DIGITAL LIBRARY

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"Digital Library",** is the bonafide Work of **"MAKA GOPI RAJU, PALAGIRI NAVEEN REDDY, TADIGOTLA KRANTHI KUMAR REDDY, UNDELA PRAVEEN KUMAR REDDY",** who carried out the project work under my supervision.

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INTERNAL EXAMINER	**EXTERNAL EXAMINER**

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ABSTRACT

Over the last three decades a new technologies have helped the early visualizations of digital libraries to become a reality. Digital libraries are becoming a vital part of digital learning age. Their vital role is increasingly becoming a measure of the library's part to the revolution and development of a society and the nation at large. A digital library that deals with data those born digital as well as those that have been digitized from their analogue form. The aim of this paper is to discuss services and implications of digital libraries in the information age.

It represents basic concepts, historical environment, components, characteristics, process, advantages, and disadvantages in digital environment The characteristics of digital libraries include accessibility, interactivity, and interoperability. Accessibility refers to the ability of users to access the digital library from anywhere with an internet connection. Interactivity refers to the ability of users to interact with the content and other users through various tools such as annotations and comments.

Interoperability refers to the ability of digital libraries to share content and services with other digital libraries and systems. The process of creating and managing digital libraries involves several stages, including content acquisition, metadata creation, indexing and retrieval, preservation, and dissemination. Content acquisition involves the selection and acquisition of digital materials for inclusion in the digital library. Metadata creation involves the creation of descriptive information about the digital objects.

Indexing and retrieval involve the creation of indexes and search tools to enable users to find and access content. Preservation involves the long-term storage and preservation of digital materials, and dissemination involves making the content available to users. The advantages of digital libraries include increased accessibility, improved search and retrieval capabilities, and reduced storage costs. Digital libraries also facilitate collaborative research and learning and enable the sharing of resources between institutions.

KeyWords: JAVA, SQL, JAVASCRIPT, KADANES, BROUTE-FROCE

ABBREVIATION:JDK(JavaDevelopmentKit),HTML(HyperTextMarkupLanguage),CSS(CascadingStyleSheet),SQL(StructuredQueryLanguage)

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LIST OF ABBREVIATIONS

ABBREVIATION	EXPANSION
IC	Integrated Circuit
IDE	Integrated Development Environment
GPS	Global Positioning System
GSM	Global System for Mobile Communication
MEMS	Micro-electromechanical Systems
IR	Infrared Sensor
MSN	Mobile Service Node
GIWU	GSM Interworking Unit
LED	Light Emitting Diode

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In many nations and major cities today, accidents represent a serious public health concern. Bad riding behaviours, such as speeding, driving when inebriated, riding while fatigued, etc., are too responsible for this problem. In order to protect drivers from inadvertent injury, several research organisations and prominent car manufactures have developed safety measures. Just a small number of high-end automobiles now have monitoring devices since they are still too pricey for the majority of drivers. Fall detection and accident alarm systems for vehicle have lately received interest due to their potential to save lives by aiding driver in seeking prompt medical assistance. Here, were adding the Eye blinking in the system to detect tiredness and buzz the alert to. Blackbox system is used to analyses the data cause of the accident. In the black box system, we are used various types of sensors named as vibration sensor, MEMS Sensor, gas sensor, Fire sensor, IR sensor (Eye Blinking Sensor), etc**.** A mobile short message containing position from GPS (latitude, longitude) will be sent when a vehicle accident is detected. The police and insurance examiner can obtain accident history using a black box to investigate accident situations from data-logger in this device.

1.2 OBJECTIVE OF THE PROJECT

- We focus on developing the system to prevent the life loss while the event of accident occurs.
- To detect the accident.
- This device is mounted in the vehicle.

- To detect the drowsiness of the driver.
- When the event of the accident it sends the GPS location to the Black Box.
- Blackbox system is used to analyze the data cause of the accident.

1.3 STRUCTURE OF THE PROJECT REPORT

- Chapter 2 deals with Literature Survey.
- Chapter 3 deals with Proposed Methodology.
- Chapter 4 deals with Hardware Description.
- Chapter 5 deals with Software Description.
- Chapter 6 deals with Result & Discussion.
- Chapter 7 deals with Conclusion & Future Scope.

1.4 APPLICATIONS

- This device is mounted in the vehicles.
- To prevent the life loss while the event of accident occurs.
- To detect the accident.
- Event Recorder.

1.5 SUMMARY

The proposed system is highly efficient system for accident analysis. Event Data Recorded as the black box is officially called as, slowly gains an important device in investigation of vehicle accidents. It is possible to retrieve the data from the Black Box easily. By recording the events and actions of the driver including speed, drowsiness etc. seconds before the collision, the automobile black box will undoubtedly help both the police and insurance companies in reconstruction of the events before the accident. as soon as possible.

CHAPTER 2
LITERATURE SURVEY

2.1 INTRODUCTION

A literature review is a comprehensive summary of previous research on a topic. The literature review surveys scholarly articles, books, and other sources relevant to a particular area of research. The review should enumerate, describe, summarize, objectively evaluate and clarify this previous research.

2.2 EXTRACTING KNOWLEDGE FROM EXISITING SYSTEMS

- **Vehicle Black Box Using System Arduino [1];**

  This method for automobiles is suggested by authors **R. Kavya, P. Vemaiah** in the case of accidents in order to save lives. The system has sensors that can track where an incident occurs and record it. The device which is installed in automobiles, communicates with medical emergency and family members by sending them information in the form of a brief message. The brief notice includes the area's location. The data from the relevant cars is kept in the black box.

- **Automobile Black Box System for Vehicle Accident Analysis [2];**

  This technique is suggested by the authors **Sankar Narayanan R, Saravana Kumar M, Nishanth M, Saran raj K, Sujay K** for the vehicles in the case of accidents to rescue them. This system includes a Raspberry PI3, web camera, and IOT that capture everything that happens on the scene of an accident and store it to the SD Card of the Raspberry PI3. And alert the family members, hospitals, and police station with the information by short message. For investigation purposes, the data is stored via IOT page.

- **Automobile Black Box for Accident Analysis [3];**

This project for accident analysis utilising the black box has been proposed by the authors **P. Ardra, Ayisha, Ayisha Showkath, M.R. Sruthy.** The system has a camera and GPS that are capture the event’s details and sends the information, together with the precise location where it occurred, to the family members, emergency services, and police station. The black box was utilised during the collision to aid the authorities in their investigation.

- **Accident Detection and Monitoring using Black Box [4];**

This technique is suggested by the author’s **Vidya Deshmukh, Mahesh Ghate, Akanksha Sukre, Pramila Shyinde** to help those who have been in accidents. The system is equipped with a GPS module, a Bluetooth module for connecting to the appropriate Android application, and additional sensors to gather data in the case of an accident. The system sends a brief message including accident information to the appropriate device number. The Bluetooth app for Android is where the event data is stored. The accident happens right there during the police inquiry, according to an easy analysis. Here, if there is an item in the front of the car, the ultrasonic sensor is used to stop the vehicle.

- **Wireless Black Box of Accidental Monitoring of Vehicles using MEMS Accelerometer, GSM and GSM Services [5];**

  This approach was suggested by the authors **Waghule Mahesh Nanabhau, DR. Kharat Govind Ukhandrao** to save people’s lives. This technique is designed to concentrate primarily on the moment an accident happens in order to minimise the wait between the accidental and ambulance medical assistance. For quickly alerting the ambulance to save the life of the accident victim. To assist people in getting to an ambulance at a location within a specific time frame.

2.3 EXISTING SYSTEMS

In existing system most of the people associate black boxes with airplanes but they are no longer just the key tool in investigation of airplane accidents. Presently tracking system is introduced in vehicles to avoid the accidents and save peoples life. But these systems are still installed in some of the high-end vehicles only because these systems are too expensive for most of the vehicles.

2.4 DRAWBACKS IN EXISTING SYSTEMS

The implementation of Zigbee and ad hoc is time consuming. The cost is so expensive. There is no Eye blinking sensor in the system. To sense the drowsiness of the driver.

2.5 SUMMARY

The proposed system is highly efficient system for accident analysis. Event Data Recorded as the black box is officially called as, slowly gains an important device in investigation of vehicle accidents. It is possible to retrieve the data from the Black Box easily. By recording the events and actions of the driver including speed, seat belt etc. seconds before the collision, the automobile black box will undoubtedly help both the police and insurance companies in reconstruction of the events before the accident. This data also has the potential to augment data in crash databases, by providing information especially relating to system performances. This is also very helpful as emergency aids can be provided as soon as possible. The system requires a few sensors, GPS, GSM and camera. The system would serve as an effective source of information when an accident occurs automobile black box provides necessary data to generate the report of accident and about its causes. This Automobile Black Box system designed may be enforced in any vehicle.

CHAPTER 3

PROPOSED METHODOLOGY

3.1 PROPOSED SYSTEM

The system with a microcontroller unit, GPS gadget, GSM module, and MEMS to transmit a short message. Real-time judgements on falls and accidents are made utilising the vehicle's speed and a threshold algorithm for fall detection and accident detection. A quick mobile message indicating the location (latitude, longitude) of the vehicle is sent when an accident involving a vehicle is detected. Eye blinking alert and detecting device with a buzzer, collision monitoring system, and accident avoidance.

3.2 PROPOSED METHODOLOGY

The original data will be divided into fall and non-fall classes as part of our signal processing goal. At sampling rates of 60 hertz or more, this system captured and processed the input data from the three-axis accelerometer in real-time. The sensor was fitted I to a vehicle in order to align the accelerometer's axis and guarantee that the response of acceleration data is accurately specified. The categorization of the fall detection utilised the 3-axis acceleration signals from the MEMS accelerometer and the ground speed from the GPS module.

3.3 PROPOSED BLOCK DIAGRAM

This Block diagram is proposed to focus on developing the system to prevent the life loss while the event of accident occurs. To detect the accident. This device is mounted in the vehicle. To detect the drowsiness of the driver. When the event of the accident it sends the GPS location to the Black Box.

Blackbox system is used to analyze the data cause of the accident as shown in figure 4.1: Block Diagram.

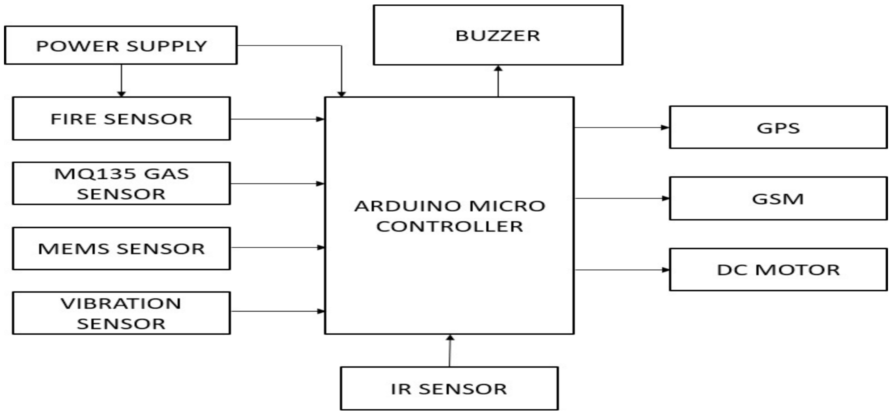

Figure 3.1: Block Diagram

3.4 PROPOSED CIRCUIT DIAGRAM

This circuit diagram is proposed to focus on developing the system to prevent the life loss while the event of accident occurs. To detect the accident in real time system as shown in figure 3.2: circuit diagram.

