ACCIDENT DETECTION SYSTEM USING IoT

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Abstract : This paper presents review on the accident detection techniques and some future possibilities in this field. Now-a-days lots of accidents happen on highways due to increase in traffic and also due to rash driving of the drivers. And in many situations the family members or the ambulance and police authority is not informed in time. This result in delaying the help reached to the person suffered due to accident. Road accidents constitute the major part of the accident .The purpose of this paper is to find the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system Most of the times we may not be able to find accident location because we don't know where accident will happen. In this paper Real Time Vehicle Tracking and Accident Detection with GSM is designed to avoid such situations.

Keywords **– Detection, Sensor, Arduino, GPRS, Tracking.**

I. INTRODUCTION

An embedded system is a controller programmed and controlled by a Real-Time Operating System (RTOS) with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors manufactured are used in embedded systems.

Examples of properties of typical embedded computers when compared with general-purpose counterparts are low power consumption, small size, rugged operating ranges, and low per-unit cost. This comes at the price of limited processing resources, which make them significantly more difficult to program and to interact with. However, by building intelligence mechanisms on top of the hardware, taking advantage of possible existing sensors and the existence of a network of embedded units, one can both optimally manage available resources at the unit and network levels as well as provide augmented functions, well beyond those available.[5] For example, intelligent techniques can be designed to manage power consumption of embedded systems.

Modern embedded systems are often based on microcontrollers (i.e. CPUs with integrated memory or peripheral interfaces) [7] but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more complex systems. In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. The processor(s) used may be types ranging from general purpose to those specialized in certain class of computations or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).

The high demand of automobiles has also increased the traffic hazards and the road accidents. Life of the people is under high risk. This is because of the lack of best emergency facilities available in our country. This design is a system which can detect accidents in significantly less time and sends the basic information to first aid centre within a few seconds covering geographical coordinates, the time and angle in which a vehicle accident had occurred. This alert message is sent to the rescue team in a short time, which will help in saving the valuable lives. When the accident occurs the alert message is 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. The accident can be detected precisely with the help of both Micro Electro Mechanical Systems (MEMS) sensor. The Angle of the rolls over of the car can also be known by the message through the MEMS sensor. This application provides the optimum solution to poor emergency facilities provided to the roads accidents in the most feasible way.

Proposed system makes an effort to provide the emergency facilities to the victims in the shortest time possible. In big organizations the drivers make illegal use of the vehicles thus resulting in financial, time loss of the organization. Apart from these purposes the system can be used for tracking of stolen vehicles or travelling luggage, fleet management and vehicular sales etc. The system incorporates a single-board embedded system that contains GPS and GSM modems connected with a microcontroller. The entire set-up is installed in the vehicle. A MEMS sensor is used. It measures the vibration at the location it is placed. The signal is then compared with the standard values which further confer the accident of the car, unnecessary shock or vibration produced by machines, tilt of the car with respect to the earth's axis can be identified with the level of acceleration. Global Positioning System (GPS) is used to identify the location of the vehicle.GSM is used to inform the exact vehicular location to the pre-coder numbers. Message will give longitude and latitude values. From these values location of accident can be determined.GSM modem provides a two way communication by using a SIM card. Such a module works the same as a regular phone. This paper aims at intelligent security system providing situational awareness and agile safety.

Road accidents are a human tragedy. They involve high human suffering and monetary costs in terms of untimely deaths, injuries and loss of potential income. There are so many new techniques such as Antilock Breaking System (ABS), Adaptive Cruise Control (ACC), and Anti Collision System (ACS) to avoid accidents and in spite of all this, such large number of accidents takes place. Hence this paper presents a system which gives an idea about what can be done to provide medical help and other facilities after accident as soon as possible.

- The drawbacks of this type of detection system is that
- Someone has to witness the incident.
- Moreover, there are delays and inaccuracies due to the expression problem of the witness.

In the proposed system, we are introducing vehicle monitoring using GPS and upload the location using GPRS.
In this system we can monitor the status of the vehicle i.e., accident detection using MEMS etc. and send data to the owner using GPRS.

