

Design and Implementation of a Smart Data Gathering and Monitoring System using Black-Box Concept

Sainath Kandala¹

sainathk619@gmail.com

S. Arif Hussain²

arifhussainstar@rediffmail.com

¹ PG Scholar, Dept Of ECE, SVR College of Engineering, Ayyaluru Metta(v) , Nandyal Mandal , Kurnool Dist, Andhra Pradesh, India.

² Guide, Associate Professor, Dept Of ECE, SVR College of Engineering, Ayyaluru Metta(v) , Nandyal Mandal , Kurnool Dist, Andhra Pradesh, India.

Abstract: The main focuses of paper is to design Black box that will be building on a system which vehicle safety authorities can implement to enhance the reporting of vehicle crashes, provide post-crash analysis using sensors, GSM and GPS. Black box refers to collection of several different recording devices. Car black box is “Event Data Recorder”. Black Box records the relevant details about a Vehicle such as Engine Temperature, Distance from obstacles, Speed of Vehicle, Detect vibration of the vehicle Detect orientation or inclination of vehicle. The ordinary systems are simply based on the concept of sensors. They sound an alarm on detecting movement. This system of technology has now lost its appeal as it has become a common sighting in vehicles where these alarms go off unnecessarily. We proposed with GSM techniques and a better decision making process is built to make our vehicle more secure. It is a unique wireless home/car security device that gives instant alerts on your mobile phone the crash breach is detected. And also record of the event in values and reduce the time it takes for emergency rescue to arrive at the crash location. By using GPS pinpoint the exact location of the accident and send that data immediately to an emergency rescue authority using Short message service. Our main target was to build a low cost infrastructure that everyone can afford and use in their vehicle.

Keywords: GSM, GPS, UART ARM7.

I. INTRODUCTION

The vehicle accident is a major public problem in many countries. This problem is still increasing due to rider's poor behaviors all those accidents they need immediate help for others unfortunately up to know there is no automatic accidents location identification system due to this number of accidental deaths are increases. the reasons why the accident

occurred what are the causes for the accident we don't know and also claiming the insurance is typical because of we don't know the reason for the accident that's why we are introducing application in our vehicles. This is used to record information related to accidents. Car black boxes is having logical feature considering that more people are die in car accidents than an airplane crashes of investigation .The causes of car accident are not to difficult to investigate as plane crashes but there are cases that are very difficult to solve due to contradictory stories of drivers .black box in aircraft help to determine the cause of an airplane accident ,car black box helps to determine what has caused a car accident .They are particularly valuable when no witness are present at the scene of accident and when each drivers has his/her own version of event .Car black box is digital electronics device, which records and store vehicles speed ,vehicle location ,vehicle temperature ,vibration, distance from obstacles ,real time and vehicle other status information .It help to discover and to analyze the reason of an accident easily and to settle many disputes related to car accident such as crash and insurance settlements.

II. LITERATURE SURVEY

In this paper, how to effectively collect and manage information obtained from car black boxes in vehicular networks. The car black box is a vehicle-based CCTV which records video images, sound, GPS position, speed, and time. These data can be used for accurate car accident investigation and some public crimes prevention. However, there are important issues such as user privacy and a data management for a vehicle-based CCTV records. The proposed evidence collection system can reduce driver privacy concerns and communication and management overheads.[1]

N. Watthana wisuth[2] has designed a system using MEMS accelerometer and GPS tracking system to monitor the accidents. The components include an accelerometer, microcontroller unit, GPS device and GSM module. As accident occurs, the wireless device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and nearest hospital.

Hoang Dat Pham [3] presented GPS and GSM systems to track down the vehicle more effectively. The vehicle location can be obtained in form of coordinates which can be transmitted using GSM modem to the relevant person's mobile phones.

