechanical Systems consists of mechanical elements, sensors, actuators, and electrical and electronics devices on a common silicon substrate. Here we use MEMS sensor for accident detection which contains XYZ axis as output. When an accident occurs XYZ axis get interchanged thus the MEMS sensor sends an information as accident detected.



2.6 Motor Drive

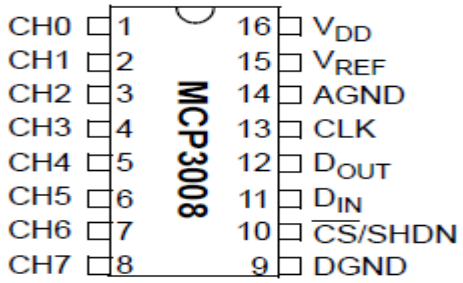
Motor driver is a quadraple High current half H drivers, which is designed to produce bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. It is used to run the prototype model.



2.7 MCP3008 8 channel ADC

The MCP3008 is a 10bit 8-channel Analog-to-digital converter (ADC) which contains 16 pins. It is easy to connect and doesn't require any additional components. It uses the SPI bus protocol which is supported by the Pi's GPIO header.

Here we use ADC for converting the analog values of the MEMS sensor to digital values.



MCP3008 Pin's	Description
VDD	3.3v
VREF	3.3V
AGND	GROUND
CLK	GPIO11 (Pin no. 23)
DOUT	GPIO9 (Pin no. 21)
DIN	GPIO10 (Pin no. 19)
CS	GPIO8 (Pin no. 24)
DGND	GROUND

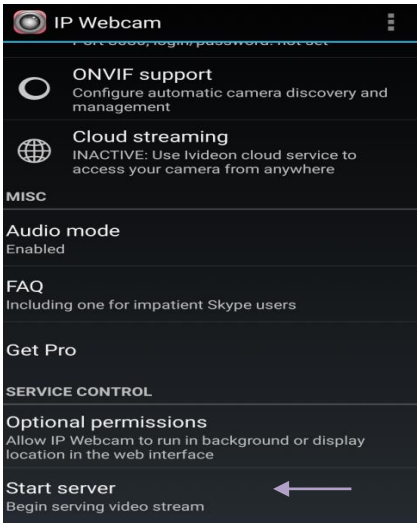
2.8 GPS

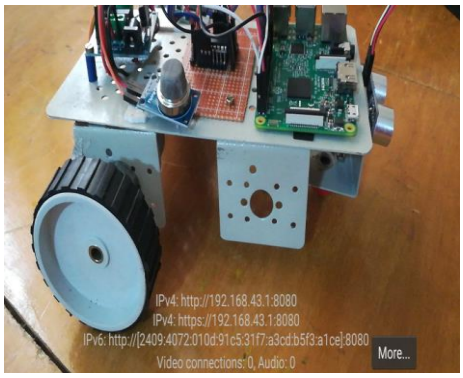
The GPS (Global Positioning System) is used to pinpoint the exact location which we want to find out. It makes possible for people to find their geographic location.

Here we use mobile GPS i.e., IMU+GPS Stream mobile application for identifying the location of the vehicle which is met up with the accident. This location is sent via mail to the pre-stored mail id.

2.9 Camera

Camera we use here is IP Webcam a Mobile Application. Using the IP Webcam Application we can turn our android device into a wireless IP camera including audio, video, talk, text to speech and commands. Connect the android device to wireless network. Start the IP webcam application by pressing "Start Server" at the bottom of main menu we can access to Webcam.





3. SOFTWARE DESCRIPTION

3.1 Python

Python is a high level, interpreted, interactive and object oriented scripting language. It is easily understandable for the reader as well as writer.

IDLE- In this project Python IDLE is used, which is Python's Intergrated Development and Learning Environment. Code for this project is written in IDLE. It has two main window types, the Shell window and the Editor window. It is possible to have many editor windows simultaneously.

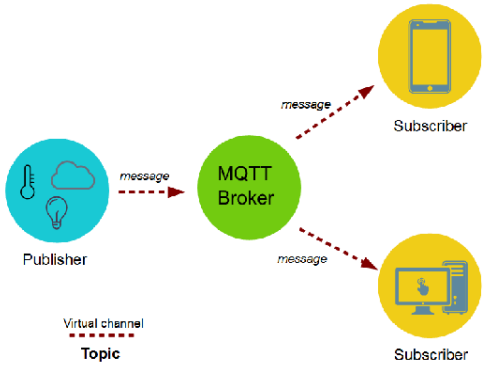
3.2 Raspbian OS

Raspbian is a free operating system based on Debian optimized for Raspberry Pi hardware .An operating system is the set of basic programs and utilities, which makes Raspberry Pi run. Raspbian comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation of Raspberry Pi. Initially build packages, optimized for best performance on the Raspberry Pi [2].

The Operating System used in this project is Raspbian Jessie with PIXEL. It belongs to the OS family unix-like. The programs for this project runs using this Operating System.

3.3 MQTT

MQTT is a Message Queuing Telemetry Transfer. It allows us to send commands to control outputs, read and publish data from the sensors and much more. This lightweight, open, simple and easy-to-implement protocol is suitable for constrained devices with low bandwidth, hence it is a perfect solution for IOT applications. MQTT enables resource-constrained IOT devices to send, or publish, information about a given topic to a server that functions as an MQTT message broker.