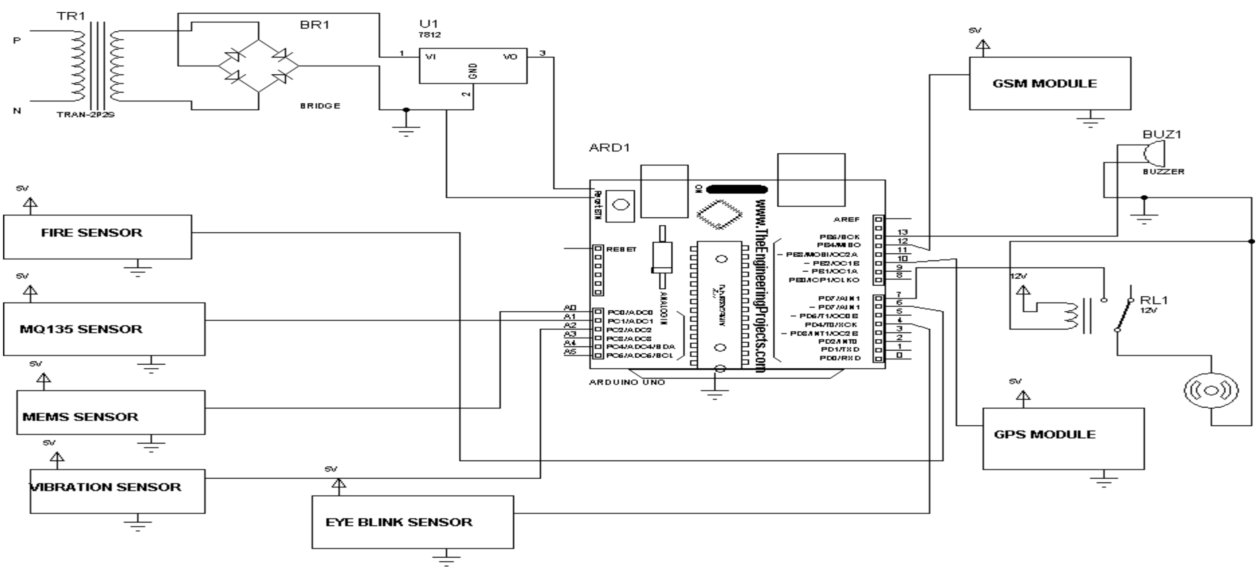

Figure 3.2: Circuit Diagram

3.5 FLOW CHART WITH IMPLEMENTATION STAGES

The Arduino Uno ATmega-328P is connected with respective sensors like IR Sensor, Fire Sensor, MEMS Sensor, MQ135 Gas Sensor, Vibration Sensor, Buzzer, DC Motor it started to reads the values of the recorded in the time of event of accident occurs it sends the GPS exact the location to particular contact number by using the GSM module. Wireless Black Box is used to store the data in the event occur. IR Sensor is used to drowsiness of the driver. Black Box is used in the investigation time, crash litigation, driver performance, vehicle maintenance as shown in figure 3.3 flow chart.

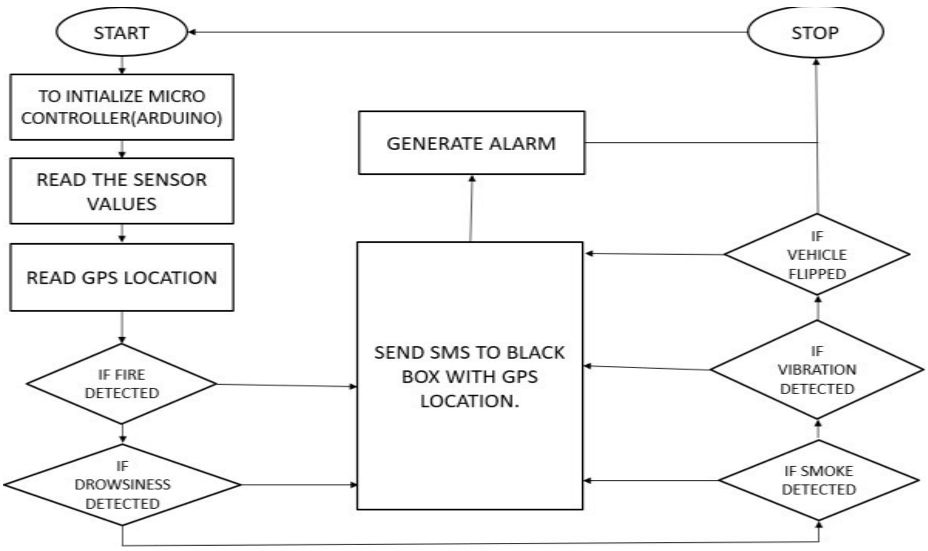

Figure 3.3: Flow Chart

3.6 SUMMARY

The proposed system to help the in the real time of motoring vehicle accidents using a wireless black box to prevent the accidents and also detect the accidents. The system with a microcontroller unit, GPS gadget, GSM module, and MEMS to transmit a short message. Real-time judgements on falls and accidents are made utilising the vehicle’s speed and a threshold algorithm for fall detection and accident detection. A quick mobile message indicating the location (latitude, longitude) of the vehicle is sent when an accident involving a vehicle is detected. Eye blinking alert and detecting device with a buzzer, collision monitoring system, and accident avoidance. The Arduino Uno ATmega-328P is connected with respective sensors like IR Sensor, Fire Sensor, MEMS Sensor, MQ135 Gas Sensor, Vibration Sensor, Buzzer, DC Motor it started to reads the values of the recorded in the time of event of accident occurs it sends the GPS exact the location to particular contact number by using the GSM module. Wireless Black Box is used to store the data in the event occur. IR Sensor is used to drowsiness of the driver. Black Box is used in the investigation time, crash litigation, driver performance, vehicle maintenance

CHAPTER 4

HARDWARE DESCRIPTION

4.1 INTRODUCTION

The fire sensor, MQ135, MEMS, vibration sensor, Eye blink sensors are connected to the Arduino. If the fire sensor detects any fire around it sends the data 1 to the digital pin in the Arduino or else its sends 0. If the data 1 is detected then it sends the warning message and GPS location to the mobile number added in the GSM module. The MQ135 sensor detects any poisonous smoke in the automobile and send the warning message to the mobile with the location of the automobile. The MEMS sensor or the accelerometer sensor detects the calibration of the automobile. Initially the sensor is placed in a position and defined as initial position of the car. If there is any change in the calibration it means that the car is flipped or twisted. So it sends the warning message to the mobile along with GPS location of the car. The vibration sensor detects vibration in the automobile. If a crash occurs it creates a vibration so that we can identify it with the help of this sensor. Eye blink sensor is nothing but an IR sensor which notices the eye blinking time. If we close the eyes then it goes HIGH and sends the data to the Arduino. If we close the eyes for three seconds it turns ON a buzzer for the driver to wake up. If we doesn't get up after the buzzer after five seconds it sends the location to the number and also turns off the motor.

4.2 POWER SUPPLY UNIT

Power supply unit consists of following units

i) **Transformer**

ii) **IC Voltage Regulators**

4.2.1 TRANSFORMER

The potential transformer will step down the power supply voltage (0-230V) to (0-5V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output, as shown in figure Transformer.

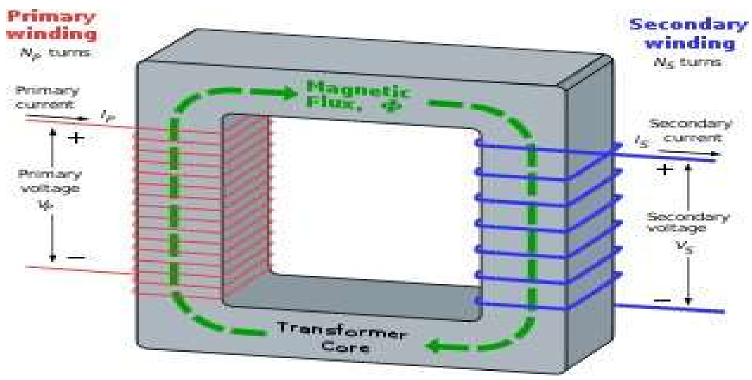

Figure 4.1: Transformer

4.2.2 IC VOLTAGE REGULATORS

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage, as shown in
figure 4.2: IC Voltage Regulators.

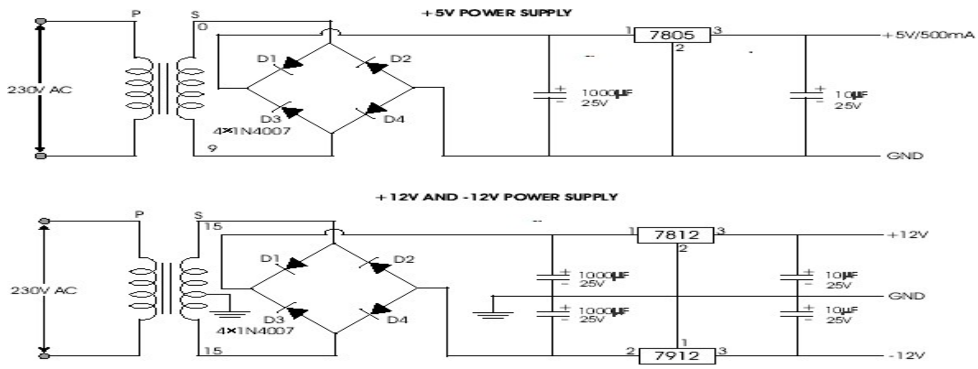

Figure 4.2: IC Voltage Regulators

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

4.3 ARDUINO UNO

ARDUINO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010. 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 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 pre-programmed 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 uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter, as shown in figure 4.3:Arduino Uno.

ARDUINO UNO:

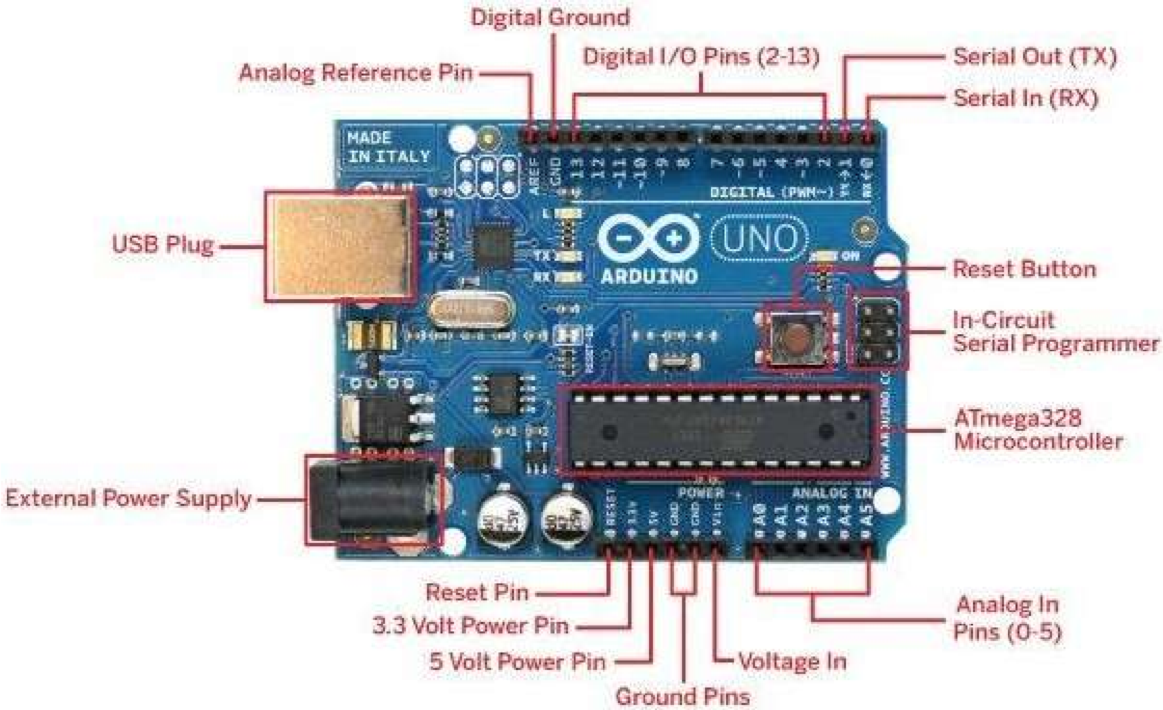

Figure 4.3: Arduino Uno

4.3.1 SPECIFICATIONS

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14
- PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)
- UART: 1
- I2C: 1
- SPI: 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
- ICSP Header: Yes
- Power Sources: DC Power Jack, USB Port and the VIN pin (+5 volt only)

4.3.2 PIN FUNCTIONS

- 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 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.

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pinMode(), digitalWrite(), and digitalRead() 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 analogReference() 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 analogWrite() 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.

4.3.3 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 SoftwareSerial library allows serial communication on any of the Uno's digital pins.

4.3.4 APPLICATIONS

- Real time biometrics
- Robotic applications
- Academic applications

4.4 FIRE SENSOR

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

4.4.1 WORKING PRINCIPLE

This sensor/detector can be built with an electronic circuit using a receiver like electromagnetic radiation. This sensor uses the infrared flame flash method, which allows the sensor to work through a coating of oil, dust, water vapor, otherwise ice.

