

Design and Development of Real Time Vehicular Crash Detection System

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Abstract—Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Main causes for these road accidents are: lack of training institutes, unskilled drivers, poor road conditions, use of cell phone while driving, over loading and poor governmental plans in this regard. This paper presents solution for accident detection for human life safety. It presents about intelligent detection of an accident at any place and reports about the accidents on predefined numbers. The microcontroller continuously records all the parameters of automobile. When a vehicle meets with an accident, immediately vibration sensor will detect the signal and then microcontroller sends the alert message through the GSM modem.

Index Terms— Crash detection, ADXL335, GPS, GSM, Microcontroller.

I. INTRODUCTION

India has the highest motorization growth rates in the world accompanied by poor infrastructure and congested transport network. This led to an increase in the number of road accidents. The "Globe Status Report on Road Safety" listed by the World Health Organization (WHO) identified the major causes of traffic collisions as driving over the speed limit, driving under the influence, and not using helmets and seat belts. Failure to maintain lane or yield to oncoming traffic when turning are major causes of accidents on four lane, non-access controlled National Highways.

Road accidents are the outcomes of the interplay of various factors such as length of road network, vehicle population, human population and adherence/enforcement of road safety regulations etc. Road accident causes fatalities, injuries, disabilities and hospitalization with severe socio-economic costs across the country. Consequently, road safety has become an issue of concern both at national and international level. The United Nations has rightly proclaimed 2011-20 as the Decade of Action on Road Safety. India is also signatory to Brasilia Declaration and is committed to reduce the number of road accidents and fatalities by 50 per cent by 2020.

According to the Statistics report submitted by Ministry of Road Transport and Highways, total number of road accidents increased by 2.5 per cent from 489,400 in 2014 to 5,01,423 in 2015. The total number of persons killed increased by 4.6 per cent from 139,671 in 2014 to 146,133 in 2015. Road accident injuries have also increased by 1.4 percent from 493,474 in 2014 to 500,279 in 2015. Accident severity (number of

persons killed per 100 accidents) has gone up from 28.5 in 2014 to 29.1 in 2015. The analysis of road accident data 2015 reveals that about 1374 accidents and 400 deaths take place every day on Indian roads. It further reveals that 57 accidents take place and 17 lives are lost every hour on an average in road accidents in our country.

Another study conducted by the Bangalore Traffic Police in 2017 (September), show the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Vehicle accidents are something which do not knock on your door before taking place. These clearly bring to light the gravity of the situation and the enormous responsibility of vehicle drivers towards causing road accidents. These deaths could have avoided if the victims were treated as soon as possible.

The three major causes for road accidents are – Negligence, Overtaking, and use of alcohols while driving. Defensive drivers neither drink nor take drugs and drive. They understand that alcohol and drugs impair your ability to determine distances, reaction time, judgement and vision. However, modern – day cars have implemented few technologies to prevent accidents.

Different governmental and non-governmental organizations all around the world carry out workshops and other training programs to make people aware of careless driving. But still, this whole process has not been very successful till date. Some threatening statistics of road accidents that took place in India inform us that the emergency services are not being provided at proper time. The statistics included that the road accidents in one of the years, caused death of more than 130,000 and it indicates that it might jump to 150,000 by 2015. Although India has just 1 % of the world's vehicles, but accounts are 10% of world's total accidents. Mortality rate per 10,000 vehicles is 14 (less than two for developed countries). According to the study conducted by the Bangalore Traffic Police in 2017 (September) shown in figure 4, the number of road accidents in Bangalore alone is 3818 out of which 469 were fatal leading to 499 deaths. Having known about such threatening statistics, we aimed at implementing a system which could give immediate information to a rescue team about the accident occurrence, by which the rescue team can arrange for immediate safety measures. This helps the humanity by a great deal as human life is very crucial.

II. RELATED WORK

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. In previous works, when an accident occurs, the alert message has been sent automatically to the rescue team and to the police station. The message is sent through the GSM module and the location of the accident is detected with the help of the GPS module [1]. This application has provided an optimum solution to poor emergency facilities provided to the road accidents in the most realistic way.

