A PROJECT REPORT

ON

"MOUNTAIN CLIMBER'S HEALTH AND GPS TRACKING SYSTEM"

SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS OF DEGREE OF

BACHELOR OF ENGINEERING

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2022-23

Certificate

This is to certify that the Major Project entitled "**Mountain Climber Health and GPS Tracking System"**is a bonafide work of **Krutika Bhagane, Nikhil Bhosale, Abhishek Gambre** submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **"Undergraduate"** in **"Computer Engineering".**

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Project Report Approval for B.E

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Date:

Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included. We have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will because for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Krutika Bhagane

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Abhishek Gambre

Date:

Abstract

Mountaineering has always been a very adventurous & enthusiastic activity. But with adventure comes risk. Mountain climbers are always at the risk of accidents. If any such accident happens at high altitudes or remote locations, search and rescue operations are sometimes unsuccessful. As, the search and rescue team doesn’t know the location of the accident or search & rescue team doesn’t know if the person is alive or not, and if alive, what is his condition.

This project allows to track vitals of climbers in real time as well as monitor their location over IOT. This provides the live Heartbeat monitoring, GPS Location Tracking, Altimeter, Fall detection and Barometer sensor to sense the condition of a mountaineer, monitoring them and transmitting this over the IOT for live monitoring in a form of SMS to mountaineers configured/saved contact number's device.

Abbreviations

IOT – Internet Of Thing

GSM - Global System for Mobile Communication

ICT - Information and Communications Technologies

GPS - Global Positioning System

LCD – Liquid Crystal Display

SMS - Short Message Service

ECG - Electro-cardiogram

IDE - Integrated Development Environment

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Chapter 1

Introduction

1.1 Background

Mountaineering has continuously been a really adventurous & glowing activity. However with journey comes risk. Mountain climbers square measure continuously beneath risk of accidents. Once any such accident happens at high altitudes or remote locations, search and rescue operations aren't continuously thriving because The news of accident takes hours or maybe days of reach search & rescue team, search and rescue team doesn't recognize the placement of the accident, search & rescue team doesn't recognize if the person is alive or not, and if alive what's his condition. The sensible adventurer permits for groups to trace organ of climbers in real time still as monitor their location over IOT.

The smart mountain climber allows for teams to track vitals of climbers in real time as well as monitor their location over IOT. The system makes use of a Heartbeat and temperature sensor with at mega controller, Wifi module, LCD Display and GSM Module with Power supply to develop this system. The pulse sensor is use to sense the user heart rate and transmit it to the controller.

1.2 Motivation

As this project is mainly focused for mountain climbers to examine their live health condition and keep a track on there actual position. This project provided awareness about the importance of Information and Communications Technologies (ICTs) in healthcare as well. A health tracker lets you watch and record your heart rate. Also, a such tracking system allows a healthcare provider to log and monitor the progress of a person through the provision of care during their journey and stay there. Health monitoring provides a track of any aspect of a structure's health by reliably measured data and analytical simulations in conjunction with heuristic experience so that the current and expected future performance of the composite part for at least the most critical limit events, can be described in a proactive manner throughout the mountain climbing journey. Whereas for position tracking GPS(Global Positioning System) is required to keep a track on a live position of a mountain climber. With the help of important aspects of Real-Time Tracking, Route Replay, Climbers Behaviour Tracking , Improved ETA's, etc in GPS, It provides the ability to track the behaviour of a mountain climber and share their location with their respective partner.

1.3 Objective

To overcome the higher than limitation, to attain the amount of goals, the most objectives of this analysis are going to be as follows:

- Keeps a track on live health condition.
- Added SMS alert in case of limit crossings.
- Tracks the actual location using GPS and Altimeter.
- Analysis the atmospheric pressure at certain position using barometer.

Our primary objective in doing this project is to build a device for a mountain climber to analyse the live health condition and positioning. A device which provides a climber to keep a track on their physical activity using pulsometer, oximeter, temperature sensor for health tracking and for position tracking using GPS, altimeter, barometer. Therefore, we decided to make a device to provide such features in a form of working prototype model.

Chapter 2

Literature Survey

2.1 Basic Terminologies

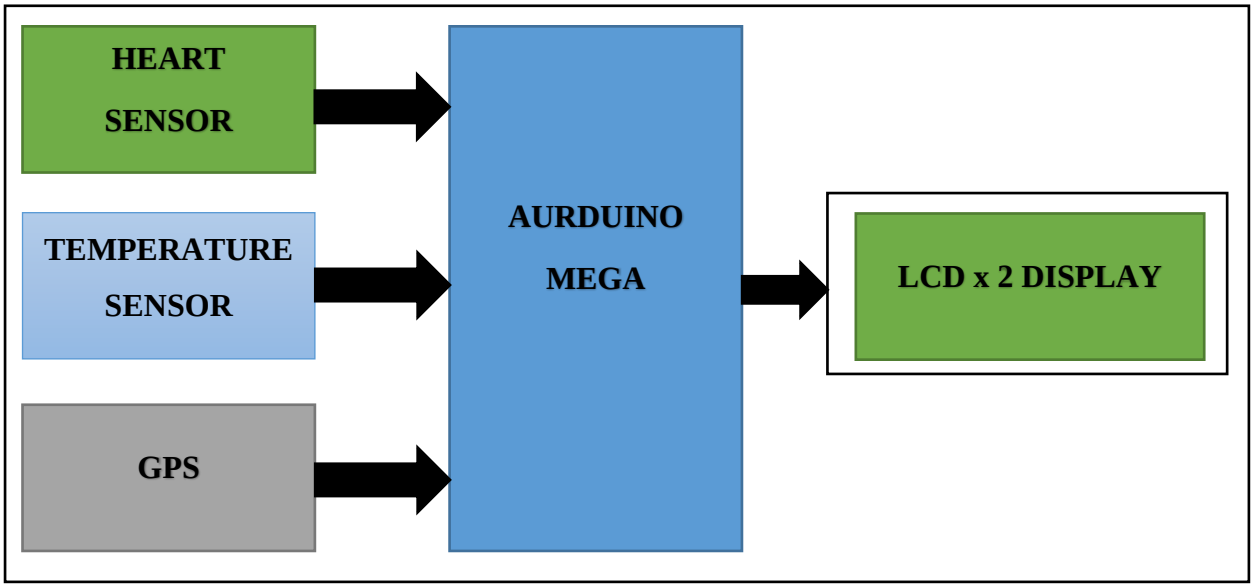

Figure 2.1 Basic Implementation

In this Project the main components are health monitoring using heart pulse sensor and GPS for Position tracking. we have designed a Heart Rate Monitor System using Arduino and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor, working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor.

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. Heart rate is simply measured by placing the thumb over the subject's arterial pulsation, and feeling, timing and counting the pulses. Electro-cardiogram (ECG) is one of the frequently used methods for measuring the heart rate. But it is also an expensive device. Other devices in the form of wrist watches are also available for the instantaneous measurement of the heart rate. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Such devices can give accurate measurements but their cost is usually in excess of several thousand rupees, making them uneconomical. So, the proposed heart rate monitor with a heart-beat sensor is definitely a useful instrument for finding the pulse and the temperature for a mountain climber.

The Global Positioning System (GPS) is a satellite-based navigation system that consists of 24 orbiting satellites, each of which makes two circuits around the Earth every 24 hours. These satellites transmit three bits of information – the satellite's number, its position in space, and the time the information is sent. These signals are picked up by the GPS receiver, which uses this information to calculate the distance between it and the GPS satellites.

2.2 Existing system

Figure 2.2 Health Monitoring and GPS Tracking Gadgets

For monitoring actual condition of a climber and tracking its position we require certain gadget. Gadgets like Smart watch offering features through sensors like pulse heart rate sensor, calorie counter, GPS tracking, temperature sensors and others gadget like GPS mobile phones which are specially build to track the exact location of a person.

Advantages and Features of certain gadgets:-

- Live Heartbeat Monitoring
- Upper & Lower Limit Settings
- IOT Live Vitals Display
- GPS Location Tracking
- Live monitoring results are displayed

Drawback:-

The major drawback of the follow existing system is that there pricing. The gadgets provided in the market are much expensive and they provide particular form of feature. A normal trekker would find it difficult to purchase different gadget which provide individually and respective form of feature.

2.3 Survey Table:-

Sr.no	Title	Author	Description
1.	Monitoring the health and Position Tracking 2017	Niket patil & Brijesh lyer	The paper reports an Internet of Thing (IoT) based health monitoring and tracking system.
2.	Development of IoT Heartbeat and Body Temperature Monitoring System 2020	Vipa Thananant, thanakorn Khunkhao	The portable measuring device can measure the heart rate and body temperature. The device uses Arduino board that connects to the heartbeat and temperature sensor.
3.	Design of Portable Barometric Altimeter System 2022	Su Zhihua, Yan Lihong	Improvement on the detection accuracy and sensitivity of the air pressure height, this paper completes the design and implementation of the air pressure height detection system based on the air pressure sensor SCP1000-D01
4.	IoT Based Fall Detection Monitoring and Alarm System 2020	Akash Gupta, Rohini Shrivastav, Himanshu Gupta, Basant Kumar	A complete algorithm has been designed for the detection of genuine fall.

