

DESIGN & IMPLEMENTATION OF BLACK BOX IN AUTOMOBILES SYSTEM

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Abstract - Accidents are rapidly increasing in numbers in our over crowded cities. So, we are designing a device for vehicle which will not only prevent the accidents but will also look over the safety of the driver. The Automobile Black Box has functions similar to an airplane black box. It is used to analyze the cause of vehicular accidents and prevent the loss of life and property arising from vehicle accidents. This paper proposes a prototype of an Automobile Black Box System that can be installed into vehicles. The system also involves the improvement of the security by preventing the damage of the Black Box data.

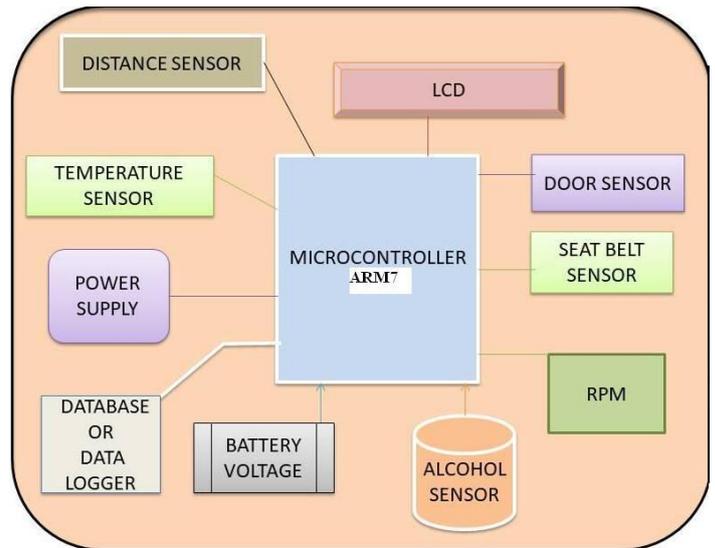
An Events Data Recorder (EDR) is a device which is used to record the movement parameter of a vehicle mainly used for accident analyzes purposes and for safety measures. There are many EDR has designed for automobiles, however they have to be physically connected to sensors integrated with the car's engine and system. This research will be continued in the near future by researching new features such as data compression, security, low energy, and more safety measures.

Key Words: Black Box, EDR (Event Data Recorder), ARM7 Processor.

1.INTRODUCTION

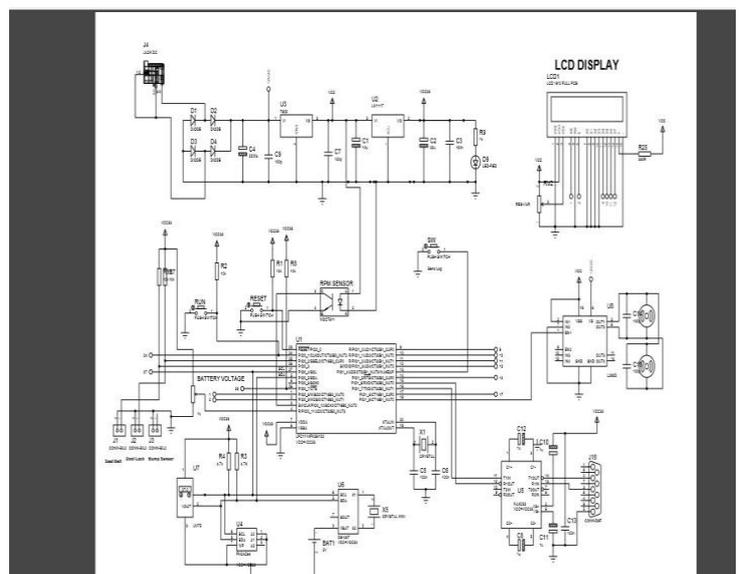
In day to day life vehicle accident is a major problem in many cities. This problem is still increasing in number due to poor riding behaviors such as driving at high speed, drunk driving, riding without safety etc. Car black boxes is having logical feature and functions considering that more people die in car accidents than an airplane crashes. Black box in aircraft help to determine the cause of an airplane accident and car black box helps us to determine what has caused a car accident. The causes of car accident are not to difficult to investigate as plane crashes. They are particularly valuable when no witness are present during the accident and when each drivers has his/her own version of event. Car black box is a digital electronics device, which is used during the investigation of the accident which records and store vehicles speed, vehicle temperature, vibration, distance from obstacles, real time and vehicle other status information. EEPROM is used for recording the data. Event data recorder holds the proof of the accident and it is useful for the police in investigation and for Insurance company, as they can find out what really caused the accident.

