

## **Design of ARM based EDR & Evidence Collecting System**

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**Abstract-** Automotive electronics plays an important role in the automobile industry and provides high features and importantly addresses the safety and security. This is similar to flight data recorder (“black box”). Motor vehicle event data recorder is a device which is installed on a vehicle to record information regarding to the vehicle conditions. This device that installed in vehicle to record information related to vehicle accidents or crashes. This data are useful to understanding of how certain crashes come out. The data can be collected by using various sensor on the basis of analysis will be available. These designs provide information related to position on real time basis ARM7 processors, sensors and modules.

**Index Terms-** ARM7 processor, Sensors, Modules etc.

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### **1. INTRODUCTION**

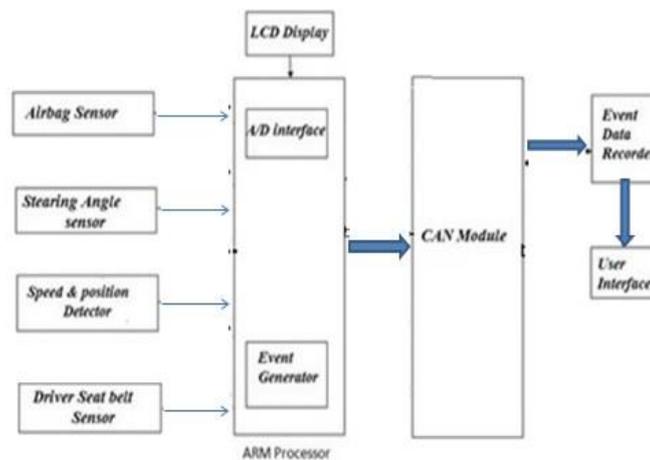
According to the World Health Organization, in 2011, there are 1.3 million people can be die which is the highest number of road accidents in 2011, and 20-50 million people can suffer non-fatal injuries with many sustaining a disability. A road accident can be happens every 2 min in Taiwan.

The black box is introduced firstly in 1953 by David Warren. The main purpose of event data recorder is to investigation of an aircraft incident or accident. The black box was record all data of the flight instruments and the cockpit voices of the flight. The event data recorder is to records the information from a vehicle immediately before and/or during most serious accident. This module provides information about accident to monitor station. Police and crash investigators can download the data to help understand what happened to the vehicle. Crash reconstruction is possible by using applied physics for analyzing vehicle collision.

The project is about the composition and function of the event data recorder. The data recorder cab be record the driving data in real time and then display messages on LCD to avoid further accident event. This data can send to the main stations for monitoring. The Black Box can receive data including position, speed and status about the all sensors. This design consists of the ARM processor, GSM module, GPS module and various sensors. The SD card is required for huge capacity and long term data storage. This event data recorder provides the fault protection message on LCD.

In the section 2, block diagram is described. In the section 3, system interfacing are described, in section 4, circuit description can be explain and the working of this project are described in section 5. In the section 6, result of the project can be explained. Application which are useful for the people which is explained in section 7. The conclusion of this project is explained in section 8 and future works are summarized in section 9.

## 2. BLOCK DIAGRAM

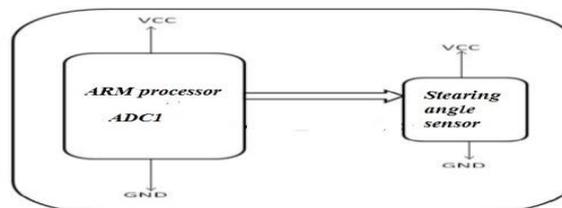


*Fig.1 Block diagram of event data recorder*

In this block diagram, all the sensors are connected to the ARM processor. The ARM processor includes analog to digital interface module for the processing of the data of the sensors and also includes the event generator. The CAN module can be connect to the ARM processor for the circuitry handle. All the data can be saved in the event data recorder. And all the information can be show on the server webpage.

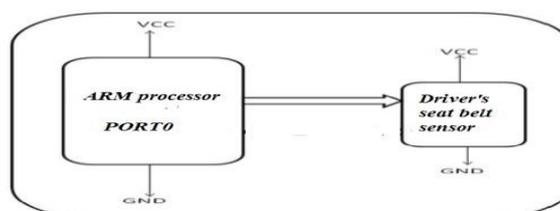
## 3. INTERFACING WITH COMPONENT

The ARM processor is connected to the steering angle sensor. The ADC1 port can be used for the connection fig no. The gyro sensor is used as the steering angle sensor. This is single-axis gyro sensor which is essentially a breakout board. The output of this sensor is an analog voltage which is proportional to the angular rate. Gyro sensor include a sensing element and an IC interface. The gyro sensor is a low power single axis yaw rate sensor.



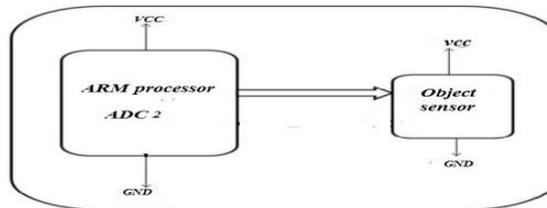
*Fig.2 Interfacing with steering angle sensor*

The ARM processor is connected to the driver's seat belt sensor. The driver's seat belt sensor is connected to port0 of ARM processor. This is the simple connection of male-female connection of two devices.