Table 2.3 Survey Table

2.4 Problem Statement

For Mountain Climbing having proper technical training and being in excellent physical shape are critical to be a successful mountaineering experience. But, before you head out on your mountaineering trip, you need to be sure you're equipped with the right gear, clothing, monitoring and navigation tools or devices. As there may be some mountaineers, likely to be fall sick though out their journey. So, this project focuses on the a typical mountain climber providing them a device which keep a track on their physical condition. Preventing a mountain climber to face any critical condition and providing them some medical aid accordingly.

As this project is contribute towards the mountain climbers while they are trekking. Providing them a device which keeps on monitoring the health condition and track the actual live position through sensors and GPS tracking components respectively.

As per the given existing system, gadgets like Smart watch provide features of heart pulse monitoring and GPS tracking. Also a dedicated GPS mobile device/gadget which keeps a accurate live tracking on the movements of a person/climber. But the major drawback is the pricing at which a individual device provides the feature respectively. For example, a single GPS tracking gadget which provides greater feature of tracking a persons position would cost around 6000rs. to 8000rs. INR.

Taking such drawback into consideration, this project is made for budget mountain climbers.

Chapter 3
Requirement Gathering

3.1 Software and Hardware Requirements

Software:-

Arduino:-

Figure 3.1 Arduino Software

Arduino is an open - source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool developed in Go.

The Arduino project began in 2005 as a tool for students at the Interaction Design Institute Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

Hardware:-

Arduino mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Applications:-

- Embedded Design & Development
- Industrial
- Communications & Networking
- Sensing & Instrumentation
- Automation &
- Process Control

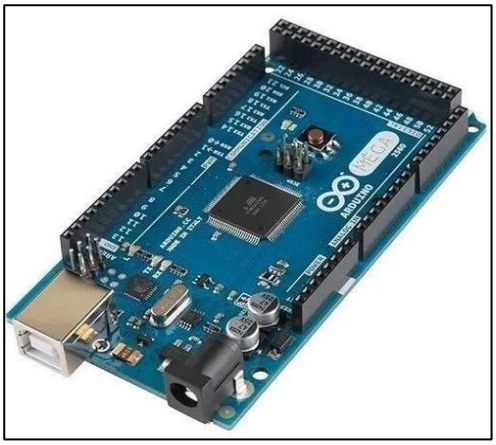

Figure 3.2 Arduino Mega 2560

LCD 16x2 screen

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Applications:-

- Temperature display
- Time display
- Any project that requires a simple display

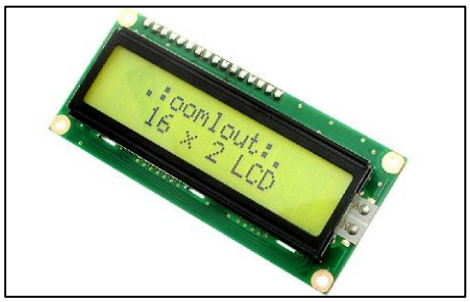

Figure 3.3 LCD 16x2 screen16x2

Pulsometer, Oximeter(MAX30100)

The MAX30100 is an integrated pulse oximetry and heartrate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals. The MAX30100 operates from 1.8V and 3.3V power supplies and can be powered down through software with negligible standby current, permitting the power supply to remain connected at all times.

Applications:-

- Wearable Devices
- Fitness Assistant Devices
- Medical Monitoring Devices

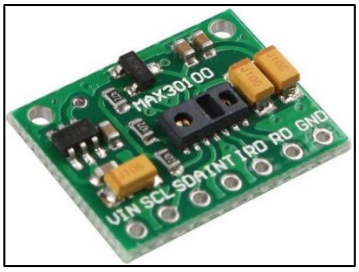

Figure 3.4 Pulsometer, Oximeter(MAX30100)

Temperature Sensor(MLX90614)

The MLX90614 is an Infra Red thermometer for noncontact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASSP are integrated in the same TO-39 can. Thanks to its low noise amplifier, 17-bit ADC and powerful DSP unit, a high accuracy and resolution of the thermometer is achieved. The thermometer comes factory calibrated with a digital PWM and SMBus (System Management Bus) output. As a standard, the 10-bit PWM is configured to continuously transmit the measured temperature in range of -20…120˚C, with an output resolution of 0.14˚C. The factory default POR setting is SMBus.

Applications:-

- High precision non-contact temperature measurements.
- Thermal Comfort sensor for Mobile Air Conditioning control system.
- Temperature sensing element for residential, commercial and industrial building air conditioning.
- Windshield defogging.
- Automotive blind angle detection.

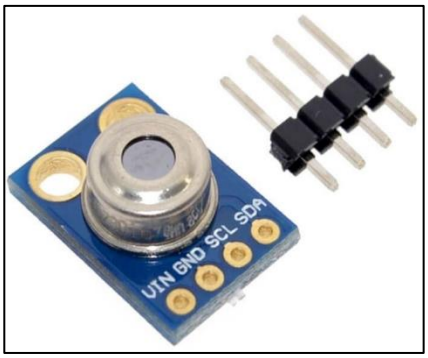

Figure 3.5 Temperature Sensor(MLX90614)

Accelerometer(Mpu-6050)

MPU6050 is a Micro Electro-mechanical system (MEMS), it consists of three-axis accelerometer and three-axis gyroscope. It helps us to measure velocity, orientation, acceleration, displacement and other motion like features. The MPU6050 includes an embedded temperature sensor that can measure temperature over the range of -40 to 85°C with accuracy of ±1°C.

Applications:-

- For recognizing in-air gestures this module is used.
- In the security and authentication systems, MPU6050 is used for gesture recognition.
- In drones and quadcopters, MPU6050 is used for position control.
- Highly preferred for robotic arm control.
- Wearables used for health, fitness and sports also containMPU6050.

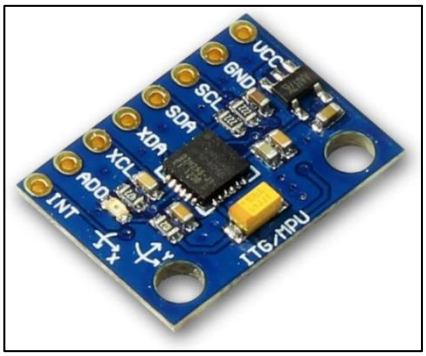

Figure 3.6 Accelerometer(Mpu-6050)

Barometer, Altimeter(BMP280)

Bosch Sensortec BMP280 Digital Pressure Sensor is an absolute barometric pressure sensor especially designed for mobile applications. The sensor module is housed in an extremely compact package. Bosch Sensortec BMP280 Digital Pressure Sensor small dimensions and its low power consumption allow for the implementation in battery driven devices such as smartphones, GPS modules, and wearables.

Applications:-

- Enhancement of GPS navigation (e.g. time-to-first-fix improvement, dead-reckoning, slope detection)
- Indoor navigation
- Outdoor navigation, leisure and sports applications
- Weather forecast, Home weather stations
- Health care application
- Vertical velocity indication
- Handsets such as mobile phones, tablet PCs, GPS devices

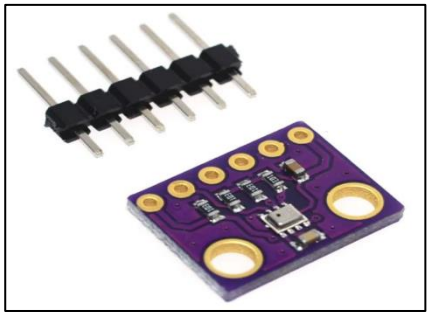

Figure 3.7 Barometer, Altimeter (BMP280)

- Flying toys
- Watches

GSM Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. The modem (modulator-demodulator) is a critical part here.

These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

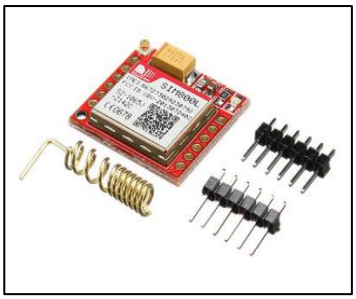

Figure 3.8 GSM Module

Jumper wires

A **jump wire** is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Types of Jumper Wires

Jumper wires come in three versions:

- Male-to-male jumper
- Male-to-female jumper
- Female-to-female jumper

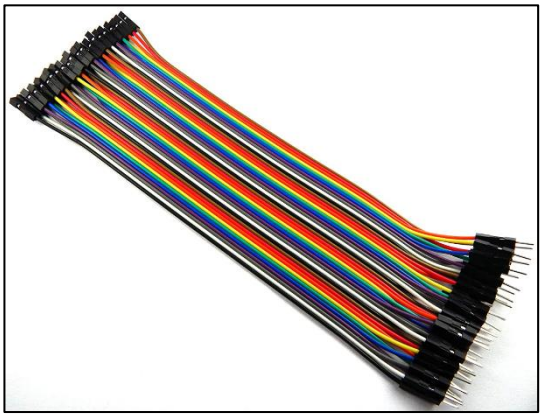

Figure 3.9 Jumper wires

Chapter 4

Plan of Project

4. Plan of Project

4.1 Proposed System Architecture

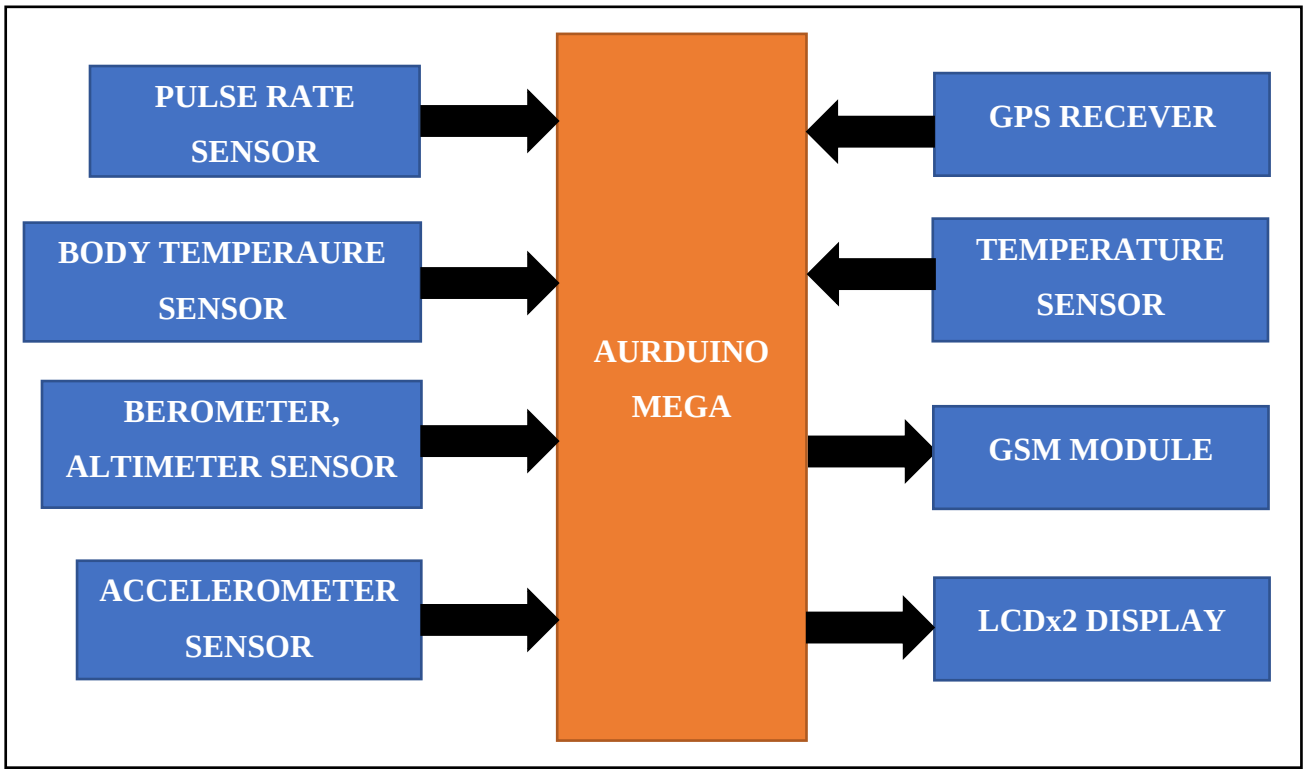

Figure 4.1 Simple Block Diagram

The following image shows the proposed system diagram of the Arduino based Heart Rate Monitor using Heartbeat Sensor and GPS tracking using GSM module. Types of sensor we are including in our project are heart pulse rate sensor, body temperature sensor, barometer, altimeter sensor and accelerometer sensor, for the position tracking we are using GSM module and for displaying sensor information we are using LCDx2 display. All these are connected simultaneously to Arduino Mega 2560.

The heart sensor has a LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate. Hence configuring and ready to use sensor to monitor heart pulse rate. Body temperature sensor which has an Infra Red thermometer for noncontact temperature measurements. Also, a Accelerometer sensor is used for fall detection purpose and a Barometer, Altimeter sensor whish is great for all kinds of weather sensing.

4.2 Methodology

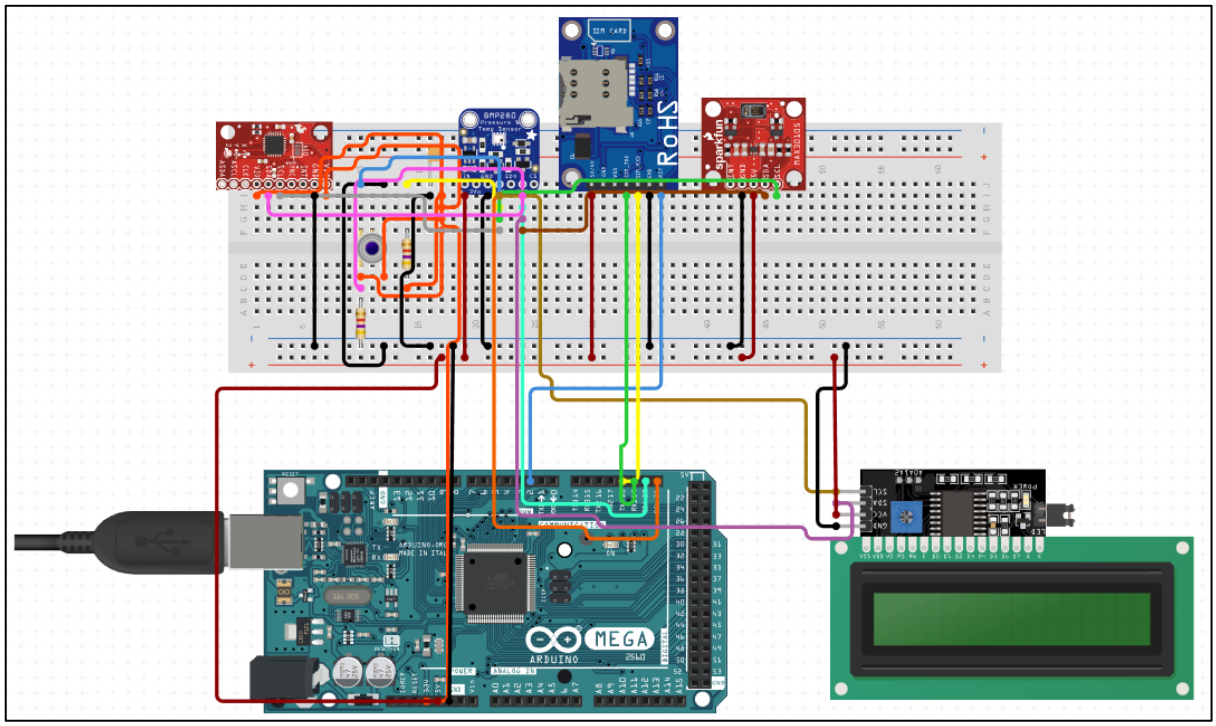

Figure 4.2 Circuit Diagram

Components:-

Heart Sensor

Temperature Sensor

Accelerometer Sensor

Barometer, Altimeter sensor

Breadboard

Jumper wires

Arduino Mega 2560

Arduino Software Program and Sketch

LCDx2 Display Screen

Power Supply

Before heading towards the working of the model each sensors and module components must be configured via Arduino Mega 2560.

Heart Sensor (MAX30100):-

Connect the Vin pin of MAX30100 to Arduino 5V or 3.3V pin, GND to GND. Connect the I2C Pin, SCL & SDA of MAX30100 to A5 & A4 of Arduino. Similarly connect the LCD pin 1, 5, 16 to GND of Arduino and 2, 15 to 5V VCC. Similarly connect LCD pin 4, 6, 11, 12, 13, 14 to Arduino pin 13, 12, 11, 10, 9, 8. Use 10K Potentiometer at pin 3 of LCD to adjust the contrast of LCD.

Temperature Sensor (MLX90614):-

This temperature sensor module comes with a 3.3 voltage regulator, I2C Bus with internal pullup resistors to define a default state and a capacitor for noise filtering. The pinout of the non-contact MLX90614 IR Temperature Sensor module. It has 4 pins VCC, GND, SCL, SDA. Connect Arduino Mega 2560's 5v, GND, SDA, SCL to Sensor pins VCC, GND, A4, A5 along with the LCDx2 Display screen pins GND, VCC, SAD, SCL respectively.

Accelerometer Sensor (MPU 6050):-

MPU 6050 comes in a Module form, with 8 pins, but don't worry, we will use only 4 important pins and it will be sufficient to integrate with our Arduino Board. So we have VCC, ground, which takes any input from 2v to 5v, since this board has a voltage regulator on board and thus supports 3.3v logic high and 5v logic high. Connect sensor pins- VCC, GND, SCL, SDA to Arduino mega 2560 pins- 5v, GND, A5, A4.

Barometer, Altimeter sensor (BMP280):-

The BMP280 chip works with maximum voltage of 3.6V (supply voltage range is from 1.71 to 3.6V) which means we've to use a 3V3 voltage regulator to supply it from a 5V source. BMP280 module has at least 4 pins because it can work in SPI mode or I2C mode. For the I2C mode we need 4 pins: VCC, GND, SDA and SCL. Connect sensor pins- GND, VCC, SDA, SCL to Arduino mega 2560 pins- GND, 5v, A4, A5.