The IEEE journal on "Vehicle black box with 24GHz FMCW radar,[4] proposed by Jung-Hwan Kim, Sun-Kyu Kim and Sang-Hyuk Lee, is an automobile Black Box is a digital data recorder used to record information related to accidents in automobile. It provides critical data for crash investigation as the Black box in an aircraft provides critical data for air crash investigations. Black box can effectively track the happenings in vehicles during and after the crash. The data from the Black box is accompanied by the inputs given by victims and eye witnesses. Most important requirements for designing evidence collecting automobile Black Box and various design approaches are identified in this survey. The true cause of accident can be found if the events that lead to the accident are known. Thus, finding out the cause for the accident is necessary which can be achieved using Black Box.

The IEEE journal on "Accident Alert and Vehicle Tracking System", [5] proposed by KiranSawant, Imran Bhole, Prashant Kokane, Piraji Doiphode, Prof. Yogesh Thorat created an accident alert system using GSM and GPS modem and ARM. A piezoelectric sensor first senses the occurrence of an accident and gives its output to the microcontroller. The GPS detects the latitude and longitudinal position of a vehicle. The latitudes and longitude position of the vehicle is sent as message through the GSM. The static IP address of central emergency dispatch server is pre-saved in the EEPROM. Whenever an accident has occurred the position is detected and a message has been sent to the pre-saved static IP address.

The IEEE journal on "Accident Detection and Reporting System using GPS, GPRS and GSM

Technology", [6] proposed by Md. Syedul Amin, Jubayer Jalil, M. B. I. Reaz explains about Glass Box. It focuses on building an infrastructure which vehicle safety authorities can implement to enhance the reporting of vehicle crashes, provide post-crash analysis using motion sensors, record of the event in images and reduce the time it takes for emergency rescue to arrive at the crash location. We have achieved this using existing cellular network infrastructure already in place and also using GPS to pinpoint the exact location of the crash and send that data to an emergency rescue authority (such as Hospital, Fire Department, Police) using GSM text service.

The IEEE journal on "Accident Detection and Ambulance Control using Intelligent Traffic Control System", [7] Mrs. Manasi Patil, Aanchal Rawat, Prateek Singh, Srishtie Dixit, described a better traffic management system using Raspberry pi and RFID technology. The vehicle has a raspberry pi controller fixed in it which is interfaced with sensors like gas sensor, temperature sensor and shock sensor. These sensors are fixed at a predetermined value before accident. When an accident occurs the value of one of the sensor changes and a message to a predefined number (of the ambulance) is sent through GSM. The GPS module which is also interfaced with the controller also sends the location of the vehicle. When the message is received by the ambulance, a clear route has to be provided to the ambulance. The ambulance has a controller ARM which is interfaced with the RFID tag sends electromagnetic waves. When an ambulance reaches the traffic signal the RFID reader which is placed on the joints detect the electromagnetic waves of the tag. If the traffic signal is red, then the readers goes through the database in fraction of seconds and turn the red light green. And automatically in such condition the RFID on opposite joints turn the opposite signal red. This provides a clear route to the ambulance.

The IEEE journal on "Black Box: An Emergency Rescue Dispatch System for Road Vehicles for Instant Notification of Road Accidents and Post Crash Analysis", [9] proposed by Sayem Chaklader, Junaed Alam, Monirul Islam, Ali Shihab Sabbir describes that to utilize the capability of a GPS receiver to monitor speed of a vehicle and detect accident basing on monitored speed and send accident location to an Alert Service Center. The

GPS will monitor speed of a vehicle and compare with the previous speed in every second through a Microcontroller Unit. The system will then send the accident location acquired from the GPS along with the time and the speed by utilizing the GSM network. This will help to reach the rescue service in time and save the valuable human life.

Chanjin Kang and Seo Weon Heo[10] has designed a Intelligent Safety Information Gathering System which collects the accident or safety information using an intelligent black box system which analyzes and gathers information of neighboring vehicles while driving. They add a recognition engine to extract and record the license plate number and color of neighboring vehicles.