4.4.2 FLAME SENSOR MODULE

The pin configuration of this sensor is shown below. It includes four pins which include the following. When this module works with a microcontroller unit then the pins are shown in figure 4.4: fire sensor

Figure 4.4: Fire Sensor

- Pin1 (VCC pin): Voltage supply rages from 3.3V to 5.3V
- Pin2 (GND): This is a ground pin
- Pin3 (AOUT): This is an analog output pin (MCU.IO)
- Pin4 (DOUT): This is a digital output pin (MCU.IO)
- Different Types
- Flame-sensors are classified into four types
- IR multi-spectrum
- UV flame detectors
- UV/ IR flame detectors

4.4.3 FEATURES & SPECIFICATIONS

The features of this sensor include the following.

- Photosensitivity is high
- Response time is fast
- Simple to use
- Sensitivity is adjustable
- Detection angle is 600,

- It is responsive to the flame range.
- Accuracy can be adjustable
- Operating voltage of this sensor is 3.3V to 5V
- Analog voltage o/ps and digital switch o/ps
- The PCB size is 3cm X 1.6cm
- Power indicator & digital switch o/p indicator
- If the flame intensity is lighter within 0.8m then the flame test can be activated, if the flame intensity is high, then the detection of distance will be improved.

4.5 MQ135 SENSOR

AIR QUALITY SENSOR-MQ13

The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element, as shown in figure 4.5: MQ135 Gas Sensor Circuit Diagram.

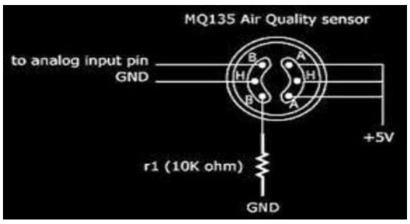

Figure 4.5: MQ135 Gas Sensor Circuit Diagram

This changes the resistance of the sensing element which alters the value of the current going out of it.

Pin Configuration MQ-135 gas sensor from left to right first pins are as follows:

- A0 Analog output
- D0 Digital output
- GND Ground
- Vcc Supply (5V)

4.5.1 SPECIFICATIONS OF MQ-135 GAS SENSOR

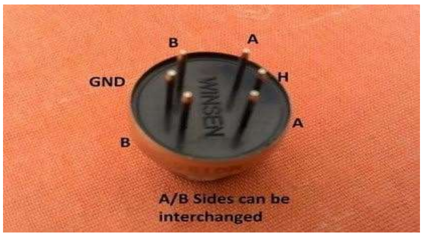

Figure 4.6: MQ135 Gas Sensor Pin Diagram

- Wide detecting scope
- Fast response and High sensitivity
- Stable and long-life Simple drive circuit
- Used in air quality control equipment for buildings/offices, is suitable for detecting of NH3, NOx, alcohol, Benzene, smoke, CO2, etc.
- Size: 35mm x 22mm x 23mm (length x width x height)
- Working voltage: DC 5 V
- Signal output instruction.
- Dual signal output (analog output, and high/low digital output)
- 0 ~ 4.2V analog output voltage, the higher the concentration the higher the voltage.

It is 6 terminal device which is symmetric in terminal placement; both the sides of the terminal are interchangeable. Here is the illustration of pins:

4.5.2 Here is a basic connection diagram

Two ‘A’ pins are shorted internally and two ‘B’ pins are shorted internally. H and H pins is heater coil of the sensor. The heater coil is used to heat up the air around the sensor, so that it can detect the chemical content in the air optimally.The sensor can take up to few minutes to heat up to reach optimal working condition. It not advisable to touch the sensor while operating because it can get pretty warm. The sensor has an operating voltage of 5V; the sensor must be powered from external sources only, as it consumes about 200mA for heating. The Arduino voltage regulator can’t deliver this much current, as shown in figure 4.7: MQ135 Gas Sensor.

Figure 4.7: MQ135 Gas Sensor

For testing, you can connect an ammeter in mA range at the output pin B and bring a cigar gas lighter. Try to leak the gas without igniting it near the sensor. As the concentration of gas rises around the sensor, the current flow through ammeter increases. If this works, your sensor is working normally.

4.6 MEMS SENSOR

MEMS - Micro-Electromechanical Systems

MEMS are low-cost, and high accuracy inertial sensors and these are used to serve an extensive range of industrial applications. This sensor uses a chip-based technology namely micro-electro-mechanical-system. These sensors are used to detect as well as measure the external stimulus like pressure, after that it responds to the pressure which is measured pressure with the help of some mechanical actions.

The best examples of this mainly include revolving of a motor for compensating the pressure change. The MEMS IC fabrication can be done with silicon, whereby slight material layers are placed otherwise fixed onto a Si substrate. After that selectively fixed away to leave microscopic 3D structures like diaphragms, beams, levers, springs, and gears mems-ic, as shown in figure 4.8: MEMS Sensor.

Figure 4.8: MEMS Sensor

The MEMS fabrication needs many techniques which are used to construct other semiconductor circuits like oxidation process, diffusion process, ion implantation process, low-pressure chemical vapor deposition process, sputtering, etc. Additionally, these sensors use a particular process like micromachining.

4.6.1 MEMS SENSOR WORKING PRINCIPLE

Whenever the tilt is applied to the MEMS sensor, then a balanced mass makes a difference within the electric potential. This can be measured like a change within capacitance. Then that signal can be changed to create a stable output signal in digital, 4-20mA or VDC. These sensors are fine solutions to some applications which do not demand the maximum accuracy like industrial automation, position control, roll, and pitch measurement, and platform leveling.

Types of MEMS

The common types of MEMS sensors are obtainable within the market are

- MEMS accelerometers
- MEMS gyroscopes
- MEMS pressure sensors
- MEMS magnetic field sensors

4.7 VIBRATION SENSOR

Piezoelectric/Vibration Sensors

The Piezoelectric effect is an effect in which energy is converted between mechanical and electrical forms. It was discovered in the 1880's by the Curie brothers. Specifically, when a pressure (piezo means pressure in Greek) is applied to a polarized crystal, the resulting mechanical deformation results in an electrical charge. Piezoelectric microphones serve as a good example of this phenomenon. Microphones turn an acoustical pressure into a voltage. Alternatively, when an electrical charge is applied to a polarized crystal, the crystal undergoes a mechanical deformation which can in turn create an acoustical pressure. An example of this can be seen in piezoelectric speakers. (These are the cause of those annoying system beeps that are all too common in today's computers), as shown in figure 4.9: Internal Structure of an electret.

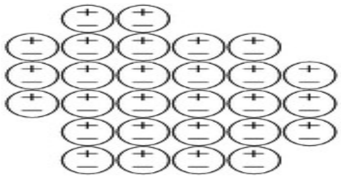

Figure 4.9: Internal Structure of an electret

Electrets are solids which have a permanent electrical polarization. (These are basically the electrical analogs of magnets, which exhibit a permanent magnetic polarization). Figure 3 shows a diagram of the internal structure of a electret.

In general, the alignment of the internal electric dipoles would result in a charge which would be observable on the surface of the solid. In practice, this small charge is quickly dissipated by free charges from the surrounding atmosphere which are attracted by the surface charges. Electrets are commonly used in microphones.

Permanent polarization as in the case of the electrets is also observed in crystals. In these structures, each cell of the crystal has an electric dipole, and the cells are oriented such that the electric dipoles are aligned. Again, this results in excess surface charge which attracts free charges from the surrounding atmosphere making the crystal electrically neutral. If a sufficient force is applied to the piezoelectric crystal, a deformation will take place. This deformation disrupts the orientation of the electrical dipoles and creates a situation in which the charge is not completely canceled. This results in a temporary excess of surface charge, which subsequently is manifested as a voltage which is developed across the crystal, as shown in figure 4.10: A sensor based on the piezoelectric effect**.**

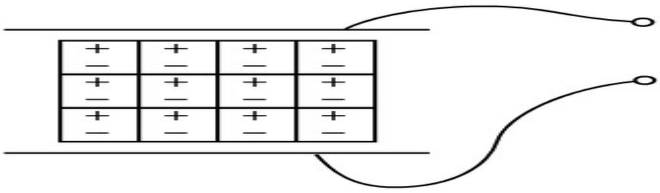

Figure 4.10: A sensor based on the piezoelectric effect

In order to utilize this physical principle to make a sensor to measure force, we must be able to measure the surface charge on the crystal. Figure 4 shows a common method of using a piezoelectric crystal to make a force sensor. Two metal plates are used to sandwich the crystal making a capacitor. As mentioned previously, an external force causes a deformation of the crystal results in a charge which is a function of the applied force. In its operating region, a greater force will result in more surface charge. This charge results in a voltage , where is the charge resulting from a force *f*, and *C* is the capacitance of the device.

In the manner described above, piezoelectric crystals act as transducers which turn force, or mechanical stress into electrical charge which in turn can be converted into a voltage. Alternatively, if one was to apply a voltage to the plates of the system described above, the resultant electric field would cause the internal electric dipoles to re-align which would cause a deformation of the material. An example of this is the fact that piezoelectric transducers find use both as speakers (voltage to mechanical) and microphones (mechanical to electrical), as shown in figure 4.11: Vibration Sensor.

Figure 4.11: Vibration Sensor

4.8 EYE BLINK SENSOR- IR SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors erasure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation, as shown in figure 4.12: IR Sensor.

Figure 4.12: IR Sensor

IR - INFRARED SENSOR

These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

4.8.1 WORKING PRINCIPLE

The working principle of an infrared sensor is similar to the object detection sensor. This sensor includes an IR LED & an IR Photodiode, so by combining these two can be formed as a photo-coupler otherwise optocoupler. The physics laws used in this sensor are planks radiation, Stephan Boltzmann & weins displacement.

IR LED is one kind of transmitter that emits IR radiations. This LED looks similar to a standard LED and the radiation which is generated by this is not visible to the human eye. Infrared receivers mainly detect the radiation using an infrared transmitter. These infrared receivers are available in photodiodes form. IR Photodiodes are dissimilar as compared with usual photodiodes because they detect simply IR radiation. Different kinds of infrared receivers mainly exist depending on the voltage, wavelength, package, etc.

Once it is used as the combination of an IR transmitter & receiver, then the receiver's wavelength must equal the transmitter. Here, the transmitter is IR LED whereas the receiver is IR photodiode. The infrared photodiode is responsive to the infrared light that is generated through an infrared LED. The resistance of photo-diode & the change in output voltage is in proportion to the infrared light obtained. This is the IR sensor's fundamental working principle.

Once the infrared transmitter generates emission, then it arrives at the object & some of the emission will reflect back toward the infrared receiver. The sensor output can be decided by the IR receiver depending on the intensity of the response.

4.8.2 TYPES OF INFRARED SENSOR

Infrared sensors are classified into two types like active IR sensor and passive IR sensor.

ACTIVE IR SENSOR

This active infrared sensor includes both the transmitter as well as the receiver. In most of the applications, the light-emitting diode is used as a source. LED is used as a non-imaging infrared sensor whereas the laser diode is used as an imaging infrared sensor. These sensors work through energy radiation, received & detected through radiation. Further, it can be processed by using the signal processor to fetch the necessary information. The best examples of this active infrared sensor are reflectance and break beam sensor.

PASSIVE IR SENSOR

The passive infrared sensor includes detectors only but they don't include a transmitter. These sensors use an object like a transmitter or IR source. This object emits energy and detects through infrared receivers. After that, a signal processor is used to understand the signal to obtain the required information.

The best examples of this sensor are pyroelectric detector, bolometer, thermocouple-thermopile, etc. These sensors are classified into two types like thermal IR sensor and quantum IR sensor. The thermal IR sensor doesn't depend on wavelength. The energy source used by these sensors is heated. Thermal detectors are slow with their response and detection time.

4.8.3 IR SENSOR CIRCUIT DIAGRAM

An infrared sensor circuit is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real-time. This circuit comprises the following components

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo-ohms.
- Variable resistors.
- LED (Light Emitting Diode).

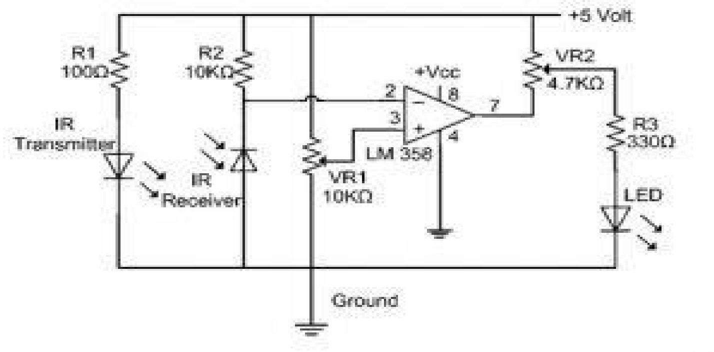

Figure 4.13: IR Sensor Circuit Diagram

INFRARED SENSOR CIRCUIT DIAGRAM

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analysed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as a comparator circuit. When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus, the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives a signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing.