II. HARDWARE REQUIREMENTS

2.1 Arduino:

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources.

Figure 1: Arduino Module

The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C, no need to worry as only a few commands are needed to perform useful functions. The power of the Arduino is not its ability to crunch code, but rather its ability to interact with the outside world through its input-output (I/O) pins. The Arduino has 14 digital I/O pins labeled 0 to 13 that can be used to turn motors and lights on and off and read the state of switches.

Each digital pin can sink or source about 40mA of current. This is more than adequate for interfacing to most devices, but does mean that interface circuits are needed to control devices other than simple LED's. In other words, you cannot run a motor directly using the current available from an Arduino pin, but rather must have the pin drive an interface circuit that in turn drives the motor. A later section of this document shows how to interface to a small motor.

2.2 Atmega328pFeatures

1. High Performance, Low Power AVR® 8-Bit Microcontroller
2. Advanced RISC Architecture
3. 131 Powerful Instructions
4. Most Single Clock Cycle Execution
5. 32 x 8 General Purpose Working Registers
6. Fully Static Operation
7. Up to 20 MIPS Throughput at 20 MHz
8. On-chip 2-cycle Multiplier
9. High Endurance Non-volatile Memory Segments
10. 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory
11. (ATmega48PA/88PA/168PA/328P)
12. Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
13. 23 Programmable I/O Lines
14. Temperature Range is -40°C to 85°C

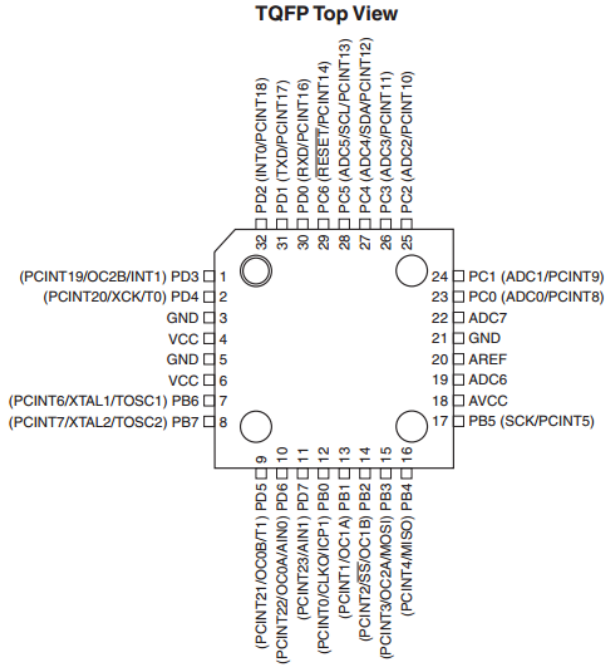

Figure 2: Pin Configuration (Top View)

The ATmega48PA/88PA/168PA/328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega48PA/88PA/168PA/328P achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an information file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer.

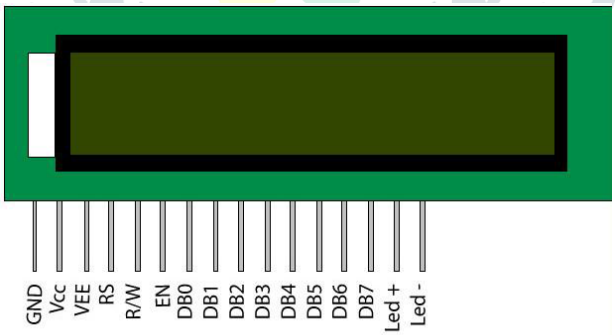

Figure 3: LCD Pin Diagram

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical and easily programmable. The LCD pin diagram is shown in figure 3.

III. General Packet Radio Service (GPRS)

The introduction of second generation cellular mobile systems witnessed an impressive growth in the number of mobile subscribers. The most popular second generation systems are GSM and IS-95. The GSM system is based on FDMA-TDMA technology and many parts of Asia and Africa. The IS-95 system is based on CDMA technology and is used in North America. With the increasing popularity of these systems there was an increasing demand for the data services over the wireless.