1.1 Proposed Block Diagram



In this section, the proposed block diagram shows the general idea about how we are going to make this project along with the other peripherals. Some sensors are used in this prototype for safety purposes. The ARM processor are based on RISC architecture and this architecture has provided small implementation, and very low power consumption.

2. CIRCUIT DIAGRAM.

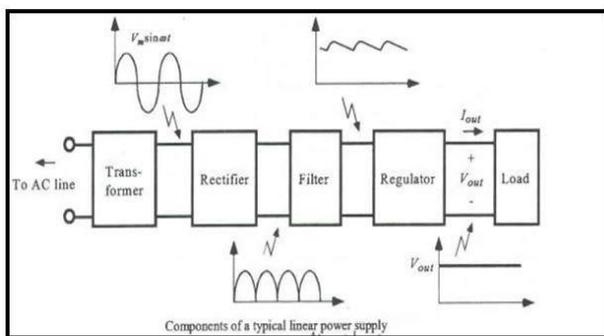


This section shows the circuit diagram of the Black Box in which we used the ARM7 processor along with the other peripherals. This block diagram shows the connection of all the sensors to the processor. This circuit diagram has been made in PROTEUS 8.0 software. It is easy to use and simple but effective interface.

This block diagram consists of:

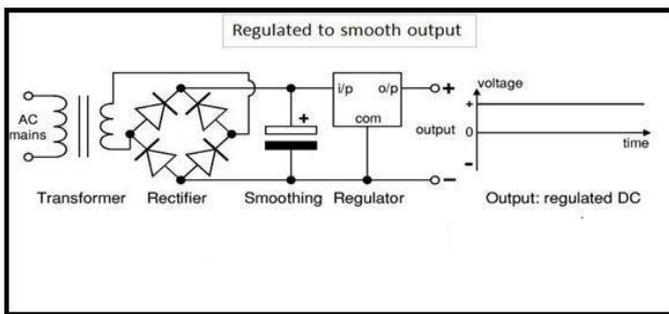
1. POWER SUPPLY:

In the power supply, LPC2148 works on 3.3 V power supply. LM 75 is used for generating 3.3 V supply. However, basic peripherals like LCD, Motor Driver IC works on 5V. So AC mains supply is converted into 5V. LM 75 is used to convert 5V into 3.3V. Power supply has been made by



Transformer: It is used to step down 230V AC to 9V AC supply. It also provides isolation between power grids and circuit.

Rectifier: It is used to convert AC supply into DC.



Filter: It is used to reduce ripple factor of DC output from rectifier end.

Regulator: It is used to regulate DC supply output.



2. Reset Circuit:

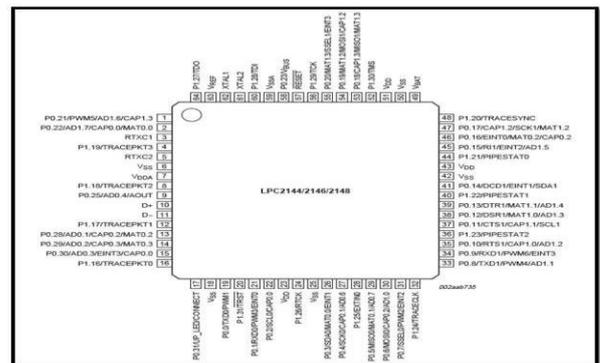
Reset BUTTON: It is essential in the system to avoid programming pitfalls and sometimes to manually bring back the system to the initialization mode.

3. OSCILLATOR:

Oscillations are provided using a crystal and are necessary for the system to work.

4. ARM 7 (LPC2148):

In ARM7 family, LPC2148 is widely used IC. ARM processor is based on reduced instruction set computing (RISC) architecture. The instruction set of ARM is uniform and fixed in length. 32-bit ARM processor has two instruction set: general 32 bit ARM instruction set and 16-bit Thumb instruction set. It supports multiple stage pipelining in a simple three stage pipeline, the instructions follow three stages: Fetch, Decode and Execute.



TEMPERATURE SENSOR:(LM75):

The LM75 temperature sensor includes a delta-sigma analog-to-digital converter, and a digital over temperature detector. The host can query the LM75 through its I2C interface to read temperature at any time. The open-drain over temperature output (OS) sinks current when the programmable temperature limit is exceeded. The OS output operates in either of two modes, comparator or interrupt.

Power-up is in comparator mode, with defaults of TOS = +80°C and THYST = +75°C. The 3.0V to 5.5V supply voltage range, low supply current, and I2C interface make the LM75 ideal for many applications in thermal management and protection.



