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Accident Reporting and Vehicle Monitoring System

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ABSTRACT: Nowadays, with ever-increasing population the use of automobiles has become superfluous as a consequence of which, people lose their lives every single day due to road accidents and poor emergency services. The large loss of human life and property due to these road accidents is increasing at an alarming rate becoming a major concern globally. During accidents, the most evident reason for a person's death is unavailability of the first aid, which is mainly due to the delay in notifying the ambulance or to the hospital. If proper medical attention was provided at the right time, these precious lives could be saved. The automotive industry is constantly developing new technologies to make vehicles more secure and safe to drive. But these technologies requires upgrading the hardware and software increasing the installation cost making these vehicles quite expensive which everyone cannot afford. This paper implies a system which is an optimum solution which, if not prevent the accident, but at least can reduce its repercussions. Our system aims at determining the state of any accident and reporting the precise location and time to the registered mobile number immediately upon its occurrence.

KEYWORDS: Speed, Accident Detection; GPS; GSM; Notification

I. INTRODUCTION

In today's world, transportation has great importance in our daily life and the constant development has made many of our daily chores quite easy. But the increased usage of automobiles has also resulted in rise of road accidents making it the second leading cause of death globally. According to report published by Transport Research wing under Ministry of Road Transport & Highways, Government of India, almost 1317 road crashes occur every day in India and about 413 people lose their life in these road accidents every day. Speeding is a major cause of these accidents accounting to 66.5% of all road accidents. Delay of emergency services lead to 47 deaths every day. Comparing this statistics with the previous year's data shows that the number is consistently increasing making it a major issue of concern. If no action is taken, road traffic crashes are predicted to result in the deaths of around 1.9 million people annually by the year 2020.

Accident prevention is not completely possible, but at least the repercussions can certainly be reduced. The increased number of vehicles leads to heavy traffic jams and accident victim does not get help instantaneously. The most crucial time between the accident and the victim getting proper medical treatment is often the difference between life and death. Moreover, each minute passed while providing an accident victims with emergency medical care can make a huge difference in his/her survival rate. Analysis shows that decreasing accident response time by 1 minute correlates to a six percent difference in the number of lives saved.Generally the ambulance and victim's family is not notified immediately. Also locating the accident spot accurately is quite difficult for the emergency services. The victim's life can certainly be saved by expediting the ambulance to the hospital.

To overcome this drawback, our project on accident detection and reporting system provide an optimum solution with advantages such as low cost, small size, portability and ability to easily extend. Our project proposes a new dimension to control these accidents and also reduces the response and rescue time. This system detects the accident

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location precisely with the help of GPS module and the GSM module is used to send the emergency notification to the registered mobile number.

II. RELATED WORK

There are few system in the literature which were thoroughly reviewed to define the scope and requirement of this project work and their special features were also studied.

In [1] authors programmed a GPS and GSM module by adding a crash detector in order to report automatically via the GSM module (using messaging) to the nearby agencies, providing the precise location of the accident. The authors used Telit GM862-GPS wireless system which uses the positioning signal provided by the satellite to the machines equipped with GPS chip, which determines its location with a precision of approximately 1-10m. Their system architecture shows that if an accident takes place at a certain place, then message is sent to 5 pre-configured numbers. The GPS/GSM module works with a crash detector which is installed but if the predefined numbers are out of the network coverage areas, the accident is not reported.

In [2] authors worked on a system with three modules consisting of an automatic speed control module, accident detection and information sending module and security enabling module. The automatic speed control module includes a RF transmitter and RF receiver installed at specific position in the vehicle. Accident detection module consists of GSM and GPS module. Security enabling module has a sensory units which checks the condition of seat belt and the driver. In case of any accident, the vibration in vibration sensor increases beyond the limit and information is sent to GSM module. The GSM module then notifies to respective authority reporting the accident occurrence with the help of a message.

[3] Authors introduced an automatic alarm device for traffic accidents. Their system can automatically detect an occurrence of an accident, locate for the accident spot and then alerts the emergency services within two seconds within the nearby geographical coordinates. The GPS module installed in the vehicle starts communicating with the satellite and gets the co-ordinates in form of latitude and longitude and send this information to the centralized server. The server then searches for the nearby hospital and sends the accident alert to the hospital.

[4] The authors designed a system that senses any accident and notifies pre-configured numbers. The GSM technology is used to send the location of the vehicle. The position of the vehicle can be determined by vehicle owner by sending a message to the number of the sim card installed in GSM module. The message consists of date, time, latitude and longitude positions of the vehicle. When there is an accident, the accelerometer sensor detects the change in position and sends a signal to the processor. The processor analyses the signal and sends the vehicle location and an accident alert to the pre-configured numbers.

