IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Volume 1, PP 79-84

Immediate Rescue System with Anti-theft Protection

Jigar Bhatt[1], Nimisha Menat[2] , Pradnya Mestry[3],Manali Mestry[4], Divya Sharma[5]

[1,2,3,4,5] *(Department of Electronics and Telecommunication, Atharva College of Engineering, India)*

Abstract: *The work presented in this paper covers the development of a low cost robust embedded system using Global System for Mobile Communication (GSM) and Global Positioning System(GPS) technologies that is capable of ensuring prompt action in case of a vehicle crash in notifying emergency hotline services. GSM module Sim900a and GPS module Sim28ml serve as the key components in the system with Atmega328p as the microcontroller. The system also acknowledges the issue of vehicle theft and tactfully notifies the owner in case of a car theft. A number of tests of the system in lab proved the system to be extremely accurate and quick in terms of response which can further be replicated in a real working environment as a fully functional system in a car.*

Keywords: *Embedded System,GSM ,GPS,Atmega328p,Vehicle Crash,Vehicle Theft*

I. INTRODUCTION

Today automobiles have become an integral part of the society. With the technology growing at such a fast rate, use of automobiles is at the apex. With this rapid upsurge in the number of automobile owners, the number of accidents has also escalated sharply. According to government reports, in the year 2016 alone, 4,80,652 accidents occurred taking a toll on 1,50,785 lives as shown in [1]. The detailed description of statistics of number of accidents occurred year-wise along with death toll is shown in table 1. Case studies show that in 70% of the cases, the victim of the accident could have been saved if medical attention would have been given at the right time. This inability of quick action leads to huge number of casualties. The two major reasons behind the delay is huge traffic congestion and ignorance of the people in helping the victims commonly termed as "the bystander effect" due to fear of police harassment and getting stuck into long judicial process. While the traffic congestion problem is an issue that cannot be solved any time soon. But the latter can be resolved and that serves as the motivating force behind this project. Another big problem the country faces is theft of cars. Ever increasing vehicle theft is also an issue that needed to be addressed. Not only India but the entire world has been facing the problem since a while now .The facts and figures listed on nation master [4] clearly indicate the magnitude of the problem on the global scale. Taking these issues into consideration, the system is designed to perform a host of functions and can be broadly divided into two sections.

Year	Total Number of Road Accidents (in numbers)	Total Number of People Killed (in numbers)
2005	4,39,255	94,968
2006	4,60,920	1,05,749
2007	4,79,216	1,14,444
2008	4,84,704	1,19,860
2009	4,86,384	1,25,660
2010	4,99,628	1,34,513
2011	4,97,686	1,42,485
2012	4,90,383	1,38,258
2013	4,86,476	1,37,572
2014	4,89,400	1,39,671
2015	5,01,423	1,46,133
2016	4,80,652	1,50,785

Table.1 Statistics of accidents

1.1 AUTOMATIC ACCIDENT DETECTION AND RESCUE

The system is primarily designed to avail quick response and notifying the emergency services like ambulance, police and fire-brigade in case of an accident to minimize the risk of fatalities due to crash. For quick action, the occurrence of accident must be quickly acknowledged. This is facilitated by a simple collision

sensor. As soon as the microcontroller gets a signal from the collision sensor, the microcontroller enters in wait state and looks whether the reset switch is activated or not. If the reset switch is activated, that indicates the system that the owner is not affected by the accident and does not need any rescue operation. If the switch is not pressed within 5 seconds, it issues a location requests signal to GPS for precise location details of the accident from the GPS receiver and embed the location with alert message and transmits a distress message using GSM module Sim900a to a Central Accident Management Authority that further issues the notification to the nearest emergency service providers about a possible collision. Factors like date, time, classification of accident as minor, major, etc. as well as details of the location of the accident can prove beneficial during the analysis of the accident as correctly noted in [2].

Fig.1 Overview of Detection and Rescue process [9]

1.2 ANTI THEFT PROTECTION AND SECURITY

The system makes use of set of IR sensor to monitor the car when the owner leaves the car. If in case anyone tries to take over the car, the sensors sense the occurrence of theft and gives signal to the microcontroller about a possible car theft. The system responds by sending an emergency notification message to the owner of the car who can immediately immobilize the car remotely via SMS.

II. RELATED WORK

Many authors have initiated a research on accident detection and anti-theft mechanism and came up with different approaches towards building a system capable of ensuring car safety. Most of them seem to have done an excellent job in figuring out the real issue and resolving it employing various technologies. But on closer inspection, there seem to be certain loopholes in the system that may cause problems and the safety and wellbeing of the owner might be at risk. The work presented in this paper tries to compensate for the loopholes and come up with a more robust and dynamic system. Various versions of accident detection have been tried before. Md. Syedul Amin et al in [7] have presented a way to detect the accident using GPS technology in order to calculate the speed and later on judge the occurrence of the accident on the basis of certain pre-defined threshold. But this technique in deciding the accident may produce a lot of false alarms. Li Chuan-zhi et al in [8] have employed an accident detection unit using airbag sensor to detect accident. While this method is considerable but not all vehicles have an airbag facility inside the vehicle. Also the accuracy using airbag detection is questionable. Sometimes airbags do not deploy during the accident and ultimately the accident would go undetected. Hence a much stable sensing mechanism with utmost accuracy is needed. This project uses collision sensors to sense the accident which have a pretty high accuracy. A number of anti-theft systems have been designed back in the past but failed to make an impact. Kyungroul et al in [5] have wonderfully presented a thorough comparison between outdated systems and newer ones and what features need to be implemented in future. Widad Ismail et al in [6] have developed an anti-theft mechanism based on RFID detection. A smart way to keep the car protected but thieves have grown much smarter and exposed various loopholes to RFID protection. This project aims to develop a robust and resilient immune to any attempts of attacks from the thief.

