Proof Collection in Car Black box Using Android Application

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***Abstract*—The main purpose of the paper is to develop a prototype of Car Black Box For vehicle diagnosis that can be installed into any vehicle. This prototype can be designed with minimum number of circuits. This can contribute to construct safer vehicles, improving the treatment for crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate. This Paper represents a vehicular digital video recorder system acts as the flight recorder of a vehicle which is used to record the behavior of a running vehicle. This proposed system provides information related to scenario of accident occurred and collecting information on real time basis, from obstacle detection and video camera. This information is collected by Raspberry Pi processors using module and camera which are connected to the processor which is based on Linux operating system gives all the collected data information to the monitoring system. The monitoring system display the data in real time which help the police investigation to find out the scenario of accident occurred exactly after accident which displays the scenario of accident in image format on police station server window. This information is used to analyze the behavior of accident easily and conflicts related to car accident such as investigation process and falsification of data collected from car black box is avoided and it gives high performance advantages of evidence collection from car black box.**

Keywords—Black box, GSM, RENESAS microcontroller, Smartphone, Accident

I. INTRODUCTION

The vehicle accident is a major public problem in many countries, particularly India. Despite awareness campaign, this problem is still increasing due to rider's poor behaviors such as speed driving, drunk driving, riding without sufficient sleep, etc. The numbers of death and disability are very high because of late assistance to people who got the accident. These cause huge social and economic burdens to people involved. Therefore, several research group and major motorcycle manufacturers have developed safety devices to protect riders from accidental injuries. However, good safety device for vehicles is difficult to implement and very expensive. On the roadway driver usually keep a safety distance from one another.

On the other hand, due to the driver's interruption, long-time driving tiredness, or a sudden break applied by another car, a serious collision may occur. Even though the driver is in a conscious mind, he cannot respond immediately to control his/her vehicle. Sometimes crash may occurs due to bad weather situations as mist, vapor, fog and so on. Like Black Box of airplane, Car Black Box (known as Event Data Recorder) is used to record information related to accidents. Car black box records driving data, visual data, collision data and position data before and after the accidents so that it can be used to analyze the accident easily and to settle many disputes related to car accident such as crash litigation, insurance settlements. It can be used to not only reconstruct what happened before an accident by Insurance agents and police but improve vehicle design, roadway design and emergency medical service by automakers, government and hospital. In addition to the basic function, the car black box equipped with wireless communication system can send accident location information to central emergency and disaster server in real-time.

Therefore drivers who want help can receiveservice quickly by rack car, police and hospital ambulance. Car Black Box detects a crash automatically, and also records the motion of the vehicle and driver's actions during a predefined time period before and after the accident. It consists of data collection devices for collecting the information about car's status and the driver's actions, a nonvolatile memory device for recording, a microprocessor for controlling the unit and a wireless modem for communication.

The main objective of the proposed work is: developing a prototype of Black Box For vehicle diagnosis that can be installed into any vehicle. This prototype can be designed with minimum number of circuits. This can contribute to construct safer vehicles, improving the treatment for crash victims, helping insurance companies with their vehicle crash investigations, and enhancing road status in order to decrease the death rate.

II. SYSTEM DESCRIPTION

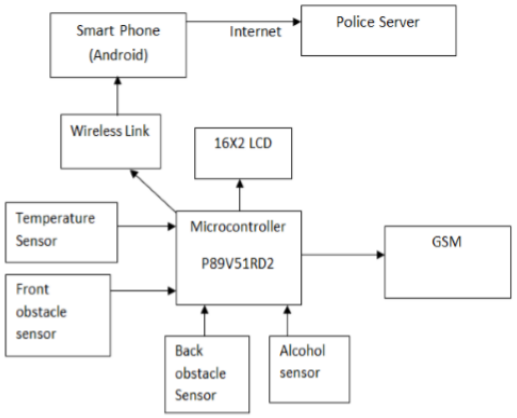

Fig 1: Black diagram of car black box

Block diagram in our proposed system is shown in Fig1. Black box contains the alcohol sensor, temperature sensor, front and back IR sensors, GSM & 16x2 LCD [7]. It detects the engine temperature, location (GPS), obstacle presences & alcoholic content. The outputs of these parameters are displayed on the LCD. The system developed also has the facility of taking snap shots during the accident using smartphone which could be vital for post-crash analysis. This collected information's along with the snaps are send to the police server through the internet. GPS tracking system developed in this paper helps to track the vehicle in case of accident and enables authorities to extend immediate emergency medical service [2,3,9].