In order to understand the GPRS system architecture it is helpful to first understand the architecture of GSM system. We therefore discuss the architecture of GSM system prior to discussing the architecture of GPRS.

3.1 GSM System Architecture

In GSM system the mobile handset is called Mobile Station (MS). A cell is formed by the coverage area of a Base Transceiver Station (BTS) which serves the MS in its coverage area. Several BTS together are controlled by one Base Station Controller (BSC). The BTS and BSC together form Base Station Subsystem (BSS). The combined traffic of the mobile stations in their respective cells is routed through a switch called Mobile Switching Center (MSC). Connection originating or terminating from external telephone (PSTN) are handled by a dedicated gateway Gate way Mobile Switching Center (GMSC). The architecture of a GSM system is shown in the figure below.

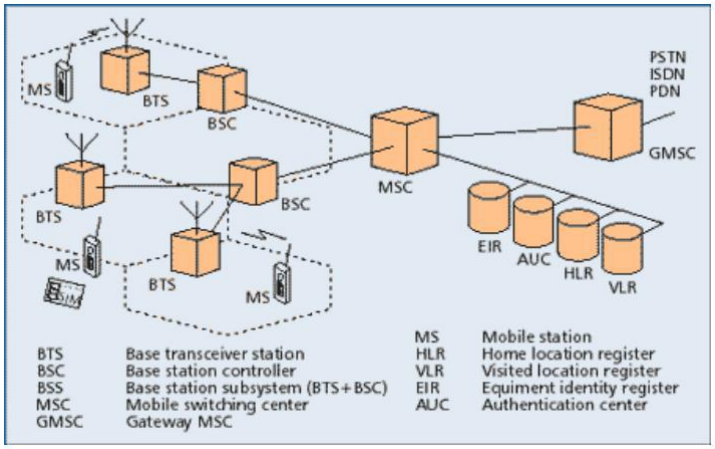

Figure 4: GSM Architecture

In addition to the above entities several databases are used for the purpose of call control and network management. These databases are Home Location Register (HLR), Visitor Location Register (VLR), the Authentication Center (AUC), and Equipment Identity Register (EIR).

Home Location Register (HLR) stores the permanent (such as user profile) as well as temporary (such as current location) information about all the users registered with the network. A VLR stores the data about the users who are being serviced currently. It includes the data stored in HLR for faster access as well as the temporary data like location of the user. The AUC stores the authentication information of the user such as the keys for encryption. The EIR stores data about the equipments and can be used to prevent calls from a stolen equipments.

All the mobile equipments in GSM system are assigned unique id called IMSI (International Mobile Equipment Identity) and is allocated by equipment manufacturer and registered by the service provider. This number is stored in the EIR. The users are identified by the IMSI (International Module Subscriber Identity) which is stored in the Subscriber Identity Module (SIM) of the user. A mobile station can be used only if a valid SIM is inserted into equipment with valid IMSI. The "real" telephone number is different from the above ids and is stored in SIM.

The most important network nodes added to the existing GSM networks are:
- SGSN (Serving GPRS Support Node).
- GGSN (Gateway GPRS Support Node).

IV. Proposed Method

In this paper, Arduino is used for controlling whole the process with a GPS Receiver and GSM module.GPS Receiver is used for detecting coordinates of the vehicle, GSM module is used for sending the alert SMS with the coordinates and the link to Google Map. Accelerometer namely ADXL335 is used for detecting accident or sudden change in any axis. And an optional 16x2 LCD is also used for displaying status messages or coordinates. It used GPS Module SIM28ML and GSM Module SIM900A.

When we are ready with our hardware after programming, we can install it in our vehicle and power it up. Now whenever there is an accident, the car gets tilt and accelerometer changes his axis values. These values read by Arduino and checks if any change occurs in any axis. If any change occurs then Arduino reads coordinates by extracting $GPGGA String from GPS module data (GPS working explained above) and send SMS to the predefined number to the police or ambulance or family member with the location coordinates of accident place. The message also contains a Google Map link to the accident location, so that location can be easily tracked. When we receive the message then we only need to click the link and we will redirect to the Google map and

then we can see the exact location of the vehicle. Speed of Vehicle, in knots (1.852 KPH), is also sent in the SMS and displayed on the LCD panel.

