

# Design of Crash Data Recorder for Motor Vehicle

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## Abstract

The project's main aim is to build a Black Box prototype for vehicle diagnosis which can be mounted into any number of vehicles. It will lead to safer cars, helping insurance agencies in their inquiries into traffic accidents, and improving road safety to reduce the death rate. In 2013, 96 per cent of every new car carry in the U.S. came with a black box, and as of Sep 01, 2014, each new vehicle had to have one. Information from the black box is used in a few high-profile inquiries. Cars can also have black boxes. That's why you should know the exact recording of that package, who can get that information, and how you can keep it under control.

**Keywords: Detector, Voltage Sensor, Temperature Sensor, RTC, Ultrasonic Sensor, Split Sensor, Belt Sensor, EEPROM, Proximity Sensor, Gyro Sensor**

## I. INTRODUCTION

According to the world health organization, more than a million people die every year in the world from transport-related accidents. To reply to this situation, the black box draws the first move to fix this question. As with flight data recorder in aircraft, equipment called "Black Box" will also play a vital role in investigating motor vehicle accidents. A Large number of on-road vehicles currently contain electronic devices that record in case of an accident. That is why having recorders that use it as a backup to what's going on in the vehicle before, after and after a crash is critical.

The embedded programming not only helps to record the data but also to retrieve the data for display from the microcontroller memory to an LCD. Different types of testing are carried out to determine the type of sensors to be mounted in the vehicle and the following are considered to be the most critical data needed after the accident: belt status, brake status, road detection, Engine Temperature and battery status.

Furthermore, in the event of a brake failure and low battery power, the device immediately alerts the car owner. Even the machine performs one function that is very important to every car. If an incident happens the system opens the emergency window automatically. Therefore, this project not only records the data from the sensors but also alerts the user about the vehicle's condition. In addition, stored data can be transmitted to a PC via serial port, the data collected by Application that is being built in VB. The data collected are then depicted for proper analysis in graphical form.

## II. PROPOSED SYSTEM

This proposed system consists of sensory networks, such as when brake failure occurs, comparator IC provides zero output and this output is fed to output status. Microcontroller will display the output of break.

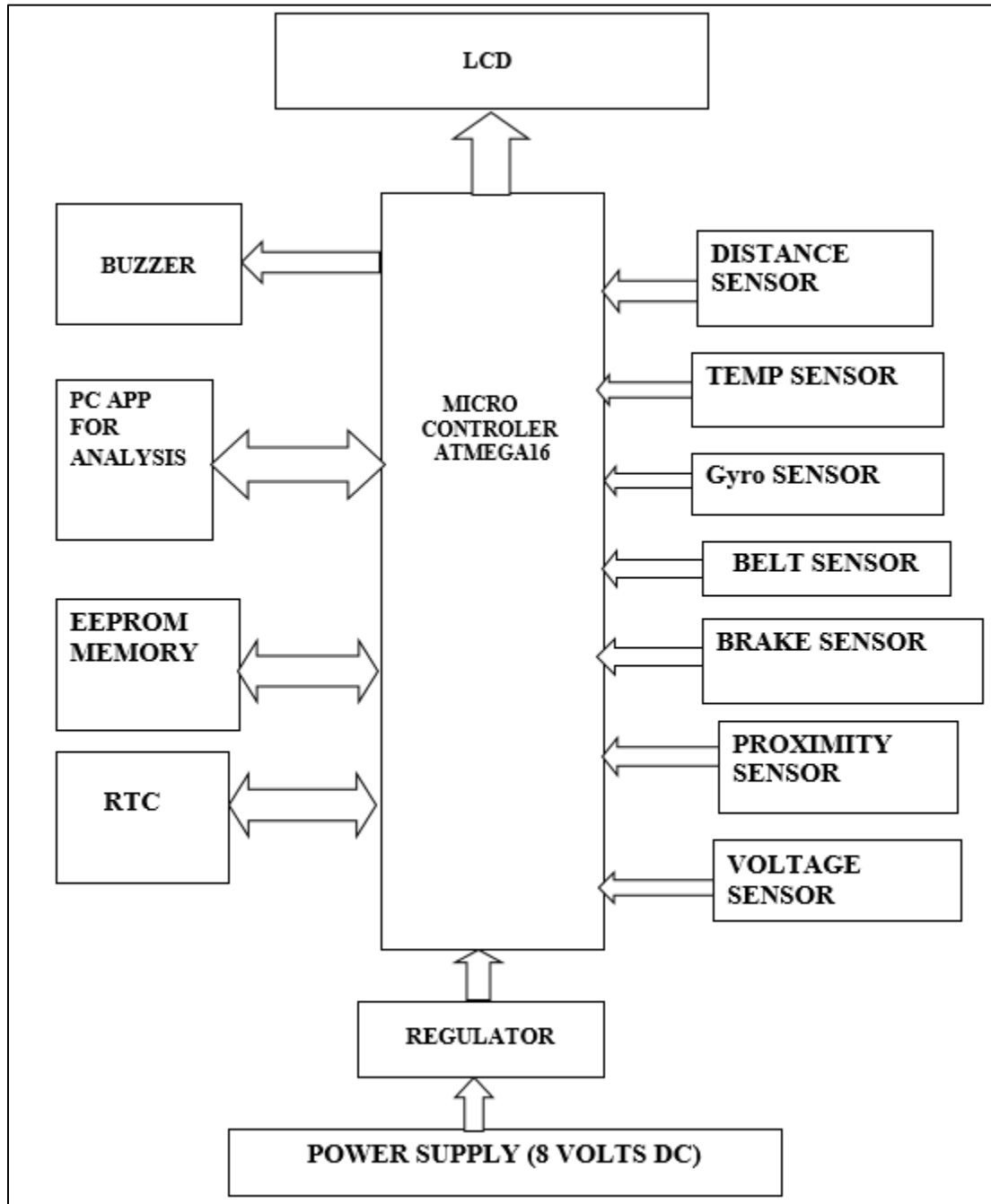
The proximity sensor consists of an IR transmitter, and the receiver is contrasted with the op-amp (LM358) reference voltage. It gives microcontroller high output voltage (digital 1) in the event of any object detection. When the performance is zero it implies that behind the car there is no object, and vice versa. Any vehicle's engine temperature is also important for knowing the safety of that particular vehicle. Temperature sensor LM35 is mounted in the vehicle to detect the current engine temperature level.

