Soldier Health Monitoring and Position Tracking System

By: Parithosh Dinesh Poojary (17BEC7050)

Guide: Dr.Suseela Vappangi

CONTENTS

INTRODUCTION

- In today’s era, enemy warfare is an important factor in any nation’s security.
- The national security mainly depends on Army, Navy and Air-Force. The important and vital role is played by the soldiers.
- So, to support this technological idea, in this project I have come up with a system which will track soldiers position as well as give their health status during a operation/mission.
- This system in particular will be useful for individuals, who involve in missions or in special operations.

OBJECTIVE

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

APPLICATIONS

DEFENCE FORCES

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

CIVILIANS

This project can also be utilized by individuals who work in remote areas or high altitudes wherein the most basic information should be known to someone dear to them or their guardian’s.

PROGRESS SCHEDULE

OCTOBER 03, 2020

HARDWARE IMPLEMENTATION

Implementing the whole project with the acquired hardware components.

NOVEMBER 01, 2020

TESTING/IMPROVEMENTS

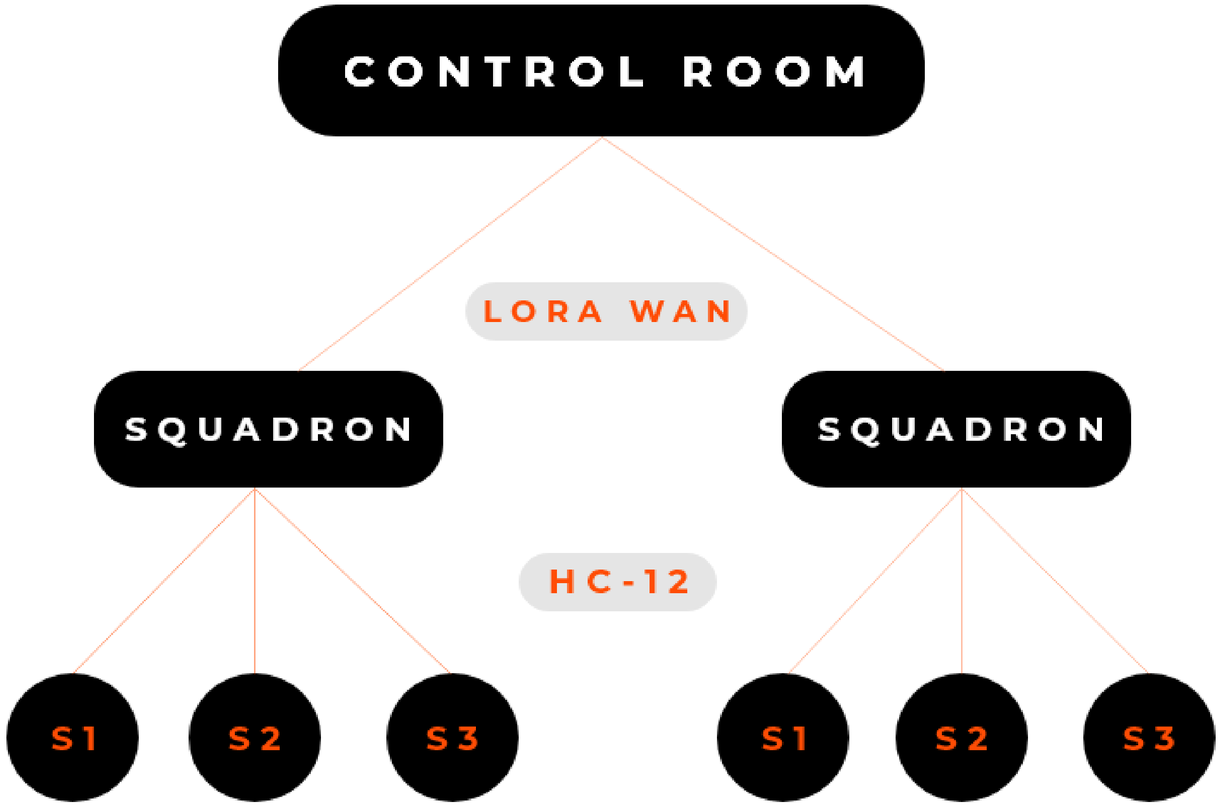
Testing of the designed hardware model, and if any improvements required, adding it accordingly.

