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"IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM"

Project Stage-II
Report
submitted
in
partial fulfillment of requirement
for the award of **degree of**

Bachelor of Engineering in Electrical Engineering

Submitted by

KHAN SHAHZER MUSHTAQ (18DEE25)

SAYYED ABBAS ARIF (18DEE23)

SHAIKH MOHAMED ADNAN FIROZ AHMED (18DEE28)

KHAN ARSHAD MANSOOR AHMAD (18DEE08)

Under The Guidance Of

Prof. Ankur Upadhyay

Department of Electrical Engineering
Anjuman-I-Islam's Kalsekar Technical Campus, Panvel
Mumbai University, Mumbai

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CERTIFICATE

This is to certify that the dissertation titled **"IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM"** which is being submitted herewith for the award of the, **'Bachelor of Engineering'** in **Electrical Engineering** of Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel (M.S., India). This is the result of the original research work and contribution by **'Mr. Shahzer khan, Mr. Abbas Sayyed, Mr. Adnan Shaikh and Mr. Arshad khan'** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of award of any degree or compatible certificate or similar title of this for any other diploma/examining body or university to the best of knowledge and belief.

Place: Panvel

Date:

Name of Guide
Prof. Ankur Upadhyay

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DECLARATION

I hereby declare that I have formed, completed and written the dissertation entitled. It has not previously submitted for the basis of the award of any degree or diploma **"IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM"** or either similar title of this for any other diploma/examining body/university.

Place: Panvel

Date:

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It is a matter of great pleasure and proud privilege to be able to present this project "IOT BASED AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM” We would like to express our deep regards and gratitude to the Head of the department **Mr. Rizawan Farade.**

The completion of this project work is a milestone in student life and its execution is inevitable in the hands of a guide. We are highly indebted to our project guide **Prof. Ankur Upadhyay**, for his invaluable guidance and appreciation for giving form and substance to this report. It is due to his enduring efforts, patience, and enthusiasm which has given this project a sense of direction and purposefulness to this project and ultimately made it in success.

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ABSTRACT

It gives me immense pleasure to present this project on " AUTOMATIC VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM" carried out at AIKTC, New Panvel in accordance with prescribed syllabus of University of Mumbai for Electrical Engineering. I express my heartfelt gratitude to those who directly and indirectly contributed towards the completion of this project. I would like to thanks Mr. Abdul Razzak Principal, ACEM for allowing me to undertake this guide Prof. Ankur Upadhyay for continuous support. I would like to thanks all the faculty members, non-teaching staffs of Electrical Engineering of our College for their direct and indirect support and suggestion for performing the project.

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CHAPTER-1: INTRODUCTION

MOTIVATION AND BACKGROUND

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. Automobile has a great importance in our daily life. We utilize it to go to our work place, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. In 2019, 1,54,732 people died in vehicle accident only in INDIA. However, many lives could have been saved if the emergency service could get the crash information in time. A study by Virtanen et al. shows that 4.6% of the fatalities in accidents could have been prevented only in Finland if the emergency services could be provided at the place of accident at the proper time. As such, efficient automatic accident detection with an automatic notification to the emergency service with the accident location is a prime need to save the precious human life.

The Global Positioning System (GPS) is a popular technology which was developed by American Department of Defense (DoD) for military use. Later on it was available for civilian use. It is utilized for wide range of applications such as location, direction, speed, timing, surveying, logistics, traffic management, security etc. Nowadays, it has become an integral part of a vehicle system for tracking and navigation system. It can provide accurate time, location coordinate and speed. On the other hand, Global System for Mobile communications (GSM) is a digital mobile telephony system that is widely used. More than 690 mobile networks provide GSM services across 213 countries and GSM represents 82.4% of all global mobile connections. Besides the voice communication it also offers Short Message Service (SMS) and General packet radio service (GPRS) to transfer data. This project proposes to utilize the capability of a GPS receiver to send the location of the accident and send it to emergency services with the help of GSM.

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OBJECTIVE

The main objective of the system to provides the safe drive for that we have designed the system in which until the driver buckle up the seat belt the car won't get turned on as well as provides solution for accident detection and alert system. This is achieved by sensing the vibration as the accident occurs the system will automatically notify the emergency number which is fed into the system or nearest control room which is located by GPS via GSM module. To decrease the numbers of accidents occurring on road and to provide immediate medical assistance to the injured our system will be majorly effective.

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Thesis Overview

With the improvement in transportation infrastructure and in-vehicle technology in addition to a meteoric increase in the total number of commercial and non-commercial vehicles on the road, traffic accidents may occur, which usually cause a high death toll. More than half of these deaths occur due to a delayed response by medical care providers and rescue authorities. The chances of survival of an accident victim could increase drastically if immediate medical assistance is provided at an accident location. This work proposes a low-cost accident detection and notification system, which utilizes a multi-tier ARDUINO based accident detection and alert system.

To provides the safe ride to the passengers for that we have designed the system in which until the driver buckle up the seat belt the car won't get turned on as well as provides solution for accident detection and alert system. This is achieved by sensing the vibration as the accident occurs the system will automatically notify the emergency number which is fed into the system or nearest control room which is located by GPS via gam module. To decrease the numbers of accidents occurring on road and to provide immediate medical assistance to the injured our system will be majorly effective.

Summary:

This project is merely focused on developing a system which focuses on the safety of the passenger’s life. However, many lives could have been saved if the emergency service could get the crash information in time. Fatalities in accidents could have been prevented only if the emergency services could be provided at the place of accident at the proper time. As such, efficient automatic accident detection with an automatic notification to the emergency service with the accident location is a prime need to save the precious human life. The system comprises of two sections smart seat belt and accident detection alert system.