Resistor R1 (100), R2 (10k), and R3 (330) are used to ensure that a minimum of 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

4.8.4 IR SENSOR CIRCUIT USING TRANSISTOR

The circuit diagram of the IR sensor using transistors namely obstacle detection using two transistors is shown below. This circuit is mainly used for obstacle detection using an IR LED. So, this circuit can be built with two transistors like NPN and PNP. For NPN, BC547 transistor is used whereas, for PNP, BC557 transistor is used. The pinout of these transistors is the same, as shown in figure 4.14: IR Sensor Circuit using Transistor.

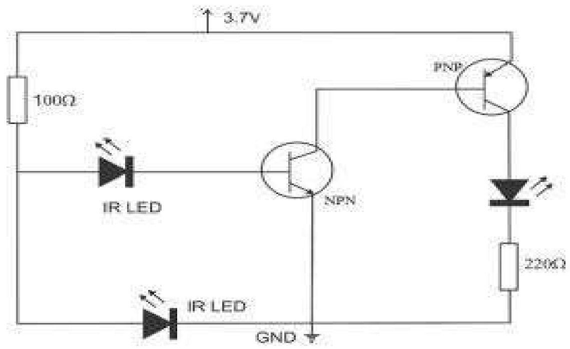

Figure 4.14: IR Sensor Circuit using Transistor

INFRARED SENSOR CIRCUIT USING TRANSISTORS

In the above circuit, one infrared LED is always switched on whereas the other infrared LED is allied to the PNP transistor's base terminal because this IR LED acts as the detector. The required components of this IR sensor circuit include resistors 100 ohms & 200 ohms, BC547 & BC557 transistors, LED, IR LEDs-2. The step by step procedure of how to make the IR sensor circuit includes the following steps.

- Connect the components as per the circuit diagram using required components
- Connect one infrared LED to the BC547 transistor's base terminal
- Connect an infrared LED to the base terminal of the same transistor.
- Connect the 100Ω resistor toward the residual pins of the infrared LEDs.
- Connect the base terminal of the PNP transistor toward the collector terminal of the NPN transistor.
- Connect the LED & 220Ω resistor as per the connection in the circuit diagram.
- Once the connection of the circuit is done then gives the power supply to the circuit for testing.

CIRCUIT WORKING

Once the infrared LED is detected, then the reflected light from the thing will activate a small current that will supply throughout the IR LED detector. This will activate the NPN transistor & the PNP; therefore the LED will switch ON. This circuit is applicable for making different projects like automatic lamps to activate once person approaches close to the light.

4.8.5 BURGLAR ALARM CIRCUIT USING IR SENSOR

This IR burglar alarm circuit is used at entries, doors, etc. This circuit gives a buzzer sound to alert the concerned person whenever someone crosses throughout the IR ray. When the IR rays are not visible to humans, then this circuit works as a hidden safety device. As show in figure 4.15: Burglar Alarm Circuit using IR Sensor.

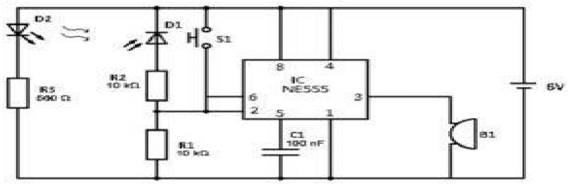

Figure 4.15: Burglar Alarm Circuit using IR Sensor

BURGLAR ALARM CIRCUIT USING IR SENSOR

The required components of this circuit mainly includes NE555IC, resistors R1 & R2 = 10k & 560, D1 (IR photodiode), D2 (IR LED), C1 Capacitor (100nF), S1 (push switch),B1(Buzzer)&6vDCSupply.

This circuit can be connected by arranging the infrared LED as well as the infrared sensors on the door opposite to each other. So that IR ray can fall on the sensor properly. Under normal conditions, the infrared ray drops always over the infrared diode & the output condition at pin-3 will stay in the low condition. This ray will be interrupted once a solid object crosses the ray. When the IR ray smashes, the circuit will activate & the output turns to ON condition. The output condition remains till it retunes by shutting the switch that means, when the interrupt of the ray is detached then an alarm remains ON. To avoid others from deactivating the alarm, the circuit or reset switch must be located distant or out of sight from the infrared sensor. In this circuit, a ‘B1’ buzzer is connected to produce sound with an inbuilt sound and this inbuilt sound can be replaced with an alternative bells otherwise loud siren based on the requirement.

4.9BUZZER

A buzzer is a device used to produce sound when triggered by the microcontroller. The buzzer is connected to the relay out and the relay out is controlled by the Arduino. When the Arduino gives a trigger to relay the buzzer goes high and gives the tone. There are two types of buzzers Active and Passive, as shown figure 4.16: Buzzer.

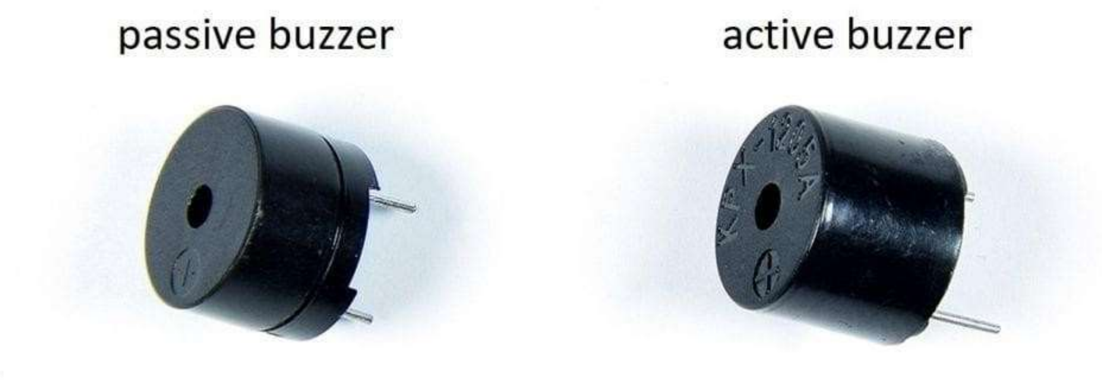

Figure 4.16: Buzzer

4.10 GSM

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz, It is estimated that many countries outside of Europe will join the GSM partnership.

Cellular is one of the fastest growing and most demanding telecommunications applications. Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. This presented many problems directly related to compatibility, especially with the development of digital radio technology. The GSM standard is intended to address these problems.

From 1982 to 1985 discussions were held to decide between building an analog or digital system. After multiple field tests, a digital system was adopted for GSM. The next task was to decide between a narrow or broadband solution. In May 1987, the narrowband time division multiple access (TDMA) solution was chosen.

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware, as shown in figure 4.17: GSM Block Diagram.

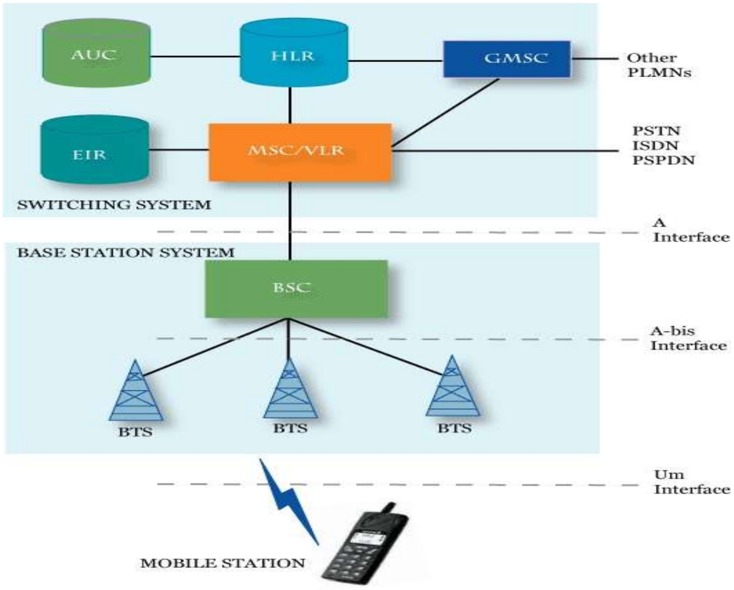

Figure 4.17: GSM Block Diagram

The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS).

4.10.1 GSM Summery

The Switching System:

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The switching system includes the following functional units.

- Home Location Register (HLR) —The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.

- Mobile Services Switching Center (MSC) —The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.
- Visitor Location Register (VLR) —The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

Authentication Center (AUC)

A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

Equipment Identity Register (EIR)

The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

The Base Station System (BSS):

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

- BSC —The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.
- BTS —The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.

The Operation and Support System:

The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS). The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional, and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations.

Additional Functional Elements:

- Message Center (MXE) —The MXE is a node that provides integrated voice, fax, and data messaging. Specifically, the MXE handles short message service, cell broadcast, voice mail, fax mail, e-mail, and notification.
- Mobile Service Node (MSN) —The MSN is the node that handles the mobile intelligent network (IN) services.
- Gateway Mobile Services Switching Center (GMSC) —A gateway is a node used to interconnect two networks. The gateway is often implemented in an MSC. The MSC is then referred to as the GMSC.
- GSM Interworking Unit (GIWU) —The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR
- GSM Cellular Network:

  GSM-900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction (downlink), providing 124 RF channels (channel numbers 1 to 124) spaced at 200 kHz. Duplex spacing of 45 MHz is used. In some countries the GSM-900 band has been extended to cover a larger frequency range. This 'extended GSM', E-GSM, uses 880–915 MHz (uplink) and 925–960 MHz (downlink), adding 50 channels (channel numbers 975 to 1023 and 0) to the original GSM-900 band. Time division multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots (giving eight burst periods) grouped into what is called a TDMA frame.

Half rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms.

GSM has used a variety of voice codecs to squeeze 3.1 kHz audio into between 5.6 and 13 kbit/s. Originally, two codecs, named after the types of data channel they were allocated, were used, called Half Rate (5.6 kbit/s) and Full Rate (13 kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codecs also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal

GSM Network Classification:

There are five different cell sizes in a GSM network—macro, micro, Pico, femto and umbrella cells.

The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Pico cells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femto cells are cells designed for use in residential or small business environments and connect to the service provider’s network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred meters to several tens of kilometers. The longest distance the GSM specification supports in practical use is 35 kilometers (22 mi). There are also several implementations of the concept of an extended cell, where the cell radius could be double or even more, depending on the antenna system, the type of terrain and the timing advance.

Indoor coverage is also supported by GSM and may be achieved by using an indoor pico cell base station, or an indoor repeater with distributed indoor antennas fed through power splitters, to deliver the radio signals from an antenna outdoors to the separate indoor distributed antenna system. These are typically deployed when a lot of call capacity is needed indoors, for example in shopping centers or airports. However, this is not a prerequisite, since indoor coverage is also provided by in-building penetration of the radio signals from nearby cells. The modulation used in GSM is Gaussian minimum-shift keying (GMSK), a kind of continuous-phase frequency shift keying. In GMSK, the signal to be modulated onto the carrier is first smoothed with a Gaussian low-pass filter prior to being fed to a frequency modulator, which greatly reduces the interference to neighboring.

SUBSCRIBER IDENTITY MODULE

Figure 5.18: Subscriber Identity Module

GSM TRANSMITTER

One of the key features of GSM is the Subscriber Identity Module (SIM), commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking, and is illegal in some countries.

GSM security:

GSM was designed with a moderate level of security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted. The development of UMTS introduces an optional USIM, that uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user - whereas GSM only authenticates the user to the network (and not vice versa). The security model therefore offers confidentiality and authentication, but limited authorization capabilities, and no non-repudiation. GSM uses several cryptographic algorithms for security. The A5/1 and A5/2 stream ciphers are used for ensuring over-the-air voice privacy. A5/1 was developed first and is a stronger algorithm used within Europe and the United States; A5/2 is weaker and used in other countries. Serious weaknesses have been

found in both algorithms: it is possible to break A5/2 in real-time with a cipher text-only attack, and in February 2008, Pico Computing, Inc revealed its ability and plans to commercialize FPGAs that allow A5/1 to be broken with a rainbow table attack [1]. The system supports multiple algorithms so operators may replace that cipher with a stronger one.