The prototype model of automatic vehicle accident detection and messaging using GSM and GPS modem has to be made in the following steps:

The layout of the whole set up has to be drawn in form of a block diagram.

The accelerometer sensor will first sense the occurrence of an accident and give its output to the microcontroller.

The latitudes and longitude position of the accident place is to be sent as message through the GSM.

The phone number will be pre-saved in the EEPROM.

Whenever an accident has occurred the position is detected and a message is to be sent to the nearest ambulance and the pre-saved number.

Hoang Dat Pham presented the development of the vehicle tracking system's hardware prototype [1]. The system utilizes GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions.

Fogue M presented the fast detection of traffic accidents [2], improving the assistance to injured passengers by reducing the response time of emergency services through the efficient communication of relevant information. This requires installing on board units (OBUs) in vehicles, in charge of detecting accidents and notifying them to an external control unit (CU), which will estimate the severity of the accident and inform the appropriate emergency services.

Figure 1 represents the statistics of road accidents and table 1 represents the statistics of the study conducted by Bengaluru traffic police.

TABLE I: STATISTICS OF THE STUDY CONDUCTED BY THE BENGALURU TRAFFIC POLICE

Accident Statistics					
YEAR	Fatal	Killed	Non-Fatal	Injured	Total
2006	880	915	6581	6048	7561
2007	957	961	7469	6591	8426
2008	864	892	6908	6150	7772
2009	737	761	6138	5658	6875
2010	816	858	5667	5343	6483
2011	727	757	5297	4976	6024
2012	740	760	4767	4471	5502
2013	737	771	4493	4289	5230
2014	711	737	4293	4096	5004
2015	714	740	4114	4047	4828
2016	754	793	6752	4193	7506
2017 (September)	469	499	3349	3182	3818



Figure 1 Statistics of Road Accidents

III. PROPOSED SYSTEM

Figure 2 represents the block diagram of the proposed system. The system consists of three units: vehicle unit, control unit and ambulance unit.

Vehicle Unit: For implementation of this project, vehicle unit should be installed in every vehicle. It consists of a microcontroller along with the accelerometer, GPS and GSM module and sensors to sense the accident. The accelerometer is used to check the speed of the vehicle. The changes in the axis of the accelerometer are observed. If the observed value is greater than the threshold value accident has occurred. On impact or when the speed increases, information about accident is sent to the control unit. This information consists of location of accident detected by the GPS module and then it is passed onto the GSM module.

Control Unit: Control unit is the brain of our system. It will contain all the information about the hospital location and the contact number of all the hospitals in order to send an ambulance to the accident spot. It calculates the nearest distance from the accident spot to the nearest hospital location through a Google API. It receives the message from another GSM module about the accident location and responds.

Ambulance Unit: This unit sends the ambulance to the accident location. The ambulance serves the victim from the accident location.

Anti lock breaking system (ABS) is an automobile safety system which allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while breaking preventing the wheels from locking up and avoiding uncontrolled skidding. Figure 3 represents ABS found in cars.

IV. SYSTEM DESIGN

The Embedded Technology is at its peak and acting as a game changer in many industries. It plays a major role in wide spread of industries, because of the key feature called integration. It brings different sources of departments, under a single umbrella. This increases productivity and quality of product with less human interference.

GPS and GSM module placed in the vehicle will send the location of the injured accident to the main server which will rush an ambulance from a nearest hospital to the accident spot. This system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time.