CHAPTER-2: LITERATURE SURVEY

Table:2.1 Literature Survey

Sr.No	Author	Name of Paper	Year	Application
1	Md. Saeef Abdul Hadi	A Smart Accident Detection and Control System in Vehicular Networks	2018	Developed smart accident detection in vehicles
2	Hsiao-Chu Cheng	An Effective Seat Belt Detection System on the Bus	2020	Seat belt detection
3	C. Mohamedaslam	A smart vehicle for accident detection	2016	A smart vehicle for accident detection
4	T Kalyani	Accident Detection and Alert System	2019	LCD interfacing
5	Asad Ali	An automated systems for Accident Detection	2015	Use of ARDUINO

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CHAPTER-3: RELATED THEORY

3.1 ARDUINO UNO

Fig 3.1: ARDUINO

The Arduino-Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it

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uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Features:-

Microcontroller: Microchip ATmega328P
Operating Voltage: 5 Volts
Input Voltage: 7 to 20 Volts
Digital I/O Pins: 14 (of which 6 can provide PWM output)
UART: 1
I2C: 1
SPPI: 1
Analog Input Pins: 6
DC Current per I/O Pin: 20 mA
DC Current for 3.3V Pin: 50 mA
Flash Memory: 32 KB of which 0.5 KB used by bootloader
SRAM: 2 KB
EEPROM: 1 KB
Clock Speed: 16 MHz
Length: 68.6 mm
Width: 53.4 mm
Weight: 25 g

General Pin Function:-

LED: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.

VIN: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.

3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND: Ground pins.

IOREF: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF

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pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.

Reset: Typically used to add a reset button to shields that block the one on the board.

Special pin functions:-

ach of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pin Mode(), digital Write(), and digital Read() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analog Reference() function.

In addition, some pins have specialized functions:

Serial / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.

External interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analog Write () function.

SPI (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.

TWI (two-wire interface) / I^2C: pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.

AREF (analog reference): Reference voltage for the analog inputs.

Communication:-

The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, 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, a .inf file is required. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the 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 (but not for serial communication on pins 0 and 1). A Software Serial library allows serial communication on any of the Uno's digital pins.

CHAPTER-4: METHODS OF IMPLEMENTATION

4.1 HARDWARE COMPONENTS

PIEZOELECTRIC SENSOR

BUZZER

RELAY

LCD 16x2

VARIABLE RESISTOR

GPS & GSM Module

4.1.1 PIEZOELECTRIC SENSOR

A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, ((strain, or force by converting them to an electrical charge. The prefix Piezo- is Greek for 'press' or 'squeeze'. A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, ((strain, or force by converting them to an electrical charge. The prefix Piezo- is Greek for 'press' or 'squeeze'.

Piezoelectric sensors are versatile tools for the measurement of various processes. They are used for quality assurance, process control, and for research and development in many industries. Pierre Curie discovered the piezoelectric effect in 1880, but only in the 1950s did manufacturers begin to use the piezoelectric effect in industrial sensing applications. Since then, this measuring principle has been increasingly used, and has become a mature technology with excellent inherent reliability.

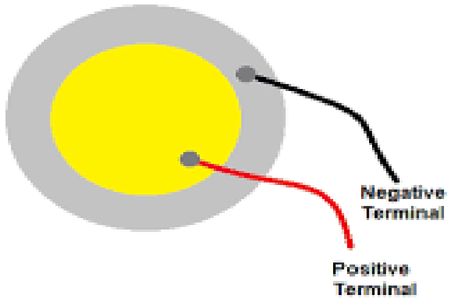

Fig 4.1.1(a): Piezo-electric Sensor

Principle of operation:-

Transverse
Longitudinal
Shear

Transverse effect:-

A force applied along a neutral axis (y) displaces charges along the (x) direction, perpendicular to the line of force. The amount of charge (Qx) depends on the geometrical diemensions of the respective piezoelectric element. When dimensions a,b,d apply,

Qx = dxyfyb/a,

Where a is the dimension in the line with the neutral axis, bis in line with the charge generating axis and d is the corresponding piezoelectric coefficient.

Longitudinal effect-

The amount of charge displaced is strictly proportional to the applied force and independent of the piezoelectric element size and shape. Putting several elements mechanically in series and electrically in parallel is the only way to increase the charge output. The resulting charge is

Qx = dxxFxn,

Where dxx is the piezoelectric coefficient for a charge in x-direction. Fx is the applied force in x-direction [N] and n corresponds to the number of stacked elements.

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Shear effect:-

The charge produced is exactly propotional to the applied force and is generated at aright angel to the force. The charge is independent of the element size and shape. For n elements mechanically in a series and electrically in parallel the charge is

Qx = 2dxxfxn

In constrast to the longitudinal and shear effect, the transverse effect make it possible to fine-tune sensitivity on the applied force and element dimension.

Electrical properties:-

A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source and filter network. The voltage *V* at the source is directly proportional to the applied force, pressure, or strain. The output signal is then related to this mechanical force as if it had passed through the equivalent circuit.

For use as a sensor, the flat region of the frequency response plot is typically used, between the high-pass cutoff and the resonant peak. The load and leakage resistance must be large enough that low frequencies of interest are not lost. A simplified equivalent circuit model can be used in this region, in which C_s represents the capacitance of the sensor surface itself, determined by the standard formula for capacitance of parallel plates. It can also be modeled as a charge source in parallel with the source capacitance, with the charge directly proportional to the applied force, as above.