4.3 Project Plan (Gantt Chart)

TASKS	June	July	August	September	October	November	December	January	February	March
Research										
Planning										
Domain Selection										
Topic Finalization										
Project Implementation										
IOT Component Study										
Assembling of the Components										
Programming										
Testing and Verifying										
Developing Final Model										

Chapter 5

Project Analysis

5.1 Use Case Diagram

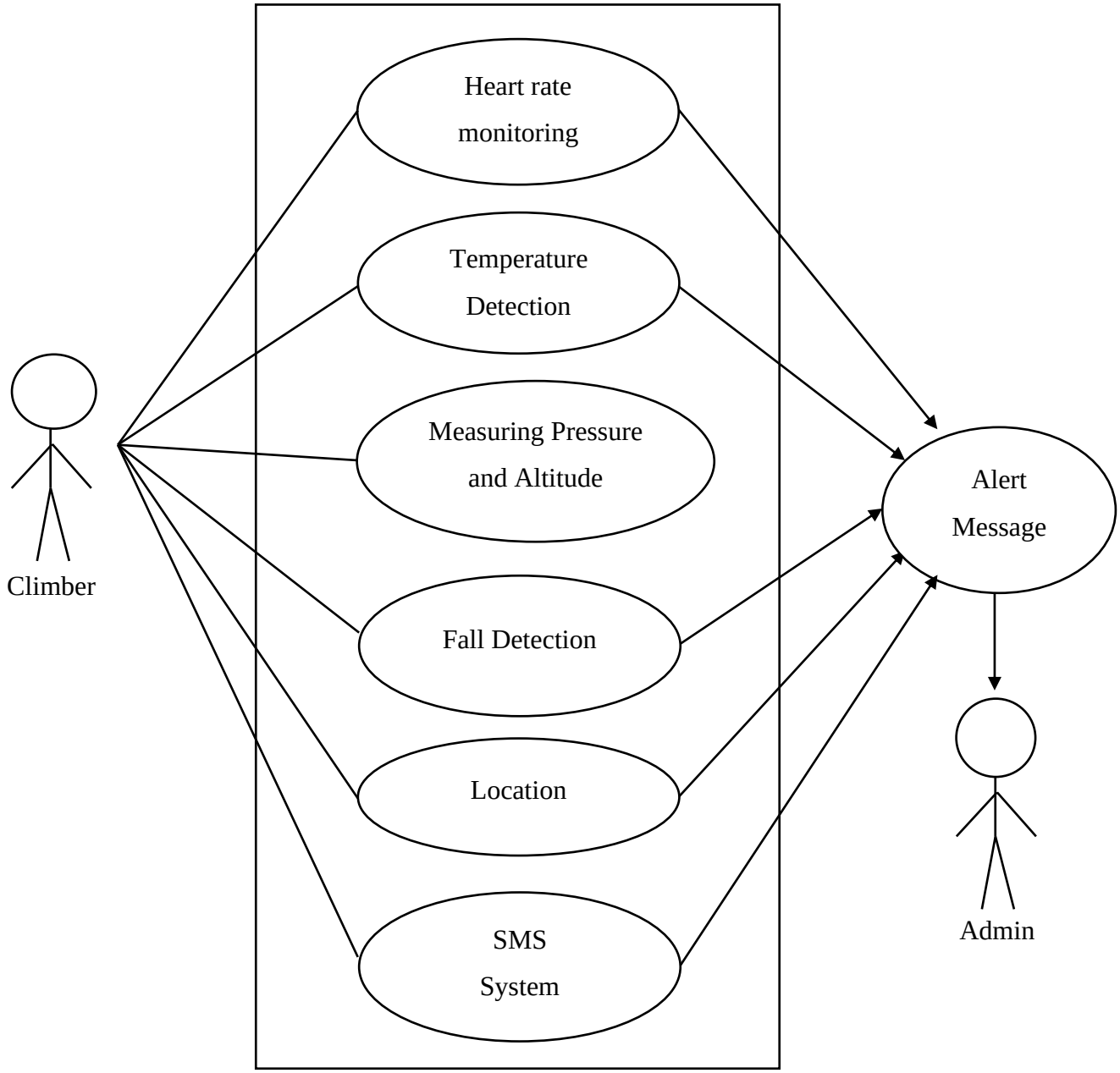

Figure 5.1 Use Case Diagram

5.2 Use Case Analysis

Heart Rate Monitor System using Arduino and Heartbeat Sensor. You can find the Principle of Heartbeat Sensor, working of the Heartbeat Sensor and Arduino based Heart Rate Monitoring System using a practical heartbeat Sensor.

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy. Heart rate is simply measured by placing the thumb over the subject’s arterial pulsation, and feeling, timing and counting the pulses. Electro-cardiogram (ECG) is one of the frequently used methods for measuring the heart rate. But it is also an expensive device. Other devices in the form of wrist watches are also available for the instantaneous measurement of the heart rate. In order to measure the body temperature, we use thermometers and a sphygmomanometer to monitor the Arterial Pressure or Blood Pressure. Such devices can give accurate measurements but their cost is usually in excess of several thousand rupees, making them uneconomical. So, the proposed heart rate monitor with a heart-beat sensor is definitely a useful instrument for finding the pulse and the temperature for a mountain climber.

The Global Positioning System (GPS) is a satellite-based navigation system that consists of 24 orbiting satellites, each of which makes two circuits around the Earth every 24 hours. These satellites transmit three bits of information – the satellite's number, its position in space, and the time the information is sent. These signals are picked up by the GPS receiver, which uses this information to calculate the distance between it and the GPS satellites.

Including Accelerometer, Barometer, Altimeter Sensors. Accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smartphones, and wearable devices, etc. Here accelerometer is used for the purpose of fall detection sensor. A barometric pressure sensor is a sensor that detects atmospheric pressure, hence it is used to monitor the atmospheric condition and for exact position tracking An altimeter is used which is a device that measures altitude, the distance of a point above sea level.

