International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org Volume 3 Issue 4‖ April 2014 ‖ PP.06-10

Online Black Box System for Cars

[1,]Mr. Kishor Rane , [2,]Mr. Rahul Tichkule , [3,]Mr. Mohit Shinde
[4,]Prof. S.I.Nipanikar
[1,2,3,4,]*(E&TC, PVPIT, Pune Country INDIA)*

ABSTRACT : *This paper describes the design process of Car Black Box system IC. As x by wire is introduced to the several part in vehicle, the demand of automotive semiconductors are increasing. Because it will be mandatory for every car to be equipped with Car Black Box, it is expected that many ICs for Car Black Box also will be integrated. Unlike general electronic control units as PCB or module, car black box implemented on a single chip can reduce its size, power consumption and the cost. So the topic of this paper is to develop the Embedded controller for Car Black Box using SoC (System on Chip) technique. System on Chip (SoC) is the effective method to implement embedded system like car black box, which consists of processor, various sensors like temp , eye blink , stearing position , over speed , alcohol sensors , SD card (to store the data) ,GPS and GSM(to send online (real time)information).*

KEYWORDS: *Embedded system, system on chip(SoC), GPS, GSM module, visual basic*

I. INTRODUCTION

Black Box has been proven indispensable in improving car safety reliability. Unfortunately, on most real-life situations, Black Box fail to deliver their most essential feature - a faithful replay of the events in real time. The aircraft flight data recorder, Black Box continuously records the various parameters execution, even on deployed systems, logging the execution for post-mortem analysis .We are designing the flight data recorder for car accident mishap information in real time. There are many of the accident are happening world-wide but how many of them are completely clarified online black box system for cars is a system that continuously records all parameters of cars and send the information to the dedicated server so if unfortunately accident happens car black box clarify that whether it is a driver's fault or there is some malfunctioning in parts of car during accident.In this project we are using two units car unit that collects the information from the sensors and another is the PC unit it is a dedicated server, from this unit we can check the position and other parameters of car any time, it will be updated after each 20 seconds. [1] Car unit: This unit continuously scans for various parameters of car. It scans and stores the data such as fuel, engine temp, speed & steering position. As soon as the accident is detected the µc stores all this data on the sd smart card.Also the µc scans for alcohol and eye blink sensor.If the driver is found to have alcohol in the breath, the ignition is turned off by the µc .and 6hence the possibility of accident is avoided. all this information is stored in sd card. Also we have designed a eye blink sensor which continuously monitors the no. Of times the eye blinks. If the eye blinks count decreases that means the driver is sleepy in that case a buzzer is operated , this is the working of car unit.

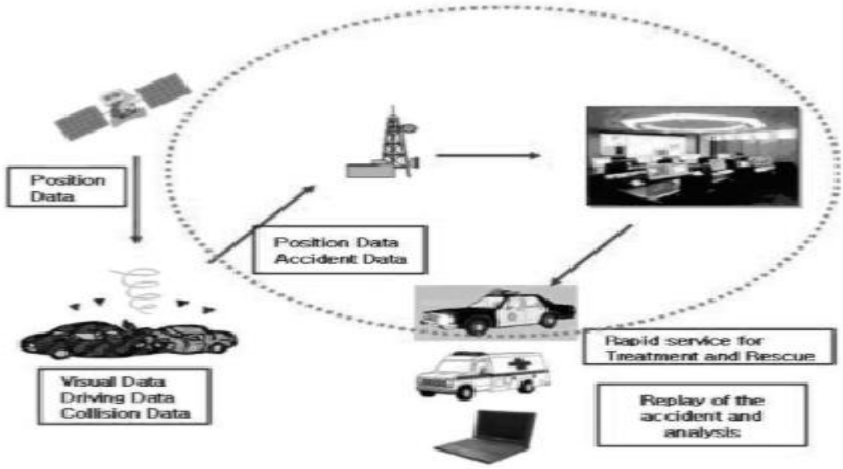


Fig 1.1 concept of car black box

[2]PC unit : This unit has a onboard vb s/w which graphically shows all the data in real time to the analyst so that the reasons of crash/accident can be understood better.On pc we will display all the critical parameter graphs for 20 sec before accident. All the graphs will be displayed separately. The readings will be read from the sd card.

