

# Deep Crash an Automobile Blackbox System

Dr. D. Rukmani devi<sup>1</sup>, B. Nikhileshwar Reddy<sup>2</sup>, G.N. Akhil<sup>3</sup>, G.V. Ajay kumar reddy<sup>4</sup>

<sup>1</sup> Professor, M.E., Ph.D., Department of Electronics & Communication Engineering, R.M.D Engineering College, Tamilnadu 601206, India

<sup>2,3,4</sup>UG Students, Department of Electronics & Communication Engineering, R.M.D Engineering College, Tamilnadu 601206, INDIA

**Abstract**—Automotive electronics plays a significant role in the automobile industry and provides luxurious features and more importantly addresses the safety and security concerns. The work presented in this paper aims at providing a cost-effective solution to the design and development of an event data recorder which has been basically adopted from the aviation sector considering the need and the correlated benefits. The paper presents an integrated design of the black box with the basic features of the data recorder which could be very useful for domestic vehicles and at the same time it also hosts several additional features that could assist in mitigating the number of accidents, or at bare minimum, will serve as an analysis tool to prevent future accidents by analyzing the previous accidents. The black box also provides automatic accident notification system which helps in informing the nearest hospital and the traffic authority by providing not only the coordinates of the accident but also the exact physical address for immediate medical attention which can save numerous lives every day. The black box also hosts several other features advanced web tracking anytime and from anywhere. Thus, the overall cost is highly optimized by integrating such multiple features

**Index Terms**— Arduino, Crash, GSM, Sensors

## INTRODUCTION

Accidents are the most common problem in the world. In so many cases people may die due to lack of communication. So, in this system, we use ARDUINO MEGA (ATmega2560) microcontroller which acts as brain of the system, because the entire system program instruction stored in it. Here we have used ultrasonic sensor, gas sensor and temperature sensor to know the status of vehicle and driver like level of fuel, detection of alcohol and temperature inside the vehicle, respectively. The data keep on reading from the vehicle using the sensors mentioned above and only the detection of crash sensor triggers to store all the

data read by sensor store to PLX DAQ. The GSM module we use here to inform respective person and public service organization. All the data are updated to cloud so that the system operation is either controlled or monitored using IOT.

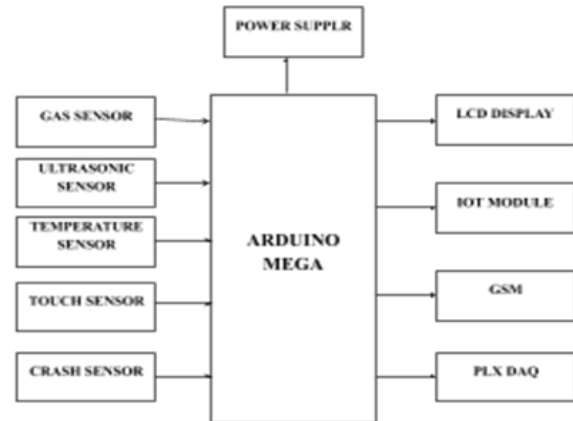
## EXISTING SYSTEM v/s PROPOSED SYSTEM

### EXISTING SYSTEM:

[1] The automotive vehicles do not have a black box system.[2] The accident data is not stored in any place.

### PROPOSED SYSTEM:

[1] In the advanced technology each vehicle is monitored, and the data are stored in memory.[2] The data are continuously uploaded to cloud.



