**A PROJECT REPORT**

**ON**

# SOLDIER'S HEALTH MONITORING AND POSITION TRACKING SYSTEM

**Submitted to**

## SAVITRIBAI PHULE PUNE UNIVERSITY

**In Partial Fulfillment of the Requirement for the Award of**

## BACHELOR'S DEGREE IN ELECTRONICS ANDTELECOMMUNICATION ENGINEERING


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**UNDER THE GUIDANCE OF**

**Prof. DHANASHREE PATIL**

Onward to Glory

**DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING**

**ARMY INSTITUTE OF TECHNOLOGY**

**ALANDI, DIGHI, PUNE - 411015**


**2019-2020**

**AFFILIATED TO**

## SAVITRIBAI PHULE PUNE UNIVERSITY

# ARMY INSTITUTE OF TECHNOLOGY

**Department of Electronics and Telecommunication Engineering**
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# CERTIFICATE

This is certify that the project entitled

## SOLDIER'S HEALTH MONITORING AND POSITION TRACKING SYSTEM

submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Electronics and Telecommunication Engineering) at Army Institute of Technology, Pune under Savitribai Phule Pune University. This work is done during year 2019-2020.

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# Acknowledgements

We are profoundly grateful to Prof. **DhanashreePatil**for her expert guidance and continuous encouragement throughout the course of this project. Her suggestions have contributed towards the timely completion of this project.

Wewouldliketoexpressourdeepestappreciationtowards**Dr.G.R.Patil**,Headof Department of Electronics and Telecommunication Engineering and **Prof. AvinashPatil**whose invaluable guidance supported us in completing thisproject.

We also express our heartfelt gratitude to all the staff members of E&TC Depart-mentand our batch mates who helped us during the course of our project.

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# Abstract

Our soldiers went missing because of Avalanche, in a deserted area or even in battlefield where health and location of soldiers in the most basic information which should be known to the control room[1]. Those people who protects our country, there should be some technology to protect them also. So to support this new technological idea we are working on Soldier's health monitoring and position tracking system.

This project consists of 3 units, first one is is the basic unit attached to all soldiers individially to monitor their heart rate, pulse rate, body temperature, location. Then all the data collected from soldiers sent to the leader of the unit which is the second unit and the third unit is all about collecting all the data at one place so if any soldier is in trouble then he/she can track down and help can be sent for relief.

# Contents

# List of Figures

# Chapter 1

# Introduction

## Overview

In today's world, warfare is an important factor in any nation's security. One of the important and vital role is played by the army soldiers. There are many concerns regarding the safety of soldiers. So for their security purpose, many instruments are mounted on them to view their health status as well as their real time location[2].
But because of network constrain of network, altitude or weather there is always been a probability of loosing that soldier's data.

## HistoricalBackground

Previously, predicting soldier work-rest cycles and training limits could only be addressed using generalized models based on estimated input about individuals and ambient conditions.
Thermal-work strain monitoring is one of the first military PSM applications to be used outside of the research community but provides only one example of near term uses.

### Military application of soldier physiological monitoring

Wearable physiological monitoring can provide predictions about an individual's health and performance from their real time physiological state. This precision medicine approach offers major improvements over population-based predictions derived from ambient conditions and the general context of a mission. Advances in computing power and microelectronics make possible this improvement in human performance assessment, with real time physiological measurement capabilities and data processing that can provide actionable and important information about the individual. This review summarizes current progress in the development of these systems for military application.

## Objectives

To track the location and monitor the health of soldier in real time who become lost and get injured in the battlefield and to minimize the time of search and rescue operation efforts of army control unit.

## Application

The project may be implemented in battlefield or high altitude areas where health and location of soldiers is the most basic information which should be known to the control room.

# Chapter 2

# Literature Survey

- **Hock Beng Lim, Di Ma, Bang Wang, ZbigniewKalbarczyk, Ravishankar K. Iyer, Kenneth L. Watkin (2010) "A Soldier Health Monitoring System for Military Applications" International Conference on Body Sensor Networks, pp: (246-249).**

The authors have discussed on various wearable, portable, lightweight and small sized sensors that have been developed for monitoring of human physiological parameters. The Body Sensor Network (BSN) consists of many biomedical and physiological sensors such as blood pressure sensor, electrocardiogram (ECG) sensor, electro dermal activity (EDA) sensor which can be placed on the human body for health monitoring in real time[10].

- **P.S. Kurhe, S.S. Agrawal (2013) "Real Time Tracking and Health Monitoring System of Remote Soldier Using ARM 7"**

The authors had introduced a system that gives the ability to track the soldiers at any moment. The soldiers will be able to communicate with control unit using GPS coordinate information in their distress. It is able to send the sensed and processed parameters of soldier in real time. It enables to army control unit to monitor health parameters of soldiers like heartbeat, body temperature, etc using body sensor networks. The parameters of soldiers are wirelessly transmitted using GSM[13].

- **William Walker ; A. L. Praveen Aroul; Dinesh Bhatia"Mobile health monitoring system"**

  The author has discussed a system which is proposed for monitoring a bicycle rider using light weight, low power wireless sensors. Biometric and environmental information pertaining to the bicycle rider is captured, transmitted to, and stored in a remote database with little user interaction required. Remote users have real time access to the captured information through a web application. Possible applications for this system include the monitoring of a soldier in the battlefield and the monitoring of a patient

- **ShrutiNikam, SupriyaPatil, PrajktaPowar, V.S.Bendre "GPS BASED SOLDIER TRACKING ANDHEALTH INDICATION SYSTEM"**

  GPS is used to log the longitude and latitude so that direction can be known easily.. RF module can be used for High-speed, short-range, soldier-to-soldier wireless communications that will be required to relay information on situational awareness, tactical instructions, and covert surveillance related data during special operations reconnaissance and other missions[11]