As we know LM35 temperature sensor gives output in analog form so its output is connected to the microcontroller's internal ADC to convert this analog value into digital. Lastly, the microcontroller shows the temperature of the engine and also correlates with predefined value. When the engine temperature in that state is very high then the buzzer starts to bit.

## III. BLOCK DIAGRAM

As shown in the block diagram, 8V power supply is given to regulator 7805 and it converts this 8V into 5V, as the microcontroller and other digital devices works on 5V supply. The microcontroller gets input from the sensors like voltage sensor, gyro sensor, distance sensor, brake sensor, belt sensor, proximity sensor and temperature sensor. RTC is used for displaying the date and time

and it also give input to the microcontroller. Whenever the microcontroller request RTC about current date and time then it transfers the information.



#### IV. HARDWARE REQUIREMENTS

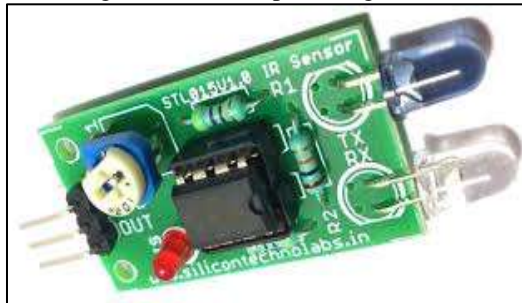
##### A. ATMEGA16

Microcontroller is a computer of general use with a broad variety of single-chip modules. In this configuration the ATMEGA 16 Microcontroller is used for this vehicle. It had 1 kb of RAM, 4k on-chip ROM bytes, 32 programmable I / O pins, Programmable Serial track, Six interrupt sources, Low power idle, and power down modes. Microcontroller purpose is to provide multiplexing for the incoming sensor signal and also to convert the values of analog sensors into digital values. This includes the vehicle track.



### **B. Proximity Sensor**

A proximity sensor is a sensor capable of detecting objects close by without any physical touch. Typically a proximity sensor emits an electrical or electrostatic field or an electromagnetic radiation pulse (e.g. infrared) and looks for field or return changes.



### **C. Gyro Sensor**

A gyro sensor used to find out the wheel position. Gyro sensor works as a tilt sensor which gives output in analogue form. It is basically three axis tilt sensors.