GSM MODEMS AND MODULES

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier, as shown in figure 4.19: GSM Module.

Sim300 GSM Module (GSM / GPRS: SIM300)

Figure 4.19: GSM Module

4.10.2 DETAILED MODEM DESCRIPTION

The Sim300 is a Tri-Brand GSM GPRS solution in a compact plug-in module.

Featuring an industry-standard interface, the sim300 delivers GSM GPRS 900 1800 1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. The leading features of Sim300 make it ideal for virtually unlimited application, such as WLL applications (Fixed Cellular Terminal), M2M application, handheld devices and much more.

1) Sim300 is a Tri-band GSM GPRS module with a size of 40x33x2. 85mm

2) Customized MMI and keypad LCD support

3) An embedded Powerful TCP IP protocol stack

4) Based upon mature and field-proven platform, backed up by our support service, from definition to design and production.

4.11 GPS

Definition: The term GPS full form is "Global Positioning System" which is a satellite navigation system that furnishes location and time information in all climate conditions to the user. GPS is used for navigation in planes, ships, cars, and trucks also. The system gives critical abilities to military and civilian users around the globe. GPS provides continuous real-time, 3-dimensional positioning, navigation, and timing worldwide, as shown in figure 4.20: GPS Device.

Figure 4.20: GPS Device

4.10.1 GPS SUMMERY

How does GPS System Work?

The GPS consists of three segments:

- The space segment: the GPS satellites
- The control system, operated by the U.S. military,
- The user segment, which includes both military and civilian users and their GPS equipment.

Space Segment:

The space segment is the number of satellites in the constellation. It comprises 29 satellites circling the earth every 12 hours at 12,000 miles in altitude. The function of the space segment is utilized to route/navigation signals and to store and retransmit the

route/navigation message sent by the control segment. These transmissions are controlled by highly stable atomic clocks on the satellites. The GPS Space Segment is formed by a satellite constellation with enough satellites to ensure that the users will have, at least, 4 simultaneous satellites in view from any point at the Earth's surface at any time.

Control Segment

The control segment comprises a master control station and five monitor stations outfitted with atomic clocks that are spread around the globe. The five monitor stations monitor the GPS satellite signals and then send that qualified information to the master control station where abnormalities are revised and sent back to the GPS satellites through ground antennas. The control segment also referred to as a monitor station.

User Segment

The user segment comprises the GPS receiver, which receives the signals from the GPS satellites and determines how far away it is from each satellite. Mainly this segment is used for the U.S military, missile guidance systems, civilian applications for GPS in almost every field. Most of the civilians use this from survey to transportation to natural resources and from there to agriculture purpose and mapping too.

How Accurate GPS is?

At present, GPS receivers are very accurate and their accuracy mainly depends on numerous variables which include the ionosphere, the available satellites, the urban environment, etc. There are some factors that obstruct GPS accuracy like the following.

Physical Obstructions

The measurements of arrival time can be skewed through large masses such as buildings, mountains, trees, etc.

Atmospheric Effects:

GPS devices mainly affected by solar storms, heavy storm cover, Ionospheric delays, etc.

Ephemeris:

In a satellite, the orbital model could be inaccurate otherwise outdated, even though this is becoming increasingly rare.

Numerical Miscalculations:

This might be a feature once the hardware of the device is not planned to conditions.

Artificial Interference:

Artificial interference mainly comprises spoofs or GPS jamming devices. In open places, the accuracy of the device is high with no contiguous big buildings that can obstruct signals. So, this effect is called an urban canyon. Once a device is enclosed through large buildings, first the satellite signal can be blocked, after that bounced off a tall building, wherever it is lastly read through the device to result in faults of the satellite distance.

Fortunately, the issues faced by GPS technology have been recognized & are nearing resolution. Here, the accuracy provided by the receivers with high quality is better than 2.2-meter level accuracy within 95% of cases & superior as compared to 3-meter accuracy within 99% of cases.

How GPS Determines a Position

The working/operation of the Global positioning system is based on the 'trilateration' mathematical principle. The position is determined from the distance measurements to satellites. From the figure, the four satellites are used to determine the position of the receiver on the earth. The target location is

confirmed by the 4th satellite. And three satellites are used to trace the location place.
A fourth satellite is used to confirm the target location of each of those space vehicles. The global positioning system consists of a satellite, control station, and monitor station, and receiver. The GPS receiver takes the information from the satellite and uses the method of triangulation to determine a user's exact position.

GPS is used on some incidents in several ways, such as:

- To determine position locations; for example, you need to radio a helicopter pilot the coordinates of your position location so the pilot can pick you up.
- To navigate from one location to another; for example, you need to travel from a lookout to the fire perimeter.
- To create digitized maps; for example, you are assigned to plot the fire perimeter and hot spots.
- To determine the distance between two different points.

Other GPS Systems:

There are different GPS systems available around the world like GNSS (Global Navigation Satellite System. The GNSS system is classified into four types like GPS by the US, GLONASS by Russia, Galileo by EU, BeiDou by China. In addition, there are two regional systems like QZSS by Japan & IRNSS/NavIC by India.

GPS System Trackers:

Generally, there are four kinds of GPS trackers available where some trackers are used for tracking vehicles and others are used for monitoring people.

Personal Trackers:

These trackers are mainly used to monitor people/pets. Generally, these trackers use a personal device namely a pocket chip otherwise bracelet to work. After that, the devices will be turned ON. Once they turned ON, operators can remotely place & track the device.

The GPS tracking devices used for dogs are called GPS-equipped collars. These devices play a key role to track pets like dogs. So these collars give peace of mind as owners can continually track & place their dogs.

Asset Trackers:

Asset trackers such as tiny radio chips to big satellite tags are used for non-vehicular items like personal trackers. This kind of tracking is used in supermarkets in order to stop a burglary. So a new solution for this is asset tracking.

Once using these trackers, cart theft in supermarkets can be decreased. In addition, some trackers will increase by recognizing items within the cart, matching them to the loyalty card of the buyer & sharing that through the advertising team!

Cell-based Vehicle Tracking:

This kind of tracking can be done through either satellite/cellular networks which are almost certainly one of the most common kinds of GPS tracking. This kind of tracking is frequently used as compared to satellite tracking. This kind of system utilizes a device to capture data from the vehicle & after that reports the data by using cell towers. As compared to satellite tracking, this kind of vehicle tracking is less costly & reports quicker. Generally, delivery companies utilize GPS tracking to make simpler the workflow of customer service like calling their vehicle & ask for their place to inform their customers.

Satellite-based Vehicle Tracking:

As compared to satellite-based vehicle tracking, cell-based tracking systems will not work properly as the towers of cells are occupied. Satellite tracking provides the best solution to this trouble because these networks can obtain updates from the most remote areas. An Alaskan trucking corporation mainly covers distant areas. The main GPS tracking challenge is to get updates even once cell towers are not accessible. These trackers provide stable updates which were utilized by vehicle drivers to call for help once their cell phones didn’t function.

Sources of GPS Signal Errors:

GPS signal & its accuracy can be affected through the following factors

Ionosphere & Troposphere Delays:

Satellite signals get slow because they flow throughout the atmosphere. So this system utilizes a fixed model to partially correct the error.

Signal Multipath:

The GPS signal may reflect off objects like big rock surfaces, tall buildings before it arrives at the receiver to enhance the signal's travel time & cause mistakes.

Receiver CLK Errors:

An in-built GPS clock in the receiver may include small timing mistakes as it is low accurate as compared to atomic clocks over GPS satellites.

Orbital Errors:

The reported place of the satellite may not be correct.

Number of Satellites Noticeable:

The accuracy mainly depends on when a GPS receiver notices a number of satellites. Once a signal is blocked, then you may get location errors. Usually, GPS units will not work underground, however, new receivers with high-sensitivity are capable to follow some signals once in buildings otherwise under tree-cover.

Satellite Geometry or Shading:

Satellite signals are very effective once satellites are placed at broad angles instead of in a tight grouping or line.

Selective Availability:

Once the U.S. DoD is applied SA (Selective Availability) to satellites, then signals will be less accurate to maintain ‘enemies’ by using GPS signals which are extremely accurate. To enhance the accuracy for civilian GPS receivers, then the government turned off Selective Availability in the year 2000, which enhanced the civilian GPS receiver’s accuracy.

4.11.2 Codes & Services of GPS

Every GPS satellite is used to transmit two signals with different frequencies like L1 & L2. A simple technique like Trilateration is used to find the location like the Longitude, Latitude & Elevation of the GPS receiver. This technique is also used to measure the location of an unidentified point using three identified points

GPS Codes

GPS codes are available in two types like the following.

- C/A code or Coarse Acquisition Code
- P-Code or Precise Code

The C/A code can be defined as the signal with ‘L1’ frequency is changed through 1.023 Mbps pseudo-random bit series and it is utilized by the public. Similarly, the signal with ‘L2’ frequency can be changed with a 10.23 Mbps pseudo-random bit series, so this is known as precise code. This code is mainly utilized in military positioning systems. Usually, this type of code is transmitted within an encrypted format, called Y code.The P-code provides superior measurement as compared to coarse acquisition code, as the bit rate of this code is higher as compared to the bit rate of Coarse Acquisition Code.

GPS Services:

GPS system provides two kinds of services like the following.

- PPS or Precise Positioning Service
- SPS or Standard Positioning Service

The precise positioning service receivers always track the two codes like C/A code & P-code on both the signals with two frequencies like L1 & L2. At the receiver, the Y-code is decrypted to get P-code whereas, SPS receivers track simply coarse acquisition code on a signal with L1.

Using a GPS Receiver:

In the GPS system, there exists simply one-way communication from satellite to consumers. So, each user does not require the transmitter, however simply a GPS receiver. It is mostly utilized to discover the precise location of an entity. It executes this task through the signals obtained from satellites. The GPS receiver's block diagram is shown below where each block's function is present within the receiver that is stated below.

Receiving Antenna:

This antenna gets the satellite signals and it is mostly an antenna with circularly polarized.

LNA (Low Noise Amplifier):

This kind of amplifier amplifies the weak received signal

Down Converter:

This kind of converter changes the signal's frequency which is received to an IF (Intermediate Frequency) signal.

IF Amplifier:

This kind of amplifier is used to change the IF (Intermediate Frequency) signal.

ADC:

Analog to digital converter is used to perform the signal conversion from analog to digital. Analyze the two blocks namely the sampling as well as quantization which are present within Analog to Digital Converter.

DSP:

The digital signal processor produces the coarse acquisition code.

Microprocessor:

The microprocessor executes the computation of position & gives the timing of the signal to manage the process of adding digital blocks. It transmits the useful data toward the display unit to exhibit it on the display.

There are several different models and types of GPS receivers. While working with a GPS receiver it is important to have:

- A compass and a map.
- A downloaded GPS cables.
- Some extra batteries.
- Knowledge about the memory capacity of the GPS receiver to prevent loss of data, decrease inaccuracy of data, or other problems.
- An external antenna whenever possible, especially under the tree canopy, in canyons, or while driving.
- A setup GPS receiver according to incident or agency standard regulation; coordinate system.
- Notes that describe what you are saving in the receiver.

GPS Error:

There are many sources of possible errors that will degrade the accuracy of positions computed by a GPS receiver. The travel time taken by the GPS satellite signals can be changed by atmospheric effects; when a GPS signal passes through the ionosphere and troposphere it is refracted, causing the speed of the signal to be different from the speed of a GPS signal in space. Another source of error is noise, or distortion of the signal which causes electrical interference or errors inherent in the GPS receiver itself. The information about satellite orbits will also cause errors in determining the positions because the satellites are not really where the GPS receiver "thought" based on the information it received when they determine the positions. Small variations in the atomic clocks onboard the satellites can translate to large position errors; a clock error of 1 nanosecond translates to 1 foot or 3 meters user error on the ground.

A multipath effect occurs when signals transmitted from the satellites bounce off a reflective surface before getting to the receiver antenna. During this process, the receiver gets the signal in a straight-line path as well as the delayed path (multiple paths). The effect is similar to a ghost or double image on a TV set.

Geometric Dilution of Precision (GDOP):

Satellite geometry can also affect the accuracy of GPS positioning. This effect is referred to as the Geometric Dilution of Precision (GDOP). Which is refers to where the satellites are about one another and is a measure of the quality of the satellite configuration. It can be able to modify other GPS errors. Most GPS receivers select the satellite constellation that will give the least uncertainty, the best satellite geometry.