The table below contains the most relevant papers:

| Paper Title | Paper Type | Author Name | Remarks |
|---|---|---|---|
| Soldier Health and Position Tracking System using GPS and GSM Modem | National | Deepa J , Ranjini, Sharanya Raj , Dr.Parameshachai B D | "So this paper focus on tracking the location of soldier from GPS, which is useful for control room station to know the exact location of soldier and accordingly they will guide them." |
| Soldier Tracking And Health Monitoring Systems | National | ShwetaShelar, nikhilPatil, manishJain, sayaliChaudhari,smitaHande | "The goal of this project is to develop a low cost, low.power, reliable, non-intrusive and non-invasive signs of health status. To track the location of the soldier i.e. longitudes and latitudes" |
| A Soldier Health Monitoring System for Military Applications | International | Hock Beng Lim, Di Ma, Bang Wang, ZbigniewKalbarczyk, Ravishankar K. Iyer, Kenneth L. Watkin | The authors have discussed on various wearable, portable, lightweight and small sized sensors that have been developed for monitoring of human physiological parameters. The Body Sensor Network (BSN) consists of many biomedical and physiological sensors such as blood pressure sensor, electrocardiogram (ECG) sensor, electro dermal activity (EDA) sensor which can be placed on the human body for health monitoring in real time |

# Chapter 3

# Block Diagram

## 3.1 Introduction

This project has the ability to track the location and monitor the health of the soldiers in real time who become lost and get injured in the battlefield. It helps to minimize the time, search and rescue operation efforts of army control unit. This system enables to army control unit to track the location and monitor the health of soldiers using GPS module and wireless body area sensor networks (WBASNs), such as temperature sensor, heart beat sensor, etc. The data coming from sensors and GPS receiver will be transmitted wirelessly using HC12 module among the fellow soldiers. Furthermore, LoRaWAN network infrastructure has been proposed to be used between the squadron leader and the control unit in high altitude warzones where cellular network coverage is either absent or does not allow data transmission. The collected data will be uploaded on the website for further analysis.