Chapter 6

Project Design

6.1 State Transition Diagram

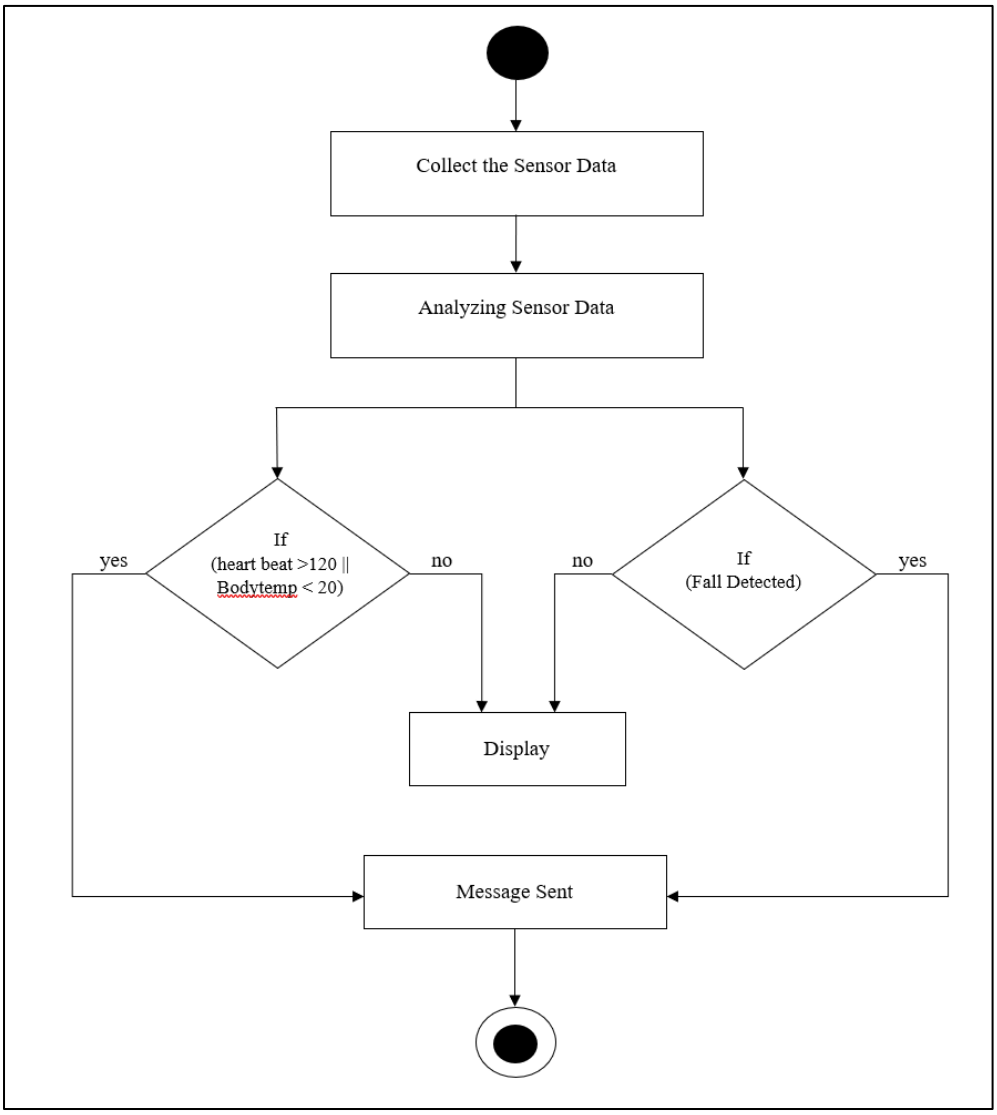

Figure 6.1 State Transition Diagram

6.2 Activity Diagram

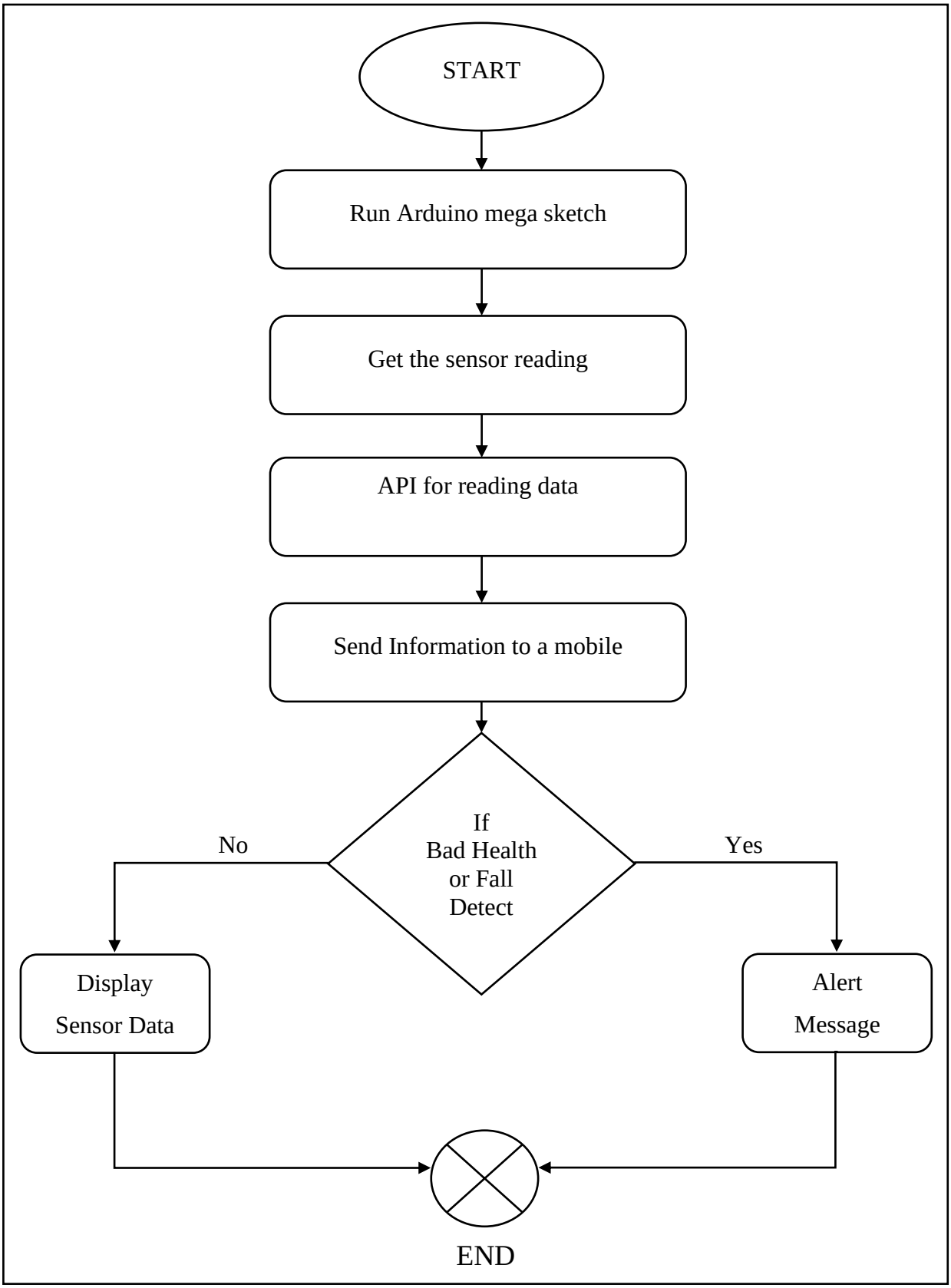

Figure 6.2 Project Activity Diagram

6.3 Class Diagram

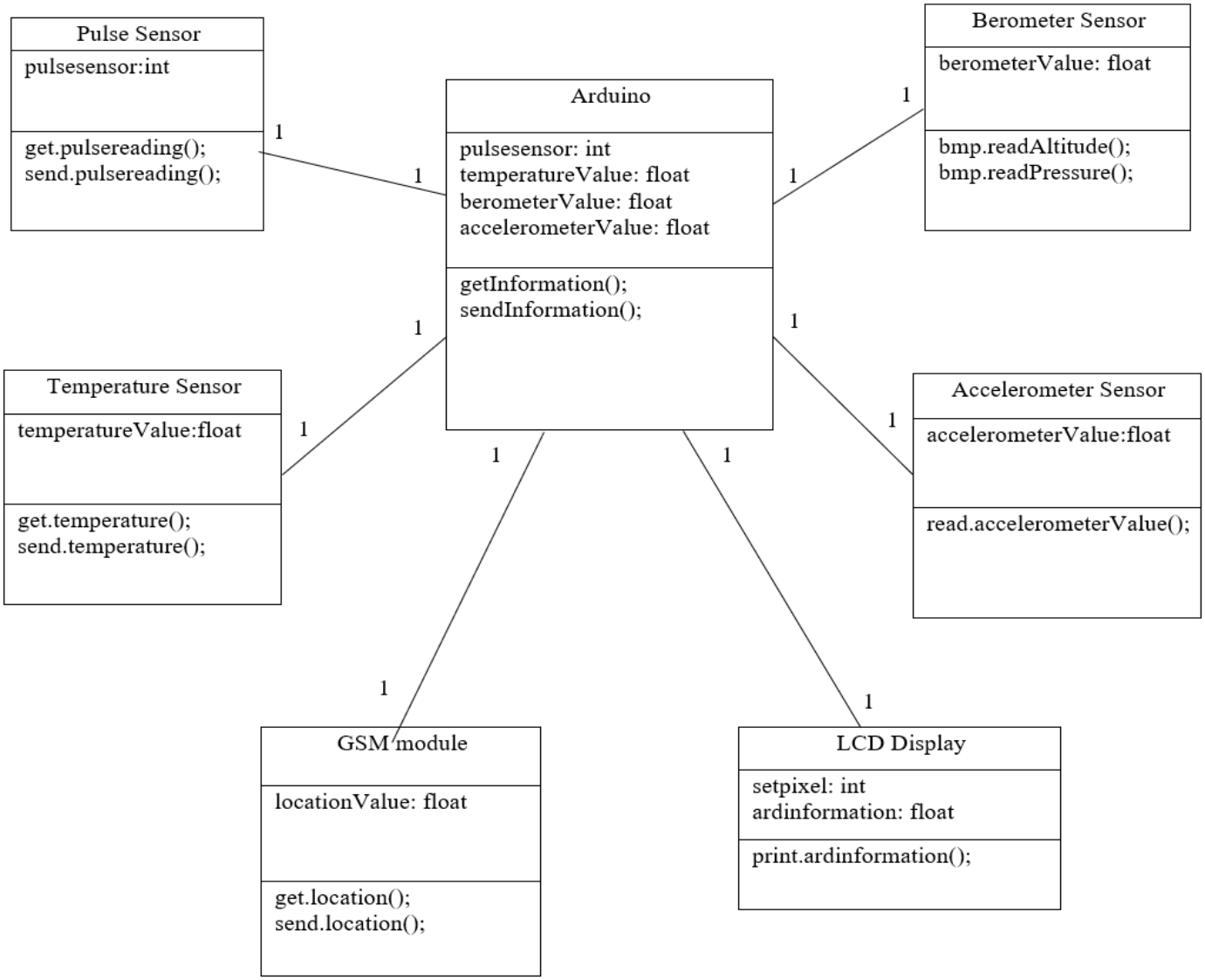

Figure 6.3 Class Diagram

Class diagram provides a high-level view of the structure of a system, and can be used to aid in the design and development of software systems. It can be particularly useful for identifying potential issues or inconsistencies in the design of a system before implementation.