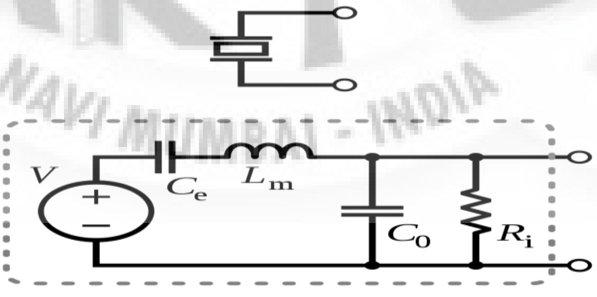

Fig 4.1.1(b): Electric model of piezoelectric sensor

4.1.2 BUZZER

Fig 4.1.2: Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (*piezo* for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

The electric buzzer was invented in 1831 by Joseph Henry. They were mainly used in early doorbells until they were phased out in the early 1930s in favor of musical chimes, which had a softer tone.

Features

Compact design

Flying leads include

Easy mounting

Loud sound output

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4.1.3 RELAY

Fig 4.1.3: Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relay.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

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Types of Relay:-

Coaxial relay

Force contact realy

Latching relay

Machine tool relay

Mercury relay

Mercury wetted relay

Multi voltage relay

Overload protection relay

Polarized relay

Reed relay

Safety relay

Static relay

Time delay relay

Vacuum relay

4.1.4 LCD 16x2

Fig 4.1.4 LCD

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very

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commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16x2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

LCD PIN CONFIGURATION:-

Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.

Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.

Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.

Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).

Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).

Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.

Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.

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Pin15 (+ve pin of the LED): This pin is connected to +5V

Pin 16 (-ve pin of the LED): This pin is connected to GND.

Features of LCD:-

The operating voltage of this LCD is 4.7V-5.3V

It includes two rows where each row can produce 16-characters.

The utilization of current is 1mA with no backlight

Every character can be built with a 5×8 pixel box

The alphanumeric LCDs alphabets & numbers

Is display can work on two modes like 4-bit & 8-bit

These are obtainable in Blue & Green Back light. It displays a few custom generated characters

4.1.5 VARIABLE RESISTOR

Adjustable resistor

A resistor may have one or more fixed tapping points so that the resistance can be changed by moving the connecting wires to different terminals. Some wire wound power resistors have a tapping point that can slide along the resistance element, allowing a larger or smaller part of the resistance to be used where continuous adjustment of the resistance value during operation of equipment is required, the sliding resistance tap can be connected to a knob accessible to an operator. Such a device is called a rheostat and has two terminals.

Potentiometer

A potentiometer is a manually adjustable resistor. The way this device works is relatively simple. One terminal of the potentiometer is connected to a power source. Another is hooked up to ground (a point with no voltage or resistance and which serves as a neutral reference point), while the third terminal runs across a strip of resistive material. This resistive strip generally has a low resistance at one end; its resistance gradually increases to a maximum resistance at the other end. The third terminal serves as the connection between

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the power source and ground, and is usually interfaced to the user by means of a knob or lever. The user can adjust the position of the third terminal along the resistive strip in order to manually increase or decrease resistance. By controlling resistance, a potentiometer can determine how much current flow through a circuit. When used to regulate current, the potentiometer is limited by the maximum resistivity of the strip.

The power of this simple device is not to be underestimated. In most analog devices, a potentiometer is what establishes the levels of output. In a loud speaker, for example, a potentiometer directly adjusts volume; in a television monitor, it controls brightness.

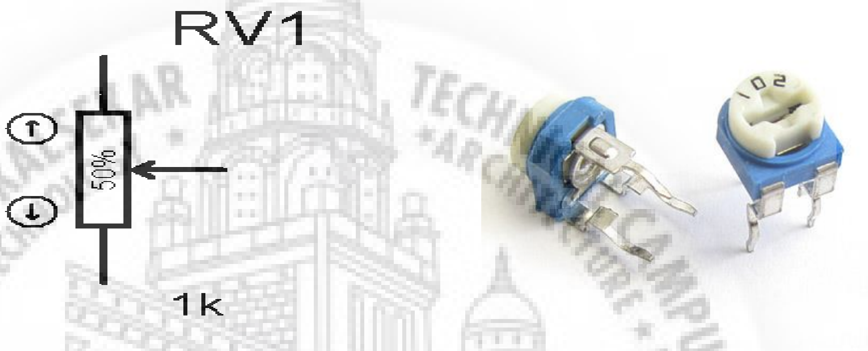

Fig 4.1.5: Potentiometer

A potentiometer can also be used to control the potential difference, or voltage, across a circuit. The setup involved in utilizing a potentiometer for this purpose is a little bit more complicated. It involves two circuits: the first circuit consists of a cell and a resistor. At one end, the cell is connected in series to the second circuit, and at the other end it is connected to a potentiometer in parallel with the second circuit. The potentiometer in this arrangement drops the voltage by an amount equal to the ratio between the resistance allowed by the position of the third terminal and the highest possible resistivity of the strip. In other words, if the knob controlling the resistance is positioned at the exact halfway point on the resistive strip, then the output voltage will drop by exactly fifty percent, no matter how high the potentiometer's input voltage. Unlike with current regulation, voltage regulation is not limited by the maximum resistivity of the strip

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4.1.6 GSM Module

The acronym for GSM is Global System for Mobile Communications. During the early 1980s, analog cellular telephone systems were experiencing rapid growth in Europe, particularly in Scandinavia and the United Kingdom, but also in France and Germany. Each country developed its own system, which was incompatible with everyone else's in equipment and operation. This was an undesirable situation, because not only was the mobile equipment limited to operation within national boundaries, which in a unified Europe were increasingly unimportant, but there was also a very limited market for each type of equipment, so economies of scale and the subsequent savings could not be realized.

