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Intelligent Vehicle Black Box

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ABSTRACT

Nowadays automobiles technologies are rapidly increase each and every year and also every second accident count also increase. So, while using some technologies like black box placed in the automobile means creating a new level of data service in vehicle. The automobile black box has functions similar to an airplane black box. It is highly useful to analyse the cause of vehicular accidents and prevent the loss of life and property arising from vehicle accident these paper presents the prototype automobile black box system it is having the group of sensor and also gives the black box sends an alert message to pre stored mobile number in the way of way2sms in the case of an accident

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.

Keywords: Black box, Accidents, Safety.

I. INTRODUCTION

- A car is the consequence of joined work of various frameworks. Every framework, however essentially free, be impacted by the impact of different frameworks connecting with it.
- Before talking about the cooperation of different frameworks, let us initially specify the different frameworks that are available in a vehicle. It is utilized to examine the reason for vehicular mishaps and forestall the death toll and property emerging from vehicle mishaps.
- The Motor Vehicles (Amendment) Bill, 2016 have been recorded for thought and entry in the present Budget Session of Parliament. It looks to deliver issues identified with street mishaps, outsider protection, and street well-being measures.
- Right now, present a few information on street mishaps, reasons for mishaps, and engine vehicle outsider protection.

According to the World Health Organization, more than a million people in the world die each year because of transportation-related accidents. Now, a day's many accidents are happening because of the alcohol consumption of the driver or person. Hence drunk driving is a major reason of accidents in almost all countries all over the world. The project is developed to record informational data, such as: speed of car temperature of engine, etc. to revolutionize the field of motor vehicle accidents investigation. It can also use for vehicle mapping and accident alert with the help of GPS and GMS technology. In order to react to this situation, the black box system draws the first step to solve this problem that crosses national boundaries and threatens the safety and health of people worldwide. As we know current accident ratio. There are different reasons behind the accident. Considering the practical aspects after accident we need to prepare for all insurance, Policy Claims. There are several clauses in policies, to satisfy each and every clause we need proper documentation. To get, that black box will help us. Black box will help you and insurance company too in order to conclude claims. In addition to that we will have accident tracking system.

Whenever the vehicle meet with an accident an Alert Message will be sent to home contact number including current GPS location of vehicle. This system will help to save life of people. Technically black box is used as a

safe to store system safely. At any Environmental condition it will remain as it is. Black box is used to store different parameter of vehicle in memory card.

1.1. PROJECT OBJECTIVE

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

II. LITERATURE SURVEY

1. **Accident Detection System using Black Box System, Tushar Shelke, Nilima Raut, Swati Sayare, Shital Bhade, Shital Manmode, Rajashri Sadawarti [1]** This study presents an accident detection system utilizing a black box for vehicles. The system integrates sensors to monitor parameters like speed, impact force, and vehicle orientation, enabling real-time data logging and transmission to emergency services for rapid response and post-accident analysis to enhance road safety.
2. **Automobiles Based Black-Box System Using IoT, S. Monika, S. Miruthulasri, R. Mano Priya, D. Murugesan [2]** This work proposes an IoT-based black box system for automobiles, collecting real-time vehicle dynamics data, such as acceleration and collision impact, and uploading it to a cloud server for remote access, improving emergency response times and aiding accident reconstruction.
3. **Black Box for Automobiles, Vandan Shah, Vatsal Sheth, Narendra Sharma, Ami Munshi [3]** This research introduces a black box system for automobiles, capturing speed, braking patterns, and crash impact with onboard sensors, designed with compact hardware and user-friendly interfaces to support accident analysis and insurance claims processing.
4. **Vehicle Black Box with Real-Time Crash Notification, Priya Sharma, Anil Kumar, Riya Patel, Sanjay Gupta [4]** This study proposes a vehicle black box system with real-time crash notification, using accelerometers and GPS to detect collisions and alert emergency services with location data, emphasizing low-cost implementation for widespread adoption and accident analysis.
5. **Smart Black Box System for Accident Monitoring and Reporting Ayesha Khan, Rohan Desai, Meera Singh, Vikram Rao [5]** This work presents a smart black box system that uses machine learning to analyze sensor data for crash severity, sending automated alerts via mobile networks, with a focus on data security and efficient real-time processing for accident monitoring.

