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Design Of Tracing Accidental Vehicle By Using Gps And Mems Accelerometer

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Abstract

This paper discusses a kind of design on tracing accidental vehicle by using GPS & MEMS accelerometer. An ultrasonic sensor is used to detect the obstacle in front of the vehicle and the vehicle gets stopped if any obstacle is detected. This may avoid accidents due to collision of vehicles with any obstacles. The accidental vehicle uses the ARM microcontroller LPC2148 as a control unit to combine with a GPS device and a GSM module. In tracing accidental vehicle, we use a global positing system (GPS) technology for locating the vehicle. With signals from an accelerometer, a severe accident can be recognized. When vehicle meets with an accident immediately, wireless device will send mobile phone short message indicating the position of the vehicle by the GPS system to authorized person, ambulance and police. If the person meets with a small accident or if there is no serious threat to anyone's life, then the alert message can be terminated by the driver by a command provided in order to avoid wasting the valuable time of the authorized person, ambulance, and police.

Keywords *— Ultrasonic Sensors, Micro Electro Mechanical System Accelerometer, LPC2148, GSM, GPS device, DC Motor.*

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1. INTRODUCTION

According to National crime records bureau, in Andhra Pradesh highways are the places for deaths. Every year, totally road accidents are 43 % occurring in Tamilnadu, Uttar Pradesh, Maharashtra, and Andhra Pradesh. In Andhra Pradesh, 13% of road accidents are mainly by truck, lorry. In Hyderabad, pedda amberpet to patancheru is the place where if any vehicle is repaired, any road accident occurs, minimum facilities are not provided upto 84Km. From one junction to another junction any road accident occurs emergency services is not provided. If any vehicle is driving very fast, police or HMDA team is not provided.

Vehicles are important in today's society. Compared to the past where it was considered as a luxury. The vehicle is the first place where safety starts. Always remember that safety starts and ends with the person who drives the vehicle. The cars, trucks, lorries found today have a high range of inbuilt safety accessories to protect their passengers. Before it used to be just seatbelts, but now more features have been included which are more advanced and efficient than seatbelts. Warning alerts and alarms are other security systems incorporated in the cars, trucks, lorries to alert us about various factors like exceeding speed limit. These are designed to make the passengers aware of crossing the limitations which is important in most of the time and in most cases. In the same way here an embedded system has been designed to make the journey of the passengers safe and secure with various safety and security measures [10].

2. PROPOSED SYSTEM

The entire system consists of ultrasonic sensors, MEMS accelerometer, ARM microcontroller LPC2148, GPS device, GSM module. From the figure 1 the system consists of different modules which are interfaced to the ARM (32 bit) microcontroller. The input power is stepped down to 12v DC from 230v AC power line by the power supply unit.

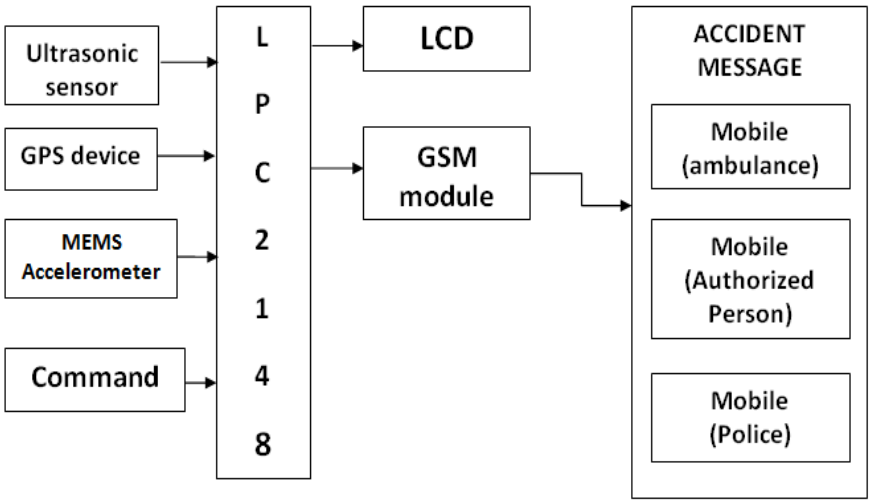

Fig-1: Block diagram of accidental vehicle using GPS and MEMS accelerometer

The main module is the ARM microcontroller LPC2148 which provides high speed processing of the data because of the pipelining technique and ability to be used as a 16 bit controller called Thumb. The main advantage of using this microcontroller is its better performance with high code density. The system also consist of ultrasonic sensor is used to detect the obstacle in front of the vehicle & the vehicle gets stopped if any obstacle is detected. If any obstacle is detected it means any other vehicle coming with fast then automatically reduce the car speed & also activates the brake system.