NOVEMBER 15, 2020

FINAL IMPLEMENTATION

Simulation of the whole project based on the final draft of the design.

DESIGN



S1,S2,S3 - Soldiers

Soldiers play a key role in the whole system – they are equipped with multiple sensors ..i.e. Temp sensor (LM-35), Pulse sensor (RC-A-4015), GPS sensor (Neo-6M), RF transmitter (HC-12) and an Arduino UNO.

Squadron Leader

Squadron leader is placed at level 2, so that information is received to him before it is received to the control room, as in to take action quite earlier if by any chance some mishap occurs. The squadron leader would also be equipped with sensors ..i.e. RF receiver (HC-12), Temp sensor(LM-35), LoRa WAN transmitter (SX-1278) and an Arduino UNO.

Control Room

Control room is level 3, where all the information received through the LoRa WAN (SX-1278) is stored in a place.

SIMULATION

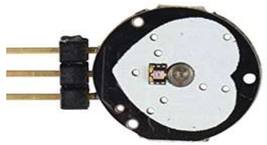
Temp Sensor (LM-35)

LM-35 is a precession integrated circuit Temperature sensor, whose output voltage varies, based on the temperature around it. It is a small and cheap IC which can be used to measure temperature anywhere between -55°C to 150°C.

Pulse Sensor (RC-A-4015)

A pulse wave is the change in the volume of a blood vessel that occurs when the heart pumps blood, and a detector that monitors this volume change is called a pulse sensor.

RC-A-4015 does the same work by using a led, which emits light and simultaneously receives the emitted light and accordingly processes the light to provide an analog value of the heartbeat.



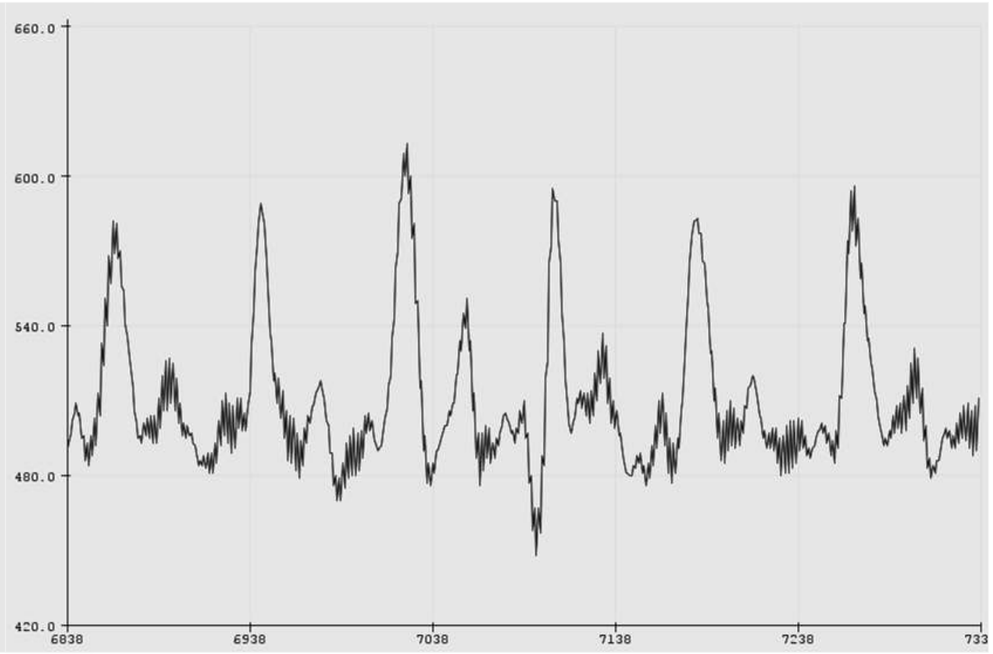
```
29.8    85.6
26.1    78.9
28.6    83.4
25.1    77.1
21.9    71.4
24.8    76.6
21.7    71.0
25.0    77.0
21.9    71.4
24.5    76.1
21.4    70.5
18.7    65.6
21.1    69.9
18.5    65.3
19.9    67.8
17.4    63.3
```

