ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Implementation of Car Black Box for Evidence Collection and Accident Locater using Embedded System

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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.

Keyword:

GPS, ARM, RISC, GCC, LINUX, GSM.

I. INTRODUCTION:

According to the World Health Organization, more than a million people in the world die each year because of transportation-related accidents. In order to react to this situation, the black box system draws the first step to solve problem. In order to overcome from this problem, in this paper we are trying to implement the concept of "black box" in the car. Car black box is a device used to record the information's such as engine temperature, presence of obstacle, alcohol content and exact location of the accident about the vehicle. Along with this we are using smartphone to get the snap shots which are related to accidents and finally send this information along with the snaps to police sever

It develops Evidence Collection System from Car Black Box with Raspberry microprocessor as its main controller and sensor and to find location vehicle collision to save victims. With a perfect support of the embedded system technology, we believe that the Evidence Collection System from Car Black Box will have better performance and broader market prospect. In addition to the basic function, the car black box equipped with GSM/GPRS communication system can send accident location information to care taker, emergency and disaster server in real-time.

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Therefore drivers who want help can receive service 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 non-volatile memory device for recording, a microprocessor for controlling the unit and a wireless modem for communication. This project shows how effectively collect and manage information obtained from car black boxes in vehicular networks.

The functions of Car Black Box follow as:

Real time Data collection

- Visual data: Visual information in front and rear side during driving from camera.
- Collision data: Time, speed from accelerometer.
- Positioning data: The car positions checked in real time by GPS.

This data is saved temporarily in RAM as memory buffer and transfer to the external memory like PEN DRIVE.

Report Generation

- Analyze the accident easily and to handle many problems related to car accident like crash litigation, insurance settlements.

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.

Proposed Scheme

The car black box contains not only a record of what was happening in the last seconds before the impact but also the record after a collision. So it should take the most recent data values and store them in buffer with a circular sequence (RAM). When the black box senses the accident, buffer refreshing is suspended and the data before and after accident are transfer to external memory automatically.Camera gets turns on only when MEMS sensor gets activated and starts recording images and stores recorded images in pen drive connected to microprocessor as well as it automatically sends alert message to control room through GSM/GPRS modem. The captured data can be transmitted and stored in pen drive through USB port from vehicle to Monitoring center data base. Depends on user requirement (owner) the data can be accessed by security and police departments to analyze the received data. This is very confidential, without permission no one can access the data. The system uses a compact circuitry built around ARM microcontroller and Programs are developed in Embedded C. Flash magic is used for loading programs into Microprocessor.

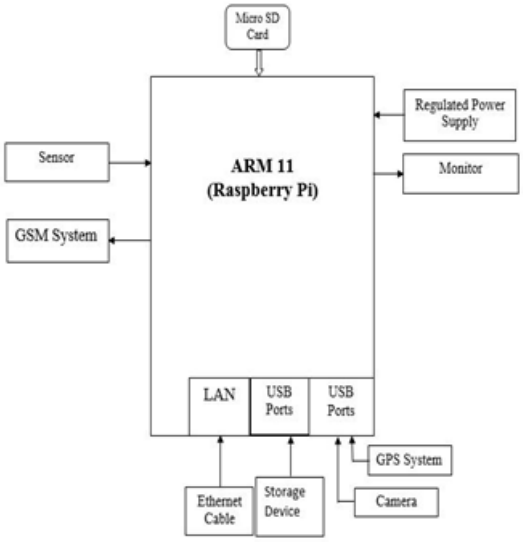

Figure.1: System Block Diagram

Hardware Design:

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor (The firmware includes a number of "Turbo" modes so that the user can attempt over clocking, up to 1 GHz, without affecting the

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warranty), VideoCore IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and long-term storage.

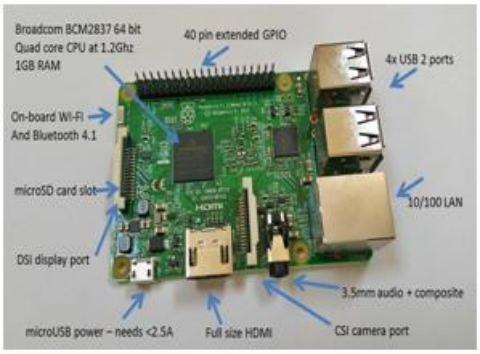

Figure 2.Raspbeery Pi Board basic Hardware

GPS System:

GPS modules are popularly used for navigation, positioning, time and other purposes. GPS antenna receives the location values from the satellites. GPS gives information about:

1) Location of Vehicle 2) Position at that time

Figure 3.GPS system board

GSM Modem:

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this Display Message on Notice Board using GSM 829 modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications.