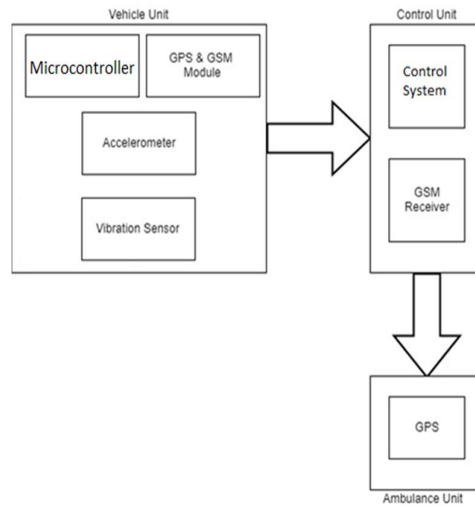


Figure 2. Block Diagram of the Proposed Work

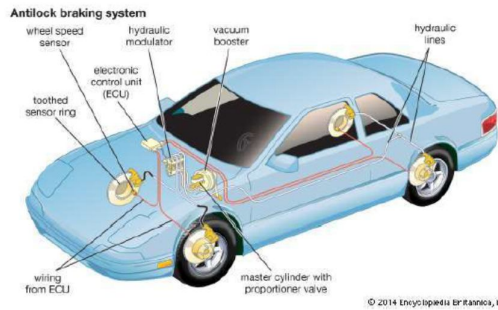


Figure 3 ABS Found in Cars

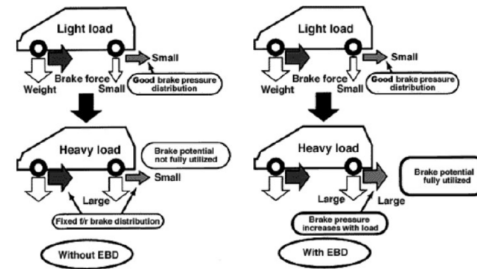


Figure 4 Working of Brakes In a Car with and without EBD

The global positioning system gives the exact coordinates when there is a change in the axis of the ADXL 335 beyond a threshold point. Figure 2 represents the messages received. The coordinates are shown in terms of longitudes and latitudes as well as the speed with which the vehicle was traveling in terms of knots. Figure 3 represents the image on google maps.

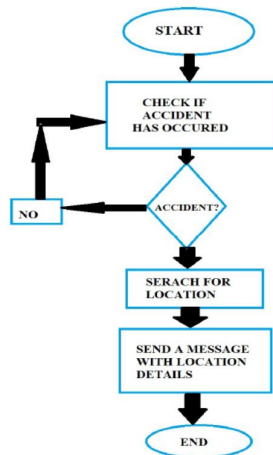


Figure 5 Flow of control in the system

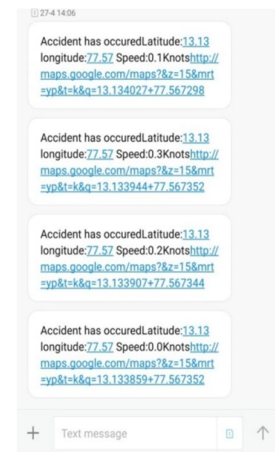


Figure 6. Sample of Messages Received

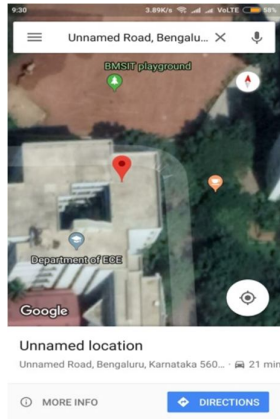


Figure 7 Image of Google Map Display

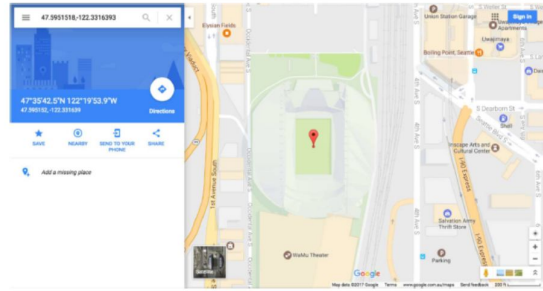


Figure 8 Location pointed using google maps

V. CONCLUSION

The system designed above reduces the loss of life due to accidents and the time taken by the ambulance to reach the hospital is also reduced. GPS and GSM modules placed the concerned vehicle will send the location of the accident to the main server. This in turn helps an ambulance from the nearest hospital to reach the accident spot without much delay. The system is completely automated; thus, it finds the accident spot and helps in reaching the hospital on time. Future enhancements which can be made to this system are: Use of 4G technology-based GSM modules, Installing Black-Box (similar to the ones used in aircrafts) and capturing the video of an accident.

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