Whenever the accident occurs, Micro electro mechanical system (MEMS) accelerometer will detects the signal and sends it to ARM microcontroller LPC2148. When the input is received by the microcontroller, the buzzer (alarm) is ON and the message is sent to the authorized person, ambulance, police with the help of the GSM module. The authorized person, ambulance, police reaches the site of the accident with the help of the location given in the message. The location or the geographical coordinates where the vehicle is present are detected by the GPS device.

An LCD display is provided to get the display of the tasks carried out. In some conditions where there are no casualties or when there is no need of the medical facility to the person, then the messaging can be terminated with the help of the command provided in order to avoid wasting the valuable time of the authorized person, ambulance, and police. The GSM module and GPS devices are interfaced to the ARM microcontroller using MAX232. All the components are interfaced precisely so that the accident detection and alert message sending are fully automated, so that the warning time is reduced significantly.

3. IMPLEMENTATION

3.1 Hardware

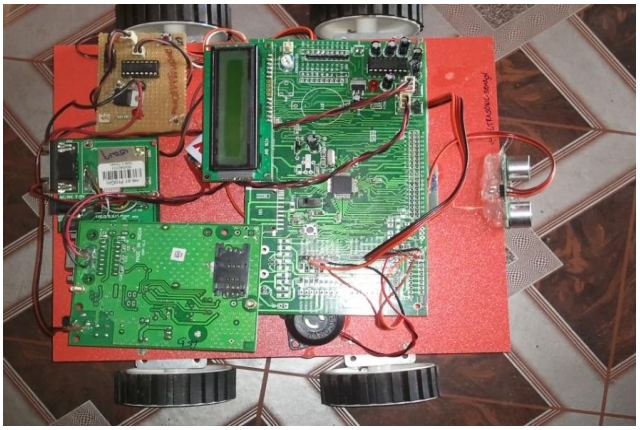

Fig-2: Hardware Implementation of accidental vehicle using GPS and MEMS accelerometer

From the figure 2 the system consists of following components:

3.1.1 Ultrasonic Sensor: The PING 28015 ultrasonic sensor detects objects by emitting a short ultrasonic burst and then "listening" for the echo. Under control of a host microcontroller (trigger pulse), the sensor emits a short 40 kHz

(ultrasonic) burst. This burst travels through the air at about 1130 feet per second.

3.1.2 GPS Device: GPS Engine Board MR-87 is a compact, high performance, and low power consumption. MR-87 uses MTK MT3301+MT3179 chipset which can track up to 32 satellites at a time and perform fast TTFF in low signal environments.ARM 7 CPU core accessible.

3.1.3 GSM: GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM is a digital mobile telephone system.

3.1.4 MEMS Accelerometer: The ADXL330 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

3.1.5 Liquid crystal display: This is used to display various information required.

3.1.6 MAX232: The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC.

3.1.7 DC Motor: L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal.

3.1.8 Microcontroller: The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S. It has two ports namely PORT 0 and PORT1.

3.2 SOFTWARE

3.2.1 Embedded C: An embedded system is the one which is designed to perform a specific task and the embedded software rules the entire system. This software for a particular embedded system could be developed using various embedded programming languages. But embedded C is the well-known embedded programming language

.

Use of C in embedded systems is driven by following advantages

• It is small and reasonably simpler to learn, understand, debug and program.
• C Compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.
• Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/ microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems.
• As C combines functionality of assembly language and features of high level languages, C is treated as a 'middle-level computer language' or 'high level assembly language'.
• It supports access to I/O and provides ease of management of large embedded projects.

Many of these advantages are offered by other languages also, but what sets C apart from others like Pascal, FORTRAN, etc. is the fact that it is a middle level language; it provides direct hardware control without sacrificing benefits of high level languages. Compared to other high level languages, C offers more flexibility because C is relatively small, structured language; it supports low-level bit-wise data manipulation.

Compared to assembly language, C Code written is more reliable and scalable, more portable between different platforms. Moreover, programs developed in C are much easier to understand, maintain and debug. Also, as they can be developed more quickly, codes written in C offers better productivity. It is easier to write good code in C and convert it to an efficient assembly code (using high quality compilers) rather than writing an efficient.