III. SYSTEM OVERVIEW

The system is divided into sections that operate individually and are responsible for carrying out a host of functions within the system. The heart of the system is microcontroller Atmega328p.With fast response, simplicity and cost being primarily the main goal of the project, Microcontroller Atmega328p came as an ideal choice for the system .It is an 8-bit microcontroller with 14 digital I/O pins, of which 6 can be used as PWM outputs and 6 analog input pins. An 8 MHz crystal is used along with 22pF capacitors for the clock for the microcontroller. It basically acts as a central unit and carries out various functions within the system. The entire

program was written in C language and later on burnt into the IC using a standard burner. Under normal conditions (i.e. no accident), the system stays in passive state. As soon as the collision sensor senses the collision, the microcontroller extracts the co-ordinates from GPS. The GPS receiver is a modem based on SIMCOM's Sim28m/Sim28ml GPS model. It has a built-in LNA and can track as low as -165 dib signal without any external network assistance. The detailed specifications have been presented in the Table.2

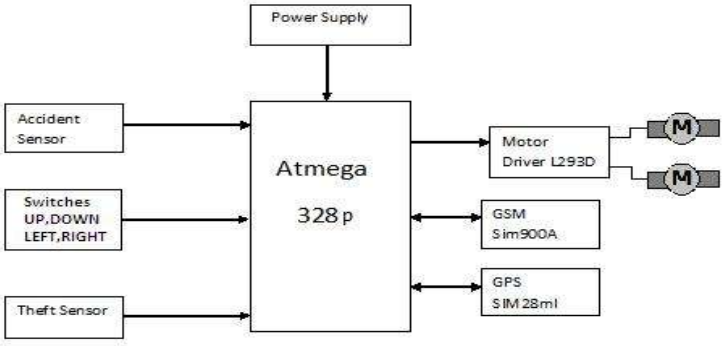

Fig.2 Block Diagram of the System

Reno	Content	Specification
1.	Dimension	16*12.2*2.4mm
2.	Weight	1g
3.	Interface	User sp1/12c
4.	Sensitivity	-165 dam
5.	Accuracy	2.5m
6.	Speed	0.1ms
7.	Operating temperature	-40c to +85c
8.	Backup power	3v
9.	Power Supply	2.9v to 3.6v
10.	Antenna type	Active, Passive

Table.2 GPS Specifications

The output from GPS is in the form of consecutive long strings which are commonly known as NMEA sentences. A very detailed description of GPS and NMEA (National Marine Electronics Association) sentences have been shown in [3]. The required parameters like latitude and longitude can be easily extracted in the programming phase. Thus information like latitude & longitude co-ordinates is concatenated to form a location link for the Google maps. The link is further forwarded to a Central Accident Management Authority using GSM module. Sim 900a is used as GSM module. An extremely affordable and accurate modem built with dual band GSM engine. It works on two frequencies namely 900 MHz and 1800 MHz and has a pretty quick response. Due to its high versatility GSM module have been adapted in a host of applications ranging from Industrial automation, GPRS based data logging, GPRS and GPS application, Home automation, Health monitoring, Vehicle tracking, Remote monitoring and controlling, etc. A detailed specification of the modem has been highlighted in Table.3

Sr. no	Content	Specification
1.	Quad-Band	850/ 900/ 1800/ 1900 MHz
2.	Dimensions:	24 x 24 x 3 mm
3.	Supply voltage range:	3.2 to 4.8VLow 9
4.	Operation temperature:	-40°C to +85°C
5.	Interfaces:	Interface to external SIM 3V/ 1.8V Analog audio interface

Table.3 GSM Specifications

A summary of the process is shown in the figure 1.