GPS receivers usually report the quality of satellite geometry in terms of Position Dilution of Precision, or PDOP. PDOP is of two types, horizontal (HDOP) and vertical (VDOP) measurements (latitude, longitude, and altitude). We can check the quality of the satellite positioning the receiver is currently available by the PDOP value.

A low DOP indicates a higher probability of accuracy, and a high DOP indicates a lower probability of accuracy. Another term of PDOP is TDOP (Time Dilution of Precision). TDOP refers to the satellite clock offset. A GPS receiver can set a parameter known as the PDOP mask. This will cause the receiver to ignore satellite configurations that have a PDOP higher than the limit specified.

Selective Availability (SA):

Selective Availability occurs when the DOD intentionally degraded; the accuracy of GPS signals is introducing artificial clock and ephemeris errors. During the implementation of SA, it was the largest component of GPS error, causing an error of up to 100 meters. SA is a component of the Standard Positioning Service (SPS).

4.12 DC Motor

A DC motor is an electrical device that converts direct current electrical energy into mechanical energy. The definition gives above suggests that a DC motor is any electric motor that utilizes direct current, or DC. This motor used like engine when accident occurs the DC motor stop runs. When the drowsiness is detected by the Eye blinking Sensor the engine will stop. In this instead of engine, we use the motor, as shown in figure 4.21: DC Motor.

Figure 4.21: DC Motor

4.13 SUMMERY

This are hardware components are used to built the system to prevent and detect the accidents. Hardware components are used to made the real time system. The Arduino Uno ATmega-328P is connected with respective sensors like IR Sensor, Fire Sensor, MEMS Sensor, MQ135 Gas Sensor, Vibration Sensor, Buzzer, DC Motor it started to reads the values of the recorded in the time of event of accident occurs it sends the GPS exact the location to particular contact number by using the GSM module. Wireless Black Box is used to store the data in the event occur. IR Sensor is used to drowsiness of the driver. Black Box is used in the investigation time, crash litigation, driver performance, vehicle maintenance.

CHAPTER 5
SOFTWARE DESCRIPTION

5.1 INTRODUCTION

The idea of software components formalizes the definition of these "smaller parts". A software component is basically a software unit with a well-defined interface and explicitly specified dependencies. A software component can be as small as a block of reusable code, or it can be as big as an entire application.

5.2 ARDUINO IDE COMPILER

The Arduino Integrated Development Environment (IDE) is cross-platform application (for Windows, macros, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.

The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

In October 2019 the Arduino organization began providing early access to a new Arduino Pro IDE with debugging and other advanced features. Once the software has been installed on your computer, go ahead and open it up. This is the Arduino IDE and is the place where all the programming will happen.

Take some time to look around and get comfortable with it, as shown in figure 5.1: Arduino Window Describe.

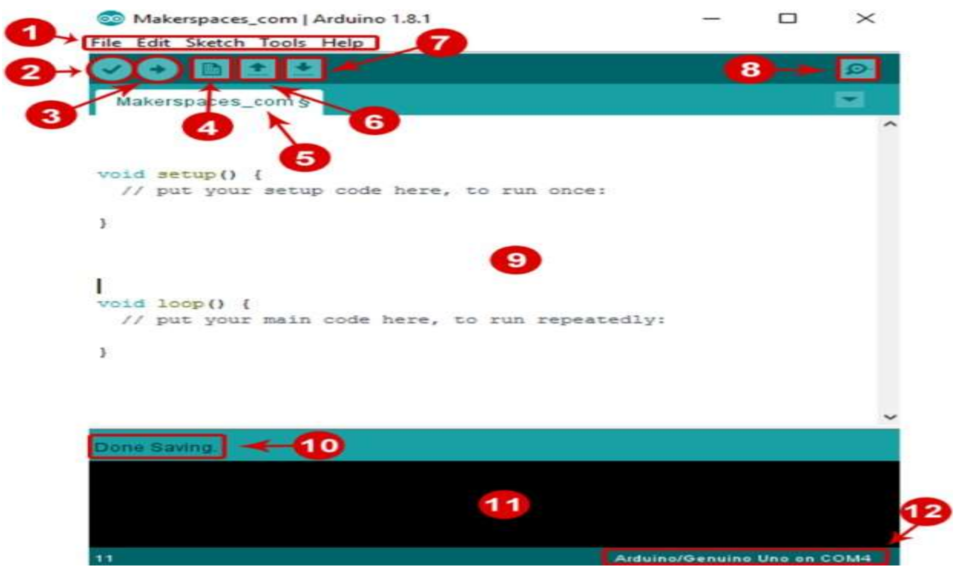

Figure 5.1: Arduino Window Describe

1. **Menu Bar:** Gives you access to the tools needed for creating and saving Arduino sketches.
2. **Verify Button:** Compiles your code and checks for errors in spelling or syntax.
3. **Upload Button:** Sends the code to the board that's connected such as Arduino Uno in this case. Lights on the board will blink rapidly when uploading.
4. **New Sketch:** Opens up a new window containing a blank sketch.
5. **Sketch Name:** When the sketch is saved, the name of the sketch is displayed here.
6. **Open Existing Sketch:** Allows you to open a saved sketch or one from the stored examples.
7. **Save Sketch:** This saves the sketch you currently have open.
8. **Serial Monitor:** When the board is connected, this will display the serial information of your Arduino
9. **Code Area:** This area is where you compose the code of the sketch that tells the board what to do.
10. **Message Area:** This area tells you the status on saving, code compiling, errors and more.
11. **Text Console:** Shows the details of an error messages, size of the program that was compiled and additional info.

12. **Board and Serial Port:** Tells you what board is being used and what serial port it's connected to.

Connect Your Arduino Uno

At this point you are ready to connect your Arduino to your computer. Plug one end of the USB cable to the Arduino Uno and then the other end of the USB to your computer's USB port. Once the board is connected, you will need to go to Tools then Board then finally select Arduino Uno, as shown in figure 5.2: Arduino Tools Describe.

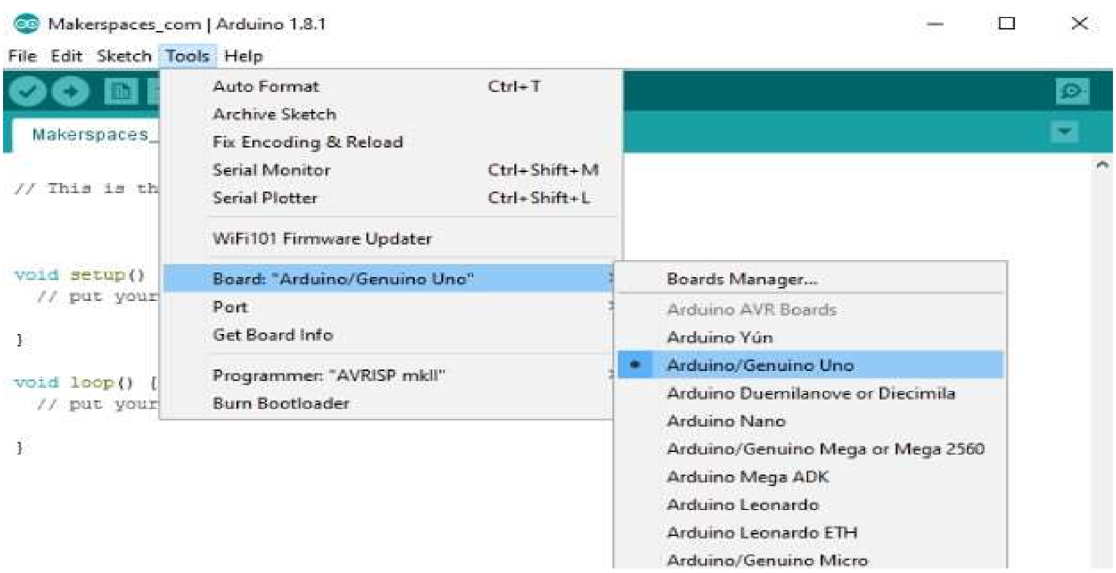

Figure 5.2: Arduino Tools Describe

Next, you have to tell the Arduino which port you are using on your computer. To select the port, go to Tools then Port then selects the port that says Arduino, as shown in figure 5.3: Arduino Tools Describe Port.

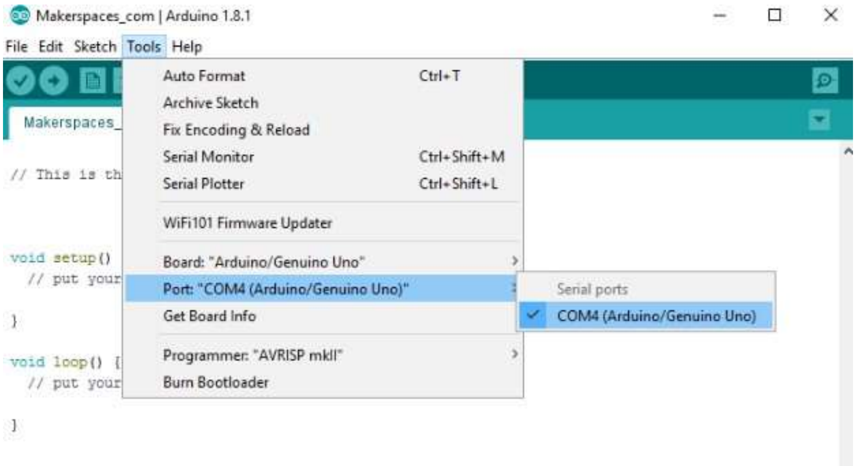

Figure 5.3: Arduino Tools Describe Port

5.3 ARDUINO UNO INSTALLATION

In these we will get know of the process of installation of Arduino IDE and connecting Arduino Uno to Arduino IDE.

STEP 1

First we must have our Arduino board (we can choose our favorite board) and a

USB cable. In case we use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega

2560 or Diecimila, we will need a standard USB cable (A plug to B plug) In case we use Arduino Nano, we will need an A to Mini-B cable.

STEP 2 - Download Arduino IDE Software.

We can get different versions of Arduino IDE from the Download page on the Arduino Official website. We must select WinRAR software, which is compatible with operating system (Windows, IOS, or Linux).

After WinRAR file download is complete, unzip the file, as shown in figure 5.4: Arduino Zip Download.

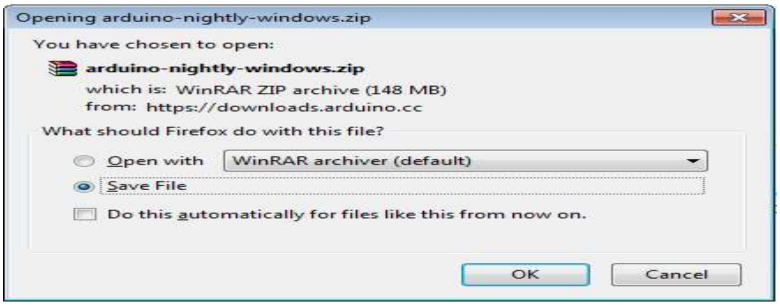

Figure 5.4: Arduino Zip Download

STEP 3 - Power up our board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If we are using an Arduino Diecimila, we have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port.

Connect the Arduino board to computer using the USB cable. The green power
LED (labeled PWR) should glow.

STEP 4 - Launch Arduino IDE

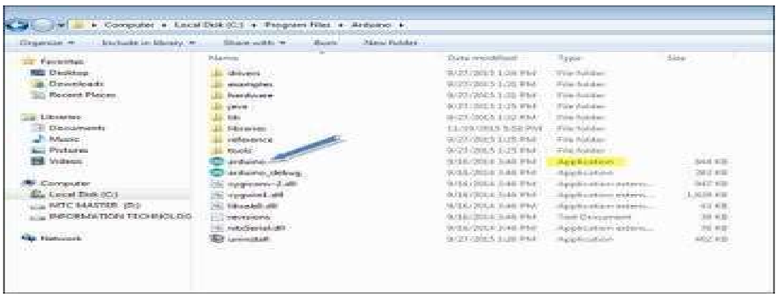

Figure 5.5: Launch Arduino Window

After our Arduino IDE software is downloaded, we need to unzip the folder. Inside the folder, we can find the application icon with an infinity label (application.exe). Double click the icon to start the IDE.

STEP 5 - Open our first project.

Once the software starts, we have two options

* Create a new project

* Open an existing project example.

✓ To create a new project, select File → New.

✓ To open an existing project example, select File → Example → Basics → Blink.

Here, we are selecting just one of the examples with the name Blink. It turns the

LED on and off with some time delay. We can select any other example from the list, as shown in figure 5.6: Open New File.