The functions of Car Black Box follow as :

1) Data collection - Visual data: Visual information in front and rear side during driving from camera. - Driving data: Driving information such as speed, brake and seat belt status, steering performance. - Collision data: Time, speed and shock power when accident from accelerometer. - Positioning data: The car positions checked in real time by GPS. These data are saved temporarily in RAM as memory buffer and transfer to the Flash memory like SD card [4].

2) Accident analysis and reconstruction - analyze the accident easily and to handle many problems related to car accident like crash litigation, insurance settlements

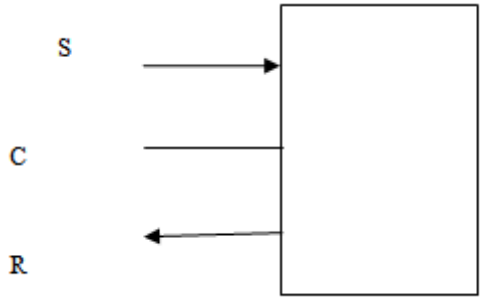
3) Wireless communication - Transmitting the all data via Wireless Network, such as CDMA and GSM/GPRS when accident to main control center. - support rapid service for rescue and treatment of accident

In this paper, we present a SoC[5] design of Embed- ded controller for Car Black Box, which integrated Car Black Box functions onto a single chip. It has several advantages with higher performance, smaller space requirements, lower power, higher system reliability, lower consumer costs. Next section describes In Vehicle Network based Car Black Box architecture and its components. The design of hardware and software and SoC design flow is presented in section 3. Section 3.4 shows the test and verification of the design.

II. RELATED WORK

A black box is a function representing a set of concert system into which stimuli S impinge and out of which reaction R emerges [11]. Te constitution and structure of the box altogether irrelevant to the approach under consideration , which is purely external . In other words , only the behavior of the system will be accounted for.

The various kind of stimuli and responses will be pictured as so many channel C along which signal is travel



The term black box was first recorded used by the RAF of approximately 1947 to describe the sealed containment used for apparatus of navigation, this usage becoming more widely applied after 1964. The identifier is therefore applied to objects known as the flight data recorder (FDR) and cockpit voice recorder (CVR). These function to record the radio transmissions occurring within an airplane, and are particularly important to persons who engage into an inquiry into the cause of a plane crashing, where the plane is caused to become wreckage. These boxes are in fact colored orange in order that they be more easily located.

The process of network synthesis from the transfer functions of black boxes can be traced to Wilhelm Cauer who published his ideas in their most developed form in 1941. According to Cauer,[7] there are three major tasks that network synthesis has to address. The first is the ability to determine whether a given transfer function is realisable as an impedance network. The second is to find the canonical (minimal) forms of these functions and the relationships (transforms) between different forms representing the same transfer function. Finally, it is not, in general, possible to find an exact finite element solution to an ideal transfer function - such as zero attenuation at all frequencies below a given cutoff frequency and infinite attenuation above. The third task is therefore to find approximation techniques for achieving the desired responses. , others who followed him certainly did describe the method as black-box analysis. Cauer discovered that all solutions for the realisation of a given impedance expression could be obtained from one given solution by a group of affine transformations

Vitold Belevitch[9] puts the concept of black-boxes even earlier, attributing the explicit use of two-port networks as black boxes to Franz Breisig in 1921 and argues that 2-terminal components were implicitly treated as black-boxes before that.A new innovation in black box is A Tool Supporting Automatic Black Box Test for Software on Smart Mobile[8] Devices e design of various components of Mobile Test. Mobile Test is an automatic black box testing tool for smart mobile devices. It can build sophisticated, maintainable and reusable test cases library for testing system level and application level software on a variety of smart mobile devices. The system uses a layered design to reduce the complexity of the whole system. Each layer provides services to upper layer with the support of lower layer. In this way, the test control layer can be separated from the peculiarities of the underlying devices.