### **D. Ultrasonic Sensor**

Ultrasonic sensor is used to measure distance from the barriers. It is thus a digital sensor that gives output in digital form. Thus, the controller receiver pin that receives data serially and then performs function according to the algorithm is given that data. Automatic mode runs in this system over this sensor automatically.

### **E. Temperature Sensor**

Temperature sensor is a measuring instrument that is used to measure any device's temperature. Temperature sensor (LM35) is used here for fire detection.

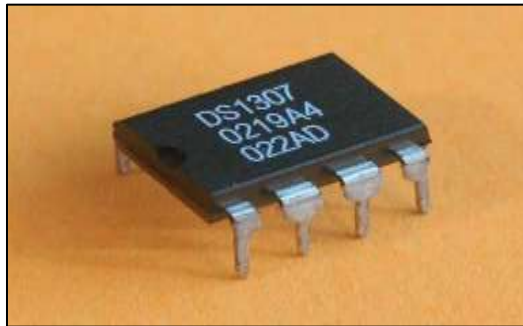
This sensor's output is in analog form, so that it is attached to the microcontroller's ADC pin to turn it into digital form. It senses ambient temperature. This system works in the range from -55 C to 150 C.



## I. RTC (REAL TIME CLOCK)

The DS1307 serial real-time clock (RTC) is a clock / calendar with low power, complete binary encoded decimal (BCD) plus 56 bytes of NV SRAM.

The clock/calendar provides seconds, minutes, hours, day, date, month, and year information.



## V. WORKING

Whenever the power source gets activated by user, this device directly starts its basic functioning like scrolling and scanning of sensor's data. During first power on microcontroller sends signal to LCD then LCD scrolls the default message and refreshes the LCD and memory. After that microcontroller fetches the digital data provided by ADC and display the measured parameters on LCD. In the meantime, it also fetches data from distance sensor and starts internal timer. Microcontroller also gets current date and time from RTC. It displays the status of sensors sequentially and simultaneously compares the critical parameters with pre-defined threshold value. Whenever the parameter of engine temperature and status of belt sensor and brake sensor crosses their threshold value, it starts notification by generating different tones through buzzers.

At every one-minute interval microcontroller punches the measured parameters and status of sensors into external memory along with current date and time. As we have used 8-volt battery so this system continuously observes the voltage level and display its condition like charged or discharged on the LCD screen.

Distance sensor consists of one transmitter and receiver which generates 38 KHZ ultrasonic sound waves and calculate the time gap between sound transmission and reception. Based on the difference between the transmission and reception time, it calculates the actual distance and this calculated distance is finally fed to microcontroller using UART Protocol.

Belt sensor is consisting of magnetic sensor. It has basically two parts one is reed switch and another one is permanent magnet. Break sensor works on the principle of continuity test in which just by passing few mile amperes current through a break wire and measure the voltage level with respect to the reference voltage produced in comparator IC (LM358).

## VI. RESULTS

The designed system/ project is working as per the project plan.

- 1) All the sensors are working fine and microcontroller displays all the parameters accurately.
- 2) It also compares the sensors value with the threshold limit and generates different tones through according to the sensor's output.
- 3) Systems also store the measured data at every one minute.
- 4) Downloaded data is transferred to the system property through serial port and display the recorded data line in text box of application.



Fig. 4.1: Device ON



Fig. 4.2: Display of Date and Time



Fig. 4.3: Angle of Tilt



Fig. 4.4: Brake Status(Failed)



Fig. 4.5: Display of Temperature



Fig. 4.6: Belt (Active) and Battery Status

## VII. PROS AND CONS

Accurate Parameter/data Recording

Quick Data Analysis

It Reduces the Accidents

Easy to claim the insurance

More events logging by increasing the Memory Size.

The only Disadvantage of this system is that the Termination of all the sensors in a common platform is a challenging task.

## VIII. CONCLUSION

This paper provided an integrated system for analyzing the data surrounding the incident. The black box system designed for installation on any car. This will start saving the events for the corresponding engine as soon as the driver starts the engine. As we know computer records the vital parameters with time stamps in external memory. Microcontroller already consists of EPROM memory but the memory size is not sufficient for data recording so we used external 64 KB EPROM memory. RS232 protocol is commonly applicable for transmission of long-distance data. So, we have also used MAX232 IC in this project which allows users to access the recorded data into external devices such as machine or PC.