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# Blackbox System for Automobiles

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**Abstract - Automobile accidents are one of the most causes of death in the world.There are many technologies used to avoid accidents.A study has been carried out to determine the cause of accidents such that further mishaps can be avoided.In this paper,an attempt has been made to record the cause of the accidents.The recording of the information of an automobile is similar as in the case of aircrafts that record information in their blackboxes.The information recorded are parameters like 3D-axis readings, temperature, humidity, direction and time duration of travel.A blackbox has been developed for automobiles using MSP-430 microcontroller.**

***Keywords*** **- Blackbox, Automobiles, Microprocessor, MSP430, Accelerometer.**

## 1. Introduction

In today's vehicular traffic,"There is a need to reduce the automobile accidents and to improve the overall safety in vehicles and roads".A blackbox is a device in an aircraft which records the information on board the aircraft,when a crash occurs information regarding the cause of the accident is collected.Further,the problem of the accident is analysed and aircraft is designed in such a way to rectify the problem in future.Similarly,a blackbox for automobiles helps us in solving the problems that causes accidents in automobiles.As the parameters are recorded and stored,it will also help in solving minor flaws in the design and manufacturing of automobiles. The proposed system is a low cost, energy efficient implementation of the blackbox. This blackbox will help in recording of information pertaining to an accident which will enable the police department as well as the insurance corporations to analyse the accidents and do the needful.

## 2. System Description

The block diagram of the figure is shown below in fig-1, The microcontroller in the block diagram is MSP-430G2253 which is powered by a 12V battery. The system also consists of accelerometer sensor, temperature and humidity sensor, magnetometer sensor, real time clock(RTC) and a seat belt monitoring system. The RTC is powered with a supply of 5V and battery of 5V for continuous time monitoring.

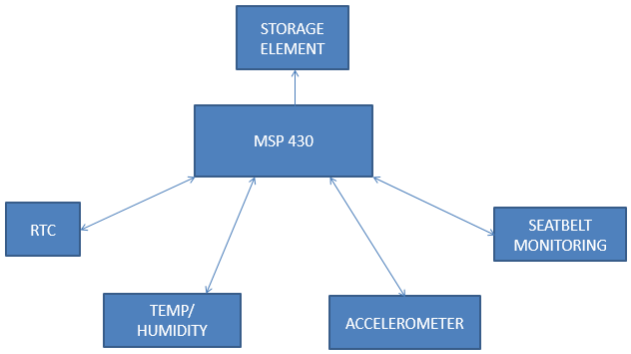


Fig-1-Block diagram

## 3. Hardware Components and Design

3.1 MSP430[MSP-EXP430G2]

The MSP430 is a mixed signal microcontroller family from Texas Instruments built around a 16-bit CPU, The MSP430 is designed for low cost and specifically for low power consumption.

Features:

- Low supply voltage range-1.8V to 3.6V.
- Ultra low power consumption.
- Active mode:230µA at 1 MHZ,2.2V.
- Standby mode:0.5µA.
- Off mode (RAM retention):0.1µA.
- 5 power saving modes,ultra fast wake up from standby mode in less than 1µs.

- 16-bit RISC architecture,62.5 ns instruction cycle time.
- Basic clock module configuration.
- Internal frequency upto 16Mhz with four calibrated frequency.
- Internal very low power low frequency (LF) oscillator.
- 32-Khz crystal,External Digital clock source.
- Two 16-bit timer A with 3 capture/compare registers.
- 16-KB flash memory and 512 bytes of RAM.

### 3.2 Temperature and Humidity Sensor

Engine temperature and the presence of humidity are important parameters to be measured.In case of an accident involving explosion or crashing of the vehicle in water,the output from the temperature and humidity module will be helpful in deduction of fault by the trained investigator,In this paper,in order to obtain the temperature and humidity values we have used HTF3223 Temperature and humidity sensor.This sensor continuously reads and the output of the sensor is fed to the microcontroller.The temperature output is given to analog pin (A7),P1.7 of the microcontroller and the humidity output is given to the digital pin 7 of the microcontroller.

### 3.3 Accelerometer Sensor

The Accelerometer helps to determine if the car is moving uphill, whether it will fall over or if it tilts anymore or whether it is flying horizontally or angling downwards.In this paper,we are using ADXL335,small,low power,3-axis accelerometer.It measures acceleration with a minimum full-scale range of ±3g.It can also measure the static acceleration of gravity in tilt sensing applications,as well as dynamic acceleration resulting from motion,shock or vibration.The outputs of ADXL335 are x_out.y_out,z_out.They are fed to the microntroleer pins A0[P1.0],A3[P1.3] and A4[P1.4] respectively.

### 3.4 Real Time Clock

Real time clock (RTC) is used to record the duration of the journey and the time of crash.In this paper,we have use DS1307 RTC module to record the time period of the journey.The DS1307 serial real time clock (RTC) is a low power,full binary-coded decimal(BCD) clock plus 56 bytes of NV SRAM.Real time clock counts seconds, minutes, hours, date of the month, month, year and day of the week.The SCL pin of DS1307 is interfaced with the $14^{th}$ pin of MSP-430.The SDA pin of DS 1307 is interfaced with the $15^{th}$ pin of the MSP-430 microcontroller.

### 3.5 Seat-belt Monitoring

In this paper, there is a system that monitors the seat belt of the driver. This data is also recorded by the black box using the contact sensor which is also interfaced with the microcontroller.

## 4. Results

The above systems are impelemented as in the block diagram and the blackbox is tested using energia software tool. The system was tested under three conditions.

Table 1: Results

| **Conditions** | **Accelerometer** | **Temperature and humidity sensor** | **RTC** | **Seat belt** |
|---|---|---|---|---|
| **Hitting a standstill vehicle** | Sudden change in acceleration | No change | Time of accident | In position |
| **Overspeeding** | Rapid increase in acceleration. | Temperature and humidity high. | Time. | Not in position. |
| **Engine failure** | Rapid decrease in acceleration. | Temperature and humidity high. | Time | In position |

## 5. Conclusion

A blackbox for automobiles is designed,implemented and tested for certain conditions.As a futue work the system has to be implemented real time and tested for various conditions like brake failure when coming down a hill,explosion due to oil leakage and roll over in a curve.

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