III HARDWARE DESCRIPTION AND DESIGN

A. *RENESAS Microcontroller*

Renesas microcontroller surpasses its predecessor i.e. 8051 family of microcontrollers, with various in-built features [5].

FEATURES

- 80C51 CPU with 5V operating voltage from 0 to 40 MHz
- 64 kB of on-chip flash user code memory with ISP and IAP. SPI and enhanced UART.
- Four 8-bit I/O ports with three high-current port 1 pin.
- Three 16-bit timers/counters.
- Programmable watchdog timer.
- Eight interrupt sources with four priority levels.
- Second DPTR register
- Low power modes

B. *Temperature Sensor*

Engine temperature is the important parameter in control unit, if this value goes to abnormal, some unwanted gases exhaust from vehicles due to improper combustion. In this paper, to obtain the vehicle engine temperature, we used LM35 as temperature sensor. It continuously senses the engine temperature and fed to the microcontroller. It converts temperature value into electrical signals. It is rated to operate over a -55 to +150°C temperature range [1].

C. *GSM Module*

GSM used in ensuring vehicle safety. It is programmed in such a way that whenever the collision occurs the location of vehicle is sent to registered telephone number through GSM & all the sent details can be used to locate the vehicle using Google map[8].

D. *LCD Display*

A liquid crystal display (LCD) is a flat panel display, electronic visual display, based on Liquid Crystal Technology. It is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. In this paper we are using 16×2 LCD [7]. It receives the

collected information's which are stored in the microcontroller and displays these messages. It uses very small amounts of electric power.

E *Slot Sensor*

This sensor is used to give the information about whether the seat belt is weared or not. This is a Optoelectronic device. It can act as a opt isolator. The IR diode in the left portion keeps emitting IR rays. The opt transistor keeps sensing these rays. The Centre portion is a slot into which a thin obstacle can pass for ex., a RFID card. Once an obstacle is detected the input to optical transistor is blocked.

F. *IR Sensor*

IR sensor is used to detect the obstacle on the vehicle travelling path. If any obstacle detected in the vehicle travelling path a warning message will be displayed on the LCD. For example If obstacle detected on front side of the vehicle message will be displayed on the LCD as "FRONT SIDE OBJECT FOUND" or "FRONT=1"

G. *Power Supply*

As per this paper design, a 5V regulated power supply is required. All the modules are selected to work with 5V supply. LM317 adjustable regulator is used generate 5V regulated power supply. A 12V, 2A SMPS AC-DC adaptor is used as an external power supply. To operate the paper the male socket to the adaptor is connected to the DC jack present on the microcontroller board. Our microcontroller power supply section is so generalized, we can use step-down transformer or DC adaptor to power ON the board.

IV SOFTWARE RESOURCES

After the hardware part of the Black Box system, it is now time to look at the software details and how the user is shown the data before and after the accident. The main details of the project are to receive the data serially, intercept and finally display the results to the user in a clear and simple way. For the software implementation, we deploy two software packages. First one is the Keil µVision 3.0. Second one is the Flash magic simulator. The Keil µVision Debugger

accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of ARM7device. Simulation helps to understand hardware configurations and avoids time wasted on setup problems. With simulation, we can write and test applications before target hardware is available. The system program written in embedded C using KEIL IDE software will be stored in Microcontroller. Keil development tools for the Microcontroller Architecture support every level of software developer from the professional applications engineer to the student for learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single-board Computers, and Emulators support all ARM7 derivatives. The Keil Development Tools are designed to solve the complex problems facing embedded software developers. Flash magic is used to dump the code to microcontroller from PC. Flash Magic is a free, powerful, feature-rich Windows application that allows easy programming of Philips FLASH Microcontrollers. Build custom applications for Philips Microcontrollers on the Flash Magic platform! Use it to create custom end-user firmware programming applications, or generate an in-house production line programming tool. The Flash Memory In-System Programmer is a tool that runs under Windows 95/98/NT4/2K. It allows in-circuit programming of FLASH memories via a serial RS232 link. Computer side software called Flash Magic is executed that accepts the Intel HEX format file generated from compiler Keil to be sent to target microcontroller. It detects the hardware connected to the serial port.

V FUNCTIONAL DESCRIPTION

When accident occurs the microcontroller gets activated and starts collecting the information such as temperature, presence of obstacle, alcohol content respectively from the sensors. This collected information is displayed and is sent to the police server through mail. By using this information police can easily know the accident spot and they get the correct proofs for the accident to provide justice.