2.1 BLOCK DIAGRAM:

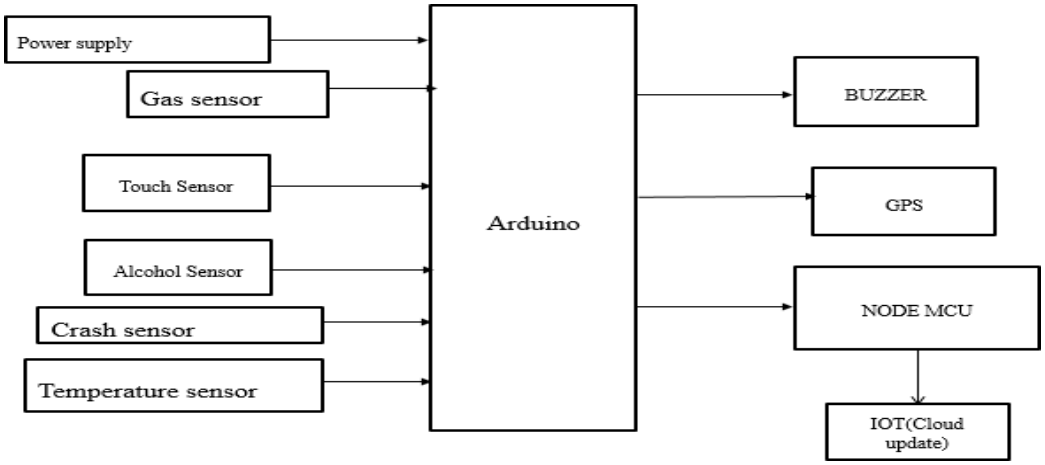

Fig 2.1: Block diagram of the project

2.2 HARDWARE REQUIREMENTS

- Arduino
- Node MCU
- Temperature sensor
- Vibration sensor
- Touch sensor
- Crash sensor
- Alcohol sensor
- Gas sensor

2.3 SOFTWARE REQUIREMENTS

- ARDUINO IDE

III. HARDWARE DESIGN

3.1 ARDUINO NANO AND ITS PROGRAMMING

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Arduino Nano:

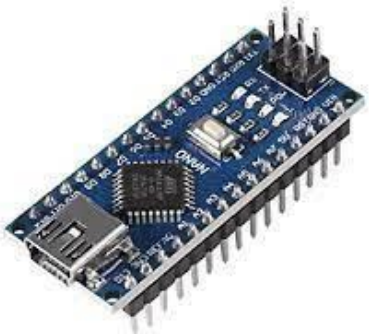

Fig 3.1 – Arduino Nano

Programming NodeMCU ESP8266 with Arduino IDE

The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use.

Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable and the NodeMCU board itself. You can check this Getting Started Tutorial for NodeMCU to prepare your Arduino IDE for NodeMCU.

NodeMCU is an open-source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro- controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open- source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in- line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects).

ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 Wi-Fi SoC, popularly called the "ESP8266 Core for the Arduino IDE".[17] This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCU's.

NodeMCU is an open-source LUA based firmware developed for the ESP8266 Wi-Fi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e., NodeMCU Development board.

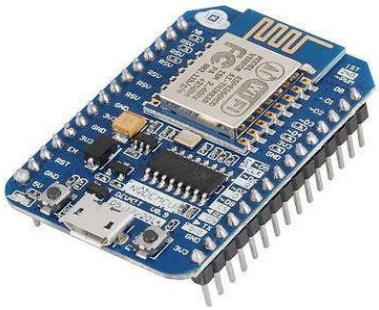

Fig 3.2 - NodeMCU Development Board (Version1)

TEMPERATURE SENSOR (LM35) FEATURES
DESCRIPTION

The LM35 series are precision integrated-circuit temperature sensors, with an output voltage linearly proportional to the Centigrade temperature. Thus, the LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain

convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C, over a full −55°C to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The low output impedance, linear output, and precise inherent calibration of the LM35 make interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 draws only 60 µA from the supply, it has very low self- heating of less than 0.1°C in still air. The LM35 is rated to operate over a −55°C to +150°C temperature range, while the LM35C is rated for a −40°C to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35Dis also available in an 8-lead surface-mount small outline package and a plastic TO-220 package.