III. OVERVIEW OF THE SYSTEM

To develop proposed system we divide into two parts

- (1). Hardware development
- (2) Software development

(1). Hardware development

To implement black box application we are considering LPC2148 as its main controller and sensors and to find location vehicle collision to save victims.

Fig 1. Explains the proposed system implementation. It consists MEMS sensor for accident recognition it will be interfaced to ARM7 board by using I2c protocol. To measure the vehicle parameters by using Temperature sensor and CO sensor this are interface analog pins of board. Ultrasonic sensor is used for nearest obstacles and that information will be given to ARM7 board by using GPIO pins. And also location of the vehicle will be obtained by using GPS Module it is interface to the ARM7 board using UART Protocol, all this information collected by ARM7 board and analysis it and transfer to authorized persons whenever accident occurred by using GSM Technology. This GSM module interface to the ARM7 board by using UART protocol.

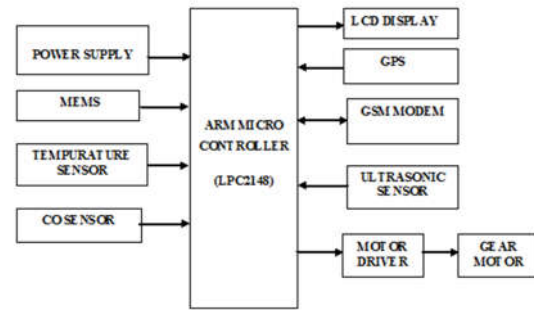


Fig.1. Black box System

(2) Software development

Embedded c language is used for programming the LPC2148. By using Keil we are writing the code and compiling it. And by using Flash magic dumping the code into LPC2148 microcontroller.

IV. HARDWARE RESOURCES

GSM

Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service. The SIM800 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM800 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM800 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.



Fig.2. SIM800 Module

MEMS

Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices. These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

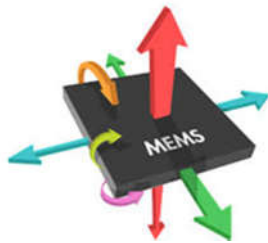


Fig.3. MEMS Sensor

MEMS are not about any one application or device, or they are not defined by a single fabrication process or limited to a few materials. They are a fabrication approach that conveys the advantages of miniaturization, multiple components and microelectronics to the design and construction of integrated electromechanical systems. MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems

GPS:

Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a vehicle, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the

location of their child, or even to monitor high-valued assets in transit.

A GPS tracking system can work in various ways. From a commercial perspective, GPS devices are generally used to record the position of vehicles as they make their journeys. Some systems will store the data within the GPS tracking system itself (known as passive tracking) and some send the information to a centralized database or system via a modem within the GPS system unit on a regular basis (known as active tracking) or 2-Way GPS.



Fig.4. GPS Receiver

SMOKE SENSOR:

Smoke sensor is used to detect any leakage of smoke and any hazardous gases such that an alarm can be initiated to avoid any damages in the industries. These sensors are also used in many applications like corporate and in any office work areas these are linked to fire alarms And buzzers through the micro-controller. There are two main types of smoke detectors: Ionization detectors and photoelectric detectors. A smoke alarm uses one or both methods, sometimes plus a heat detector, to warn of a fire. Ionization detectors have an ionization chamber and a source of ionizing radiation. The source of ionizing radiation is a minute quantity of americium-241 (perhaps 1/5000th of a gram), which is a source of alpha particles (helium nuclei). The ionization chamber consists of two plates separated by about a centimeter. The battery applies a voltage to the plates, charging one plate positive and the other plate negative. Alpha particles constantly released by the americium knock electrons off of the atoms in the air, ionizing the oxygen and nitrogen atoms in the chamber. The positively-charged oxygen particles attach to the ions and neutralize them, so they do not reach the plate. The drop in current between the plates triggers the alarm. In one type of photoelectric device, smoke can block a light beam. In this case,

the reduction in light reaching a photocell sets off the alarm. In the most common type of photoelectric unit, however, light is scattered by smoke particles onto a photocell, initiating an alarm. In this type of detector there is a T-shaped chamber with a light-emitting diode (LED) that shoots a beam of light across the horizontal bar of the T. A photocell, positioned at the bottom of the vertical base of the T, generates a current when it is exposed to light. Under smoke-free conditions, the light beam crosses the top of the T in an uninterrupted straight line, not striking the photocell positioned at a right angle below the beam. When smoke is present, the light is scattered by smoke particles, and some of the light is directed down the vertical part of the T to strike the photocell. When sufficient light hits the cell, the current triggers the alarm.