The Europeans realized this early on, and in 1982 the Conference of European Posts and Telegraphs (CEPT) formed a study group called the Group Special Mobile (GSM) to study and develop a pan-European public land mobile system. The proposed system had to meet certain criteria:

Good subjective speech quality

Low terminal and service cost

Low terminal and service cost

Ability to support handheld terminals

Support for range of new services and facilities

Spectral efficiency

ISDN compatibility

Pan-European means European-wide. ISDN throughput at 64Kbs was never envisioned, indeed, the highest rate a normal GSM network can achieve is 9.6kbs.

Europe saw cellular service introduced in 1981, when the Nordic Mobile Telephone System or NMT450 began operating in Denmark, Sweden, Finland, and Norway in the 450 MHz range. It was the first multinational cellular system. In 1985 Great Britain started using the Total Access Communications System or TACS at 900 MHz. Later, the West German C-Netz, the French Radio COM 2000, and the Italian RTMI/RTMS helped make up Europe's nine analog incompatible radio telephone systems. Plans were afoot during the early 1980s, however, to create a single European wide digital mobile service with advanced features and easy roaming.

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While North American groups concentrated on building out their robust but increasingly fraud plagued and featureless analog network, Europe planned for a digital future.

In 1989, GSM responsibility was transferred to the European Telecommunication Standards Institute (ETSI), and phase I of the GSM specifications were published in 1990. Commercial service was started in mid-1991, and by 1993 there were 36 GSM networks in 22 countries. Although standardized in Europe, GSM is not only a European standard. Over 200 GSM networks (including DCS1800 and PCS1900) are operational in 110 countries around the world. In the beginning of 1994, there were 1.3 million subscribers worldwide, which had grown to more than 55 million by October 1997. With North America making a delayed entry into the GSM field with a derivative of GSM called PCS1900, GSM systems exist on every continent, and the acronym GSM now aptly stands for Global System for Mobile communications.

The developers of GSM chose an unproven (at the time) digital system, as opposed to the then-standard analog cellular systems like AMPS in the United States and TACS in the United Kingdom. They had faith that advancements in compression algorithms and digital signal processors would allow the fulfillment of the original criteria and the continual improvement of the system in terms of quality and cost. The over 8000 pages of GSM recommendations try to allow flexibility and competitive innovation among suppliers, but provide enough standardization to guarantee proper networking between the components of the system. This is done by providing functional and interface descriptions for each of the functional entities defined in the system.

Services Provided by GSM

From the beginning, the planners of GSM wanted ISDN compatibility in terms of the services offered and the control signaling used. However, radio transmission limitations, in terms of bandwidth and cost, do not allow the standard ISDN B-channel bit rate of 64 kbps to be practically achieved.

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Telecommunication services can be divided into bearer services, teleservices, and supplementary services. The most basic teleservice supported by GSM is telephony. As with all other communications, speech is digitally encoded and transmitted through the GSM network as a digital stream. There is also an emergency service, where the nearest emergency-service provider is notified by dialing three digits.

Bearer services: Typically data transmission instead of voice. Fax and SMS are examples.

Teleservices: Voice oriented traffic.

Supplementary services: Call forwarding, caller ID, call waiting and the like.

A variety of data services is offered. GSM users can send and receive data, at rates up to 9600 bps, to users on POTS (Plain Old Telephone Service), ISDN, Packet Switched Public Data Networks, and Circuit Switched Public Data Networks using a variety of access methods and protocols, such as X.25 or X.32. Since GSM is a digital network, a modem is not required between the user and GSM network, although an audio modem is required inside the GSM network to interwork with POTS.

Other data services include Group 3 facsimile, as described in ITU-T recommendation T.30, which is supported by use of an appropriate fax adaptor. A unique feature of GSM, not found in older analog systems, is the Short Message Service (SMS). SMS is a bidirectional service for short alphanumeric (up to 160 bytes) messages. Messages are transported in a store-and-forward fashion. For point-to-point SMS, a message can be sent to another subscriber to the service, and an acknowledgement of receipt is provided to the sender. SMS can also be used in a cell-broadcast mode, for sending messages such as traffic updates or news updates. Messages can also be stored in the SIM card for later retrieval.

Supplementary services are provided on top of teleservices or bearer services. In the current (Phase I) specifications, they include several forms of call forward (such as call forwarding when the mobile subscriber is unreachable by the network), and call barring of outgoing or incoming calls, for example when roaming in another country. Many additional supplementary services will be provided in the Phase 2 specifications, such as caller identification, call waiting, multi-party conversations.

Mobile Station

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services. The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal

mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

GSM phones use SIM cards, or Subscriber information or identity modules. They're the biggest difference a user sees between a GSM phone or handset and a conventional cellular telephone. With the SIM card and its memory the GSM handset is a smart phone, doing many things a conventional cellular telephone cannot. Like keeping a built in phone book or allowing different ring tones to be downloaded and then stored. Conventional cellular telephones either lack the features GSM phones have built in, or they must rely on resources from the cellular system itself to provide them. Let me make another, important point.

With a SIM card your account can be shared from mobile to mobile, at least in theory. Want to try out your neighbor's brand new mobile? You should be able to put your SIM card into that GSM handset and have it work. The GSM network cares only that a valid account exists, not that you are using a different device. You get billed, not the neighbor who loaned you the phone.

This flexibility is completely different than AMPS technology, which enables one device per account. No switching around. Conventional cellular telephones have their electronic serial number burned into a chipset which is permanently attached to the phone. No way to change out that chipset or trade with another phone. SIM card technology, by comparison, is meant to make sharing phones and other GSM devices quick and easy.