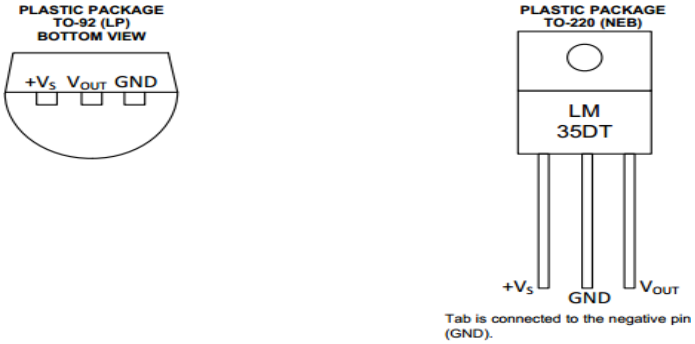

Fig3.4 - View of Temperature sensor

VIBRATION SENSORS

The piezoelectric sensor is used for flex, touch, vibration and shock measurement. Its basic principle, at the risk of oversimplification, is as follows: whenever a structure moves, it experiences acceleration. A piezoelectric shock sensor, in turn, can generate a charge when physically accelerated. This combination of properties is then used to modify response or reduce noise and vibration.

Why is that important? Because vibration and shock can shorten the life of any electronic and electromechanical system. Delicate leads and bond wires can be stressed, especially after exposure to long term vibration. Solder joints can break free and PCB traces can ever so slightly tear from impact and impulse shock, creating the hardest type of system failure to debug; an intermittent failure.

This article discusses piezoelectric shock and vibration sensors and sensor technology, focusing on available products (all parts mentioned here can be found on the Digi-Key website — links are provided), as well as design issues and design techniques.

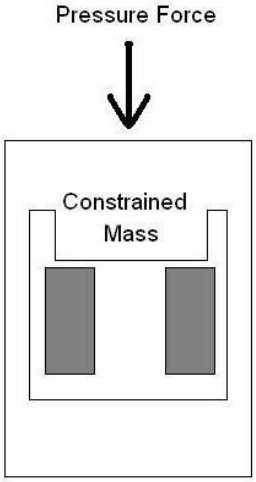

Fig 3.5: A constrained mass is allowed to deform the crystal sensor in one axis. This configuration is good for force and pressure.

An accelerometer based on the piezoelectric effect, would use a known mass to deform the sensing crystal part in either a positive or negative direction depending on the excitation force. It should be noted that you need a known modulus of elasticity in the sensor substrate.

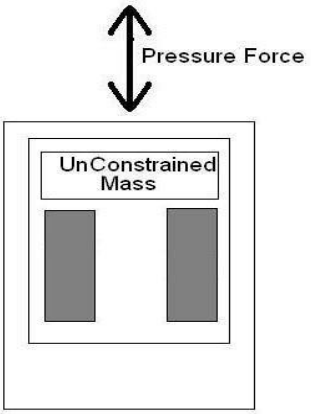

Fig 3.6: Because the modulus of elasticity is known for a substrate material, the unconstrained mass is allowed to move with vibration making this type of piezoelectric sensor ideal for detecting shock and vibration.

Alcohol Sensor

If the person inside car has consumed alcohol, then it is detected by the Alcohol sensor. In this project the MQ3 alcohol sensor is used. The MQ3 alcohol sensor is one of a series of easy-to-use gas sensors that can be directly connected to an ARDUINO. This sensor can be used to measure the percentage of alcohol content in a person by measuring the amount of alcohol is on their breath. MQ3 gas sensor has highly sensitive to alcohol and has good resistance to disturb of gasoline, smoke. The sensor would be used to detect alcohol with a different concentration; it is with a low cost and suitable for different application.

Gas sensor

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. What is this sensing element? Is it kept in some chamber or is kept exposed? How does it get current and how it is taken out? Let's find out in this Insight!!!

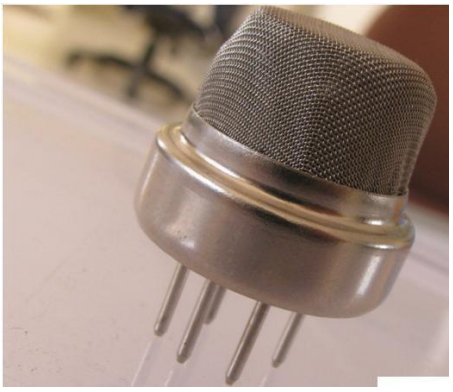

Fig 3.12 – Gas Sensor

The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

IV. SOFTWARE DESIGN

4.1 ARDUINO SOFTWARE:

ARDUINO

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g., Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

V. RESULT AND DISCUSSION

- When vehicle battery turn-on all the sensors continue to work. When vehicle ignition turned on registered mail address.
- gas and crash sensors send readings to the mobile device with If the threshold amount of gas is exceeded which means the driver or other toxic gas is pumped into the vehicle.
- Switch off the power engine and take an image, then send it to the mail, submit it to SMS with position coordinates gas sensor reading.