Fig.5. Smoke sensor

V. FLOW CHART

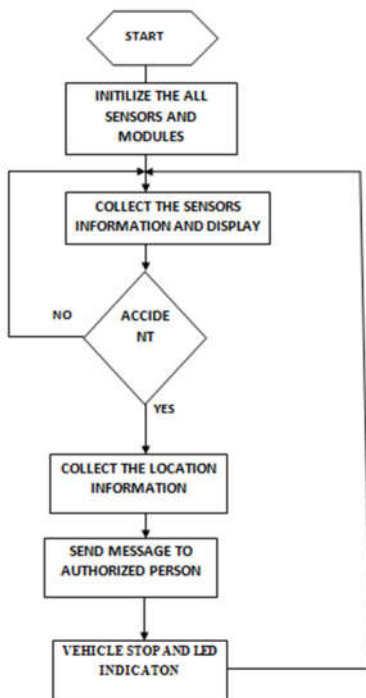


Fig.6. FLOWCHART

VI. WORKING

The main function of the system is to collect the Information of cause of accident and provide vehicle security. Our system continuously monitors the data regarding vehicle and store it in the LPC2148. In this the usage of sensors such as CO sensor, ultrasonic sensor, MEMS sensor, and location of vehicle. These data's are fed in to LPC2148 for further processing. As the vehicle starts the safety case will be in active mode. Thus whenever their occurs any kind of accidents takes place, at that moment itself the MEMS sensor trigger the LPC2148. It is basically ARM based PC. GPS system can locate accident spot in terms of latitude and longitude. The respective data is processed in the LPC2148. In this project we make use of GSM Technology. A message will be forwarded to family members and family doctors of the victim by using this. On receiving this information, the concerned people can accordingly seek for help depending on the situation.

