

E-Crashcorder Next Generation Vehicular Black Box Device integrated with Airbag Control System that records Audio and Visual Footage of the Crash Scenario in addition to Vital Vehicle Parameters

KAVITHA S, JAYANDRAN S, NAVAS
UG-Student B.E-ECE, Saveetha University,
E PREMKUMAR S
Asst professor, Saveetha University

Abstract-The project aim is to design a next generation Vehicle Black Box (EDR), named as E-Crash corder, (Enhanced Crash Data Recorder) that is the combination of all the advantages of previous Black Boxes, Event Data Recorders (EDRs) and standalone Digital Video/Audio recorders. The E-Crash corder is integrated with the Electronic Control Unit (ECU) which is responsible for the airbag

KEYWORDS-GPS,SCCB CONTROL,EDR

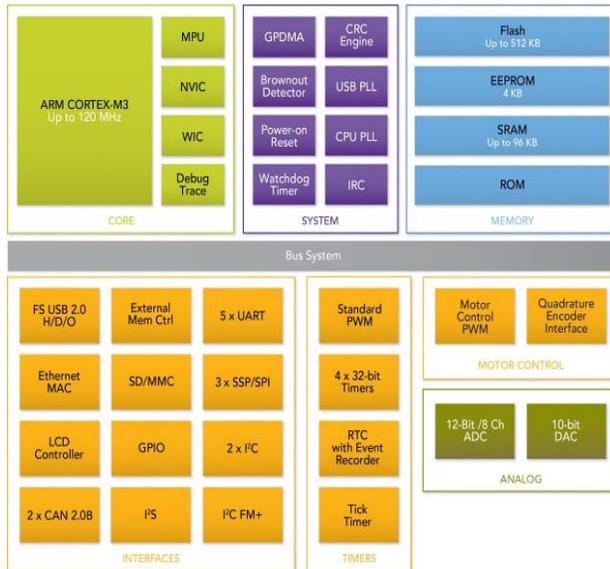
I. INTRODUCTION

The project aim is to design a next generation Vehicle Black Box (EDR), named as E-Crashcorder, (Enhanced Crash Data Recorder) that is the combination of all the advantages of previous Black Boxes, Event Data Recorders (EDRs) and standalone Digital Video/Audio recorders. The E-Crashcorder is integrated within the Electronic Control Unit (ECU) which is responsible for the airbag control and deployment and stores the status of vehicle gathered from different sensors. It is equipped with camera that records the video snapshots in front of the vehicle. It also records the audio inside the vehicle, using a microphone. The E-Crashcorder has Global Positioning System(GPS) receiver for reading the current latitude and longitude of the vehicle point. The 6 Degrees of Freedom (DOF) of inertial sensor, which is a Triple-axis accelerometer sensor and Triple-axis magnetometer sensor, is integrated with E-Crashcorder to read the velocity, acceleration and orientation of vehicle using which we analyze the stability of vehicle during the travel. After collecting and synchronizing all data, the E-Crashcorder saves them in Secure Digital (SD) Card. It has a USB port which is used to transfer the recorded data to a PC/Laptop.the crash event. Immediately after a crash event, the recorder automatically stops after a few seconds. EDR data can be retrieved and analyzed to determine the driver's actions and how the vehicle performed at the time of a crash. A real time clock running in the microcontroller is used to timestamp every data that will be recorded. Here is the list of the crash data parameters that will be recorded.

The system can be integrated with even bicycles/two wheelers with a few modifications.40 seconds of data recording that exceeds the traditional EDR limit of 10 seconds.A high performance 32-bit ARM Cortex-M3 microcontroller, consuming very low power.

USART Baud Rate Generator (BRG)

The BRG supports both the asynchronous and synchronous modes of the USART. It is a dedicated 8-bit baud rate generator. The SPBRG register controls the period of a free running 8-bit timer. In asynchronous mode, bit BRGH (TXSTA<2>) also controls the baud rate. In synchronous mode, bit BRGH is ignored. Table shows the formula for computation of the baud rate for different USART modes which only apply in master mode (internal clock). Given the desired baud rate and Fosc, the nearest integer value for the SPBRG register can be calculated using the formula in Table. From this, the error in baud rate can be determined.