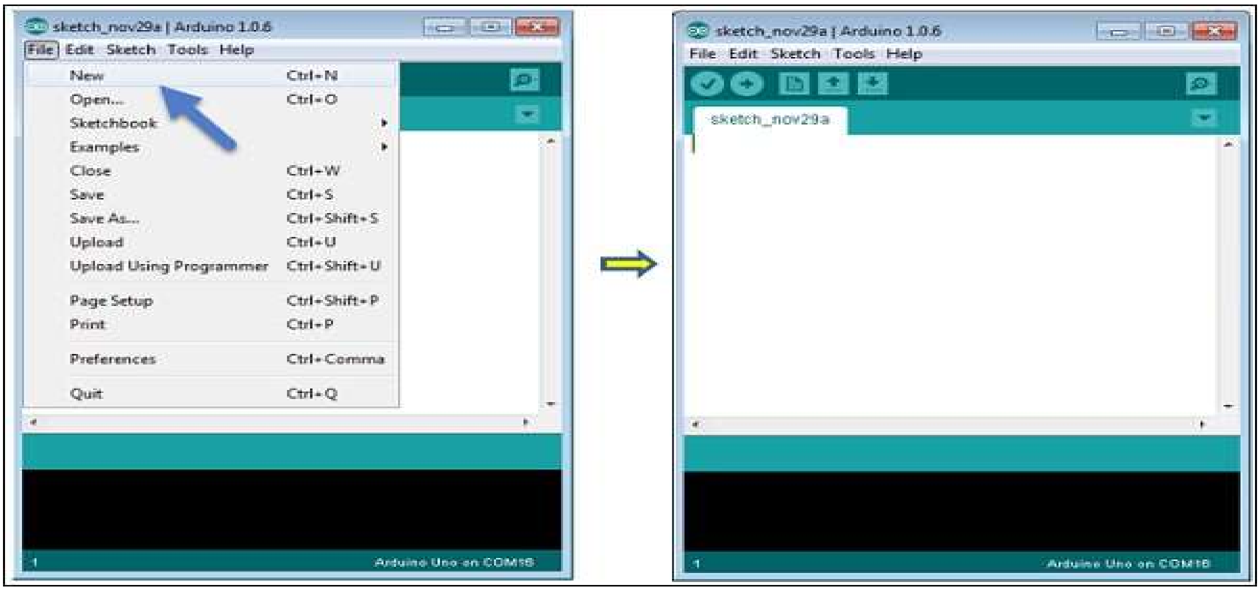

Figure 5.6: Open New File

STEP 6 - Select our Arduino board.

To avoid any error while uploading program to the board, we must select the correct Arduino board name, which matches with the board connected to computer.

Go to Tools → Board and select Arduino Uno.

Here, we have selected Arduino Uno board according to our tutorial, but we must select the name matching the board that we are using, as shown in figure 5.7: Tools Select Arduino Uno

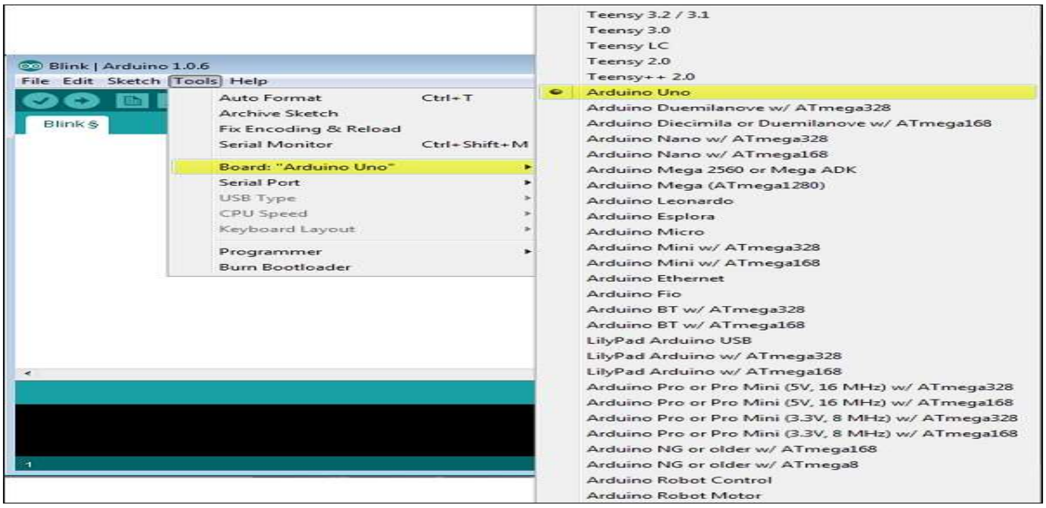

Figure 5.7: Tools Select Arduino Uno

STEP 7 - Select serial port.

Select the serial device of the Arduino board.

Go to Tools → Serial Port menu.

This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, we can disconnect Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port, as shown in figure 5.8: Tools Select Serial Port.

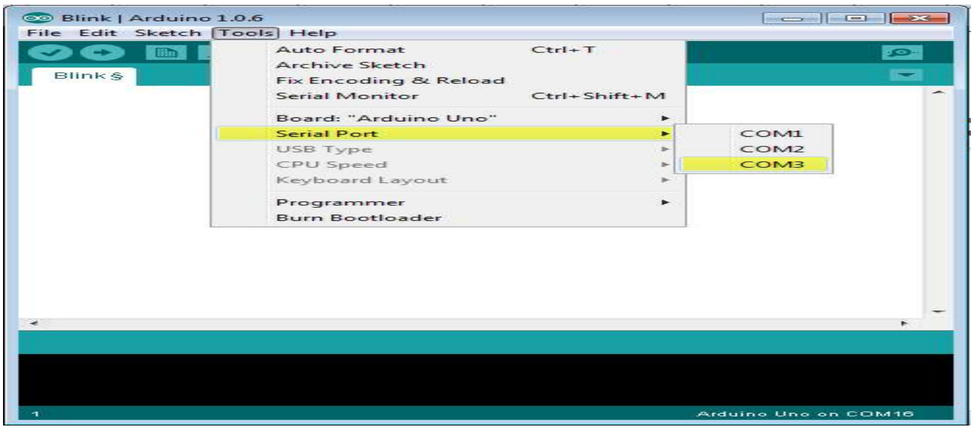

Figure 5.8: Tools Select Serial Port

STEP 8 - Upload the program to Arduino board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar, as shown in figure 5.9: Arduino Buttons.

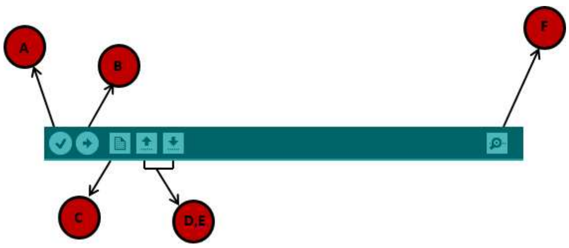

Figure 5.9: Arduino Button

A − Used to check if there is any compilation error.

B − Used to upload a program to the Arduino board.

C − Shortcut used to create a new sketch.

D − Used to directly open one of the example sketches.

E − Used to save sketch.

F − Serial monitor used to receive serial data from the board and send the serial data to

the board.

Now, simply click the "Upload" button in the environment. Wait a few seconds; we will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.

Note − If we have an Arduino Mini, NG, or other board, we need to press the reset button physically on the board, immediately before clicking the upload button on the Arduino Software.

5.4 EMBEDDED C LANGUAGE

The language: Embedded C

Embedded C is not part of the C language as such. Rather, it is a C language extension that is the subject of a technical report by the ISO working group named "Extensions for the Programming Language C to Support Embedded Processors" [3]. It aims to provide portability and access to common performance-increasing features of processors used in the domain of DSP and embedded processing. The Embedded C specification for fixed-point, named address spaces, and named registers gives the programmer direct access to features in the target processor, thereby significantly improving the performance of applications. The hardware I/O extension is a portability feature of Embedded C. Its goal is to allow easy porting of device-driver code between systems.

History

The initial development of C occurred at AT&T Bell Labs between 1969 and 1973; according to Ritchie, the most creative period occurred in 1972. It was named "C" because many of its features were derived from an earlier language called "B", which according to Ken Thompson was a stripped down version of the BCPL programming language.

The origin of C is closely tied to the development of the Unix operating system, originally implemented in assembly language on a PDP-7 by Ritchie and Thompson, incorporating several ideas from colleagues. Eventually they decided to port the operating system to a PDP-11. B's lack of functionality to take advantage of some of the PDP-11's features, notably byte addressability, led to the development of an early version of the C programming language

The original PDP-11 version of the Unix system was developed in assembly language. By 1973, with the addition of struct types, the C language had become powerful enough that most of the Unix kernel was rewritten in C. This was one of the first operating system kernels implemented in a language other than assembly. (Earlier instances include the Multics system (written in PL/I), and MCP (Master Control Program) for the Burroughs B5000 written in ALGOL in 1961.)

5.5 Comparison of Assembly Language and C

The table below further demonstrates an objective comparison between the C and the Assembly language.

```
Assembly                      |  C
______________________________|______________________________
; Use a name instead of a num |  /* Use a name instead of a num */
COUNT:  EQU  5                |  #define COUNT 5
;_____________________________|  /*____________________________*/
;start a program              |  /* To start a program */
CODE:  section  .text         |  main()
     org   $0800              |  {
     lds   #$0A00             |  }
;_____________________________|  /*____________________________*/
;allocate two bytes for       |  /* Allocate two bytes for
;a signed number              |   * a signed number */
                              |
```

```
DATA: section .data          |
     org     $0900           |
i:    ds.w    1              |  int i;
j:    dc.w    $1A00          |  int j = 0x1a00;
;____________________________|  /*____________________________*/
;allocate two bytes for      |  /* Allocate two bytes for
;an unsigned number          |   * an unsigned number */
i:    ds.w    1              |  unsigned int i;
j     dc.w    $1A00          |  unsigned int j = 0x1a00;
;____________________________|  /*____________________________*/
;allocate one byte for       |  /* Allocate one byte for
;an signed number            |   * an signed number */
                             |
i:    ds.b    1              |  signed char i;
j:    dc.b    $1F            |  signed char j = 0x1f;
;____________________________|  /*____________________________*/
;Get a value from an address |  /* Get a value from an address */
                             |
i:  ds.b   1                 |  unsigned char i;
                             |
   ldx    $E000              |  i = *(unsigned char *) 0xE000;
   ldaa   0,x                |
   staa   i                  |
;____________________________|  /*____________________________*/
; Use a variable to store    |  /* Use a variable as a pointer
; an address                 |     (address) */
i:   ds.b  1                 |  unsigned char *ptr, i;
```

```
ptr: ds.b  1                |
    ldd   #$E000            |  ptr = (unsigned char *) 0xE000;
    std   ptr               |
    ldx   ptr               |  i = *ptr;
    ldaa  0,x               |
    staa  i                 |
    ldx   ptr               |  *ptr = 0x55;
    ldaa  #$55              |
    staa  0,x               |
;______________________|  /*____________________*/
;To call a subroutine       |  /* To call a function */
  ldaa  i                   |  sqrt(i);
  jsr   sqrt                |
;______________________|  /*____________________*/
;To return from a subroutine |  /* To return from a function */
  ldaa  j                   |  return j;
  rts                       |
;______________________|  /*____________________*/
;Flow control               |  /* Flow control */
   blo                      |  if (i < j)
   blt                      |  if (i < j)
   bhs                      |  if (i >= j)
   bge                      |  if (i >= j)
```

PROTEUS STIMULATOR

Many CAD users dismiss schematic capture as a necessary evil in the process of creating PCB layout but we have always disputed this point of view. With PCB layout now offering automation of both component placement and track routing, getting the design into the computer can often be the most time-consuming element of the exercise. And if you use circuit simulation to develop your ideas, you are going to spend even more time working on the schematic.

ISIS has been created with this in mind. It has evolved over twelve years research and development and has been proven by thousands of users worldwide. The strength of its architecture has allowed us to integrate first conventional graph-based simulation and now - with PROTEUS VSM - interactive circuit simulation into the design environment. For the first time ever, it is possible to draw a complete circuit for a micro-controller-based system and then test it interactively, all from within the same piece of software. Meanwhile, ISIS retains a host of features aimed at the PCB designer, so that the same design can be exported for production with ARES or other PCB layout software.

For the educational user and engineering author, ISIS also excels at producing attractive schematics like you see in the magazines. It provides total control of drawing appearance in terms of line widths, fill styles, colours and fonts. In addition, a system of templates allows you to define a 'house style' And to copy the appearance of one drawing to another.