6.4 Sequence Diagram

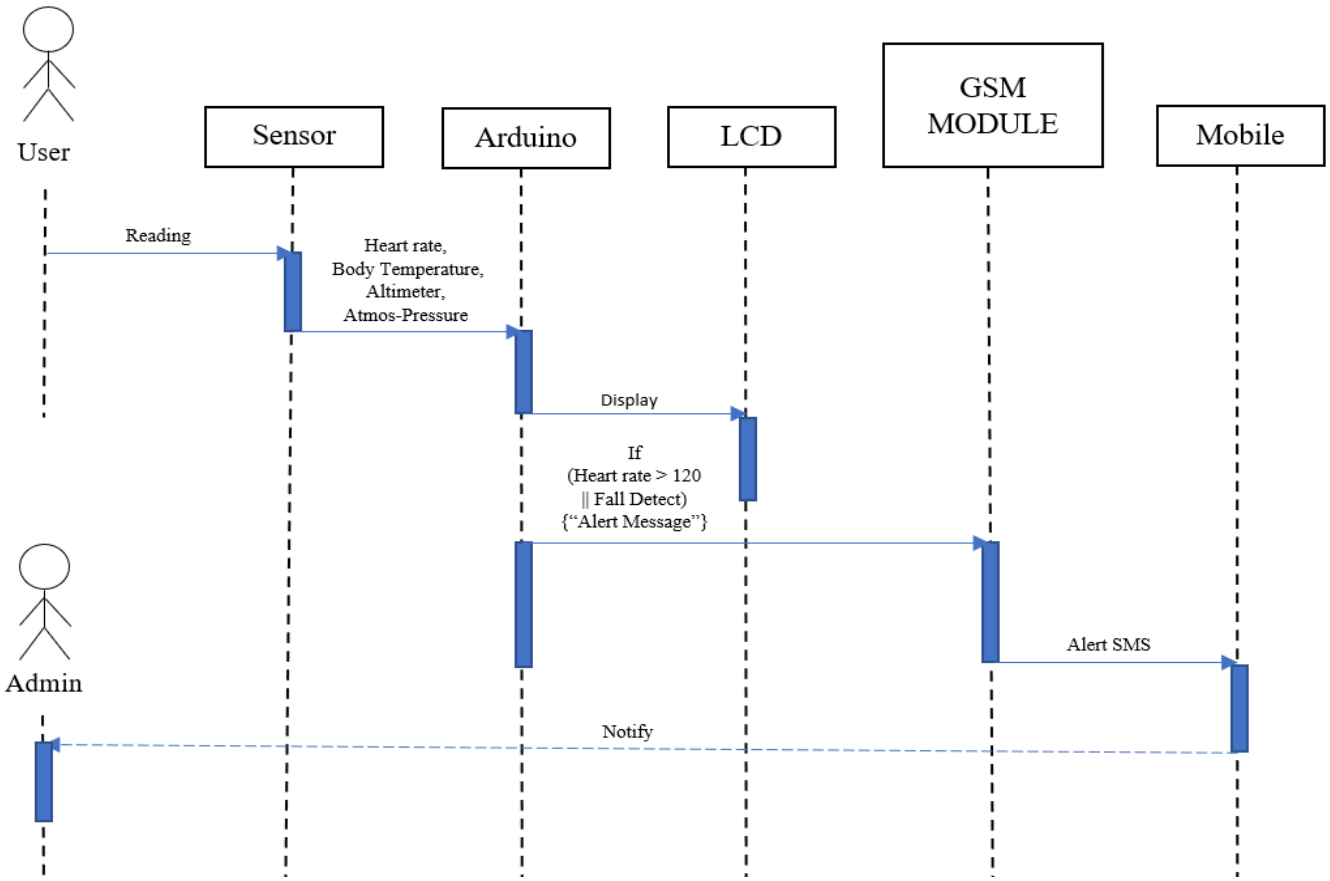

Figure 6.4 Sequence Diagram

Sequence diagrams are useful for visualizing complex processes or systems and can help to identify potential issues or areas for improvement. They are often used in software development to model the behavior of different parts of a system, and can be used to design, debug, or document a system.

In a sequence diagram, each object or component is represented by a box or rectangle, with vertical lines or arrows representing the messages or actions sent between them. The order of the messages is indicated by the vertical position of the boxes or arrows. Optional and alternative message paths can be indicated using alternative paths or loops, and conditions can be indicated using decision points or branching paths.

In Figure 6.3, the user carries the device that continuously tracks their health and GPS location while they are engaged in an activity. If a fall is detected, the device sends an alert to the Admin over GSM module with the user's GPS location and health information. The GSM module then notifies an emergency contact of the fall, and receives SMS to the Admin.

Chapter 7
Implemented System

Code:-

Libraries:-

```
#include <SoftwareSerial.h>
#include <Wire.h>
#include <Adafruit_MLX90614.h>
#include <LiquidCrystal_I2C.h>
#include <Adafruit_BMP280.h>
```

Reading of sensor:-

```
myBPM = analogRead(PulseWire); // // Read the object Heartrate
temp_obj = mlx.readObjectTempC(); // Read the object temperature in Celsius
float altitude = bmp.readAltitude(); // calculate altitude based on sea level pressure
float pressure = bmp.readPressure();// calculate altitude based on sea level pressure
```

Display Reading on LCD Display:-

```
lcd.setCursor(0, 0);
lcd.print("HR:");
lcd.setCursor(3, 0);
lcd.print(myBPM);
Serial.print("HR:");
Serial.println(myBPM);
lcd.setCursor(0, 1);
lcd.print("BT:");
lcd.setCursor(3, 1);
lcd.print(mlx.readObjectTempC());
Serial.print("BT:");
Serial.println(mlx.readObjectTempC());
Serial.print("Altitude = ");
Serial.print(altitude);
Serial.println(" m");
lcd.setCursor(8, 0);
lcd.print("A:");
lcd.print(altitude);
```

```
lcd.print("m");
Serial.print("Pressure = ");
Serial.print(pressure);
Serial.println(" hPa");
lcd.setCursor(9, 1);
lcd.print("P:");
lcd.print(pressure);
lcd.print(" hPa");
```

Fall Detection Conditon:-

```
if(Amp > 15)
{
Serial.println("FALL DETECTED");
}
delay(1000);
lcd.clear();
if(Amp > 15){
gsm.println("AT+CMGF=1");  // Set the SMS mode to text mode
delay(1000);
gsm.println("AT+CMGS=\"+91XXXXXXXXXX\"");  // Set the phone number to send the
message
delay(1000);
String Message = "FALL DETECTED!!!\nHeart Rate: " + String(myBPM) +
"\nTemperature: "
+ String(temp_obj) + "*C\nAltitude: " + String(altitude)+"m"+ "\nPressure: "
+ String(pressure) + "\nLocation:\n" + String(GPS);
gsm.println(Message);  // Send the message to the phone number
delay(1000);
gsm.write(0x1A);  // End the message by sending a Ctrl+Z character
delay(1000);
Serial.println("Message Sent for fall detection");  // Print a message to the Serial Monitor
delay(1000);
}
```

7.2 Result

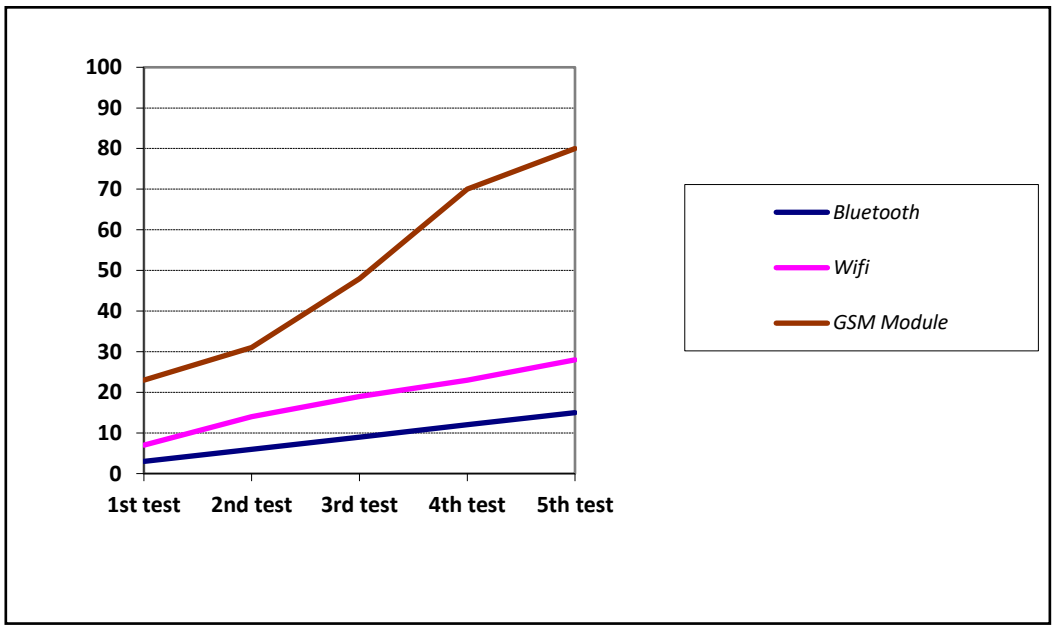

Figure 7.2(1):- Network Accuracy Graph

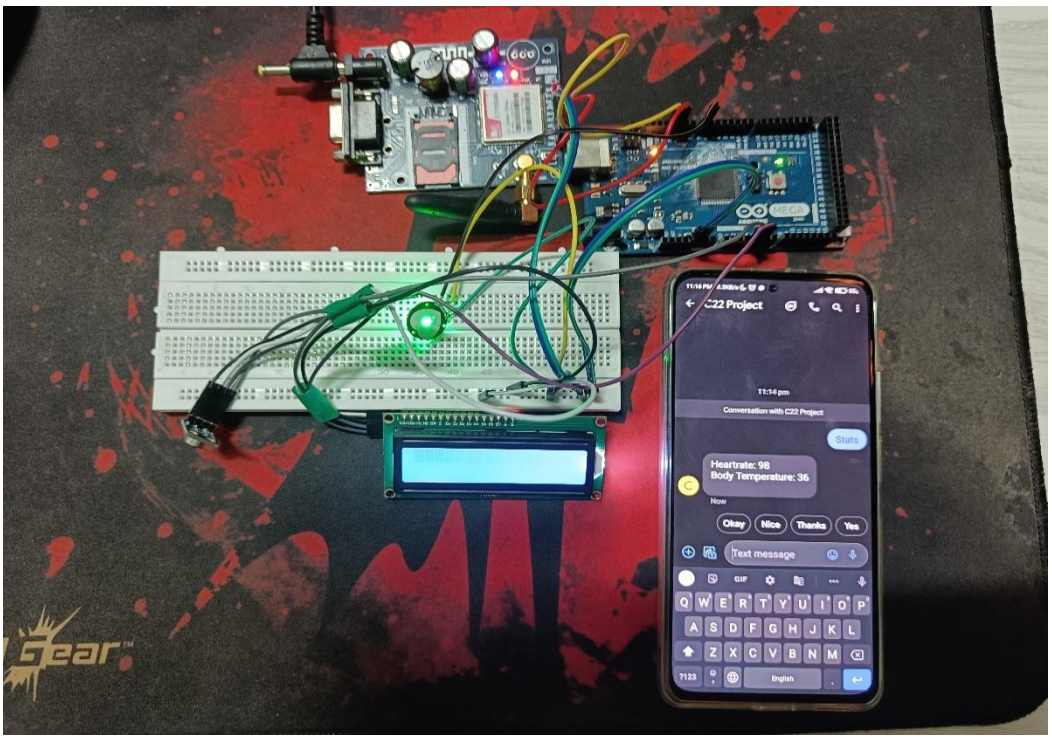

Figure 7.2(2):- Test 1 Receiving User's Health condition on Sending "Status" Message

8. Conclusion And Future Scope

8.1 Conclusion

The proposed device could assist mountaineering guides in immediately and effectively managing their teams and facilitate improving safety in mountaineering by such IOT based device. The main objective of this project is to track the location and health condition of Mountain Climber throughout the trekking. Successfully studied the components and planning to build a prototype also the device enables and guides to accurately monitor the physiological status of a mountain climber and to make punctual commands, thereby providing guides with an immediate and effective route for assistance.