CAMERA:

OV7670

VGA/OVGA Resolution.30 frames/sec frame grab DSP based image processing.Standard SCCB Interface for Control and Configuration.8-pin parallel interface for data.Low voltage low power CMOS technology.A high speed FIFO for data buffering.3Mbit FIFO size (384 kb) .

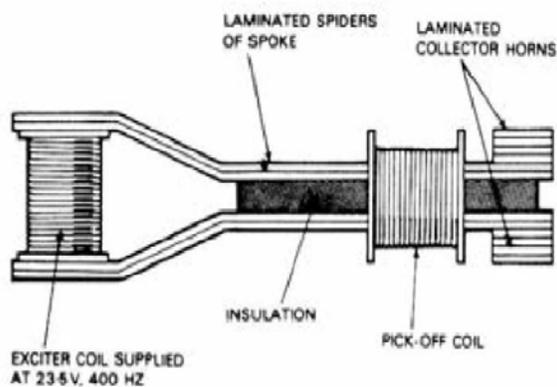
GLOBAL POSITIONING SYSTEM (GPS)

The Global Positioning System (GPS) is a location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles. GPS was developed by the United States Department of Defense (DOD), for its tremendous application as a military locating utility. The DOD's investment in GPS is immense. GPS has proven to be a useful tool in non-military mapping applications as well. The smart antenna can track upto 66 satellites at a time.Fast time to first fix, Superior sensitivity, and low power.Less than 10m Accuracy.57600bps UART interface.Up to 10Hz update rate.Built-in micro battery to preserve system data for rapid satellite acquisition.LED indicator for fix or no fix.GPS satellites are orbited high enough to avoid the problems associated with land based systems, yet can provide accurate positioning 24 hours a day, anywhere in the world. Uncorrected positions determined from GPS satellite signals produce accuracies in the range of 50 to 100 meters. Today, many industries are leveraging off the DOD's massive undertaking. As GPS units are becoming smaller and less expensive, there are an expanding number of applications for GPS. In transportation applications, GPS assists pilots and drivers in pinpointing their locations and avoiding collisions.

IV MAGNETOMETER

Magnetometers, which measure magnetic fields, are distinct from metal detectors, which detect hidden metals by their conductivity. When used for detecting metals, a magnetometer can detect only magnetic (ferrous) metals, but can detect such metals buried much deeper than a metal detector. Magnetometers are capable of detecting large objects like cars at tens of meters, while a metal detector's range is unlikely to exceed 2 meters.The magnetometer is based on the idea that the magnetic

flux moving through a coil depends on the orientation of the with respect to the magnetic field lines of the earth. It consists of three spokes which share a single exciter coil. The complete suspend in order to ensure that only the horizontal component of the magnetic field is measured. When zooming down to one of the spokes the following sketch can be made:



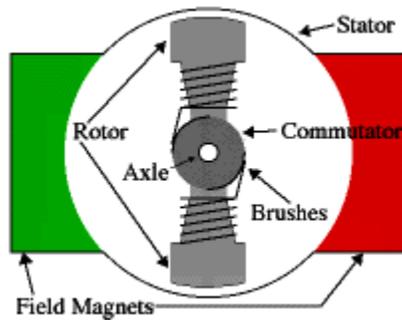
How ever with the inclusion of an external field (that of the earth for examples), changes in the total flux can be observed. This change in flux is caused by the saturation of the perm alloy used. When a magnetizable material is fully saturated. The material is completely magnetized and a stronger magnetic force as no effect on the magnetic flux density.

V DC SERVO METER

Used for position and speed control. Operated with PWM pulses @ 50Hz. Duty cycle variation controls the desired parameter. Operates with low current, ideal for battery powered applications. In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then



placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Let's start by looking at a simple 2-pole DC electric. winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization). Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization



Again, disassembling a coreless motor can be instructive -- in this case, my hapless victim was a cheap pager vibrator motor. The guts of this disassembled motor are available for you to see here (on 10 lines / cm graph paper). This is, more accurately, was a 3-pole coreless DC motor.