III. PROJECT WORK

3.1 In Vehicle Network Based Car Black Box Architecture

In Vehicle Network based Car Black Box consists of ARM 7 processor of embedded system in vast range of industry, various sensors like engine temperature , steering position , alcohol detector , eye blink Sensors, SD controller dumping the data from memory buffer to SD card, collision detector, SRAM acting as memory buffer. GPS and GSM module . These hardware modules are integrated in only one chip[3][1][6] . We implement the whole hardware onto a single PCB board. Processor initialize all sensors and SD controller and also receives data from GPS . Processor(ARM 7) not only recognizes the crash through interrupt pin connected with Collision Detector when car collision is detected but also moves the data of Memory Buffer to SD card by activating SD controller.GPS (Global Positioning System) provides continuously record vehicle position and precise time. An accelerometer is a device for measuring acceleration. It computes the change vehicle velocity during the impact and makes known existence of crash to car black box.The driving data like car speed, engine RPM, throttle position, brake status are gathered from the sensors we used. Memory buffer is the temporary storing place including GPS, image, . Because the memory of the black box is limited, it only retains the information for a few seconds .SD card is a memory card that is specifically designed to meet the security, capacity, performance and environment inherent in newly emerging audio video consumer electronic devices. It includes protection mechanism and also can support easily interface allowing a PC to be connected without special devices. In addition, If file system (FAT16 or 32) is applied, data is stored in Microsoft Access format for ease of analysis.All stored data can later be recovered using a PC equipped with appropriate software. In this architecture was excluded wireless communication function of pre-described.

3.2 Hardware

The synthesized hardware blocks by Simplify Pro 7.3.4 are placed and routed to the Altera FPGA (EP20K600EBC) by Quartus ll 4.0. The whole hardware blocks are depicted in the figure. Several serial interfaces like as CAN controller, SPI controller and I2C controller. It is compatible with standard ARM 7 and faster 10 times by designing new structure. Program ROM for storing executable code (HEX) and simple bus structure to interface serial logics is implemented. This hardware consists of CIS con- trol logic to initialize CMOS image sensor and to get out- put data of image sensor and JPEG logic to compress im- age data from image sensor. SD controller plays the rule of SRAM-to-SD card interface, which it transfers the data saved in SRAM to SD card in a block of 512 bytes through SPI bus. sd wrap block conducts to transfer data from serial to parallel and from parallel to serial between SRAM and SD interface. And sd interface block takes charge of SD card protocol. It is de- scribed by commands and responses of SD card following SPI bus protocol. The last collision detector is the logic to detect collision by estimating accelerometer data. The total sensors are embedded on the pcb. The total logic elements and memory for implementation

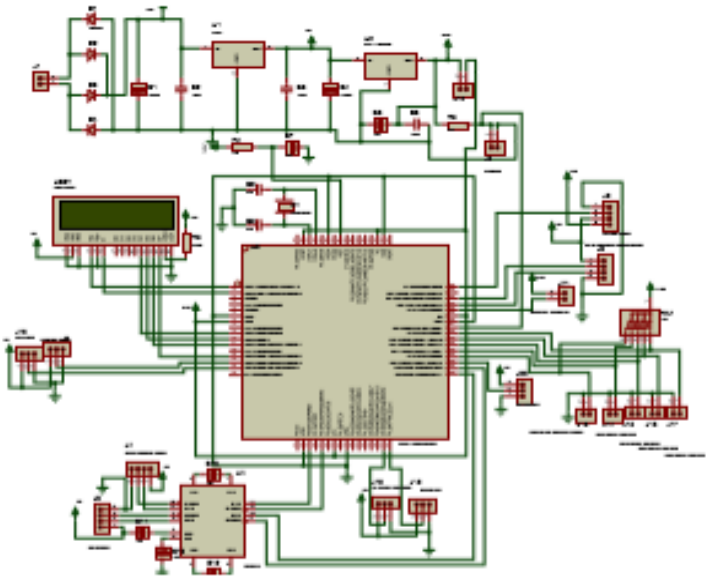


Figure 3.2 circuit diagram

As day by day accidents are increasing at faster rates there needs to be a primary security in the cars and other vehicles .Drivers safety and precaution is first concern so we design modified version of black box .Black box is actually a physical offline device which is used to store all the data from sensors and whenever accident occurs certain authority has to find out the black box first connects the box with a system i.e PC unit and then system shows the data from the sensors , but the current idea is offline device and we are modifying it by making it online(real time). Project contains basically two units car unit and the mobile unit.