This project allows to track vitals of climbers in real time as well as monitor their location over IOT. This provides the live Heartbeat monitoring, GPS Location Tracking, Altimeter, Fall detection and Barometer sensor to sense the condition of a mountaineer, monitoring them and transmitting this over the IOT for live monitoring in a form of SMS to mountaineers configured/saved contact number's device.

8.2 Future Scope

The future scope of the proposed mountaineering device includes enhancing the accuracy of location and health tracking through the integration of advanced sensors and algorithms, improving the reliability of the IOT transmission for real-time monitoring, developing a mobile application for easier monitoring and management, and incorporating machine learning algorithms for predictive analytics to aid in decision-making. These advancements can provide better safety measures and improve the overall experience of mountaineers and guides. Additionally, the data collected from the device can be used for research purposes, such as studying the effects of high altitude on the human body.

Chapter 9
References

9. References

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and Alarm System For Elderly," 2020 IEEE 7th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON), 2020, pp. 1-5, doi: 10.1109/UPCON50219.2020.9376569.

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Thanking You,

Krutika Bhagane

Nikhil Bhosale

Abhishek Gambre

List of Publications

Journal

Accepted Paper titled "Mountain Climber's Health and GPS tracking System" in Journal Of Computer Technology & Applications (JoCTA) by Scientific Technical Medical (STM) ISSN: (ONLINE): 2229-6964[STATUS : Accepted].

Mountain Climber Health and GPS Tracking System

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***Abstract*— Mountaineering is always a fun and adventurous activity. But mountaineering comes with a lot of risks. Mountain climbers have heavy chances of mishaps. Search and rescue efforts frequently fail when a similar tragedy takes place in a rural area or at a high elevation. As a result, the search and rescue team is ignorant of the accident's location or whether or not the individual is alive and, if so, what condition he is in.**

The real-time monitoring of mountaineers' vital signs and the IOT tracking of their whereabouts are both made possible by this project. This entails live heartbeat monitoring, GPS location tracking, an altimeter, fall detection, and a barometer sensor to assess a mountaineer's health. This information is transmitted via the IOT for live monitoring in the form of SMS to the mountaineer's device using their configured or saved contact number.

***Keywords*— IOT, Heartbeat Sensor, GPS Tracking, Fall Detection.**

1. Introduction

Mountaineering has continuously been a adventurous & growing activity. However, with journey comes risk. Mountain climbers square measure continuously beneath risks about getting injured or accidents. When such an incident occurs at a high altitude or in a remote area, search and rescue operations are not always successful because the rescue team may not receive accident information for hours or even days, they cannot identify the scene of the accident, they cannot determine whether the person involved is alive or dead, and they cannot determine how they are doing if they are alive. The sensible adventurer permits for groups to trace organ of climbers in real time still as to keep track of their location with the help of IOT.

Teams can track climbers' vitals and track their whereabouts using IOT thanks to the smart mountain climber. A heartbeat and temperature sensor, Arduino Mega controller, a wifi module, an LCD display, and a GSM module are all used in the system's construction. The pulse sensor is used to track and transmit the user's heart rate to the controller.. [3]

The GPS tracking aspect of the system typically involves using a GPS device or smartphone app to track the climber's location in real-time. This information can be displayed on a map, allowing friends, family, or rescue teams to keep track of the climber's progress and ensure their safety.

The health monitoring aspect of the system may include wearable devices such as fitness trackers or smartwatches that monitor a climber's heart rate, blood oxygen levels, and other vital signs. This information can be used to alert the climber or rescue teams if the climber's health is in danger, such as if their heart rate suddenly increases or their blood oxygen levels drop.

It is necessary to note down that while these systems can provide necessary information, they should not be relied upon solely for safety during mountain climbing. Climbers should always have a comprehensive understanding of the risks associated with their activity and take appropriate safety precautions. Additionally, these systems can sometimes be limited by poor or absent GPS or cellular coverage in remote areas, so it is always wise to carry backup navigation and safety equipment.

2. Literature Survey

This project uses a heartbeat sensor and GPS to monitor the health and position of a mountain climber. The heartbeat sensor measures the speed of the heartbeat and provides an economical alternative to more expensive methods like electro-cardiograms. GPS tracking helps us monitor the climber's position in real-time, ensuring their safety. The Global Positioning System (GPS) is a satellite-based navigation system that communicates information about the satellites' numbers, positions, and times. The GPS receiver utilises this data to calculate the separations between the GPS satellites.. This project combines these two technologies to create a valuable tool for monitoring the health and safety of mountain climbers.

This project focuses on health monitoring and position tracking using two primary components: a heart pulse sensor and GPS. Our team has developed an Arduino-based Heart Rate Monitor System that utilizes a practical heartbeat sensor to measure the speed of the heartbeat. While electro-cardiograms (ECGs) are commonly used to measure heart rates, they can be costly. Additionally, other devices like wrist watches that measure heart rates exist, but they may not be cost-effective. For temperature measurement, thermometers are commonly used, and for blood pressure monitoring, sphygmomanometers are

employed. These devices are accurate but can be expensive. Therefore, our proposed heart rate monitor with a heartbeat sensor is a valuable tool for monitoring the pulse and temperature of a mountain climber.

In addition to the heartbeat sensor, we use GPS to track the position of the climber. The GPS is a navigation system and it consists of a total 24 satellites that orbit the Earth. Each satellite transmits its own number, where it is located in space, and time when the information was sent. The GPS receiver catches these signals and calculates distance between it and the GPS satellites. This allows us to track the position of the mountain climber in real-time, making it easier to ensure their safety.

3. Existing System

Figure 3.1 Available Gadgets

For monitoring actual condition of a climber and tracking its position we require certain gadget. Gadgets like Smart watch offering features through sensors like pulse heart rate sensor, calorie counter, GPS tracking, temperature sensors and others gadget like GPS mobile phones which are specially build to track the exact location of a person.
The following are some benefits and features of certain devices:

- Live Heartbeat Monitoring Sensor
- Upper & Lower Limit Settings
- IOT Live Vitals Display
- GPS Location Tracking
- Live monitoring results are displayed

As per the given existing system, gadgets like Smart watch provide features of heart pulse monitoring and GPS tracking. Also a dedicated GPS mobile device/gadget which keeps a accurate live tracking on the movements of a person/climber. But the major drawback is the pricing at which a individual device provides the feature respectively. For example, a single GPS tracking gadget which provides greater feature of tracking a persons position but it will cost around 6000rs. to 8000rs. INR.

4.Survey Table

Sr.no	Author	Title	Description
1.	Niket patil & Brijesh lyer	Monitoring the health and Position Tracking 2017	The paper describes a health tracking and monitoring system powered by the Internet of Things (IoT).
2.	Vipa Thananant, thanakorn Khunkhao	Development of IoT Heartbeat and Body Temperature Monitoring System 2020	Both the body temperature and the heart rate can be determined by the portable measurement gadget. The invention makes use of an Arduino board that is wired up to a temperature and cardiac sensor..
3.	Su Zhihua, Yan Lihong	Design of Portable Barometric Altimeter System 2022	This work completes the design and implementation of the air pressure height detection system based on the air pressure sensor SCP1000-D01, improving the detection accuracy and sensitivity of the air pressure height.
4.	Akash Gupta, Rohini Shrivastav, Himanshu Gupta, Basant Kumar	IoT Based Fall Detection Monitoring and Alarm System 2020	A complete algorithm has been designed for the detection of genuine fall.

5. Proposed System

GPS tracking and a heartbeat sensor are used in an Arduino-based heart rate monitor. We are employing a variety of sensors in our project, including heart rate sensors, body temperature sensors, barometer sensors, altimeter sensors, and accelerometer sensors. We are using a GSM module to track our position and an LCDx2 display to show the sensor data. The Arduino Mega 2560 is concurrently connected to all of these.