### 3.1.1 Block Diagram

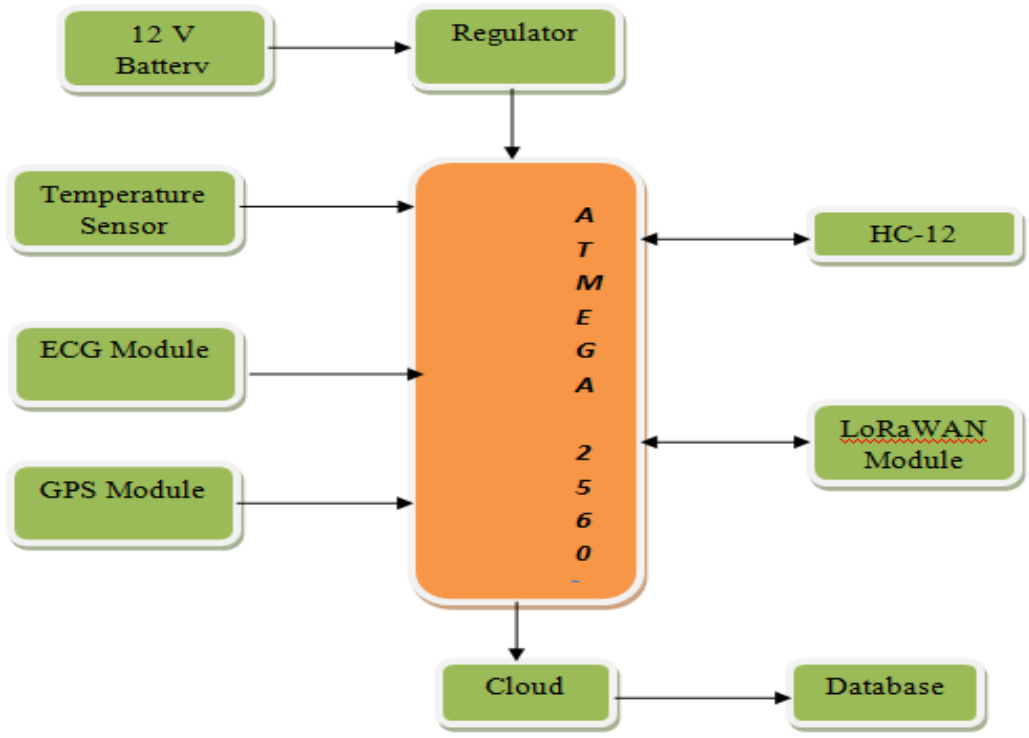



**Figure 3.1. Block Diagram of the proposed project**

## 3.2 Flow Chart

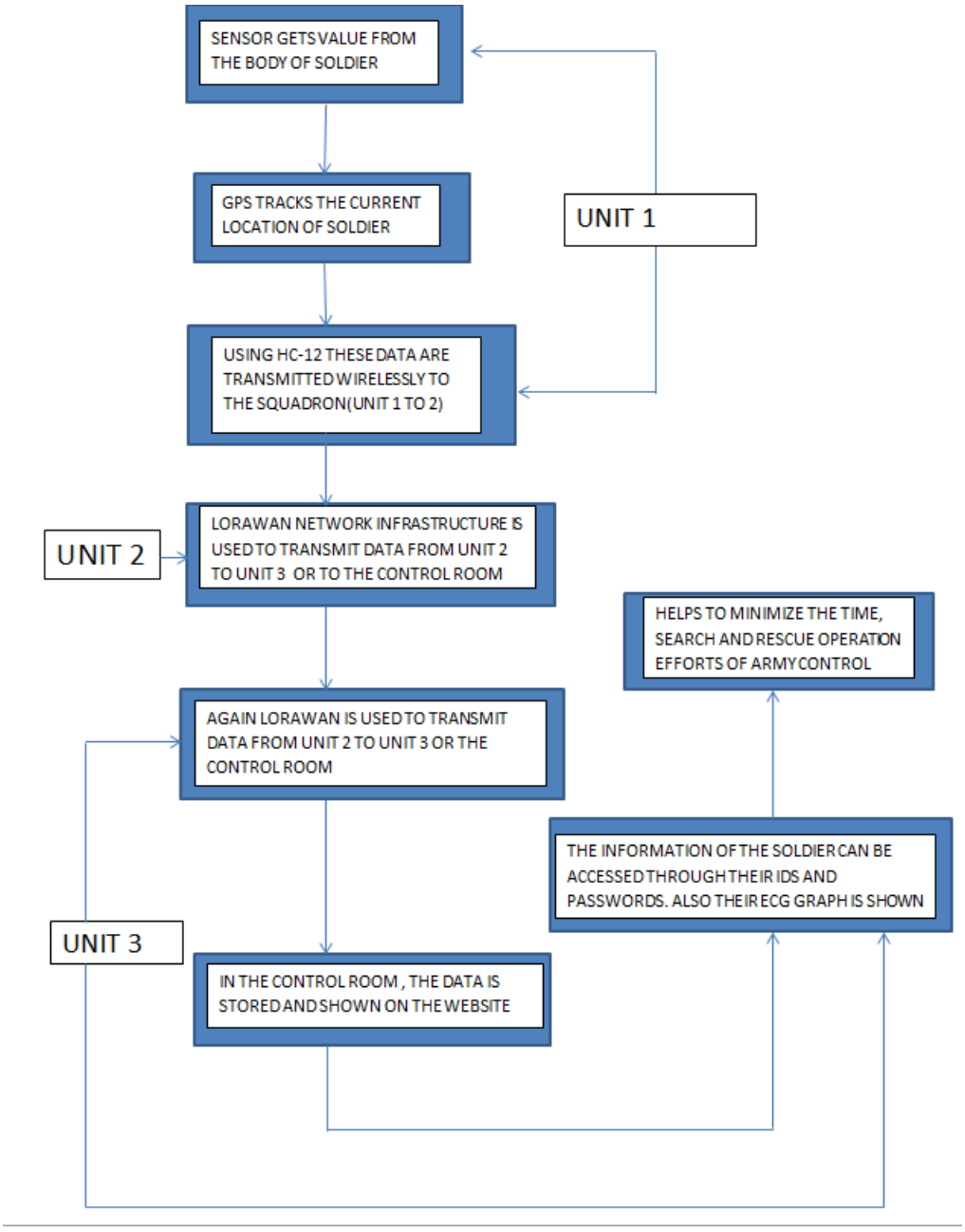



**Fig3.2. Flow Chart**

## 3.3 Network Architecture

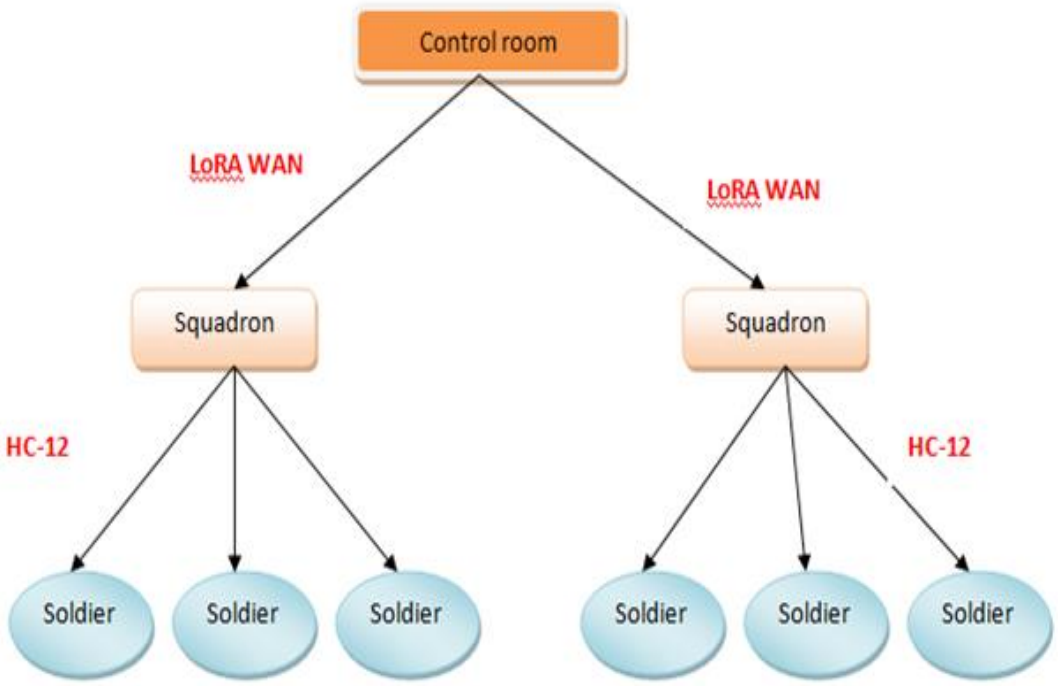



Fig. Proposed Network Architecture

**Fig3.3. Network Architecture**

# Chapter 4

# Requirement Analysis

## HardwareRequirement

### 4.1Atmega 2560:

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts

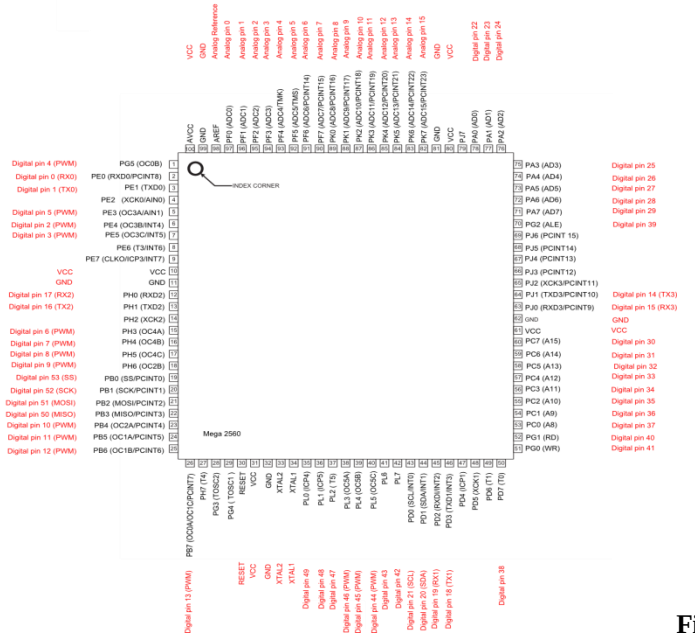



**Fig 4.1Atmega 2560**

## 4.2LORAWAN MODULE:

The term LoRa stands for Long Range. It is a wireless Radio frequency technology introduced by a company called Semtech[6]. Lora can achieve a distance of 15-20 km[7] and can work on battery for years.