LM-35

```
TEMPRATURE = 20.04C   68.07F
BPM: 77
TEMPRATURE = 26.87C   80.37F
BPM: 69
TEMPRATURE = 26.39C   79.50F
BPM: 63
TEMPRATURE = 26.87C   80.37F
BPM: 61
TEMPRATURE = 14.18C   57.52F
TEMPRATURE = 18.09C   64.55F
BPM: 53
TEMPRATURE = 17.60C   63.68F
BPM: 49
TEMPRATURE = 24.43C   75.98F
BPM: 50
TEMPRATURE = 27.36C   81.25F
BPM: 51
TEMPRATURE = 26.87C   80.37F
BPM: 52
TEMPRATURE = 26.39C   79.50F
BPM: 56
```

(LM-35) + (RC-A-4015)

```
♥ A HeartBeat Happened !
BPM: 90
♥ A HeartBeat Happened !
BPM: 82
♥ A HeartBeat Happened !
BPM: 77
♥ A HeartBeat Happened !
BPM: 78
♥ A HeartBeat Happened !
BPM: 75
♥ A HeartBeat Happened !
BPM: 78
♥ A HeartBeat Happened !
BPM: 77
♥ A HeartBeat Happened !
BPM: 76
♥ A HeartBeat Happened !
BPM: 76
♥ A HeartBeat Happened !
BPM: 75
♥ A HeartBeat Happened !
BPM: 73
♥ A HeartBeat Happened !
BPM: 74
♥ A HeartBeat Happened !
BPM: 74
♥ A HeartBeat Happened !
BPM: 73
♥ A HeartBeat Happened !
BPM: 73
```



RC-A-4015

SIMULATION

GPS Sensor (Neo-6M)

GPS sensors are receivers with antennas that use a satellite-based navigation system with a network of 24 satellites in orbit around the earth to provide position, velocity, and timing information.

RF Sensor (HC-12)

The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4-473.0 MHz range that is capable of transmitting up to 1.5 km.

```
$GPGSV,3,3,12,26,50,119,34,27,02,178,,31,44,026,26,32,22,062,36*7E
$GPGLL,1835.77628,N,07354.01345,E,120658.00,A,A*64
$GPRMC,120659.00,A,1835.77629,N,07354.01369,E,0.217,,300920,,,A*7F
$GPVTG,,T,,M,0.217,N,0.402,K,A*21
$GPGGA,120659.00,1835.77629,N,07354.01369,E,1,05,2.62,587.6,M,-67.8,M,,*74
$GPGSA,A,3,32,16,31,10,26,,,,,,,,4.06,2.62,3.10*05
$GPGSV,3,1,12,01,40,267,,03,28,326,,04,14,293,,10,16,132,25*78
$GPGSV,3,2,12,11,19,231,,16,30,166,22,21,31,201,,22,51,327,*76
$GPGSV,3,3,12,26,50,119,34,27,02,178,,31,44,026,26,32,22,062,36*7E
$GPGLL,1835.77629,N,07354.01369,E,120659.00,A,A*6A
$GPRMC,120700.00,A,1835.77630,N,07354.01365,E,0.156,,300920,,,A*70
$GPVTG,,T,,M,0.156,N,0.288,K,A*23
$GPGGA,120700.00,1835.77630,N,07354.01365,E,1,05,2.62,587.6,M,-67.8,M,,*7D
$GPGSA,A,3,32,16,31,10,26,,,,,,,,4.06,2.62,3.10*05
$GPGSV,3,1,12,01,40,267,,03,28,326,,04,14,293,17,10,16,132,25*7E
$GPGSV,3,2,12,11,19,231,,16,30,166,22,21,31,201,,22,51,327,*76
$GPGSV,3,3,12,26,50,119,33,27,02,178,,31,44,026,27,32,22,062,35*7B
$GPGLL,1835.77630,N,07354.01365,E,120700.00,A,A*63
$GPRMC,120701.00,A,1835.77631,N,07354.01379,E,0.084,,300920,,,A*73
$GPVTG,,T,,M,0.084,N,0.156,K,A*2D
$GPGGA,120701.00,1835.77631,N,07354.01379,E,1,05,2.62,587.8,M,-67.8,M,,*7E
$GPGSA,A,3,32,16,31,10,26,,,,,,,,4.06,2.62,3.10*05
$GPGSV,3,1,12,01,40,267,,03,28,326,,04,14,293,15,10,16,132,25*7C
$GPGSV,3,2,12,11,19,231,,16,30,166,23,21,31,201,,22,51,327,*77
$GPGSV,3,3,12,26,50,119,33,27,02,178,,31,44,026,26,32,22,062,36*79
$GPGLL,1835.77631,N,07354.01379,E,120701.00,A,A*6E
$GPRMC,120702.00,A,1835.77626,N,07354.01339,E,0.155,,300920,,,A*7F
```