RESULTS

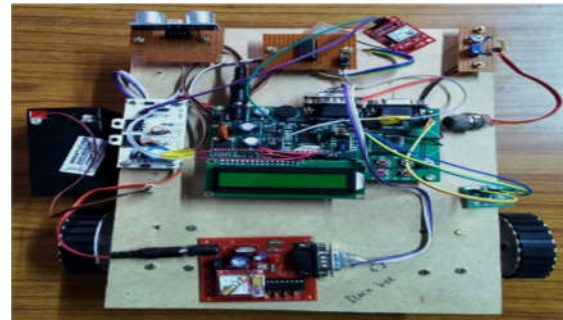


Fig.7. HARDWARE MODEL OF BLACK BOX



Fig.8. LCD Shows Temperature and smoke release from vehicle



Fig.9. LCD Shows Accident detection

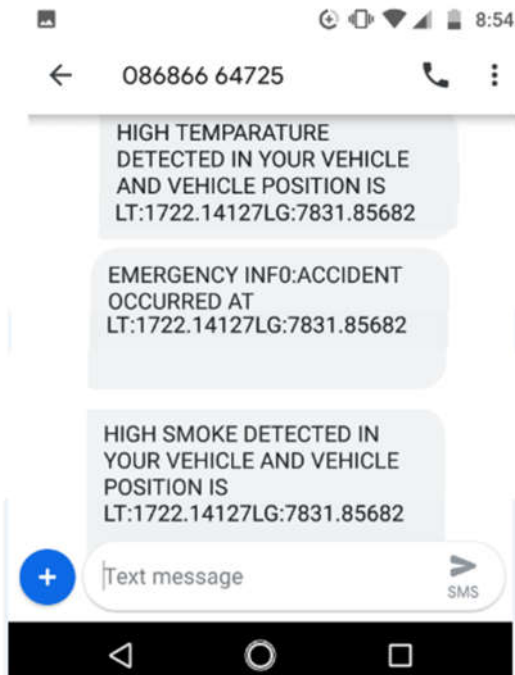


Fig.10. Messages received from black box

VII. CONCLUSION

Due to rising number of accidents and Insurance policies. Evidence or causes for accident identification will be critical. Once the public come to know about the exact proof of such accidents due to reckless and rough manner of driving they could improve and bring much change in the manner of Evidence collection system.

This paper deals with the implementation of advanced Event Data Recorder for fault protection in vehicle to get data recorded and get alert message on LCD screen and mobile. Also this paper aims to provide the actual cause of the accident or crash of the vehicle by retrieving the data from the sensors. In this paper the detection of critical as well as the

extreme conditions like recording, continuously sensing the various parameters' data such as Co, temperature, obstacle distance etc. are recorded. The system is also combination of the GSM, GPS technology. It provides management services as well as alarm monitoring for regulatory authorities. It also enables the authority to analyze the data after the occurrence of extreme condition. This will help the vehicle companies also to improvise the new parameters if there is any lag about it.

VIII. FUTURE SCOPE

- Cloud based centralized data storage.

The future scope of this work is that we can make a database where all the data will be stored. After some years Smart System for Next Generation Automobile Technology with the help of this data, we can know the areas, which are extremely prone to accident.

- Longer surveillance period.
- Centralized Monitoring
- IoT based system.

IX. REFERENCES

- [1] Kangsuk Chae, Daihoon Kim, Seohyun Jung, Jaeduck Choi, and Souhwan Jung. —Evidence Collecting System from Car Black Boxes. 2010 IEEE.
- [2] N. Watthanawisuth, "Wireless black box using MEMS accelerometer and GPS tracking for accidental monitoring of vehicles", IEEE conference in Jan, 2012.
- [3] Hoang Dat Pham, "Development of vehicle tracking system using GPS and GSM modem" IEEE conference in Dec, 2013.
- [4] Jung-Hwan Kim, Sun-Kyu Kim and Sang-Hyuk Lee, "Vehicle black box with 24GHz FMCW radar", Computer Vision and Pattern Recognition (CVPR), IEEE Conference, 2015.
- [5] Kiran Sawant, Imran Bhole, Prashant Kokane, Piraji Doiphode, Prof. Yogesh Thorat, "Accident Alert and Vehicle Tracking System", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 5, May 2016.
- [6] Md. Syedul Amin, Jubayer Jalil, M. B. I. Reaz, "Accident Detection and Reporting System using GPS, GPRS and GSM Technology ", International

Conference on Informatics, Electronics & Vision, 2012

[7] Mrs. Manasi Patil, Aanchal Rawat, Prateek Singh, Srishtie Dixit, "Accident Detection and Ambulance Control using Intelligent Traffic Control System", International Journal of Engineering Trends and Technology (IJETT) ,Volume 34-Number 8, April 2016.

[8] H. J. Hwang, J. W. Jang, K. O. Kim, and K. R. Baek, "Algorithm for parking position extraction using the acquired image from car black box in the interior of buildings," *Journal of the Institute of Electronics and Information Engineers*, vol. 2013, no. 7, pp. 761-764, July 2013.

[9] Sayem Chaklader, Junaed Alam, Monirul Islam, Ali Shihab Sabbir, "Black Box: An Emergency Rescue Dispatch System for Road Vehicles for Instant Notification of Road Accidents and Post Crash Analysis", International Conference On Informatics, Electronics & Vision 2014.

[10] Chanjin Kang and Seo Weon Heo "Intelligent Safety Information Gathering System Using a Smart Blackbox" IEEE International Conference on Consumer Electronics (ICCE) in 2017.