Block diagram of proposed system

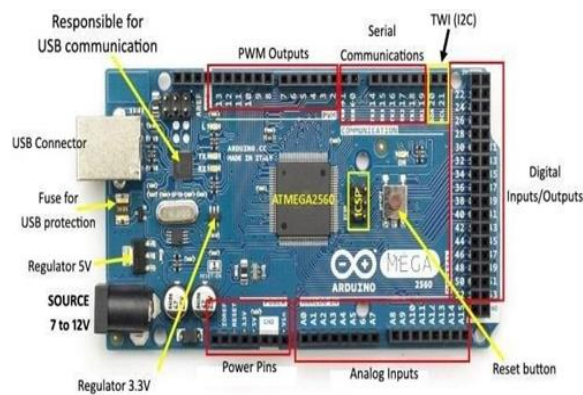
### ARDUINO MEGA

Here we use Arduino as it The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects. This gives your projects plenty of opportunities. The Arduino Mega 2560 is a

microcontroller board based on the ATmega2560. It has 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

### HARDWARE

Arduino is open-source hardware. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default boot loader of the Arduino UNO is the boot loader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS232 logic levels and transistor–transistor logic level signals. Current Arduino boards are programmed via Universal Serial Bus, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth, or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used. An official Arduino Uno R2 with descriptions of the I/O locations



### GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership. GSM/GPRS Modem RS232 is built with Dual Band GSM/GPRS engine SIM900, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands.



### INTERNET OF THINGS

The internet of things (IoT) is the network of physical devices, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as the infrastructure of the information society. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency,

accuracy, and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation, and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

ESP-12E BASED NODEMCU

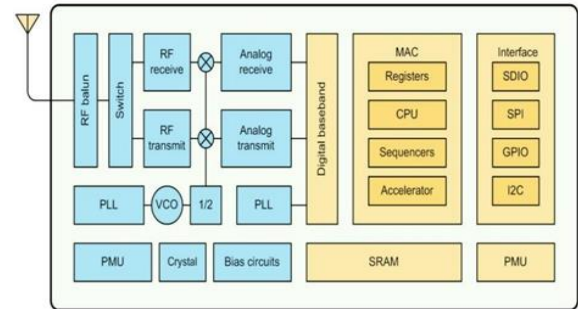
The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pinouts. With a micro USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly. ESP-12E Wi-Fi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LNA, on-board antenna.



ESP-12E BASED NODEMCU

ESP8266EX offers a complete and self-contained Wi-Fi networking solution; it can be used to host the application or to offload Wi-Fi networking functions from another application processor. When

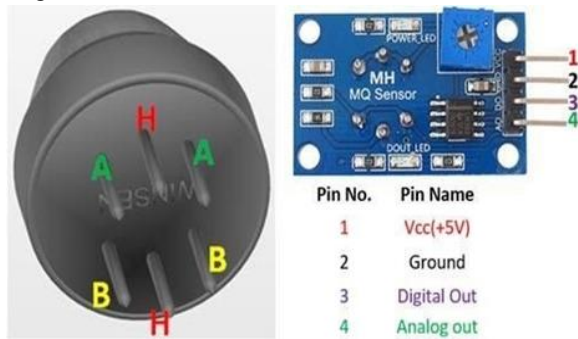
ESP8266EX hosts the application, it boots up directly from an external flash. It has integrated cache to improve the performance of the system in such applications. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity (SPI/SDIO or I2C/UART interface). ESP8266EX is among the most integrated Wi-Fi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution ESP-12E Architecture.



Gas sensor (MQ-2)

Sensitive material of MQ-2 gas sensor is SnO<sub>2</sub>, which has lower conductivity in clean air. When the target combustible gas exists, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electro circuit, convert change of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application. Sensor is sensitive to flammable gas and smoke. Smoke sensor is given 5 volt to power it. Smoke sensors indicate smoke by the voltage that it outputs. More smoke more output. A potentiometer is provided to adjust the sensitivity. But when smoke exist sensor provides an analog resistive output based on concentration of smoke. The circuit has a heater. Power is given to heater by VCC and GND from power supply. The circuit has a variable resistor. The resistance across the pin depends on the smoke in air in the sensor. The resistance will be lowered if the content is more. And voltage is increased between the sensor and load resistor. The MQ2 has an electrochemical sensor, which changes its resistance for different