III. COMPONENTS

A. *Development Board:*

Fig. 1. ARM Cortex M4 microcontroller

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STM32-P405 is a development board featuring an ARM Cortex-M4 microcontroller. It is a medium-sized development board with a small prototype area for a large number of different applications such as USB port for communication and powering; separate power jack for powering; reset and oscillator circuits; JTAG port for programming and debugging; serial driver and DE9 connector; UEXT expansion connector; prototype area; programmable LED; programmable button and many more. The board can be powered by a number of different sources.

B. *GPS Module:*

Fig. 2. GPS Module

GPS is a navigation system used globally to determine a specific location and time. Initially these were used for defense academy and later on came into usage for everyone. Main advantage of GPS is to track the location of anything which has these GPS device. It operates based on four or more satellites to get the location. In this project the GPS module is used for tracking the location of the vehicle.

C. *GSM Module:*

Fig. 3. GSM Module

GSM resembles the mobile phones where few of the mobile features are not available for the GSM. Similar to mobile phones it can connect to network operator where we can communicate through a message. The frequency band of the GSM generally varies over 900MHz or 1800MHz. It also has LEDs where it can glow up giving the power supply of 12v to the GSM sensor. Blue light which indicates the network signal it glows for every 3 seconds. Overall the sole purpose of GSM is for communication.

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D. *Accelerometer:*

Fig. 4. Accelerometer

The Accelerometer sensor measures the abrupt changes occurring in relation with vehicle's acceleration and tilt which can determine whether an accident is taken place or not. It measures through all the three axis i.e. x, y, and z. The output signals generated by these system are the analog signals proportional to acceleration.

IV. BLOCK DIAGRAM

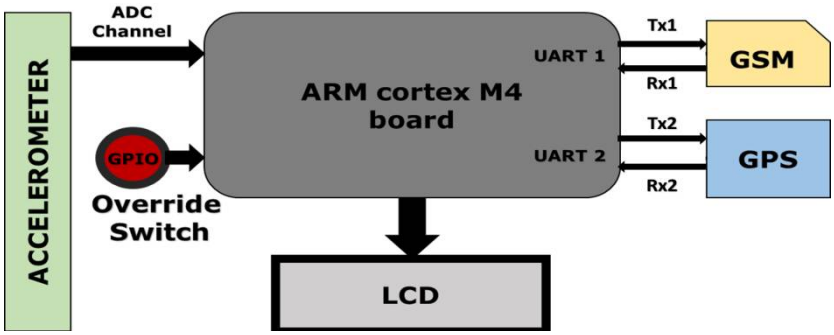

Fig. 5.Block Diagram

The Fig-5 shows the strategic installation of the components of the system which is the ARM Cortex-M4 microcontroller, GPS module, GSM module, Accelerometer and LCD screen.

The GPS module is connected via UART and the ADC output of the accelerometer is connected to the ADC channel of the microcontroller. The GPS module is connected via UART through a different channel and a SIM card is installed in it which sends the alert message when triggered.

V. WORKING

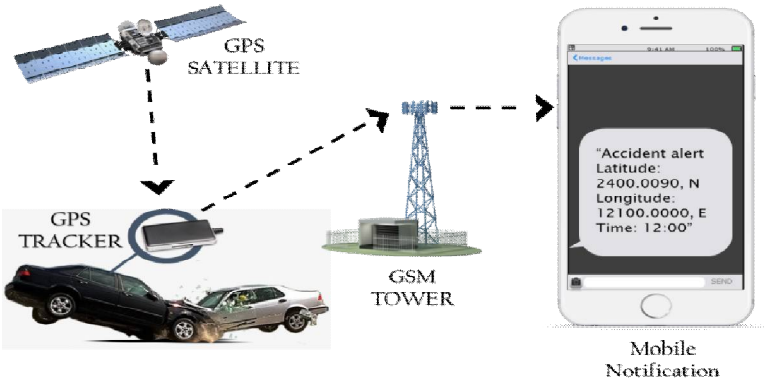

Fig. 6. Overview of the project

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The Accident Reporting System gets triggered in following mentioned scenarios:

1. Abrupt change in vehicle's acceleration.
2. Vehicle tilt is more than the specified value.
3. Vehicle acceleration is beyond speed limit.

As shown in Fig.6, the accelerometer constantly monitors the motion of the vehicle. In case of occurrence of any mentioned conditions, the accelerometer generates an interrupt. This generated interrupt triggers the GSM module which collects inputs from the GPS module in the form of GPS co-ordinates. A SIM card installed on the GSM module is used to send the data in the form of a message to the registered phone number. The message consists of the time and location of the accident so that the receiver can take the desired action.