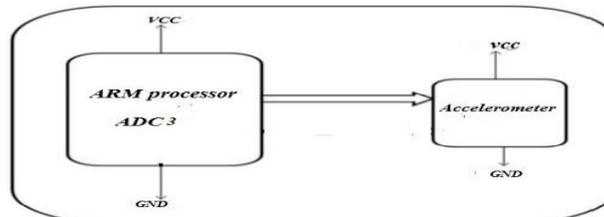
*Fig.3. Interfacing with driver's seat belt sensor*

The object sensor can be connected to the ADC2 of ARM processor. This sensor is a multipurpose sensor which can be used for obstacle sensing, line sensing and it is used as an encoder sensor etc. The sensor provides an analog and digital output. When a object is placed ahead of the sensor then the sensor outputs a logic one i.e. +5V at the digital output and a logic zero i.e. 0V, when there is a no object in front of the sensor.



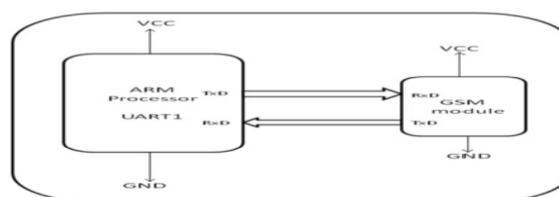
*Fig.4. Interfacing with object sensor*

The accelerometer is connected to the ADC3 of ARM processor. The accelerometer is a device that measure acceleration or vibration of the motion of a structure. In this accelerometer, the piezoelectric crystal produces an electric charge which is directly connected to the measurement instrument.



*Fig.5. Interfacing with accelerometer*

The GSM module is connected to the UART1 (universal asynchronous receiver transmitter) port. The transmitter, receiver connection of ARM processor can be connecting to the other end of GSM module of transmitter and receiver. This is a simple play and plug GSM modem with simple interface. It is used for the sending SMS, make and receive call etc. These GS operation can be controlled by the AT command.



*Fig.6. Interfacing with GSM module*

The GPS module is connected to the UART0 port. GPS module is used to find out the position of the vehicle on the earth. It provides longitude and latitude information. GPS receivers commonly used in most vehicle tracking system and they cannot communicate back with GPS or any others satellite

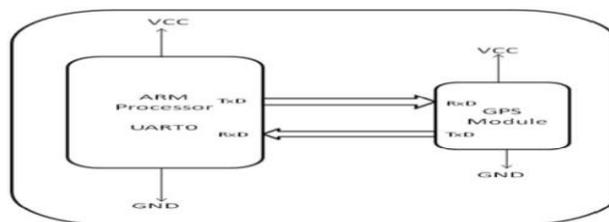


Fig.7. Interfacing with the GPS module

#### 4. CIRCUIT DESCRIPTION

LPC2148 is an ARM processor which is the main part of the system. LPC2148 has two UART ports. GPS module is connected to UART port 1 through RS2. The processor refresh in every 10 seconds itself. Two sensors, GPS modem and GSM module are connected to the LPC2148.

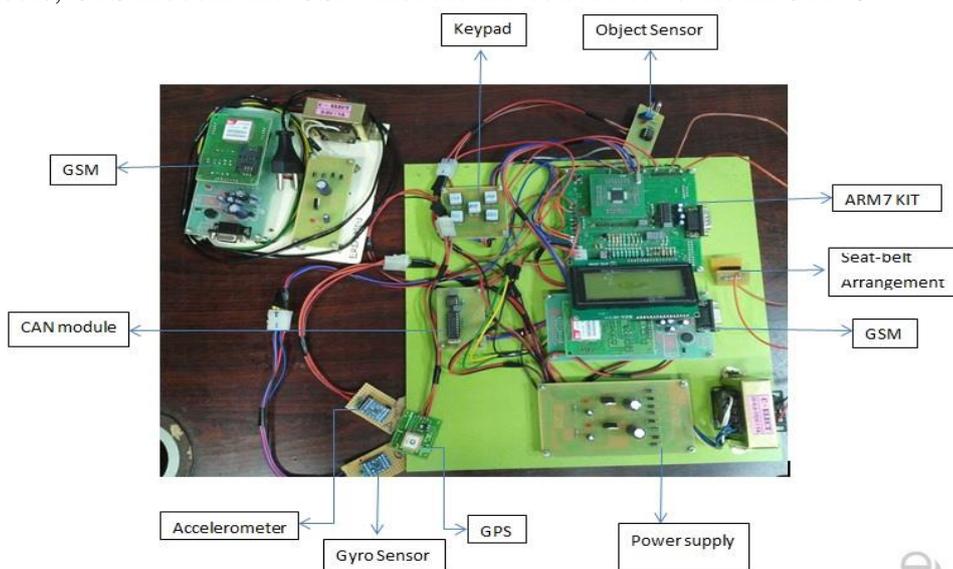


Fig.8. Circuit Diagram

The Accelerometer is connected to the voltage regulator. For e.g. if there is an accident occurred, then accelerometer vibrates and logic 0 is given out. This logic 0 is indicate that the car has met with an accident and thus it sends the data of car's location to the users provided in the AT commands. This logic 0 is an indication to send the signals. Also gyro sensor is connected to the ARM processor. The gyro sensor can calculate the steering angle. And Object sensor can connect for finding number of persons presents in the car.