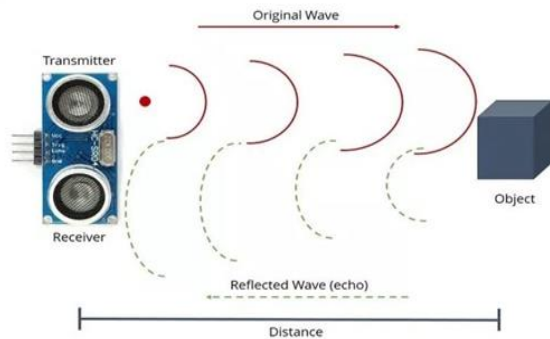
concentrations of varied gasses. The sensor is connected in series with a variable resistor to form a voltage divider circuit (figure shown below), and the variable resistor is used to change sensitivity. When one of the above gaseous elements comes in contact with the sensor after heating, the sensor's resistance change. The change in the resistance changes the voltage across the sensor, and this voltage can be read by a microcontroller. The voltage value can be used to find the resistance of the sensor by knowing the reference voltage and the other resistor's resistance. The sensor has different sensitivity for different types of gasses.



MQ-2 SENSOR PIN OUT

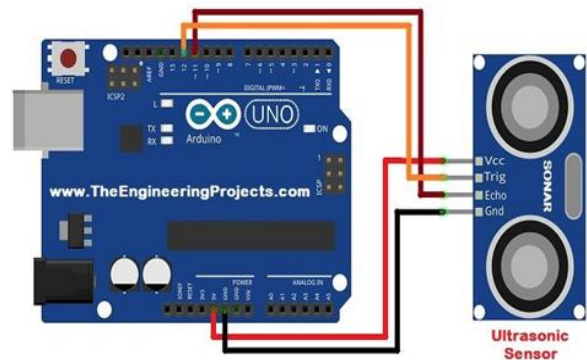
### ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with ultrasonic transmitter and receiver modules as the name indicates measure distance by using ultrasonic waves the sensor head emits ultrasonic wave and receives the wave reflected back from the target. Ultrasonic measures the distance through the target by measuring time between emission and reception



Interfacing ultrasonic sensor with arduino uno

In order to get the precise distance measurement, HC-SR04 is mostly used in combination with different Arduino Modules like Arduino Uno and Arduino Mega. You can connect Arduino with this sensor in the following way First, you need to power up the sensor using 5V DC regulated input to the sensor. Connect the ground pin with the ground of the voltage source. You can also power the sensor module using the Arduino 5V pins as the current drawn by the sensor is less than 15mA, won't be affecting the current ratings of the Arduino Module. After setting up the initial arrangement, connect both Trig and Echo pins to the I/O pins of the Arduino Board. As mentioned earlier, in order to initialize the measurement process, the Trig pin must be kept high for 10us in the start. The sensor module will start generating sound waves with the frequency around 40,000 Hz per second from the transmitter. As the waves bounce back, consequently, the Echo pin will turn on until the sounds waves are received by the receiver. This time will be calculated using Arduino Module.

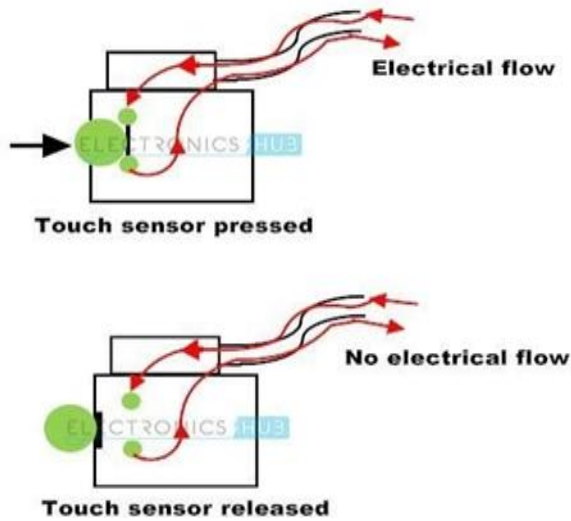


### TOUCH SENSOR

Touch sensors work similar to a switch. When they are subjected to touch, pressure or force they get activated and acts as a closed switch. When the pressure or contact is removed, they act as an open switch. Capacitive touch sensor contains two parallel conductors with an insulator between them. These conductors' plates act as a capacitor with a capacitance value  $C_0$ . When these conductor plates come in contact with our fingers, our finger acts as a conductive object. Due to this, there will be an uncertain increase in the capacitance. A capacitance measuring circuit continuously measures the capacitance  $C_0$  of the sensor. When this circuit detects a change in capacitance it generates a signal. The