To avoid a miss trigger the message, a timer kicks in which gives the driver of the vehicle 10 seconds to disengage the GSM module

VI. FLOWCHART

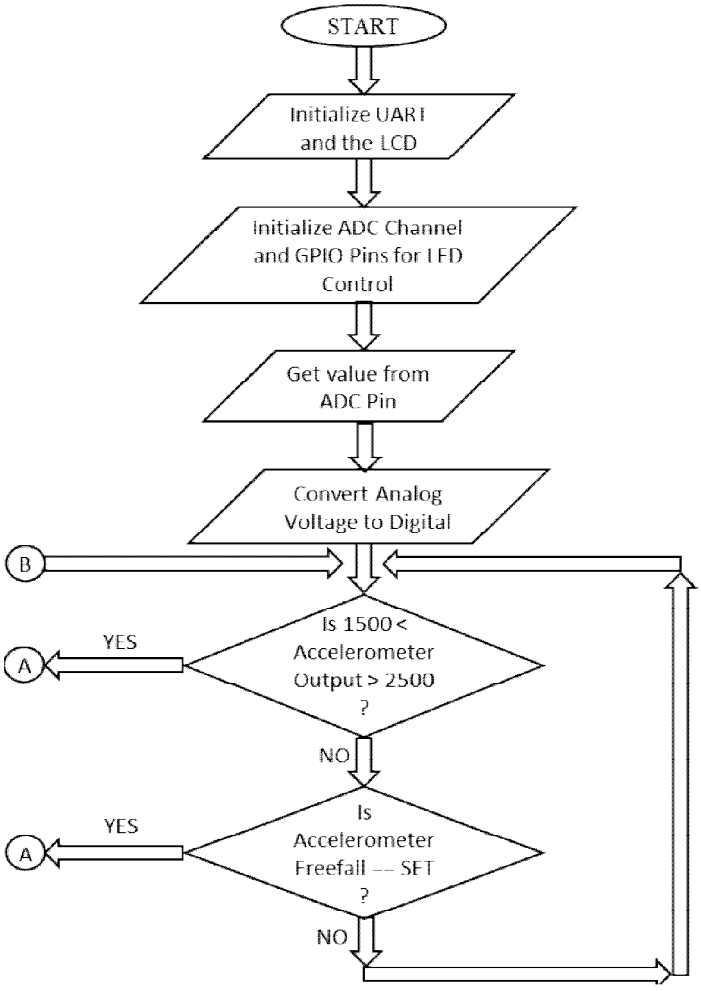

Fig.7.Accident Detection

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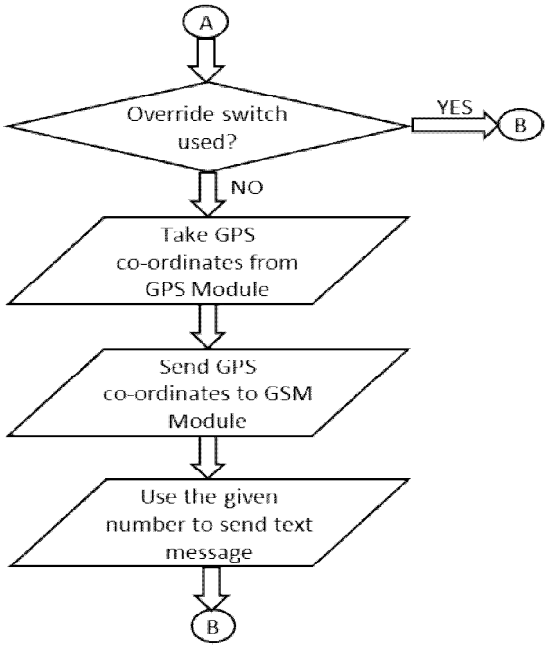