BELT SENSOR:

Belt sensor indicates whether seat belts are fastened. In our prototype we have used Audio Jack as a Belt sensor. This is ensured by checking if the button connected is pressed or not. One push button is used to detect place of the seat belt during the drive. The push button is placed on the seat belt and gives logic 'zero' when the belt is used and logic 'one' when the belt is not placed by the driver.



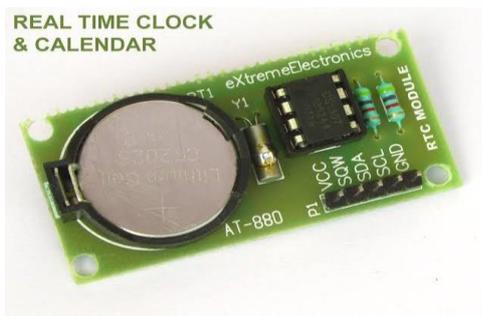
DOOR SENSOR (leaf switch):

In our prototype we use leaf switch as a door sensor to ensure that whether the door is closed or open. As this leaf switch is connected, it gives the logic 'one' that means door is closed and if it gives the logic 'zero' it means leaf switch is separated from each other and door is open.



RTC (REAL TIME CLOCK):

Real time clock (RTC) as the name recommends our clock module. The DS1307 real time clock IC is an eight pin device using an I2C interface. The clock /calendar provides seconds, minutes, hours, day, date, month and year qualified data.



OPTOCOUPLER:

In our prototype, we used MOC7811 as an opto coupler to identifying the speed of vehicle wheels. This opto coupler module with an IR transmitter & a photodiode mounted on it. This is normally used as a positional sensor switch to find out the position of the wheel. It consists of IR LED and photodiode mounted face each other and closed in plastic

body. cut the circuit from LED and photo diode, we use interrupt to calculate the rotation speed of the wheel.



RS232:

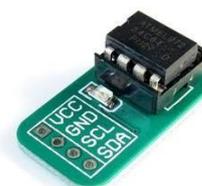
RS232 is the standard serial communication system which is used to transfer the information from microcontroller to personal computer(PC) through some variety of information cable. The pin configuration of RS 232 and its interfacing to the microcontroller using MAX232.



DATA RETRIEVING FROM EEPROM:

EEPROM is a computer memory chip that maintains stored information without requiring a power source.

As the accident occur, every detail of the sensor is calculated and stored in memory. These values are very useful to know how the accident occurred. This stored data of the accident is useful for police to investigate the case and to the Insurance company. As we get the values or data from black box which is connected to personal computer by using RS232 cable. These I2C-compatible electrically erasable programmable memory (EEPROM) devices are organized as 8192 x 8 bits (M24C64) and 4096 x 8 bits (M24C32). I2C uses a two-wire serial interface, comprising a bi-directional data line and a clock line. The devices carry a built-in 4-bit Device Type Identifier code (1010) in accordance with the I2C bus definition.



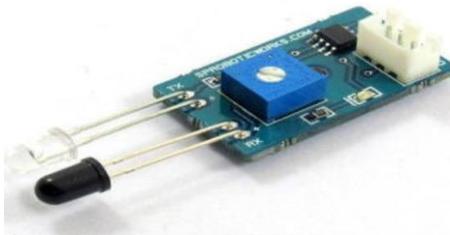
PROPOSED APPROACH:

In this section, our proposed approach is that we made two updates in our prototype. These updates are of safety features in the black box system such as -

- Infrared sensor.
- Gas sensor(smoke detector)

INFRARED SENSOR :

The infrared sensor is to measure the minimum distance from the vehicle. IR sensor generate high frequency sound wave and evaluate the heat being emitted by an object and detecting motion which is received back by the sensor. Its distance sensing range is 2cm to 3cm.



GAS SENSOR (Smoke Detector):

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down.



1. Highly sensitive to LPG, Iso butane, Propane.
2. Sensitive to alcohol, smoke.
3. Fast response.
4. Stable and long life.
5. Simple drive circuit.

3. CONCLUSIONS

The project Black Box is successfully implemented on embedded system which gave required results and expected functioning. (EDR) as the black box is officially called as slowly gains an important device in investigation of car accidents. We can easily retrieve the data from the Black Box. By recording the events and actions of the driver including speed, braking, turning, etc. seconds before the collision, the car black box will undoubtedly help both the police and insurance companies in reconstruction of the events before the accident. This data also has the potential to augment data in crash databases, by providing information especially relating to system performances. This is also very helpful as emergency medical services can be provided. This study is conducted about the event data recorder but it will also bring a number of benefits for the car's owner.

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