FEATURES:-

Low power consumption, 1mA in sleep mode

Integrated GPS/CNSS and supports A-GPS

Quad-band 850/900/1800/1900MHz

Standard SIM Card

GPRS multi-slot class12 connectivity: max. 85.6kbps(down-load/up-load)

Supports 3.0V to 5.0V logic level interface as well as RS232 Interface

GPRS mobile station class B

Controlled by AT Command

Supports charging control for Li-Ion battery

Supports GPS NMEA protocol

Supports Real-Time Clock

12V DC supply

Fig 4.1.6 GSM Module

GPS Receiver

GPS History

The Global Positioning System (GPS) is a Global Navigation Satellite System (GNSS) developed by the United States Department of Defense. It is the only fully functional GNSS in the world. It uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their current location, the time, and their velocity. Its official name is NAVSTAR GPS. Although NAVSTAR is not an acronym, a few acronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing. GPS is often used by civilians as a navigation system.

After Korean Air Lines Flight 007 was shot down in 1983 after straying into the USSR's prohibited airspace, President Ronald Reagan issued a directive making GPS freely available for civilian use as a common good. As suggested by physicist D. Fanelli.

A few years before, Since then, GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, scientific uses, and hobbies such as geo-caching. Also, the precise time reference is used in many applications including the scientific study of earthquakes. GPS is also a required key synchronization resource of cellular networks, such as the Qualcomm CDMA air interface used by many wireless carriers in a multitude of countries.

The first satellite navigation system, Transit, used by the United States Navy, was first successfully tested in 1960. Using a constellation of five satellites, it could provide a navigational fix approximately once per hour. In 1967, the U.S. Navy developed the Imation satellite which proved the ability to place accurate clocks in space, a technology that GPS relies upon. In the 1970s, the ground-based Omega Navigation System, based on signal phase comparison, became the first worldwide radio navigation system.

The design of GPS is based partly on similar ground-based radio navigation systems, such as LORAN and the Decca Navigator developed in the early 1940s, and used during World War II. Additional inspiration for the GPS came when the Soviet Union launched the first Sputnik in 1957. A team of U.S. scientists led by Dr. Richard B.

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Kershner were monitoring Sputnik's radio transmissions. They discovered that, because of the Doppler Effect, the frequency of the signal being transmitted by Sputnik was higher as the satellite approached, and lower as it continued away from them. They realized that since they knew their exact location on the globe, they could pinpoint where the satellite was along its orbit by measuring the Doppler distortion.

Working and Operation

When people talk about "a GPS," they usually mean a GPS receiver. The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else.

Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at anytime, anywhere on Earth, there are at least four satellites "visible" in the sky.

A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called trilateration. GPS receiver calculates its position on earth based on the information it receives from four located satellites. This system works pretty well, but inaccuracies do pop up. For one thing, this method assumes the radio signals will make their way through the atmosphere at a consistent speed (the speed of light). In fact, the Earth's atmosphere slows the electromagnetic energy down somewhat, particularly as it goes through the ionosphere and troposphere. The delay varies depending on where you are on Earth, which means it's difficult to accurately factor this into the distance calculations. Problems can also occur when radio signals bounce off large objects, such as skyscrapers, giving a receiver the impression that a satellite is farther away than it actually is. On top of all that, satellites sometimes just send out bad almanac data, misreporting their own position.

Differential GPS (DGPS) helps correct these errors. The basic idea is to gauge GPS inaccuracy at a stationary receiver station with a known location. Since the DGPS hardware at the station already knows its own position, it can easily calculate its

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receiver's inaccuracy. The station then broadcasts a radio signal to all DGPS-equipped receivers in the area, providing signal correction information for that area. In general, access to this correction information makes DGPS receivers much more accurate than ordinary receivers.

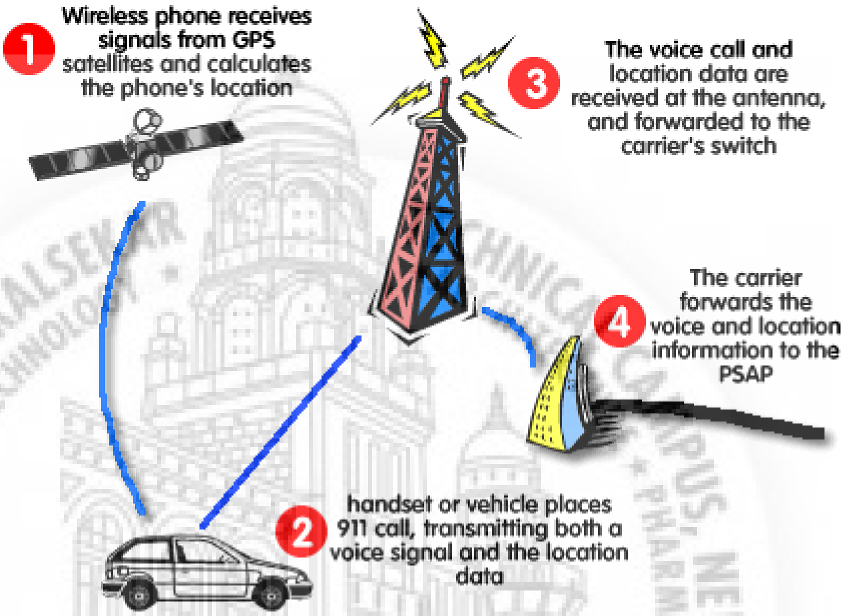

Figure 6.1 G.P.S receiver communicating with the satellite and sending information through the

GPS Data Decoding

G.P.S receiver continuously sends data and the microcontroller receives the data whenever it requires. The data sent by the G.P.S is a string of characters which should be decoded to the standard format. This is done by the program which we implement in the controller.

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4.2 SOFTWARE REQUIREMENTS

4.2.1 Programming of Arduino Module

1. DO wiring as follows:

Connect the crystal to the 9th and 10th pins of the 328.