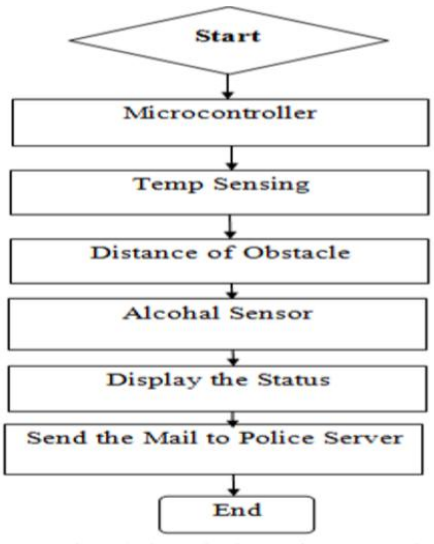

Fig 2: Functional Description of Proposed System

VI EXPERIMENTAL RESULTS

The paper has both software and hardware implementation. The intermediate results for both are explained in this paper. As the project aims at design and development of “Car black box using smart phone”, the results are shown accordingly. Whenever the power is switched on, a display appears as “WELCOME” and “GSM INITIALIZED. And the vehicle starts moving.

Fig 3: System shows the start of vehicle

If vehicle meet with an accident a message will be displayed on LCD as “accident occurred”

Fig 4: system showing accident occurred and vehicle stopped

The other parameters such as temperature, alcohol, seat belt are continuously sensed by respective sensors and are displayed on the LCD as “T= , SEAT= , RR= , FR= , GS= “

Fig 5: System showing the various parameters

In case of collision occurred a message is received by registered number from the GSM

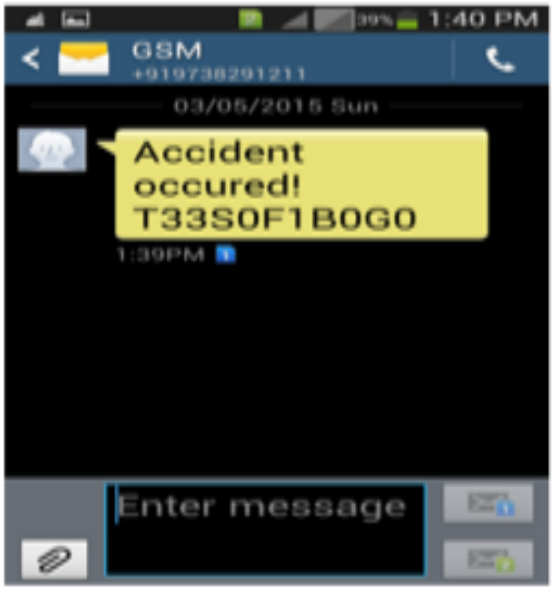

Fig 6: The messages received from GSM

The complete system of vehicle black box is as shown in the fig 7

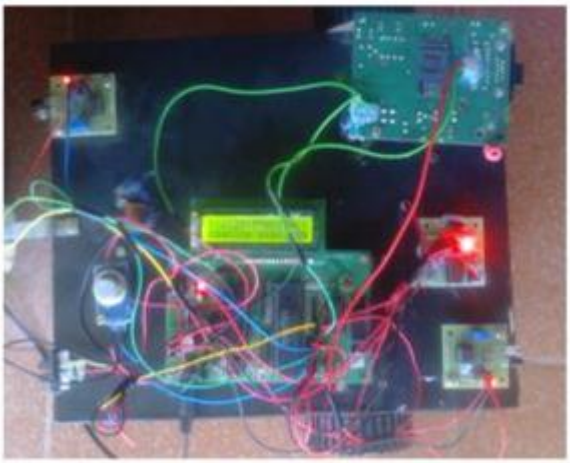
Fig 7: model of the black box

This paper attempted to equip automobiles with "Black Box' kind of equipment which aids driver for safe driving, ensures vehicle safety, help in locating vehicle in case of accidents and useful information for post-crash analysis. This paper used different sensors like temperature sensor, alcohol sensor, slot sensor and IR sensor to ensure safety of the vehicle. The obstacle detection mechanism enables and guides the driver for safe driving. The data collectedusing the above sensors are also useful in the post- accident analysis. The system developed also has video recording using webcam which could be vital for post-crash analysis. GPS tracking system developed in this paper helps to track the vehicle in case of accident and enables authorities to extend immediate emergency medical service. Measuring tyre pressure, Speed of the vehicle, Improved break failure condition using multiple sensor, Sleep alarm indicator, Video processing for panic and accelerity. Options can be provided as a part of future enhancements.

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