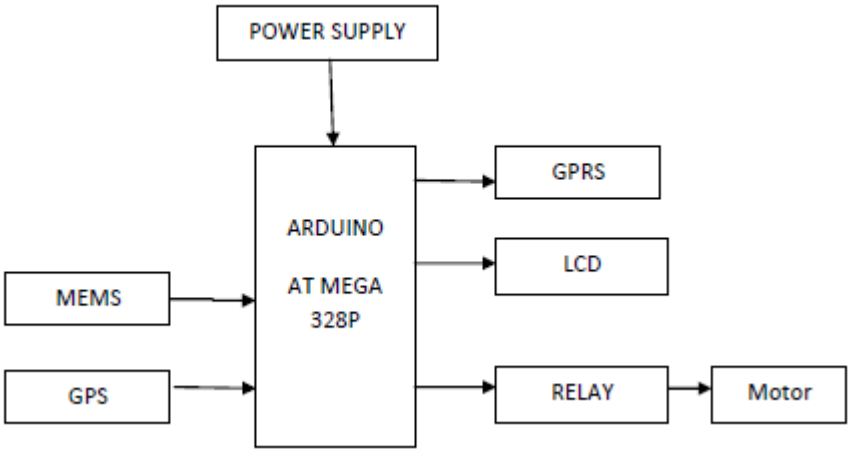

Figure 5: Block Diagram

Circuit Connections of this Vehicle Accident Alert System method is simple. Here Tx pin of GPS module is directly connected to digital pin number 10 of Arduino. By using Software Serial Library here, we have allowed serial communication on pin 10 and 11, and made them Rx and Tx respectively and left the Rx pin of GPS Module open. By default Pin 0 and 1 of Arduino are used for serial communication but by using the Software Serial library, we can allow serial communication on other digital pins of the Arduino. 12 Volt supply is used to power the GPS Module.

GSM module's Tx and Rx pins of are directly connected to pin D2 and D3 of Arduino. For GSM interfacing, here we have also used software serial library. GSM module is also powered by 12v supply. An optional LCD's data pins D4, D5, D6, and D7 are connected to pin number 6, 7, 8 and 9 of Arduino. Command pin RS and EN of LCD are connected with pin number 4 and 5 of Arduino and RW pin is directly connected with ground. A Potentiometer is also used for setting contrast or brightness of LCD. An Accelerometer is added in this system for detecting an accident and its x, y and z-axis ADC output pins are directly connected.

V. APPLICATIONS

1) Reduces number of life risks after accidents
2) Useful to protecting vehicles in parking at public places.
3) Useful in tracing vehicle.
4) Useful in monitoring the vehicle.
5) For road transportation.

VI. RESULTS

The motor will rotate before the accident when accident occurred stop running and intimate by using GPS and GPRS. It sends the SMS to family members and nearby hospitals through GSM and also alerts the nearby people with buzzer sound. GPRS sends the particular address location the family members and hospitals where the accident occurred.

Figure 6: Display at Initial Stage

Whenever the kit is switch on at the time, title is displayed on the LCD.

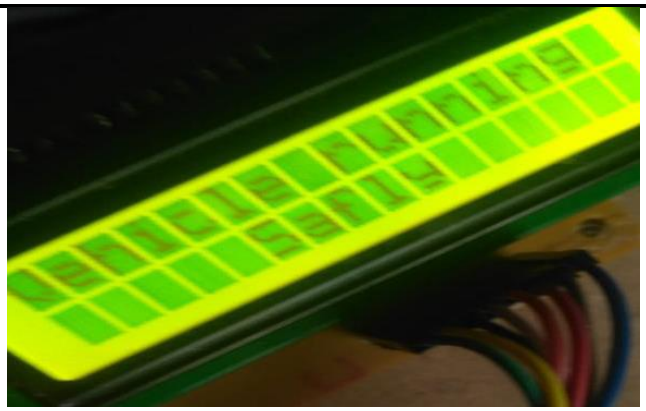

Figure 7: Vehicle is Running Safely

When the vehicle is running safely then MEMS sensor detected the vehicle and it was displayed in the LCD on the kit.