Advantages:

- Long Range
- Low Power consumption
- Small size
- Minimum cost for deployment.

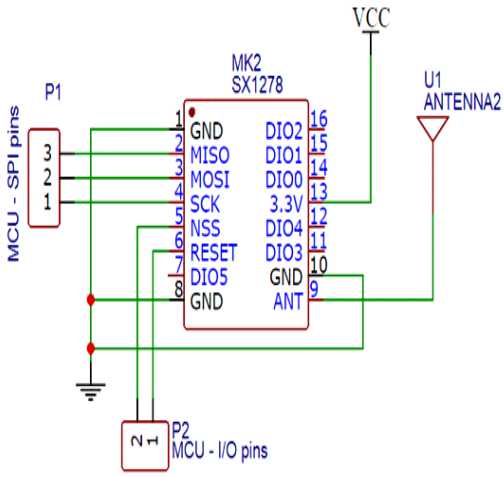
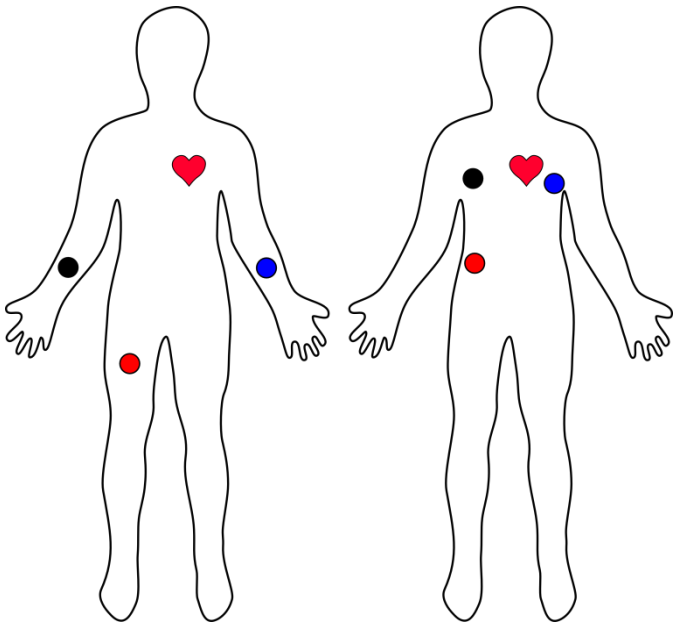




**Fig 4.2 LORAWAN MODULE** **Fig 4 .3 PIN LAYOUT**

## 4.3ECG module ECG8232

The ECG module AD8232 heart ECG monitoring sensor module Kit is a cost-effective board use to measure the electrical activity of the heart. This electrical activity can be chart as an ECG or Electrocardiogram and output as an analog reading[4].



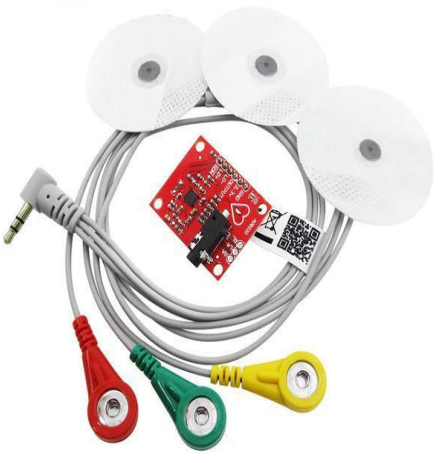


**Fig4. 5. ECG SENSOR**

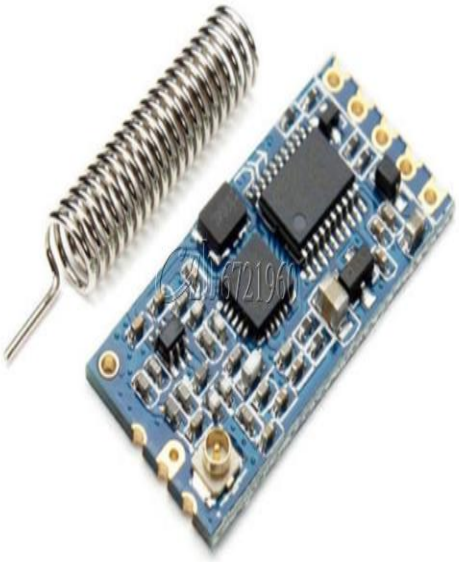
**FIG 4.4 .ECG SENSOR Placement**

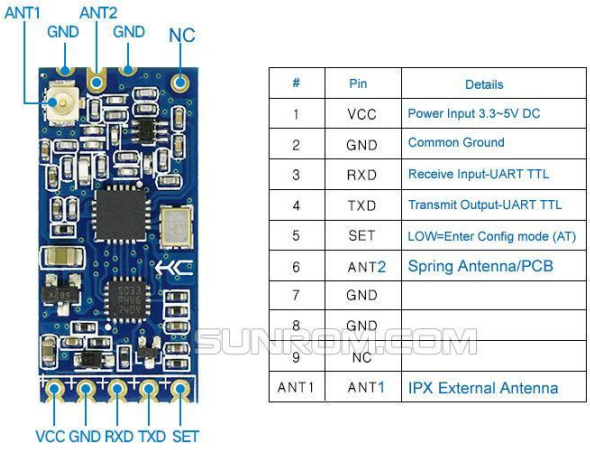
## 4.4HC-12 WIRELESS COMMUNICATION MODULE

HC-12 wireless serial port communication module is a new-generation multichannel embedded wireless data transmission module[8].