VI PROJECT ADVANTAGES

Existing EDR technology doesn't integrate audio and video into its functionality. The addition of audio and video into the recorded parameters would help to find out the true happenings and make the investigation much easier one. Records all the vehicle parameters starting from 30 seconds before crash and 10 seconds after crash. Recording the latitude and longitude of the vehicle will provide the true vehicle position and motion during a crash event. USB access to the black box device helps easy retrieval of information on any PC/Laptop. A 2GB memory card is used as the main storage memory providing enough space for all the audio, video and other vehicle parameters. The system can be integrated with even bicycles/two wheelers with a few modifications. 40 seconds of data recording that exceeds the traditional EDR limit of 10 seconds. A high performance 32-bit ARM Cortex-M3 microcontroller, consuming very low power.

CONCLUSION

The project Recorders and standalone Digital Video/Audio recorders. The E-Crashcorder is integrated within the Electronic Control Unit. Responsible for the airbag control and deployment and stores the status of vehicle gathered from different sensors. is the combination of all the advantages of previous Black Boxes, Event Data Recorders. FAT-32 embedded file system library for memory card via SPI protocol. USB 2.0 library with CDC device class acting as virtual COM. Next Generation 32-bit ARM Processor for Embedded Applications based on ARMv7-M Architecture. Harvard architecture. Separate I & D buses allow parallel instruction fetching & data storage 3-stage pipeline with branch speculation. High Performance RISC CPU. Greater performance efficiency, without increasing the frequency or power requirements. ARM Cortex-M3 processor, running at frequencies of up to 100 MHz. A Memory Protection Unit (MPU) supporting eight regions is included. Four general purpose timers / counters, with a total of eight capture inputs and ten compare outputs. DSP based image processing. Standard SCCB Interface for Control and Configuration. 8-pin parallel interface for data. Low voltage low power CMOS technology. Earth has 24 GPS satellites, at least 4 are always visible. GPS receiver calculates location using Triangulation method. Allows FAT-32 formatting for easy file management. Used as mass storage device in portable embedded system. Developed by SD Card Association. Windows compatible FAT-32 file system. Ported to Cortex-M3 and Cortex-M0. serial protocol connecting a microcontroller with a host computer such as a PC/Laptop. Used for position and speed control. Operated with PWM pulses @ 50Hz. Recording the latitude and longitude of the vehicle will provide the true vehicle position and motion during a crash event.

REFRENCE

- [1]. Box and N. R. Draper. Empirical Model Building and Response Surfaces. John Wiley & Sons, 1987. T. Ranney, W. Garrott, and M. Goodman, NHTSA Driver Distraction Research: Past, Present, and Future, National Highway Traffic Safety Administration, 2001, Tech. Rep. Paper No. 2001-06-0177. [2] V. Neale, T. Dingus, S. Klauer, J. Sudweeks, and M. Goodman, An Overview of the 100-Car Naturalistic Study and Findings, National Highway Traffic Safety Administration, 2005, Tech. Rep. Paper No. 05-0400. M. Kutila, M. Jokela, G. Markkula, and M. Rue, "Driver distraction detection with a camera vision system," in Proc. IEEE Int. Conf. Image Processing (ICIP 2007), San Antonio, TX, USA, Sep. 2007, vol. 6, pp. 201–204. [7] C.-T. Lin, R.-

C. Wu, S.-F. Liang, W.-H. Chao, Y.-J. Chen, and T.-P. Jung, "EEG-based drowsiness estimation for safety driving using independent component analysis," *IEEE Trans. Circuits Syst. I: Reg. Papers*, vol. 52, no. 12, pp. 2726–2738, Dec. 2005. E. Biham et al., "How to Steal Cars — A Practical Attack on Keeloq," *CRYPTO 2007*, 2010.

[2] A. W. M. Bonnick, *Automotive Computer Controlled Systems: Diagnostic Tools and Techniques*, Automobile Electronics, Taylor & Francis Group, 2001. A. Martínez-Ballesté, P. A. Pérez-Martínez, and A. Solanas, "The Pursuit of Citizens' Privacy: A Privacy-Aware Smart City Is Possible," *IEEE Commun. Mag.*, vol. 51, no. 6, June 2013.

Downloaded from edlib.asdf.res.in