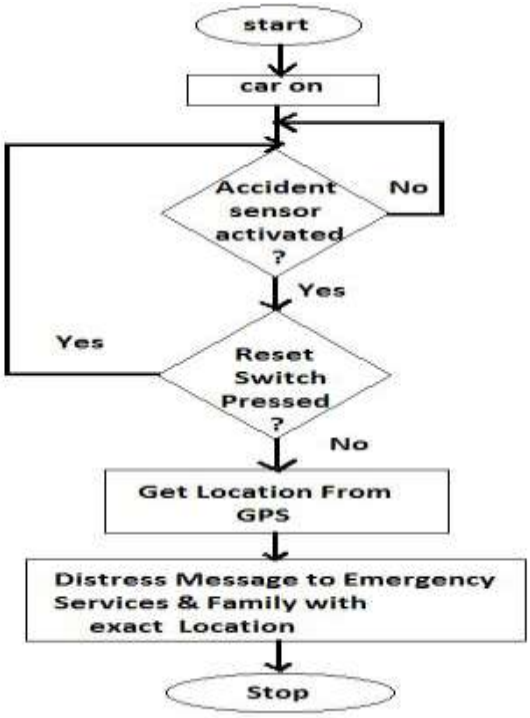

Fig.3 Work flow of the System

The second part of the system is an advanced anti-theft mechanism efficiently designed to control the motor of the engine remotely in case of a car theft thereby stopping the car. This can be availed using existing GSM unit incorporated into the system. As the owner leaves the car, the car is basically set into a high alert mode. During this period, if the sensors housed inside the car senses any movement, then microcontroller issues a notification alert to the owner's cell phone via GSM module SIM900a.The owner can immobilize the car remotely using a standard cell phone device by sending an SMS to the system. The system acknowledges the SMS and turn off the engine of the car via relay to prevent any further movement. The car can then be actively tracked and location of the car can be availed with the help of GPS integrated into the system.

IV. STIMULATION AND RESULT

Fig.4 Top view of the prototype

Before implementing the system in real world the system has to be completely dependable and error-free to avoid any inefficiencies and hazards in the real time. To make the system utterly foolproof and understand the system behavior better, we prepared a mockup simulation model as shown in Fig.4, basically a dummy vehicle controlled by a remote controller to test the system behavior in a controlled environment. The response of the system has been tested by fabricating a fake accident later on found out to be completely satisfactory. As soon as the collision sensor sensed the movement, the system was quick to send a distress message along with the precise co-ordinates of the location as shown in Fig.5 and Fig.6. Subsequently the second feature i.e. anti-theft protection was tested. The unauthorized movement into the car was quickly sensed

by the IR sensors and GSM module was quick to issue the notification alert. The final part of the system i.e. controlling the vehicle remotely via SMS was found out to be satisfactory too. As soon as the SMS with 'STOP' command was sent the microcontroller was quick to recognize the SMS from Sim900a. The connection of battery to the motor was cutoff in no time via relay.

Fig.5 Notification output to the owner

Fig.6 Location of the accident

V. FUTURE ENHANCEMENT

Another big problem associated with the accidents is police investigation. The post-accident inspection and judicial process is slow and tiresome due to lack of proof being the reason in majority of cases. The further enhancement in the project will be aimed to add data recording mechanism that can serve as valid proof and speed up judicial process and aid in insurance settlements.

VI. CONCLUSION

Multiple tests were taken to test the precision of the system and the system has been crafted to perfection with multiple trial and error. The system is completely foolproof and can be installed in a car in real world safely. The system has a lot of potential to expedite the rescue operation thereby increasing probability of lives being saved. The amount of theft in the country is also massive. The implementation of system can prove fruitful and has an immense potential to bring down the huge number.

REFERENCES

[1] Road Accidents in India 2016, Ministry of road transport and highways, Government of India. [Online]. Available: http://www.indiaenvironmentportal.org.in/files/file/Road%20acc idents%20in%20India%202016.pdf.

[2] Thorough analysis of accident studies, Accident investigations.[Online].Available: https://nptel.ac.in/courses/105101008/downloads/cete_42.pdf.

[3] Understanding GPS NMEA sentences.[Online].Available: http://www.toptechboy.com/arduino/lesson-24-understanding-gps-nmea- sentences/.

[4] Statistics of accident worldwide, Crimes in the countries compared by cartheft.[Online].Available: http://www.nationmaster.com/country-info/stats/Crime/Car-thefts#pie.

[5] Kyungroul Lee, HyungjunYeuk, Jaein Kim and KangbinYim, "Anti-theft Solutions for In-vehicle Electronic Devices", Eighth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, pp. 549-551, July 2014.

[6] ShabinarBinti Abdul Hamid, AnisDiyanaRosli, Widad Ismail and Aimi ZulliayanaRosli, "Design and Implementation of RFID-based Anti-Theft System", in IEEE International Conference on Control System, Computing and Engineering, Penang, Malaysia, pp. 452-455, November 2012.

[7] Md. Syedul Amin, JubayerJalil and M. B. I. Reaz, "Accident Detection and Reporting System using GPS, GPRS and GSM Technology", in IEEE/OSA/IAPR International Conference on Informatics, Electronics & Vision, pp. 640-643, May 2012.

[8] Li Chuan-zhi, Hu Ru-fu and YE Hong-wu, "Method of Freeway Incident Detection Using Wireless Positioning", in International Conference on Automation and Logistics Qingdao, China, pp. 2801-2802, September 2008.

[9] SayemChaklader, JunaedAlam, Monirul Islam and Ali ShihabSabbir, "Black Box: An Emergency Rescue Dispatch System for Road Vehicles for Instant Notification of Road Accidents and Post Crash Analysis", in 3rd INTERNATIONAL CONFERENCE ON INFORMATICS, ELECTRONICS & VISION, Figure (7), pp.5, May 2014.