Fig. 8. Accident Reporting

VII. RESULTS

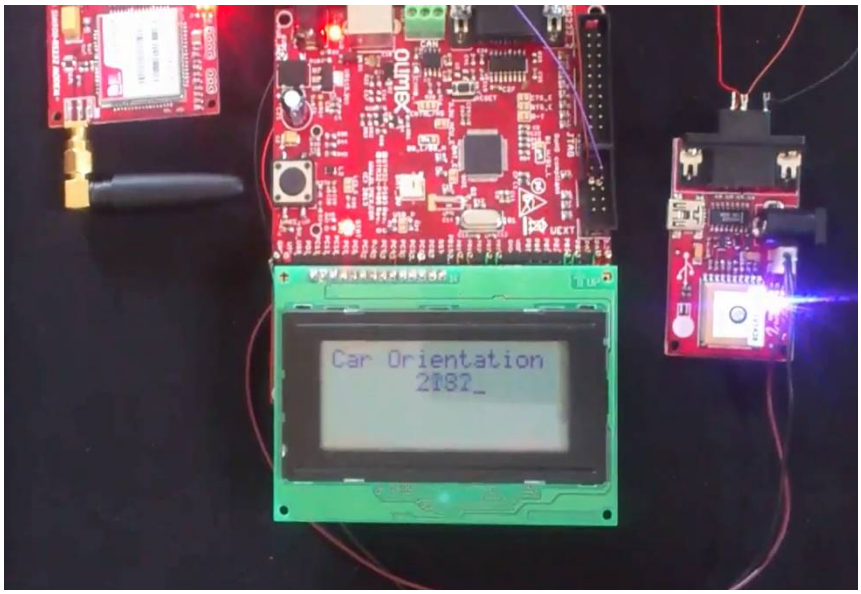

Fig. 9. Snapshot of the project's initial stage

The y axis of accelerometer is monitored as shown in fig.9 and its output can be seen on the LCD Screen. The accelerometer will trigger a series of responses when there is an abrupt change in vehicles acceleration or the value is below or beyond a certain value which can be predefined by the user. In this case the accelerometer is calibrated to generate an interrupt when the value is below 1500 or above 2600.

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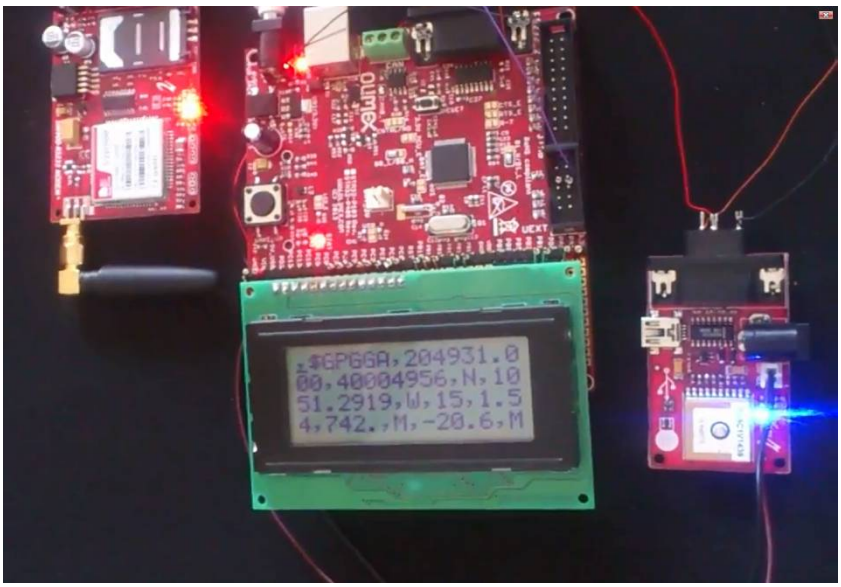

Fig. 10. Snapshot of the project's final result

When the accelerometer tilts and value goes below 1500. The LED light on development board starts to blink indicating one of the mentioned conditions has occurred. Then the inputs from the GPS module are taken and the LCD screen displays current time, latitude, longitude and altitude in standard NMEA format as shown in fig.10.

VIII. ADVANTAGES

- In case of accident, the victim's family is notified immediately reducing the response time.
- The message sent by the system consists of the time and GPS co-ordinates of vehicle, thus faster medical help can provided as exact location of the accident is known
- The system has Parental Control Mode which lets the user set a predefined speed limit and when the vehicle exceeds the speed limit, the user is alerted via SMS.
- The user can change the mobile at any time according to his requirement.

IX. LIMITATION

The proposed system requires persistent GSM network in order to send the notification to the registered mobile number. Hence it is not applicable in remote areas with poor network connectivity.

X. FUTURE SCOPE

The following modules can be implemented with the proposed system in order to prevent accident and provide high automotive security.

- Obstacle detection and alerting the driver.
- Interfacingthe system with vehicle airbag system for more safety.
- Monitor parameters of vehicle like overheat or LPG gas leakage.
- Introducing Alcohol sensor to avoid 'drink and drive' situation.
- Detecting driver drowsiness using MATLAB based eye monitoring.

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XI. CONCLUSION

This proposed system can precisely track vehicle's location automatically and send an alert SMS regarding accident to registered mobile numbers. Thus the time spent in searching the location is reduced and the victim can be treated in shortest possible time.Experimental work is been carried out carefully and the result indicates higher sensitivity and accuracy making this project quite user-friendly and reliable. Our project will provide a feasible solution to traffic hazards and will give security to the vehicle and also reduce the loss of valuable lives and property. Hence the proposed method is verified to be highly beneficial for the automotive industry.

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