**Specifications :**

- Long communication distance (About 1800 meters at default setting).
- Operating frequency range (433.4—473.0MHz)
- Transmit power (max: 20dBm)
- Power supply voltage (DC 3.2V ~5.5V)






| # | Pin | Details |
|---|---|---|
| 1 | VCC | Power Input 3.3~5V DC |
| 2 | GND | Common Ground |
| 3 | RXD | Receive Input-UART TTL |
| 4 | TXD | Transmit Output-UART TTL |
| 5 | SET | LOW=Enter Config mode (AT) |
| 6 | ANT2 | Spring Antenna/PCB |
| 7 | GND | |
| 8 | GND | |
| 9 | NC | |
| ANT1 | ANT1 | IPX External Antenna |

**FIG 4.6.HC-12 MODULE** **FIG 4.7.PIN LAYOUT**

## 4.5GPS Module

The signal of time is sent from a GPS satellite at a given point. Subsequently, the time difference between GPS time and the point of time clock which GPS receiver receives the time signal will be calculated to generate the distance from the receiver to the satellite. The same process will be done with three other available satellites. It is possible to calculate the position of the GPS receiver from distance from the GPS receiver to three satellites. However, the position generated by means of this method is not accurate, for there is an error in calculated distance between satellites and a GPS receiver, which arises from a time error on the clock incorporated into a GPS receiver. For a satellite, an atomic clock is incorporated to generate on-the-spot time information, but the time generated by clocks incorporated into GPS receivers is not as precise as the time generated by atomic clocks on satellites. Here, the fourth satellite comes to play its role: the distance from the fourth satellite to the receiver can be used to compute the position in relations to the position data generated by distance between three satellites and the receiver, hence reducing the margin of error in position accuracy


**FIG 4.8 .GPS MODULE**

## 4.6LM35 Temperature sensor

The body temperature is measure by LM35 in which we can Measure the temperature in Fahrenheit. The LM35 device has an advantage over linear temperature sensors calibrated in degrees Kelvin, because the user is not required to subtract a large constant voltage from its output to obtain convenient Fahrenheit scaling.


**Fig 4.9 . LM35**

# Chapter 5

# System Design

## Methodology

The participants are the Soldier, Sqadron, Control room and website server . The system will be comprised of the following phases:1. Gathering information 2.Infomation received by Sqadron 3. Information transmission to control room 4. Uploading received data on website

1. GATHERING INFORMATION: temperature sensor and ECG sensor and GPS module records the data from soldier and data get saved in microcontroller.
2. INFORMATION RECEIVED BY SQADRON: By using HC12 module wireless data transmission takes place between soldier and squadron.
3. INFORMATION TRANMISSION YO CONTROL SYSTEM:By using LoRaWAN terminal device, data transfer takes place by using single-hop data transfer to gateway.
4. UPLOADING RECEIVED DATA ON WEBSITE: Person in control room updates the data on website.

# Chapter 6

# Project Implementation

The project is based on the wireless data communication between the soldier and his leader and control room so that in case of emergency, the data of individual can get tracked for further action. We also propose the smooth data communication even in extreme environment.

Soldier should wear the jacket which consists of Temperature sensor, GPS module, ECG sensor, HC12, Microcontroller. It is assumed that the Sqadron leader is in the range of 1800 metre. Then data from all soldiers gets transmitted toward their Sqadron.
Sqadron leader is also equipped with the same components as soldiers with an extra module which is LoRaWAN.

Whole data from soldiers and squadron gets transmitted from squadron to control room by using LoRaWAN through gateway in high altitude warzones where cellular network coverage is either absent or does not allow data transmission.

Collected data gets updated on the website.
Website is designed in a way to collect data from admin or directly from soldier. So there is admin login and user login.
In user login , soldier can register himself as a part of the network by entering his cadet number, name and contact details.
Control room operator acts as admin and update the database on website regularly, so in case of emergency directly data on website can be refered.