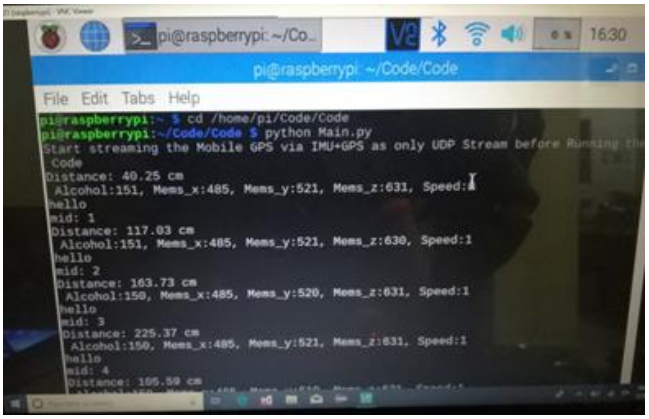


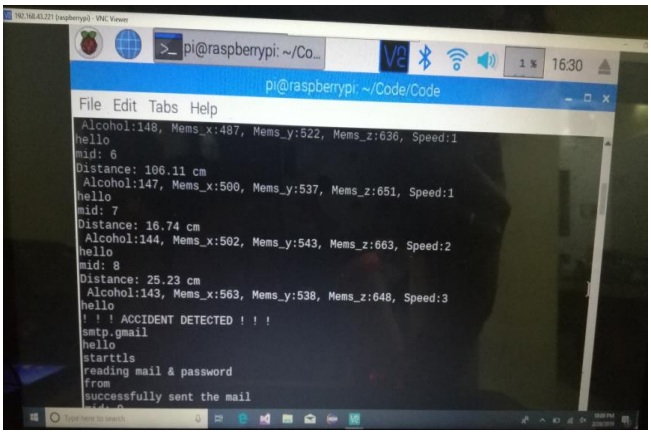
3.4 Internet of Things (IoT)

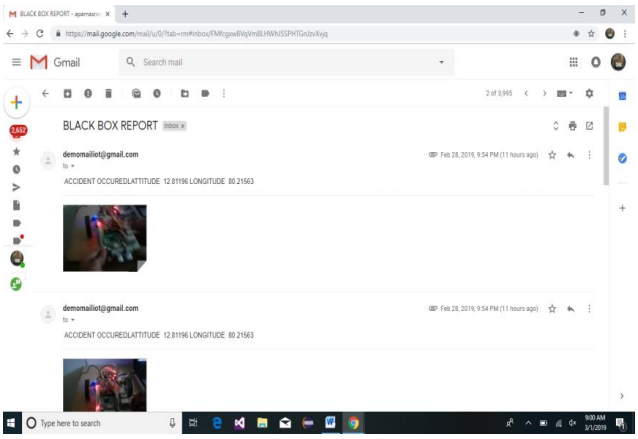
The Internet of Things is the device like vehicles and other electronic appliances that contains software and sensors which are connected to the internet. It is also called as Machine to Machine Communication. In this project the behavior of driver is monitored with the use of IOT Technology. When an accident detected, the mail containing location and image is send to the pre-stored mail-id using IOT. Mail can be read Any time, Anywhere in the world.

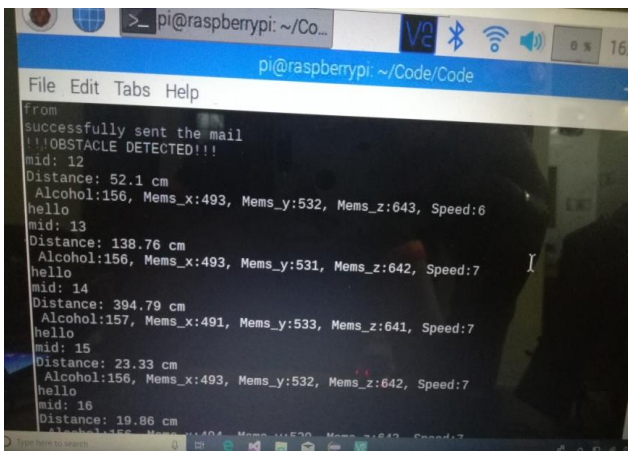
4. EXPERIMENTAL RESULT

All the sensors and camera interfaced with Raspberry pi. Once the program starts executed it will wait for interrupt. Once the abnormal value occurs it will create the incident data Log and send to the MQTT cloud by using mobile app. User can visualize the values anywhere in the world.









5. FUTURE SCOPE

According to the survey, most of the accident occurs due to rash driving and drowsiness in case of long driving. Thus this project is enhanced by keeping a speed alert in the case of rash driving and drowsiness detection with alert in case of driver feels drowsy.

6. CONCLUSION

A prototype of the Black Box Analysis System for Vehicles was designed and implemented successfully. The designed system comprises of camera, GPS, ultrasonic sensor, alcohol sensor, speed sensor, MEMS sensor and motor drive which were placed in and around the prototype model. Each of the sensors was tested and found to give desired output. These outputs were communicated to the raspberry-Pi controller. The Raspberry Pi controllers communicate with each other and regulate the sensors successfully. The data retrieved from the sensors are stored successfully and can be fully retrieved when required. The system also incorporates an emergency help module which automatically alerts the relatives via mail about the accident with the image and location.

REFERENCES

[1] Automobile Black Box System for Accident Analysis by Monisha J Prasad, S Arundathi, Nayana Anil Harshikha , B S Kariyappa,IEEE 2015.

[2] Raspbian OS - www.domoticx.com.

[3] https://internetofthingsagenda.techtarget.com/definition/MQTT-MQ-Telemetry-Transport

BIOGRAPHIES

P. Akshaya:
Student, ECE Department,
Jeppiaar SRR Engineering college,
Tamil Nadu, Chennai, India.

L. Aparna:
Student, ECE Department,
Jeppiaar SRR Engineering college,
Tamil Nadu, Chennai, India.