AT command used for communication between microcontroller unit and GSM interface to GSM module. AT command are send to mobile unit by connecting hyper terminal using USB serial port. The ASCII code for various commands sends by microcontroller for message transfer.

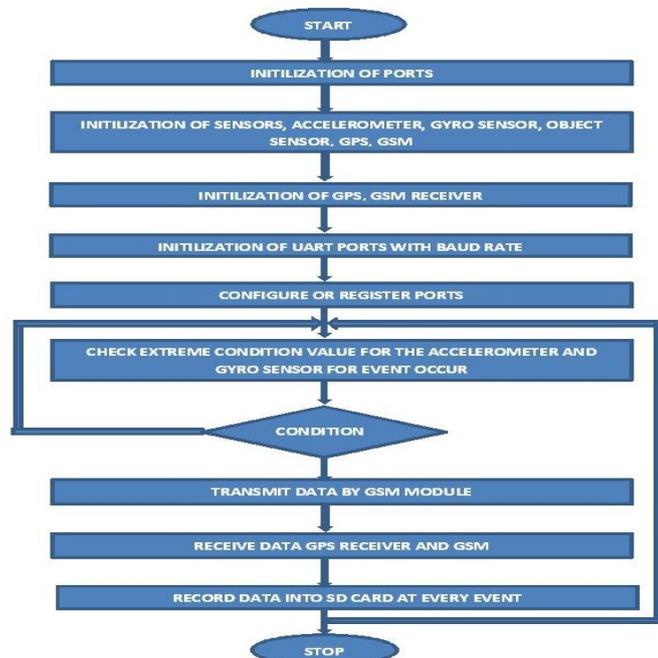
These stages are repeated and the number of times to get the updating of the sensor's value and the other factors in a continuous manner. The old data gets saved and also the process is repeated again and again. For storing the all type of data, SD card storage capacity will also requires in large amount.

#### 5. WORKING

The car black box can be fitted in the below the seat. All the sensors can be fitted with the vehicular instruments. The sensors are accelerometer, object sensor for finding the number of person in the vehicle, gyro sensor for calculating the steering angle and also the GPS for the position of the vehicle,

GSM for the sending the data. When the accident occurs, then accelerometer vibrates. Then at that instant all the data of the sensors can be sending to server via GSM module. If the car moving left and right randomly and then car can be dashed, i.e. the accident due to steering angle. Also at that time, the all the data of the sensor can be send to the main server. The data of the sensor include a status of the seat belt, airbag status, position of the vehicle, steering angle and accelerometer values. In this project, the threshold value can be set for the accelerometer and the gyro-sensor.

The process of this project takes place in the following manner:



*Fig.9. Flow Chart*

The System is started. The system senses the parameter of the devices from various parts of the vehicle. and then sends the collected information to the Analog to digital converter. Then ARM processes the data and takes immediate steps. If sensors parameters reaches their limit then ARM LPC2148 send commands to the relay to stop the engine. If for a crash or an accident, it sends the data over GPS and GSM of the user. The all this process can be explained in low chart.

## 6. RESULT

This project which would help to analysis the root cause of accident with the help of data from various sensors connected. Inside the vehicle that are explained below as per the following parameters:-



*Figure 10 : Output of GPS on LCD Screen*

The GSM sends the coordinates to the user whose number is saved in the SIM provided in the GSM kit. The number is save by using the AT commands.



## **8. CONCLUSION**

The developed Enhanced Event Data Recorder system based on ARM for Vehicle Monitor. This project aims to implement enhanced Event Data Recorder fault protection mechanism for vehicle to get data recorded and get alert message on LCD and all this data also shown on the webpage in the control room. In this project, detection of extreme conditions, sensing data and recording the respected conditional data and shown on webpage.

The developed system is a simple solution for monitoring, security, surveillance. They primarily refer to increasing the reliability of the end system with respect to prototype. It can achieve the information exchange between vehicle terminal and monitoring centre.

.In Large capacity, the storage system require sufficient capacity to store the data. The data in the event data recorder should maintain and completely in a long term without any lost and damage.

## **9. FUTURE SCOPE**

The future work will be to monitor to the each module connected to the system means as it working properly and also simultaneously video record of that extreme condition.

The Event Data Recorder is the most robust of the existing hardware devices. Increase the utility of the system to a greater extent providing it a global connectivity and also many useful features like speed of vehicle and position of vehicle. If the android or other application can be made the device can be very effectively used and use of TCP/IP protocol is very efficient for further development of project.

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