# Chapter 7

# Observations and readings from sensors

### ECG sensor reading

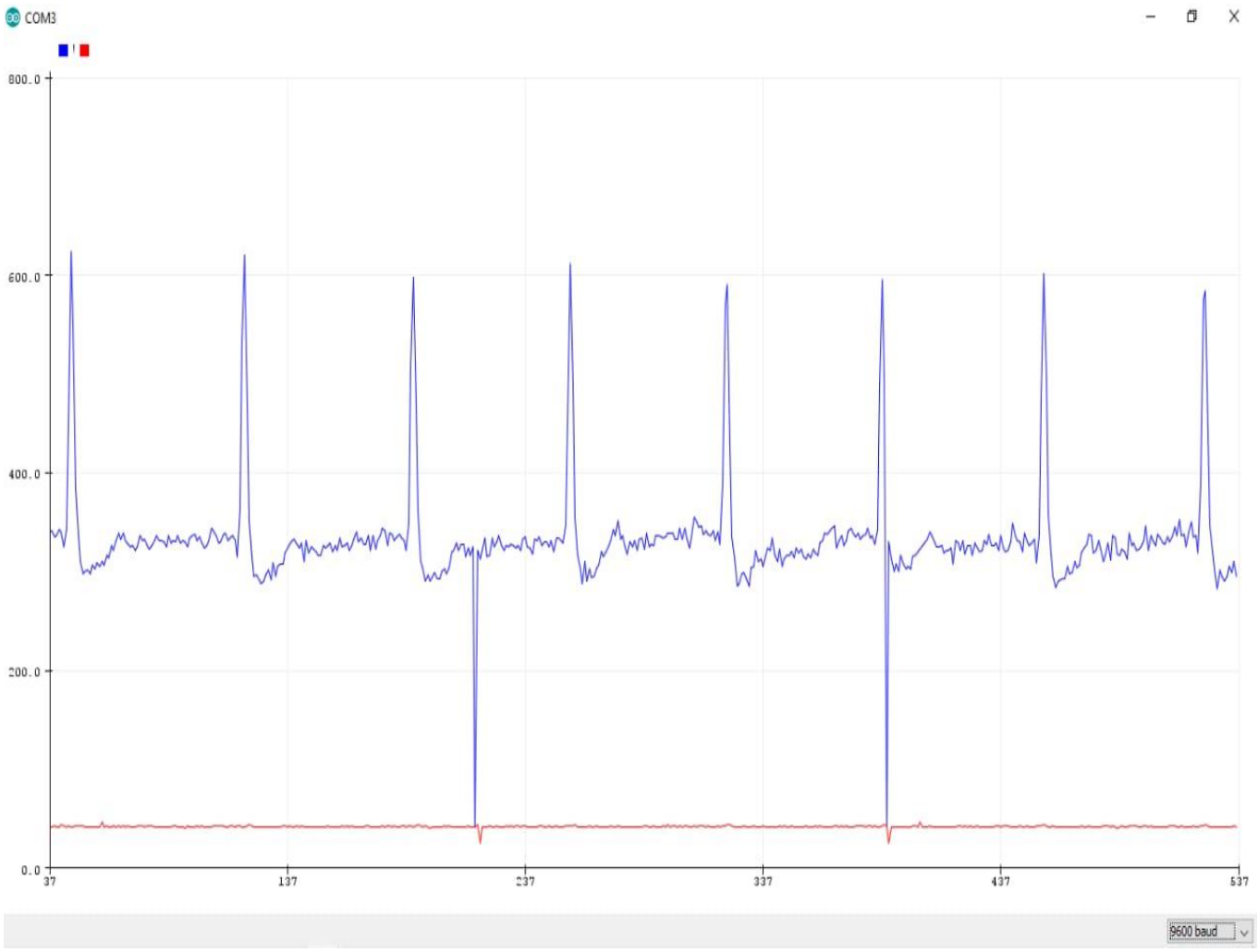



Fig 7.1 ECG sensor readings

**LM35 readings:**

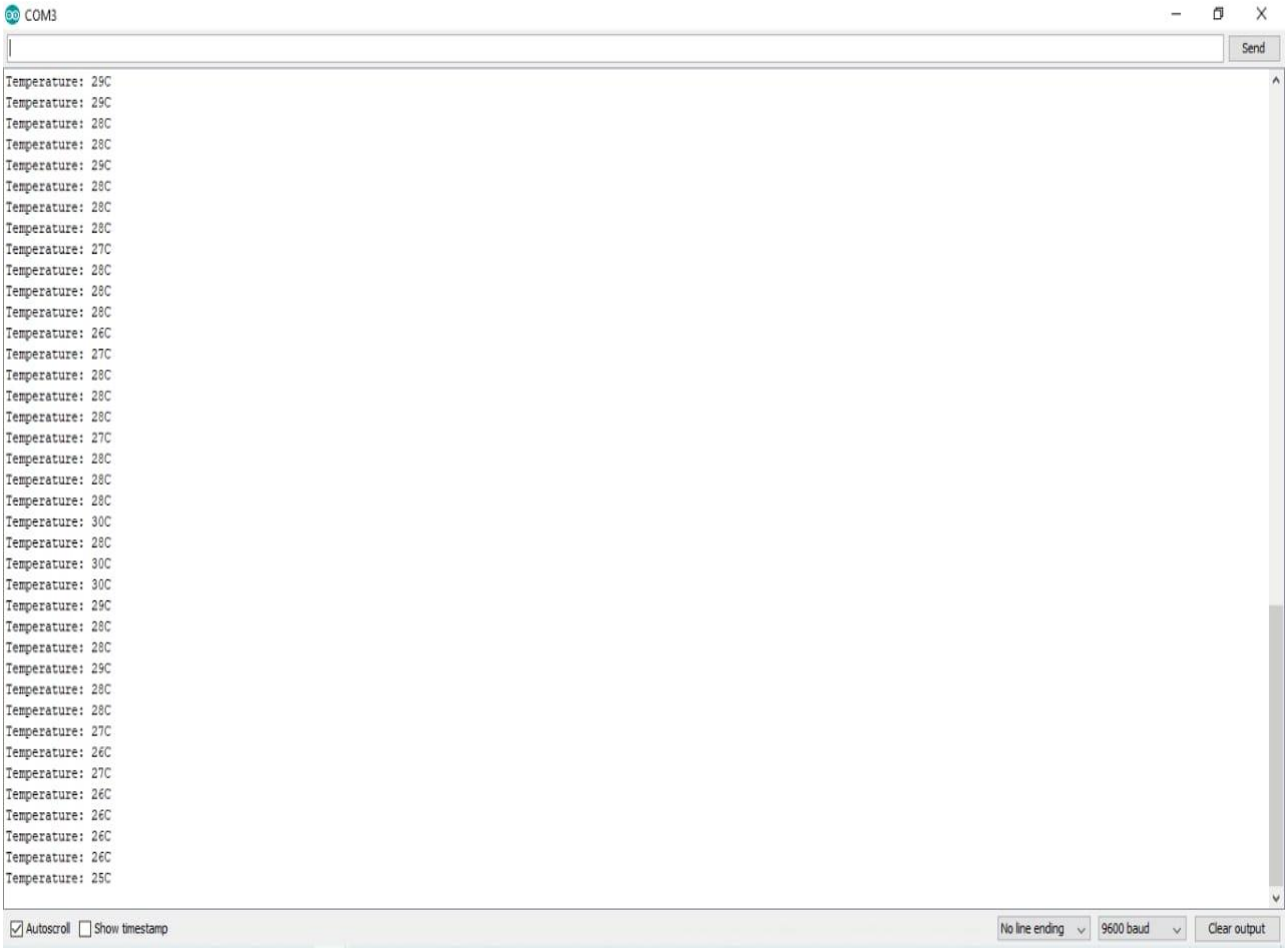



Fig 7.2 LM35 readings

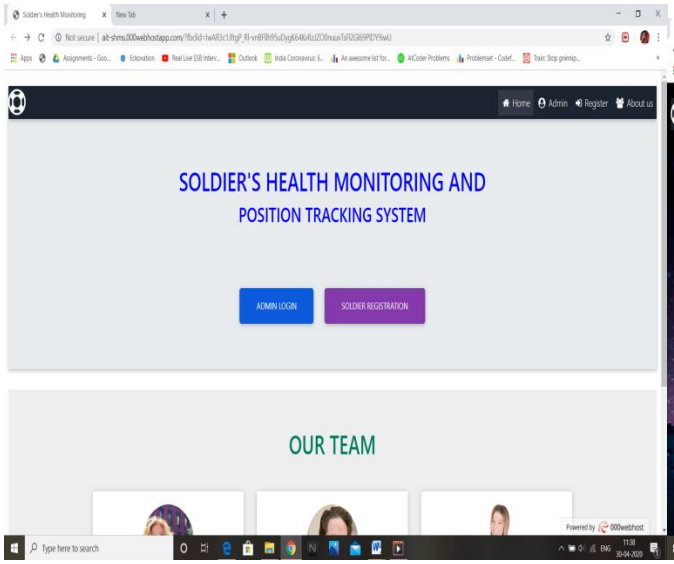
## Code :

```
intpinTemp = A1;
void setup() {
Serial.begin(9600);
pinMode(10, INPUT); // Setup for leads off detection LO +
pinMode(11, INPUT); // Setup for leads off detection LO -

}

void loop() {

for(int i=0;i<3;i++){
if((digitalRead(10) == 1)||(digitalRead(11) == 1)){
Serial.println('!');
  }
else{
Serial.println(analogRead(A0));
  }
  }
delay(1000);
int temp = analogRead(pinTemp);    //Read the analog pin
temp = temp * 0.48828125;   // convert output (mv) to readable
celcius
Serial.print("Temperature: ");
Serial.print(temp);
Serial.println("C");  //print the temperature status


}
```