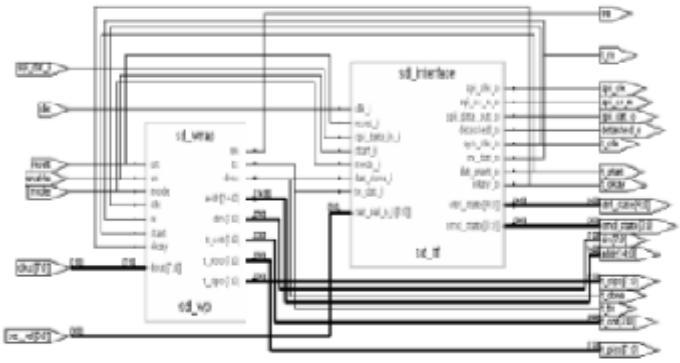


Fig 3.2 SD card controller

3.3 Software

Embedded software in car black box is executed by ARM 7. The software is designed in assembler using Keil software and then input in ROM of ALTERA as initialize file formatting HEX. GPS data are collected and saved to designated address of SRAM. To get useful data from CAN bus the code is described to set baud rate, message filtering and to input identifier of CAN remote frame. When collision detected by interrupt pin of SD controller is enable by ARM and then stored car black box data to external memory (SD card) automatically. In addition to that, the software for UART transfer is described to debug that valid data is recorded in SD card. The external interrupt 0 indicates collision detection and interrupt 1 indicates the end of SD card read/write operation. All data of Car Black Box are updated per 1 sec. Embedded software in car black box is executed by 8051. The software is designed in assembler using Keil software and then input in ROM of ALTERA as initialize file formatting HEX. CAN and GPS data are collected through CAN controller and UART of CBNU8051 and saved to designated address of SRAM. To get useful data from CAN bus the code is

described to set baud rate, message filtering and to input identifier of CAN remote frame. When collision detected by interrupt pin of 8051 SD controller is enable by ARM and then stored car black box data to external memory (SD card) automatically. In addition to that, the software for UART transfer is described to debug that valid data is recorded in SD card. This is the software design flow. The external interrupt 0 indicates collision detection and interrupt 1 indicates the end of SD card read/write operation. All data of Car Black Box are updated per 1 sec.

3.3. Test and Verification

To verify that correct data of car black box is recorded in SD card, we use serial port. Stored data in SD card are transferred by UART of ARM and displayed serial monitor in PC. Next is the monitored result of car black boxes data for the data saved memory buffer and the data stored in SD card. The monitored result of Car Black Box data We can monitor image data, acceleration data, GPS data .The required data will be sent on the dedicated server after a fixed time delay

IV. CONCLUSION

In this paper, we present the design of Embedded controller for Car Black Box. We made a System on Chip design for Car Black Box through integrating and verifying each IP of ARM, SD controller and other components. The design result for Car Black Box system IC is implemented and is verified in the test board system for demonstration.

V. ACKNOWLEDGEMENTS

The authors would like to thank project guide Prof. S.I.Nipanikar and H.O.D. Prof. S.D.Joshi PVPIT, Pune (India).for their guidelines and involving in research.

REFERENCES

[1] M. Genoe, P. Delforge, and E. Schutz. "Experience of IP- Reuse in System-on-Chip Design for ADSL". ISSCC99, session 21(WA21.1):360–479, January 1999.
[2] R. B. GmbH. CAN Specification 2.0. His Publisher, Post- fachn, Stuttgar, 1991.
[3] M. Keating and P. Bricaud. Reuse Methodology Manual for System-on-a-Chip Designs, Second Edition. Kluwer SOC Se- ries, January 1999.
[4] Matsushita Electric Industrial Co., Ltd. (Panasonic), SanDisk Corporation, and Toshiba Corporation. SD Specifications Part 1 Physical Layer Simplified Specification Version 2.00. SD Card Association, September 2006.
[5] S. Sarkar, G. S. Chanclar, and S. Shinde. "Effective IP reuse for high quality SOC design". "SOC Conference, 2005. Pro- ceedings. IEEE International", pages 217– 224, September 2005.
[6] Shunzo Yamashita and Hidetoshi etc.. ,. "RTL Morph- ing: Making IP-Reuse Work in System-on-a-Chip Designs".
[7] E. Cauer, W. Mathis, and R. Pauli, "Life and Work of Wilhelm Cauer (1900 – 1945)", *Proceedings of the Fourteenth International Symposium of Mathematical Theory of Networks and Systems (MTNS2000)*, Perpignan, June, 2000
[8] Research paper on Mobile Test: A Tool Supporting Automatic Black Box Test for Software on Smart Mobile Devices by Jiang Bo, Long Xiang, Gao Xiaopeng
[9] Belevitch, V, "Summary of the history of circuit theory", *Proceedings of the IRE*, vol 50, Iss 5, pp848-855, May 1962
[10] Black-Box Testing: Techniques for Functional Testing of Software and Systems, by Boris Beizer, 1995
[11] A General Black Box Theory Mario Bunge