SIM:

SIM abbreviates as Subscriber Identity Module. It is a chip-on small card consisting of user's information as well as phone book. User can alter the operator on the same handset as per convenience .At present dual SIM handsets are also available in the market where we can use two operators on the same handset. The SIM is inserted in a slot available on the GSM Modem.

Figure 4.GSM system board

Software Design:

Software development process based OS includes: the establishment of cross-compiler, the creation of root files system, the transplant of Boot loader, the porting of embedded Linux, and the development VOIP media stream. ARM Linux gcc is the cross compiler used. Boot loader vivi is used here

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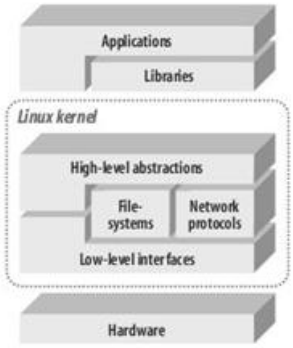

Figure.5: Typical architecture of an Embedded Linux System

The function of Boot loader is to initialize the hardware devices, establish memory mapping tables, thus establish appropriate hardware and software environment, provides interface to send commands to target board and prepare for the final call to the operating system kernel. Linux is used as operating system because Linux system is having a hierarchical structure and completely opens its kernel source. Linux can port to a wide range of hardware platforms, and can run in most of the architecture. Linux has a comprehensive set of editing, debugging and other development tools, graphical interface, a powerful network supporting and rich applications. In addition, the kernel can be reduced by configuring it.

Flow Chart:

Figure.6: Flow chart Vehicle accident and location find using GPS and GSM

Results:

In our demonstration, the evidence collection system uses the Sensor, Raspberry Pi, USB Camera, GPS Modem and GSM module. Sensor detects the collision, USB Camera captures when collision occurs, GPS modem sends longitude and latitude values to GSM modem. GSM modem receive and sends a message to registered mobile number and also transmit all the collected evidences which indeed collected and stored in storage device like pen drive. Following are the data collected at receiver end. The collected parameters are vehicle location, time, images respectively from the prototype designed, in this demonstration data collected only when collision is occurred.The collected data by controller not only transmitted to the server but also saved to the memory at transmitting end which in case of wireless transmission failure will be helpful for data extraction. It is more flexible to watch the generated reports to the person/institution have authority for that like police, insurance company etc.

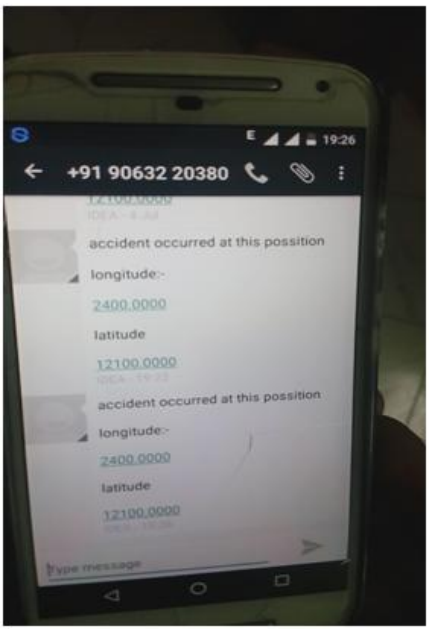

Figure.7: Snapshot of location coordinates message received in mobile

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Figure 5 shows the snapshot of USB Camera which extracts the collected parameters at receiver end. The specific user can login to the application and can generate accident analysis report.

Conclusion:

This paper focuses on solving driver privacy concerns and communication and management overheads. Our contribution is that we propose a feasible and useful scenario for public safety. It develops Evidence Collection System from Car Black Box with Raspberry microprocessor as its main controller and sensor and to find location vehicle collision to save victims. With a perfect support of the embedded system technology, we believe that the Evidence Collection System from Car Black Box will have better performance and broader market prospect.

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