Neo-6M (NMEA Data)

```
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596075,73.900329  Date 9/30/2020
Location: 18.596073,73.900329  Date 9/30/2020
Location: 18.596073,73.900329  Date 9/30/2020
Location: 18.596073,73.900329  Date 9/30/2020
Location: 18.596073,73.900329  Date 9/30/2020
Location: 18.596073,73.900329  Date 9/30/2020
```

Neo-6M(Lat, Lon and Date

```
#include <SoftwareSerial.h>
SoftwareSerial HC12(10, 11); // HC-12 TX Pin, HC-12 RX Pin
void setup() {
  Serial.begin(9600);             // Serial port to computer
  HC12.begin(9600);               // Serial port to HC12
}
void loop() {
  while (HC12.available())        // If HC-12 has data
  {
    Serial.write(HC12.read());    // Send the data to Serial monitor
  }
  while (Serial.available())      // If Serial monitor has data
  {
    HC12.write(Serial.read());    // Send that data to HC-12
  }
}
```

```
File  Edit  Sketch  Tools  Help
receiver
#include <SoftwareSerial.h>
SoftwareSerial HC12(10, 11); // HC-12 TX Pin, HC-12 RX Pin
void setup() {
  Serial.begin(9600);             // Serial port to computer
  HC12.begin(9600);               // Serial port to HC12
}
void loop() {
  while (HC12.available()) {      // If HC-12 has data
    Serial.write(HC12.read());    // Send the data to Serial mor
```

COM5

Send

HELLO THIS IS TEST PHASE - 1.0.0

COM6

HELLO THIS IS TEST PHASE - 1.0.1

HC-12 (Transmitter and Receiver)

SIMULATION

LoRa WAN (SX-1278)

The SX1278 RF module is mainly used for long-range spread spectrum communication. It has minimum current consumption. Due to the LoRa modulation technology, the SX1278 has a high sensitivity of -148 dBm with a power output of +20 dBm, a long transmission distance and high reliability.

Micro-Controller (Arduino Uno)

The Arduino Uno is a microcontroller board based on the microchip ATmega328P. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

COM6

```
LoRa Sender
Sending packet: 0
Sending packet: 1
Sending packet: 2
Sending packet: 3
Sending packet: 4
Sending packet: 5
Sending packet: 6
Sending packet: 7
Sending packet: 8
Sending packet: 9
Sending packet: 10
Sending packet: 11
Sending packet: 12
Sending packet: 13
Sending packet: 14
Sending packet: 15
Sending packet: 16
Sending packet: 17
```

SX-1278 (Sender's Data)

COM5

```
LoRa Receiver
Received packet 'hello 1' with RSSI -82
Received packet 'hello 2' with RSSI -82
Received packet 'hello 3' with RSSI -96
Received packet 'hello 4' with RSSI -89
Received packet 'hello 5' with RSSI -87
Received packet 'hello 5' with RSSI -87
Received packet 'hello 6' with RSSI -89
Received packet 'hello 7' with RSSI -87
Received packet 'hello 8' with RSSI -83
Received packet 'hello 9' with RSSI -86
Received packet 'hello 10' with RSSI -85
Received packet 'hello 11' with RSSI -85
Received packet 'hello 12' with RSSI -85
Received packet 'hello 13' with RSSI -86
Received packet 'hello 14' with RSSI -94
Received packet 'hello 15' with RSSI -94
Received packet 'hello 16' with RSSI -94
Received packet 'hello 17' with RSSI -95
Received packet 'hello 18' with RSSI -91
```

SX-1278(Receiver's Data)

sx_and_tempsensor

```
  int myBPM = pulseSensor.getBeatsPerMinute();  // Calls function
  if (pulseSensor.sawStartOfBeat())
```