# Chapter 8

# Website -

ait-shms.000webhostapp.com



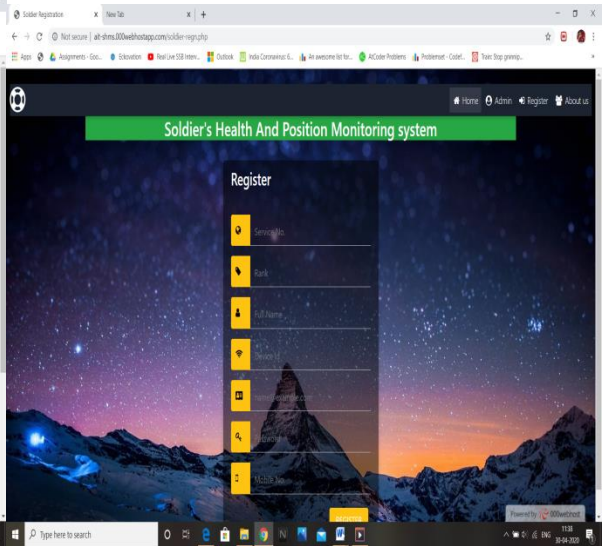




**Figure 8.1: Website to login and to save data of soldiers** **Figure 8.2: Website register page**

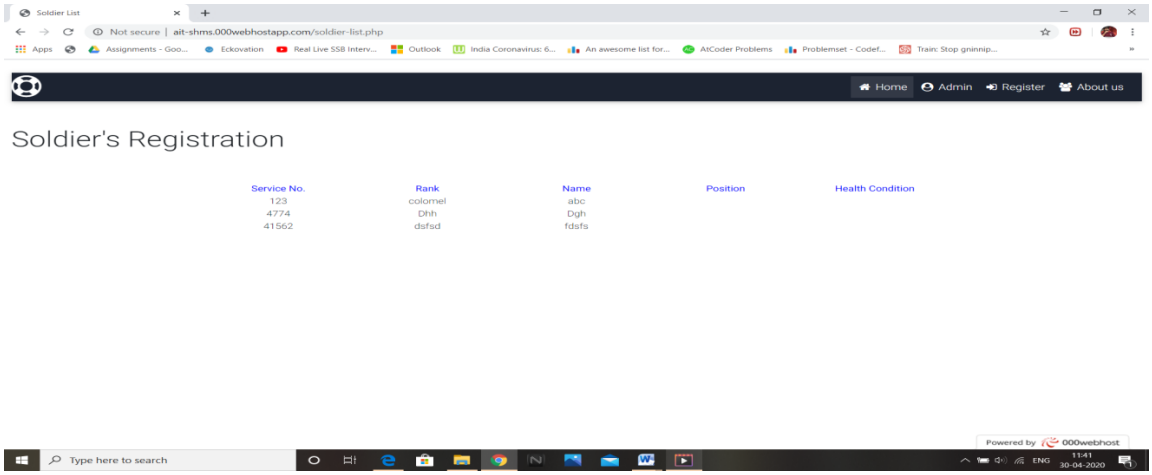



**Figure 8.3: Website page where soldier data has been shown**

# Chapter 9

# Project schedule

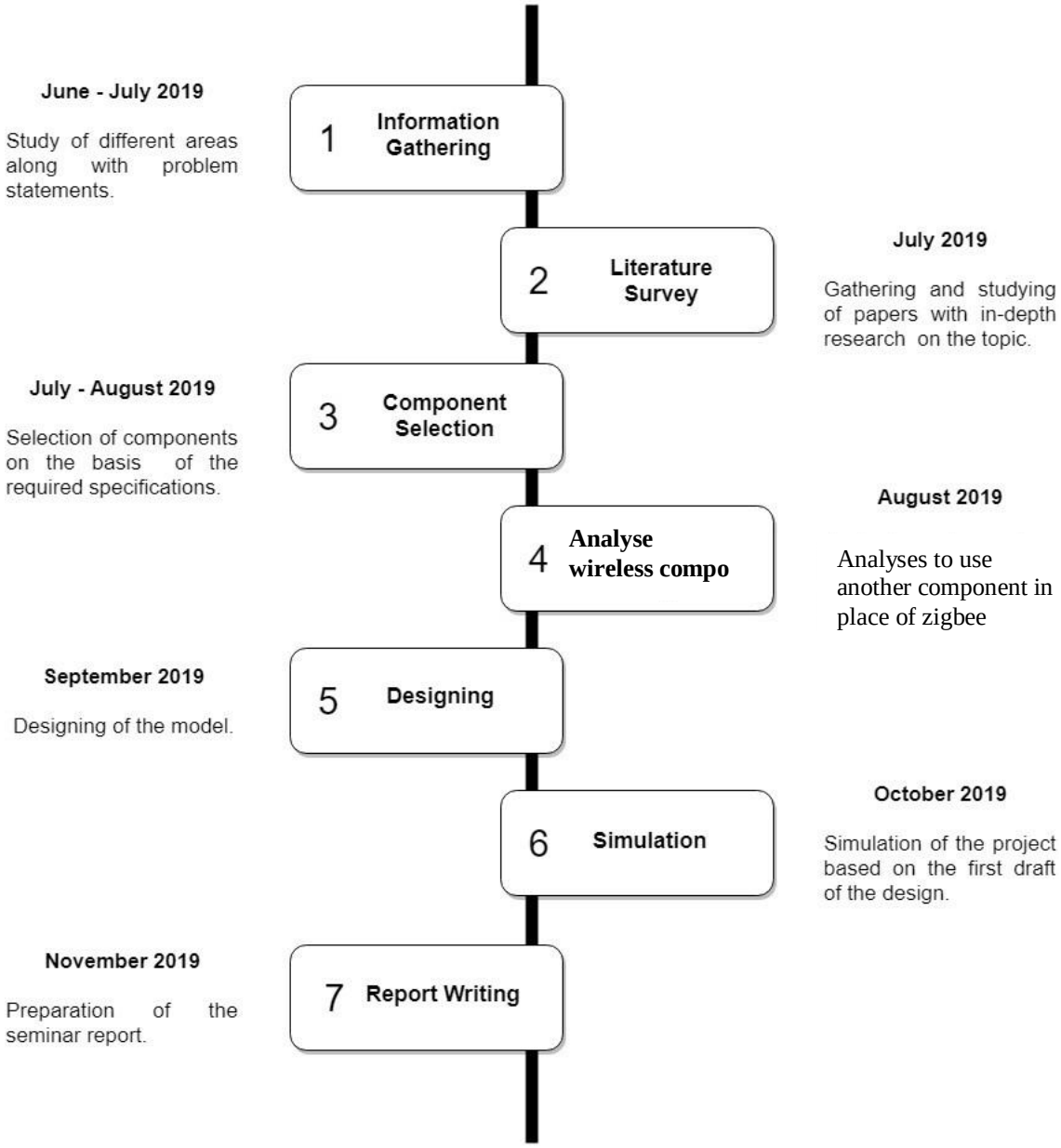



**Figure 9.1: Project schedule for the first semester**

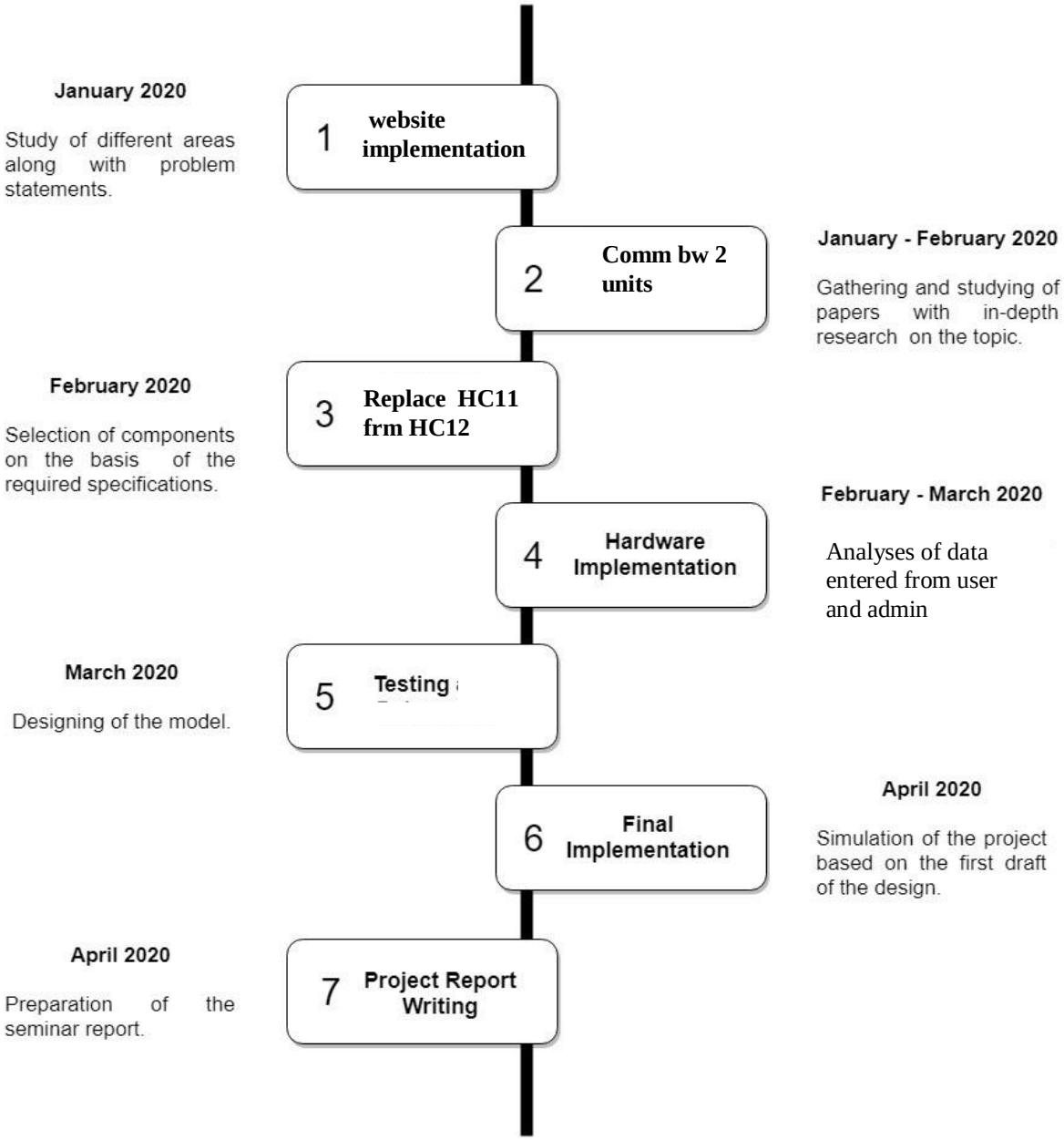



**Figure 9.2: Project schedule for the second semester**

# Chapter 10

# Conclusion and Future Scope

## 10.1 Conclusion

GPS tracks position of soldier anywhere on globe and also health system monitors soldier's vital health parameters and environmental situation which provide security and safety for soldiers. Modules used are smaller in size and also lightweight so that they can be carried around.So in this way, concept of tracking and navigation system is very useful for soldiers when they are on military field during war. And also for base station so that they can get real-time view of soldier.

## 10.2 FutureScope

1. This project can be further improved for implementation in a battalion
2. Project can be improved by setting a limit range for body temperature and heart beat so, if there is any abnormal fluctuation in readings then only data gets transmit to squadron and control room otherwise only steady observation is required.

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