Connect two 22 pF capacitors to each of the two legs of crystal and ground them.

Connect PIN 7 and 20 to a 5V pin of Arduino.

Connect PIN 8 and 22 to the ground of Arduino.

Connect PIN 10 of Arduino to PIN 1 (reset) of 328.

Connect PIN 11 of Arduino to PIN 17 of 328.

Connect PIN 12 of Arduino to PIN 18 of 328.

Connect PIN 13 of Arduino to PIN 19 of 328.

Connect Vcc and Gnd from the Arduino board to the microcontroller.

Connect the RESET pin of the Arduino board to PIN 1 of ATmega 328.

Connect the Rx pin of Arduino to the PIN 2 of 328.

Connect the Tx pin of Arduino to PIN 3 of 328.

2. Now connect the Arduino board to the computer

3. From MENU select Tools>Programmer>arduino as ISP

4. From MENU, select Tools >Board > Arduino Duemilanove or Diecimila.

5. now select , Tools > Processor > ATmega328.

6. Now the entire programming setup is ready.

7. write the program, click upload the program will be uploaded to the microcontroller.

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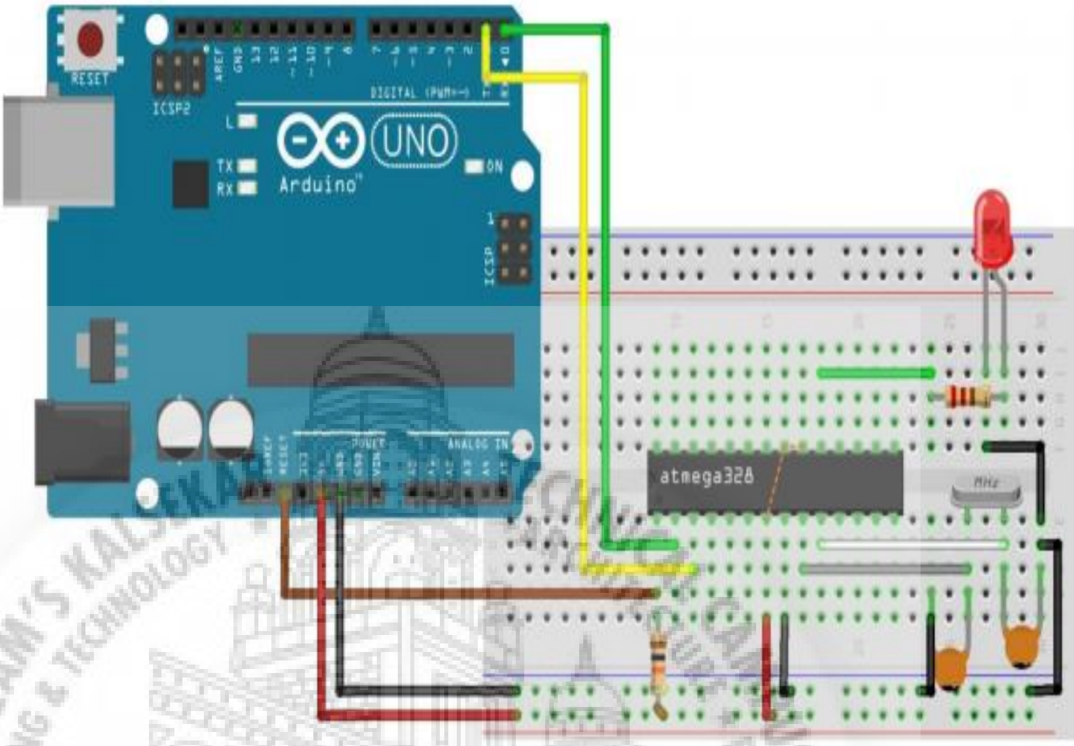

Fig 4.2.1 Arduino UNO Breadboard view

4.2.2 CODE

```
#include<LiquidCrystal.h>
#include <SoftwareSerial.h>
SoftwareSerial gps(2,3);            //Rx tx
LiquidCrystal lcd(8,9,10,11,12,13); //RS,EN,D4,D5,D6,D7
#define but 5
#define vehi 4
#define hit 6
#define buzzer 7
#define seat A5
/********DHT 11**********/
int butt = 0,hitt=0,duration=0; //on off button
char str[70];
String gpsString="";
char *test="$GPGGA";
```


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```
String latitude="28.672385 N";
String longitude="77.382335 E";
int temp=0,i;
boolean Serial_status=0;
void setup()
{
 pinMode(vehi,OUTPUT);
 digitalWrite(vehi,HIGH);
 lcd.begin(16,2);
 lcd.setCursor(0,0);
 lcd.print("Smart Vehicle");
 lcd.setCursor(0,1);
 lcd.print("waiting......");
 delay(1000);  // MILLISECOND
 lcd.clear();
 Serial.begin(9600); // BPS
 gps.begin(9600);    // BAUDRATE BPS
 pinMode(but,INPUT_PULLUP);
 pinMode(seat,INPUT_PULLUP);
 pinMode(hit,INPUT);
 pinMode(buzzer,OUTPUT);
}
void loop()
{
 int belt=digitalRead(seat);
 hitt=digitalRead(hit);
 if(hitt==LOW)
 {
  lcd.clear();
  lcd.setCursor(0,0);
  digitalWrite(buzzer,HIGH);
  digitalWrite(vehi,HIGH);
  lcd.print("ACCIDENT OCCUR");
  trigger();
```