Other general features include:

- Runs on Windows 2k and XP.
- Automatic wire routing and dot placement/removal.
- Powerful tools for selecting objects and assigning their properties.

- Total support for buses including component pins, inter-sheet terminals, module ports and wires.
- Bill of Materials and Electrical Rules Check reports.
- Netlist outputs to suit all popular PCB layout tools.

For the 'power user', ISIS incorporates a number of features which aid in the management of large designs. Indeed, a number of our customers have used it to produce designs containing many thousands of components.

· Hierarchical design with support for parameterized component values on sub-circuits.

· Design Global Annotation allowing multiple instances of a sub-circuit to have different component references.

· Automatic Annotation - the ability to number the components automatically.

· ASCII Data Import - .this facility provides the means to automatically bring component stock codes and costs into ISIS design or library files where they can then be incorporated or even totaled up in the Bill of Materials report.

5.6 SYSTEM REQUIREMENTS:

Performance in ISIS is scaleable according to your computer specification. The following are the recommended minimums requirements:

- 1GHz or faster Intel Pentium processor (AMD processors fine but less optimised).
- Graphics card supporting OpenGL Version 2.0 or higher and multi-sampling (MSAA).
- 256Mb RAM (recommended 512Mb).
- Windows 2000 or later.

In particular, note that if your graphics card does not satisfy the above requirements the software will run in Windows GDI mode. This means that display of the screen is handled by Windows and not your graphics hardware and therefore that some features of the software will not be available.

As a general rule, manufacturer graphics cards such as ATI and NVIDEA will satisfy these requirements whilst chipset graphics such as those supplied by Intel will not.

5.7 SUMMERY

This are software components to a software component is basically a software unit with a well-defined interface and explicitly specified dependencies. A software component can be as small as a block of reusable code, or it can be as big as an entire application.

CHAPTER 6

RESULT & DISCUSSION

6.1 RESULT

The output of the system delivers the updated information of the vehicle when event of the accident occurs. It sends the short message to particular family member, emergency medical services, hospitals and police station. The data is used to analysis the accident by in the time of accidents occurs, as shown in figure 6.1: Implementation of the system.

Figure 6.1: Implementation of the System

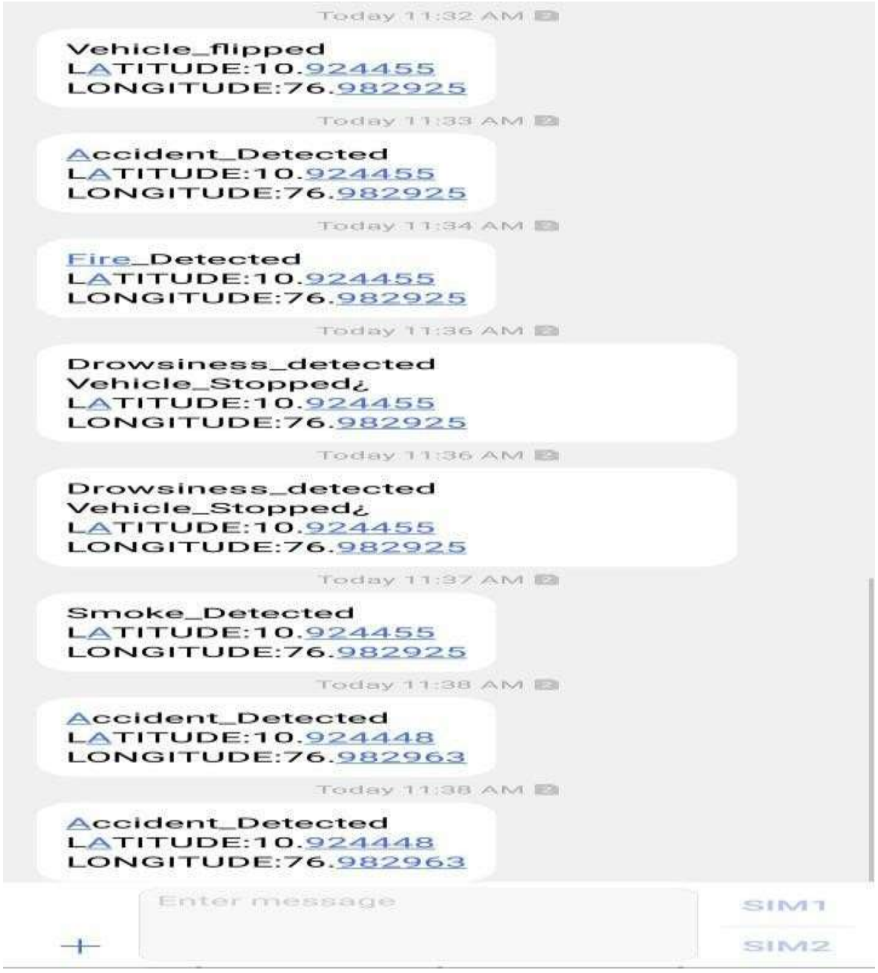

Figure 6.2: Message received from the System

6.2 ADVANTAGES

- Used to identify fire or poisonous gas.
- Used to give medical facility immediately after an accident
- Easy to locate with the help of GPS.
- Cost efficient and effective.
- Easy to install and use

CHAPTER 7

CONCULSION & FUTURE SCOPE

7.1 CONCULSION

The proposed system is highly efficient system for accident analysis. Event Data Recorded as the black box is officially called as, slowly gains an important device in investigation of vehicle accidents. It is possible to retrieve the data from the Black Box easily. By recording the events and actions of the driver including speed, seat belt etc. seconds before the collision, the automobile black box will undoubtedly help both the police and insurance companies in reconstruction of the events before the accident. This data also has the potential to augment data in crash databases, by providing information especially relating to system performances. This is also very helpful as emergency aids can be provided as soon as possible. The system requires a few sensors, GPS, GSM and camera. The system would serve as an effective source of information when an accident occurs automobile black box provides necessary data to generate the report of accident and about its causes. This Automobile Black Box system designed may be enforced in any vehicle.

7.2 FUTURE SCOPE

- This device can be connected to a vehicle's airbag system, which shields passengers in side from hitting things like the steering wheel or windows.
- This can also be accomplished by attaching a camera to the controller module, which will snap a picture of the accident scene and facilitate simpler tracking.

APPENDIX

Source Code

```
//BLACK BOX//
#include <LiquidCrystal.h>
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
SoftwareSerial GPS_SoftSerial(4,5);/* (Rx, Tx) */
TinyGPSPlus gps;



#define gas_sen A0
#define mems_sen A1
#define vibration_sen A5
#define eyeblink_sen 2
#define fire_sen 3
#define buzzer 6
#define motor 7

volatile float minutes, seconds;
volatile int degree, secs, mins;
double lat_val, lng_val, alt_m_val;
uint8_t hr_val, min_val, sec_val;
bool loc_valid, alt_valid, time_valid;

int vib_count=0,eye_blink_count=0;
```

```
int
gas_sen_val,vibration_sen_val,mems_sen_val,eyeblink_sen_val,fire_sen_val;
const int rs =13,en =12,d4 =11,d5 =10, d6 =9,d7 =8;
LiquidCrystal lcd(rs, en, d4, d5, d6,
d7);

void gps_read();
void smartDelay(unsigned long ms);
void DegMinSec( double tot_val);
void adc_read();
void digital_read();
void gsm_write(String x);

void setup() {
Serial.begin(9600);
GPS_SoftSerial.begin(9600);

lcd.begin(16,2);

pinMode(gas_sen,INPUT);
pinMode(vibration_sen,INPUT);
pinMode(mems_sen,INPUT);
pinMode(eyeblink_sen,INPUT);
pinMode(fire_sen,INPUT);
pinMode(buzzer,OUTPUT);
pinMode(motor,OUTPUT);
}
```

```
void loop() {
 delay(500);
 adc_read();
 digital_read();
 gps_read();
 lcd.clear();
 lcd.setCursor(0,0);
// lcd.print("v:");
// lcd.print(vib_count);
  lcd.print("Lat:");
  lcd.print(lat_val, 6);
  lcd.setCursor(0,1);
//  lcd.print("VV:");
//  lcd.print(vibration_sen_val);
  lcd.print("Lon:");
  lcd.print(lng_val,6);
 if (fire_sen_val==1)
  {
  gsm_write("Fire_Detected");
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Fire_Detected");
  }
 if (vibration_sen_val==0)
  {
  vib_count++;
```

```
}
if(vib_count==2)
{
 gsm_write("Accident_Detected");
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Accident_Detected");
 vib_count=0;
}
if (gas_sen_val>=400)
{
 gsm_write("Smoke_Detected");
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Smoke_Detected");
}
if (mems_sen_val>300)
{
 gsm_write("Vehicle_flipped");
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Vehicle_flipped");
}
 if (eyeblink_sen_val==1)
{
 eye_blink_count++;
}
```

```
if(eye_blink_count==3)
 {
  digitalWrite(buzzer,HIGH);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Drowsiness_detected");
 }
  else if(eye_blink_count==5)
  {
   gsm_write("Drowsiness_detected  Vehicle_Stopped` ");
   digitalWrite(buzzer,LOW);
   digitalWrite(motor,HIGH);
  eye_blink_count=0;
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Drowsiness_detected");
  lcd.setCursor(0,1);
  lcd.print("Vehicle_stopped");
  }
}

void adc_read()
{
 gas_sen_val=analogRead(gas_sen);
 mems_sen_val=analogRead(mems_sen);
 vibration_sen_val=analogRead(vibration_sen);
}
```

```
void digital_read()
{

fire_sen_val=digitalRead(fire_sen);
eyeblink_sen_val=digitalRead(eyeblink_sen);

}
void gsm_write(String x )

{
  String a=x;
 delay(2000);
 Serial.print("at+cmgs=\"+919052142468\"\r"); // number to receive msg
 delay(1000);
 Serial.println(a);
 Serial.print("LATITUDE:");
 delay(100);
 Serial.println(lat_val, 6);
 Serial.print("LONGITUDE:");
 delay(100);
 Serial.print(lng_val,6);
 delay(100);
 Serial.print((char)26);
 delay(1000);
}

void gps_read()
```

```
{
        smartDelay(1000);
        unsigned long start;

        lat_val = gps.location.lat();
        loc_valid = gps.location.isValid();
        lng_val = gps.location.lng();
        alt_m_val = gps.altitude.meters();
        alt_valid = gps.altitude.isValid();
        hr_val = gps.time.hour();
        min_val = gps.time.minute();
        sec_val = gps.time.second();
        time_valid = gps.time.isValid();
        if (!loc_valid)
        {
          Serial.print("Latitude : ");
          Serial.println("*****");
          Serial.print("Longitude : ");
          Serial.println("*****");
        }
        else
        {
          DegMinSec(lat_val);
          Serial.print("Latitude in Decimal Degrees : ");
          Serial.println(lat_val,6);
//          lcd.setCursor(0,0);
//          lcd.print("lat:");
```

```
//          lcd.print(lat_val, 6);
          DegMinSec(lng_val); /* Convert the decimal degree value into degrees
minutes seconds form */
          Serial.print("Longitude in Decimal Degrees : ");
          Serial.println(lng_val,6);
        }
        if (!alt_valid)
        {
         // Serial.print("Altitude : ");
          //Serial.println("*****");
        }
        else
        {
         // Serial.print("Altitude : ");
         // Serial.println(alt_m_val, 6);
        }
        if (!time_valid)
        {
         // Serial.print("Time : ");
          //Serial.println("*****");
        }
        else
        {
          char time_string[32];
          sprintf(time_string, "Time : %02d/%02d/%02d \n", hr_val, min_val,
sec_val);
          //Serial.print(time_string);
```

```
        }
}
void smartDelay(unsigned long ms)
{
  unsigned long start = millis();
  do
  {
    while (GPS_SoftSerial.available()) /* Encode data read from GPS while
data is available on serial port */
      gps.encode(GPS_SoftSerial.read());
/* Encode basically is used to parse the string received by the GPS and to
store it in a buffer so that information can be extracted from it */
  } while (millis() - start < ms);
}

void DegMinSec( double tot_val)   /* Convert data in decimal degrees into
degrees minutes seconds form */
{
  degree = (int)tot_val;
  minutes = tot_val - degree;
  seconds = 60 * minutes;
  minutes = (int)seconds;
  mins = (int)minutes;
  seconds = seconds - minutes;
  seconds = 60 * seconds;
  secs = (int)seconds;
}
```

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