resistive touch sensors calculate the pressure applied on the surface to sense the touch. These sensors contain two conductive films coated with indium tin oxide, which is a good conductor of electricity, separated by a very small distance. Across the surface of the films, a constant voltage is applied. When pressure is applied to the top film, it touches the bottom film. This generates a voltage drop which is detected by a controller circuit and signal is generated thereby detecting the touch. Touch sensors are also called as tactile sensors and are sensitive to touch, force or pressure. They are one of the simplest and useful sensors. The working of a touch sensor is similar to that of a simple switch. When there is contact with the surface of the touch sensor, the circuit is closed inside the sensor and there is a flow of current. When the contact is released, the circuit is opened and no current flows.



**CRASH SENSOR**

A miniature snap-action switch, also trademarked and frequently known as a micro switch, is an electric switch that is actuated by very little physical force. Micro switches are very widely used; among their applications are appliances, machinery, industrial controls, vehicles, and many other places for control of electrical circuits. They are usually rated to carry current in control circuits only, although some switches can be directly used to control small motors, solenoids, lamps, or other devices. This is a small micro switch sensor designed for the Arduino. It could be directly connected to the IO Expansion shield. It integrates the pull-up resistor and the status indicator

LED onboard. That makes it easier for testing. The miniature snap-action micro switch with roller lever make it suitable for more different environment application. Robot Crash Sensor is arduino compatible and can be used for robot collision detection, touch collision detection. It is based on the high sensitivity crash sensor.

When touch, output low level; when release, maintain a high level robot Crash Sensor pin definitions: (1) Output (2) Vcc (3) GND



SKU: SEN0138

If collision happens upfront of where collision module is installed, module outputs low level signal, no collision, outputs high level signal. Module reserves M3 mounting hole, convenient for fixation on a car. With switch indicator light if there is collision, light is on; no collision, light is off

**ARDUINO SOFTWARE (IDE)**

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

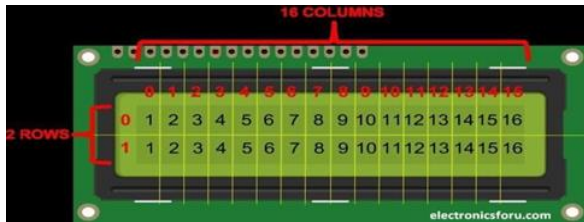
```

sketch_aug22a | Arduino 1.8.5
File Edit Sketch Tools Help
sketch_aug22a
void setup() {
  // put your setup code here, to run once:
}

void loop() {
  // put your main code here, to run repeatedly:
}
    
```

### LIQUID CRYSTAL DISPLAY

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.



The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. Processing for commands happens in the command register. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. When we send data to LCD it goes to the data register and is processed there. When RS=1, data register is selected.

### RESULT

This paper is developed to reduce the rescue time and mortality of injured persons involved in high speed and single-vehicle accidents. This method focuses on implementing a Blackbox system in automobiles. This method also used to know the location of the place where the accident occurred. The main advantage of this is each vehicle is monitored and data is stored in

memory. This product is built and obtained at affordable cost. This makes a rescue unit to easily identify the location and save lives.

### CONCLUSION

In this paper, we propose that with the help of Iot module the data is continuously uploaded to the cloud. This method focuses on analyzing the cause of accidents and preventing the loss of life. However, in the existing system it is difficult to identify the accident that occurred to the vehicle and here the data is not stored in any place. In the proposed system we can record all data including number of persons in vehicle, fuel information, temperature by using temperature, touch, ultrasonic sensors. We can also send message to the family member or to the control room through the gsm module.

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