SCREENSHOT OF THE PROJECT

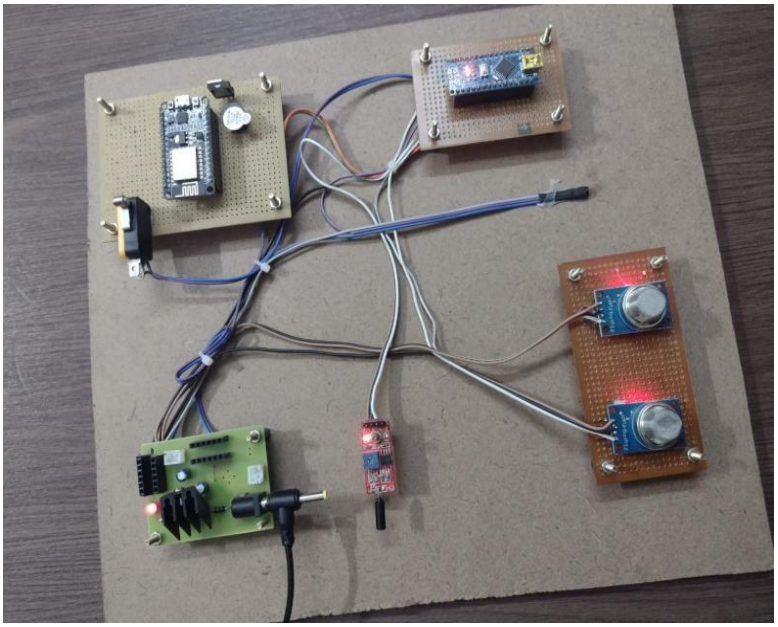

Fig 5.1 – Project hardware setup

Fig 5.2 – Project Code

Fig 5.3 – Output in Ubidots

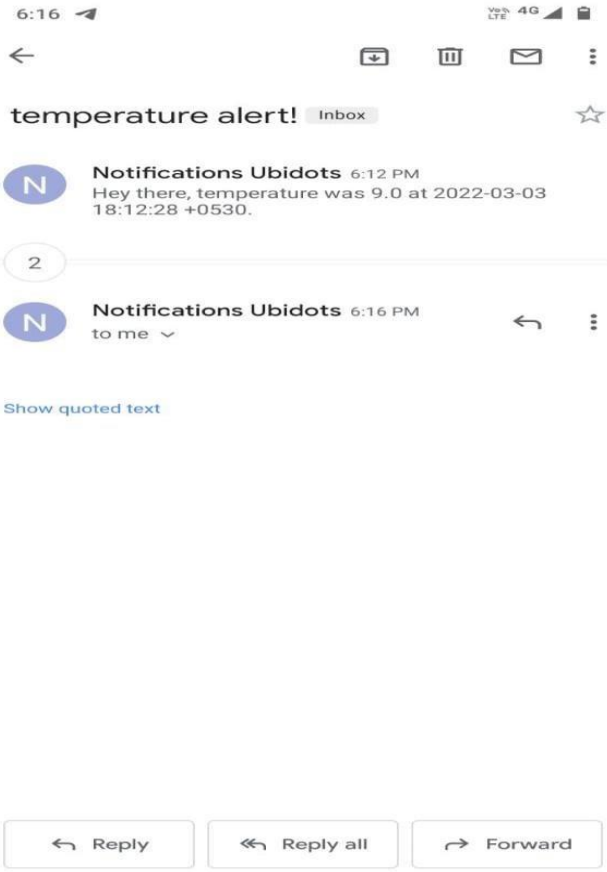

Fig 5.4 – Email Notification

VI. CONCLUSION

Setting up a postal contact and creating a black box to transfer data and pictures using the Internet of Things and using a webcam to figure out who took the vehicle by getting their snapshot while taking vehicle and data to find the vehicle if the vehicle is stolen using GPS coordinates. When the crash has happened, give the details of the sensor with the coordinates to the ambulance squad to save their lives. Additionally, the key system to provide coordinates with the position and speed of the vehicle in a smartphone device.

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