With the use of LEDs, a photodetector, specifically created optics, and sophisticated low-noise analogue signal processing, the heart sensor can precisely measure pulse oximetry and heart rate. Consequently, the sensor is configured and ready to use to track heart rate. Infrared thermometer attached to a body temperature sensor for non-contact temperature measurements. Additionally, a

barometer and altimeter sensor, which is excellent for all types of weather sensing, are employed for fall detection. purpose.

A handy tool that measures heart rate using an electrical Heartbeat Sensor is the Heart Rate Monitor System with Arduino. When compared to conventional techniques like the sometimes-expensive Electro-cardiogram (ECG), the device is made to be more effective and efficient.. By placing the Heartbeat Sensor on the subject, the sensor detects the pulsation and calculates the heart rate.

The proposed heart rate monitor can also measure body temperature using a thermometer and arterial pressure using a sphygmomanometer, making it a useful instrument for mountain climbers. The device also includes other sensors such as an Accelerometer, Barometer, and Altimeter Sensors, which are commonly used in electronic devices, smartphones, and wearable devices to measure acceleration, atmospheric pressure, and altitude.

In addition, the device uses the Global Positioning System also known as GPS to measure the distance between the GPS receiver and the GPS satellites, which is useful for navigation purposes. The GPS system consists of 24 orbiting satellites which transmits three bits of information - satellite number, location in space, and time of transmission. The GPS receiver uses this information to measure the distance between it and the GPS satellites.

Overall, the Heart Rate Monitor System, which uses an Arduino board and a heartbeat sensor, is an economical and effective tool for measuring heart rate, body temperature, and arterial pressure. It employs GPS for navigation and has other sensors such an accelerometer, barometer, and altimeter. Here, the accelerometer serves as a sensor for detecting falls. A barometric pressure sensor measures air pressure; as a result, it can be used to track an object's precise location and to keep track of the weather. When calculating altitude, or the height of a spot above sea level, an altimeter is utilised.

6. Methodology

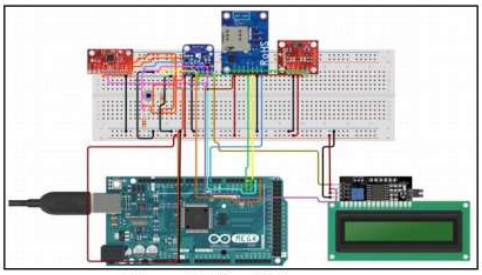

Figure 6.1 Circuit Diagram

Arduino mega 2560:-

A microcontroller board called the Arduino Mega 2560 is based on the ATmega2560 microcontroller.. It is a larger and more powerful version of the popular Arduino Uno board, with more input/output pins, more flash memory, and more RAM. The board consists of 54 digital input/output pins, of which 15 can be used as PWM (pulse width modulation) outputs, 16 analog inputs, and 4 UART (serial communication) ports. Additionally, it contains a power jack, a reset button, and a USB port for programming and communication with the computer. Applications for the Arduino Mega 2560 board span from straightforward LED blinking and sensor reading to more intricate projects requiring numerous sensors, communication interfaces, and high-speed data processing.. It is widely used in robotics, automation, and IoT (Internet of Things) projects, and is compatible with a large number of shields and libraries that can be used to extend its functionality.

Pulse Sensor:-

A sensor is a tool that generates a signal corresponding to the quality being measured. The physical characteristic being monitored is converted by the sensor into a signal that can be electronically measured. . A sensor is often used with other electronics but can be also a mechanical sensor. There are large sensors available for various applications. In this project we use Biomedical sensors.

Connections:-

Connect the + and - pins to the 5V and GND pins on the Arduino, respectively.

Connect the analog output pin to any analog input pin on the Arduino, for example, A0.

Temperature Sensor (MLX90614):-

Temperature sensor that can calculate the temperature of an object without physically touching it. It works by encountering the thermal radiation emitted by the object and converting it into a temperature reading. With a resolution of 0.02°C, the sensor can calculate temperatures between -70°C and +380°C. It is frequently utilised in sectors like industrial or healthcare when contact temperature measurement is neither feasible or practical.

Connections:-

Connect the sensor's SDA and SCL pins, respectively, to the SDA and SCL pins of the Arduino.

Connect the sensor's VIN and GND pins to the Arduino's 5V and GND pins, respectively.

Accelerometer Sensor (MPU 6050):-

Popular MEMS (microelectromechanical system) accelerometer and gyroscope sensor modules like the MPU-6050 have both of these components. It is used to measure rotational motion in three dimensions and acceleration in three axes (x, y, and z). (pitch, roll, and yaw). Numerous applications, including as robots, drones, gaming, and motion tracking, can make use of the MPU-6050. To offer a complete set of data for motion analysis and control, it is frequently used in conjunction with other sensors, such as magnetometers and barometers.

Connections:-

Connect the MPU 6050's VCC and GND pins to the Arduino's 5V and GND pins, respectively.

Connect the sensor's SDA and SCL pins to the appropriate SDA and SCL pins on the Arduino..

Barometer, Altimeter sensor (BMP280):-

A barometer is a type of sensor that is used to measure atmospheric pressure. An altimeter is a type of

instrument that is used to measure altitude, and the height above a reference point, such as above sea level. The BMP280 is a sensor module that contains a MEMS barometer and thermometer, which can be used to measure atmospheric pressure and temperature. The BMP280 can also be used as an altimeter by measuring the changes in pressure as the altitude changes. The sensor is excellent for a variety of applications, including weather monitoring, height sensing, and drone navigation, due to its high accuracy rate and large measurement range. It communicates with the microcontroller using the I2C protocol and can be easily interfaced with microcontrollers like Arduino.

nnections:-

Connect the VIN and GND pins of the BMP280 to the 5V d GND pins on the Arduino, respectively.

Connect the SDA and SCL pins of the sensor to the SDA and SCL pins of the Arduino, respectively.

GSM Modu im900L):-

The Global System for Mobile Communications (GSM) standard is used by a GSM module, such as the SIM900L, to link a microcontroller or computer to a mobile network and send and receive data through the network. The SIM900L module, which has a tiny form factor, is a whole Quad-band GSM/GPRS solution with low power requirements and high sensitivity rates. It includes a SIM card slot, an antenna connector, and a number of interface ports for interacting with the microcontroller, including UART, SPI, and I2C. Applications for the module include remote monitoring, data logging, and Internet of Things (IoT) devices that require mobile network communication.

The SIM900L module can be controlled using AT commands, which are sen ver the UART interface. These commands can be used to send and receive SMS messages, make and receive phone calls, and connect to the Internet using GPRS.

nnections:-

Connect the TX pin of the module to the RX pin of the Arduino (pin 0).

Connect the RX pin of the module to the TX pin of the Arduino (pin 1).

Connect the GND pin of the module to the GND pin on the Arduino.

Connect the Arduino's 5V pin to the VCC pin of the module.

LCD 16x2 Screen:-

A form of display known as an LCD (Liquid Crystal Display) 16x2 screen has two rows of 16 characters each, for a total of 32 characters. The screen is based on the HD44780 controller, which allows the microcontroller to display characters and graphics on the screen by sending commands and data over a parallel or serial interface.

In context of IoT also called Internet of Things, an LCD 16x2 screen can be used to display information and feedback from the sensors and actuators that connected to the microcontroller.

Connecti :-

Connect the VCC and GND pins of the LCD to the 5V and GND pins on the Arduino, respectively.

Connect the LCD's SDA and SCL pins to the Arduino's appropriate SDA and SCL pins.

Figure 6.2 Project review

7. Result

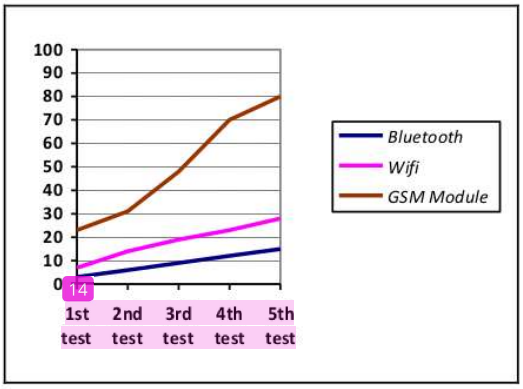

Figure 7.1 Accuracy graph

The System utilizes advanced technologies such as a Heartbeat and temperature sensor, an Arduino Mega 2560 microcontroller, an LCD display, and a GSM module (sim900L). The user's heart rate is determined by th ulse sensor, which then sends that information to the microcontroller. In order to monitor the gadget in real-time, the microcontroller then transmits the heart rate data over the IoT and displays it on an LCD display. The user can also set the system up to send SMS notifications to a specified contact number when the heart rate's upper and lower limits are reached. The microcontroller continuously checks the pulse rates, and if either the pulse rate or temperature rises above the set thresholds, it generates an alert on the IoT display device and sends a message alert with GPS coordinators, which can then be accessed via a link to send a rescue team to the scene right away. The crew can still retrieve the last recorded location via IoT to narrow down the mountaineer's search area even if the climber wanders beyond the network region. For safeguarding the security of hikers and other people in isolated areas, this technology is a practical answer.

8. Conclusion

The proposed device could assist mountaineering guides in immediately and effectively managing their teams and facilitate improving safety in mountaineering by such IOT based deviceThe primary goal of this project is to track the whereabouts and physical well-being of the mountain climber while they are trekking. Successfully analysing the parts and planning to construct a prototype also allows guides to accurately track a mountain climber's physiological condition and issue prompt commands, giving guides a quick and efficient way to help.

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