3.2.2 Keil Compiler

After developing the software, it must be downloaded to the microcontroller through any one of the downloading tools such as universal programmer. Hence the program should be cross compiled before downloading it into the microcontroller; the keil compiler comes into act at this place. Keil Software provides us with software development tools for the ARM microcontrollers. With these tools, we can generate embedded applications. Keil provides following tools for ARM family development.

1. C Cross Compiler,
2. Macro Assembler,
3. Utilities (linker, object file converter, library manager),
4. Source-Level Debugger/Simulator,
5. µVision for Windows Integrated Development Environment.

The keil tool kit includes three main tools, assembler, compiler and linker.

• An assembler is used to assemble the ARM assembly program

• A compiler is used to compile the C source code into an object file

• A linker is used to create an absolute object module suitable for the in-circuit emulator.

3.2.3 FLOW CHART

The Flow Chart of the system is shown in the figure 3. It shows the system is initialized on power ON. Ultrasonic sensor is used to detect the obstacle in front of the vehicle & the vehicle gets stopped if any obstacle is detected, it means any other vehicle coming with fast then automatically reduces the car speed. When the system is detected to be abnormal, it is confirmed that the accident has occurred. The MEMS acceleration of the vehicle is detected to confirm the cause of the accident. As soon as the accident is detected the buzzer (alarm) is ON. The command is scanned first; if it is a minor accident then the command (switch) is ON so that messaging is terminated. If it is a major accident, the command remains OFF and the message is sent automatically to the authorized person, ambulance, and police after the location is detected by the GPS.

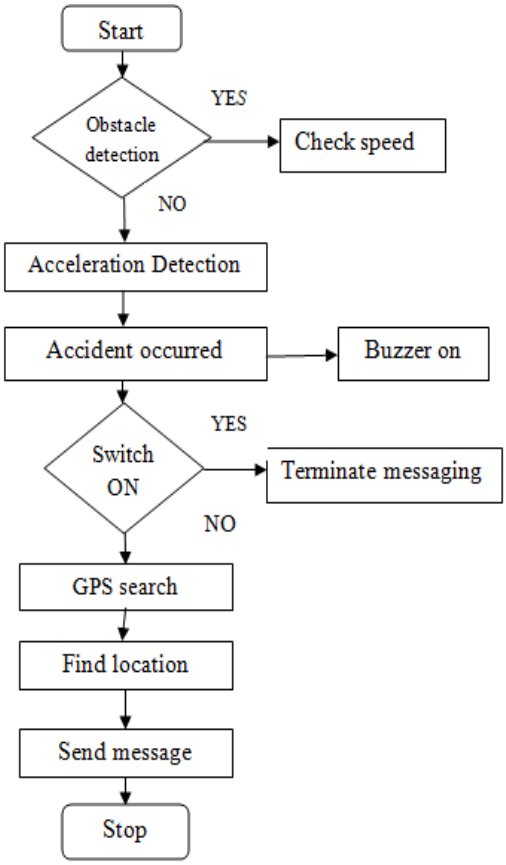

Fig- 3: Flowchart of accidental vehicle using GPS and MEMS accelerometer

4. RESULTS

Fig-4: Any obstacle is detected

Fig-5: Any obstacle is detected, vehicle stopped

Figure 4 shows if any obstacle is detected it means any other vehicle coming too fast then automatically reduce the car speed & also activates the brake system and stop the car as shown in figure 5. The accident location can be located easily and the detection of accident is done by MEMS accelerometer. In this approach the accident is detected by micro electro mechanical (MEMS) accelerometer. There is an alternative way provided to stop the whole process of messaging through a command. Hence this paper has an edge to reduce the level of seriousness to anyone's life over the other earlier approaches.

5. CONCLUSION

This system is more secure in the highways, outsides of cities where there are no proper facilities are not provided. The developed system senses the obstacles infront of the vehicle and so that the accidents due to obstacles could be avoided. The proposed system has been developed in a special motive that should protect not only the passengers inside the vehicle but also the persons around it and to prevent collision of any vehicles with another vehicle or obstacles such as trees. The proposed system is greatly helpful to avoid accidents which happen during the night time. The distance between the vehicle and the obstacle is supported by the ultrasonic sensor. There is an alternative way provided to stop the whole process of messaging through a command. This system could be further enhanced with future technologies to provide further more safety and security to the vehicle systems.

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BIOGRAPHIES

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