```
 lcd.clear();
 }
else
{
 hitt=digitalRead(hit);
 if(belt==LOW)
 {
  digitalWrite(vehi,LOW);// vehicle start
 }
 else
 {
  digitalWrite(buzzer,HIGH);
  digitalWrite(vehi,HIGH); //vehicle off
 }
 digitalWrite(buzzer,LOW);
 lcd.setCursor(0,0);
 lcd.print("life is precious");
 delay(20);
 hitt=digitalRead(hit);
 }
}

void gpsEvent()
{
 gpsString="";
 while(1)
 {
  while (gps.available()>0)          //checking serial data from GPS
  {
   char inChar = (char)gps.read();
    gpsString+= inChar;                   //store data from GPS into gpsString
    i++;
    if (i < 7)
```


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```
    {
     if(gpsString[i-1] != test[i-1])        //checking for $GPGGA sentence
     {
      i=0;
      gpsString="";
     }
    }
   if(inChar=='\r')
   {
    if(i>65)
    {
     Serial_status=1;
     break;
    }
    else
    {
     i=0;
    }
   }
  }
  if(Serial_status)
  break;
  }
}

void get_gps()
{
 Serial_status=0;
 int x=0;
 while(Serial_status==0)
 {
  gpsEvent();
  int str_lenth=i;
```


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```
 latitude="";
 longitude="";
 int comma=0;
 while(x<str_lenth)
 {
  if(gpsString[x]==',')
  comma++;
  if(comma==2)        //extract latitude from string
  latitude+=gpsString[x+1];
  else if(comma==4)        //extract longitude from string
  longitude+=gpsString[x+1];
  x++;
 }
 int l1=latitude.length();
 latitude[l1-1]=' ';
 l1=longitude.length();
 longitude[l1-1]=' ';
 lcd.clear();
 lcd.print("Lat:");
 lcd.print(latitude);
 lcd.setCursor(0,1);
 lcd.print("Long:");
 lcd.print(longitude);
 i=0;x=0;
 str_lenth=0;
 delay(20);
}
}

void init_sms1()
{
 gps.println("AT+CMGF=1");
 delay(400);
```


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```
 //gps.println("AT+CMGS=\"+919540727970\"");
 delay(400);
}
void init_sms2()
{
 gps.println("AT+CMGF=1");
 delay(400);
 gps.println("AT+CMGS=\"+9178679766591\"");   // use your 10 digit cell no.
here
 delay(400);
}
void init_sms3()
{
 gps.println("AT+CMGF=1");
 delay(400);
 gps.println("AT+CMGS=\"+918655671961\"");   // use your 10 digit cell no.
here
 delay(400);
}

void send_data(String message)
{
 gps.println(message);
 //delay(100);
}

void send_sms()
{
 gps.write(26);
}

void tracking()
{
```


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```
 send_data("https://maps.google.com/?cid=6186334667046547881 4");
 /*send_data("Latitude:");
 send_data(latitude);
 send_data("Longitude:");
 send_data(longitude);*/
 send_sms();
 delay(5000);
}
void trigger()
{
 lcd.clear();
 duration=0;
 do{
 lcd.setCursor(0,0);
 lcd.print("if you are alive");
 lcd.setCursor(0,1);
 lcd.print("press button");
 butt=digitalRead(but);
 duration++;
 delay(500);
 }while(duration<10);
 butt=digitalRead(but);
 if(butt==LOW)
 {
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("slow drive....");
  lcd.setCursor(0,1);
  lcd.print("accident occur");
  init_sms1();
  send_data("Accident occur but person is  normal condition");
  send_sms();
```


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```
 init_sms2();
 send_data("Accident occur but person is  normal condition");
 send_sms();
 delay(6000);
 lcd.clear();
}

if(butt==HIGH)
{
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("critical state");
 lcd.setCursor(0,1);
 lcd.print("need emergency");
 //get_gps();
 init_sms1();
 send_data("person is critical condition");
 tracking();
 send_sms();
 init_sms2();
 send_data("person is critical condition");
 tracking();
 send_sms();
 delay(6000);
}
```