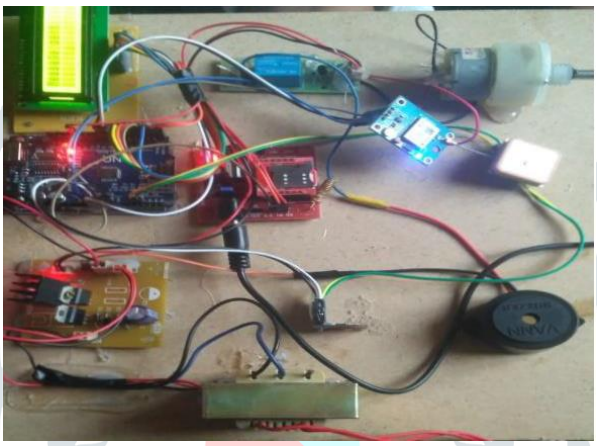

Figure 8: MEMS Sensor is at above 500 Axis

If MEMS sensor is in standing position, at that time the vehicle moving safely or running safely. If MEMS sensor is tilt at an angle of above 50^0 degrees and less that 30^0 degrees then the accident occurred to the vehicle and it was displayed in the LCD screen.

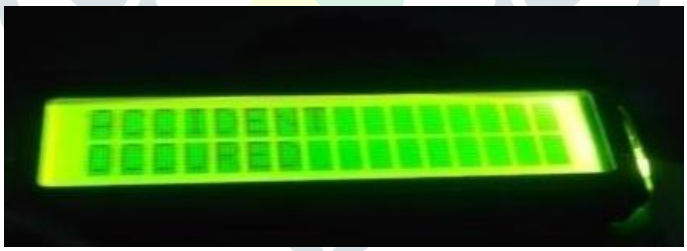

Figure 9: Accident Occurred

Whenever accident occurred it was displayed on the LCD screen then the messages sent to the given numbers in the program that is the family members and the hospital and polices. It was shown in figure 10.

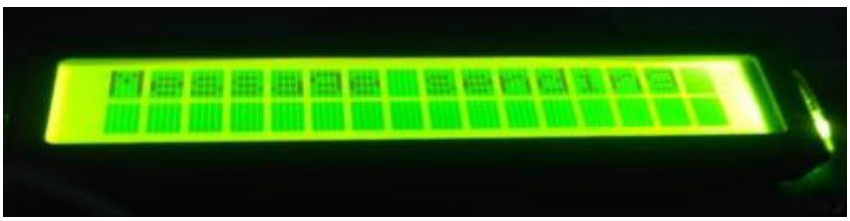

Figure 10: Message sending to the registered phone numbers

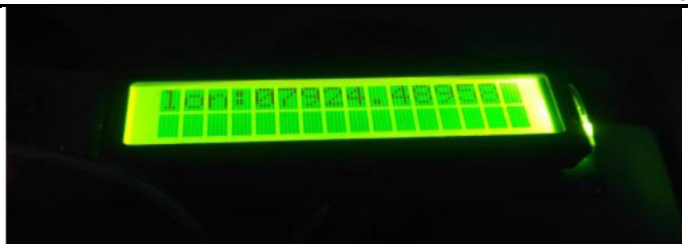

Figure 11: Address Location shared through the GPRS to the registered Phone numbers

Address location is shared through the GPRS and messages sends through the GSM module which is placed in the kit. Based the latitude and longitudes where the accident is occurred find easily and save the some of the lives.

VII. CONCLUSION

This system can overcome the problems of lack of automated system for accident location detection. Consequently, the time for searching the location is reduced and the person can be treated as soon as possible which will save many lives. This paper is to decrease the chances of casualties in such accident. Whenever accident occurs, paramedics are alerted and they reach the particular location to increase the chances of saving life.

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