CHAPTER-5: FLOWCHART

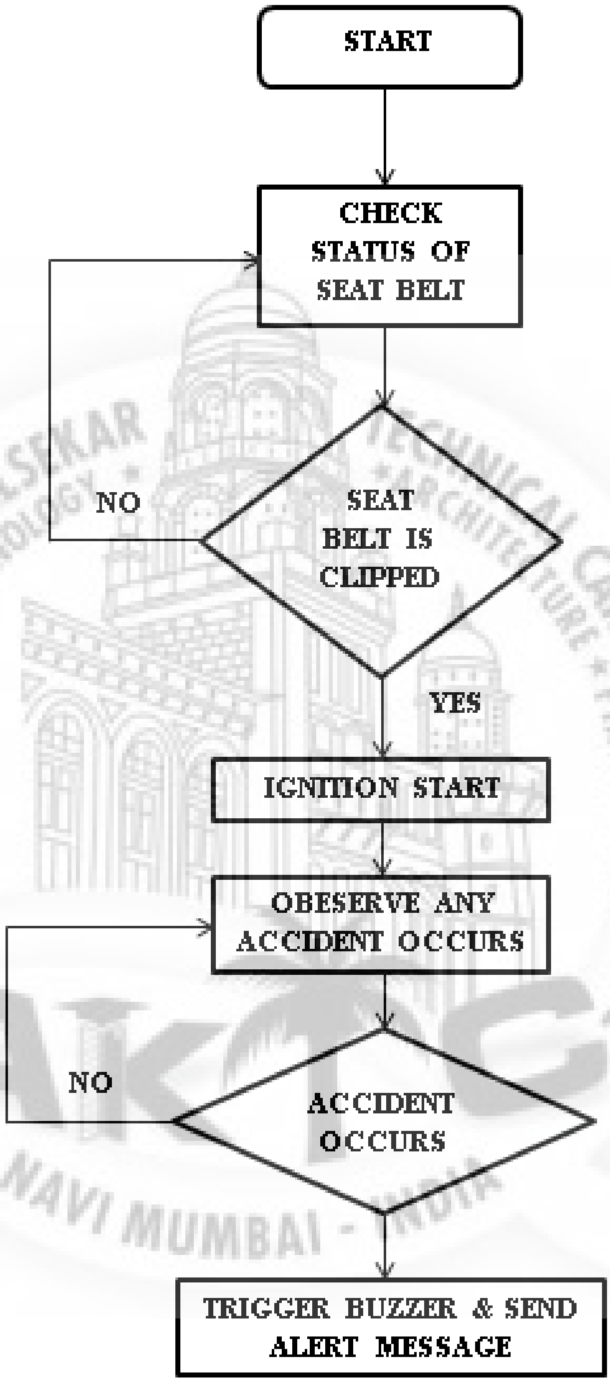

Fig 5 Flow Chart

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CHAPTER-6: RESULT & DISSCUSSION

Output Snapshot:

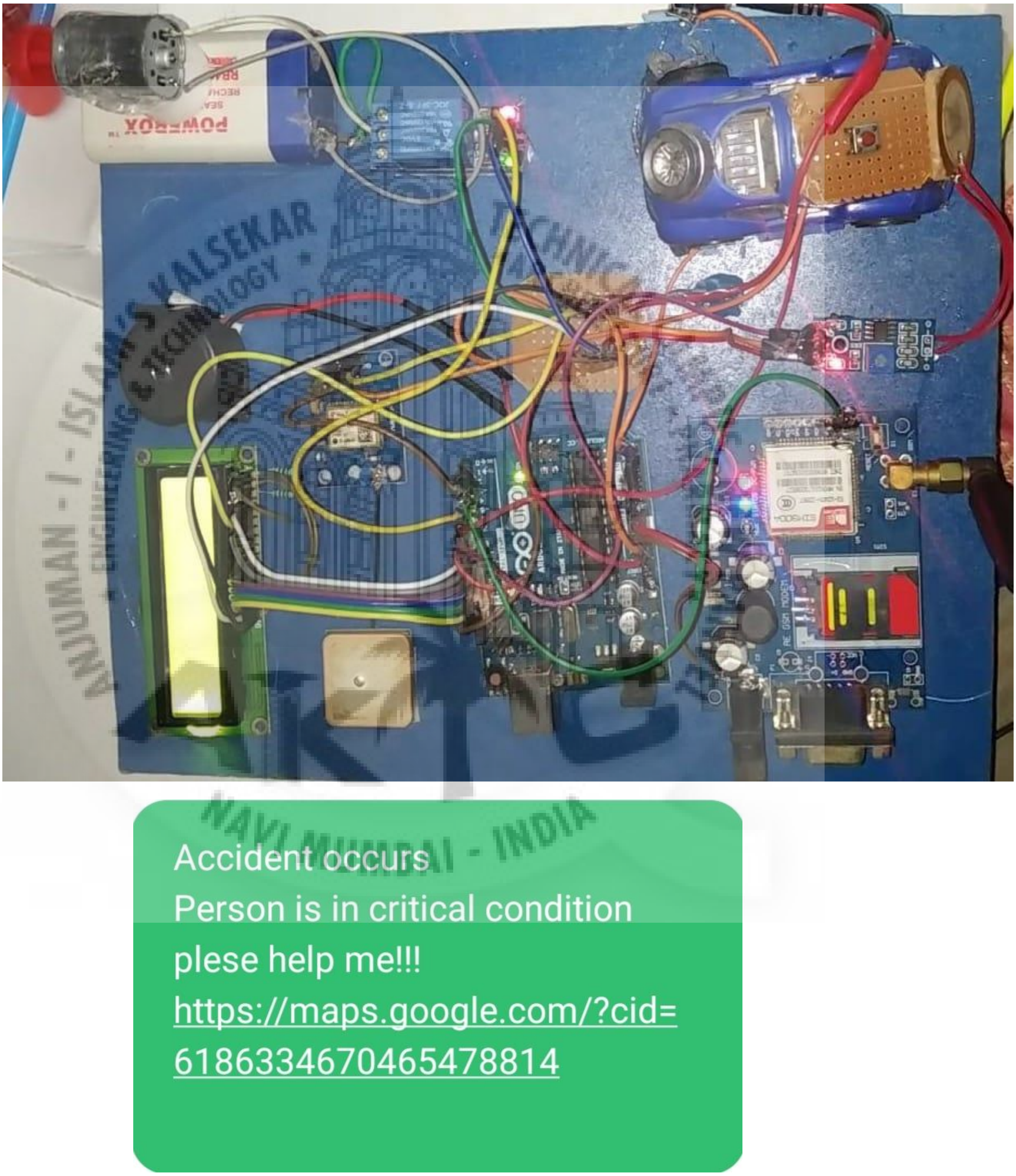

Fig 6 Output snapshot

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This project is an attempt to develop a Smart seat belt and accident detection alert system.

By making the use of male female connectors it detects seat belt present or not.

By making use of Piezo-electric sensor system detect the accident.

If accident occurs system send alert and accident location using GSM & GPS module.

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CHAPTER-7: CONCLUSION & FUTURE SCOPE

Smart seat belt and accident detection alert system has been developed. Experiments have been conducted by implementing the system in a toy car. It is observed that the system is working properly. The system sends the message to the stored emergency numbers successfully when the car is collided and toppled or tilted and if the reset button is not pressed in the stipulated time interval.

An android app can be developed for this in which instead of just receiving the co-ordinates of the location, it can be exactly pin pointed on the map. The heart rate can also be continuously monitored by the app to determine the driver's condition till the medical help arrives.

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