COM5

Send

```
.....................................
Received packet:
 Temperature:25.80C    BPM:68
.....................................
Received packet:
 Temperature:25.80C    BPM:76
.....................................
Received packet:
 Temperature:25.80C    BPM:73
.....................................
Received packet:
 Temperature:25.80C    BPM:70
.....................................
Received packet:
 Temperature:25.80C    BPM:88
.....................................
Received packet:
 Temperature:25.80C    BPM:106
.....................................
Received packet:
 Temperature:25.80C    BPM:103
.....................................
```

ReceLora

```
#include <SPI.h>
#include <LoRa.h>
```

COM6

```
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
Sent the Squadron's Data.
Sending packet:
```

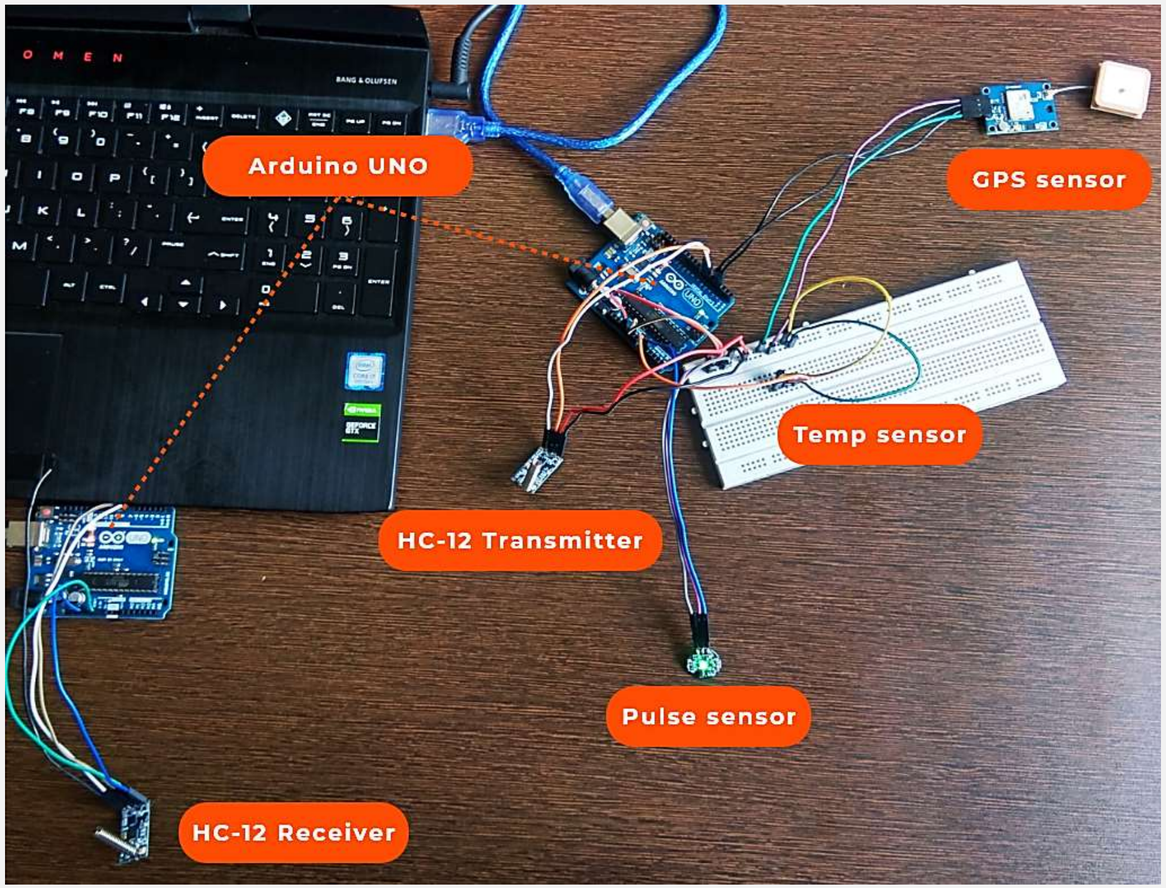
(SX-1278) + {(LM-35) + (RC-A-4015)}

HARDWARE IMPLEMENTATION

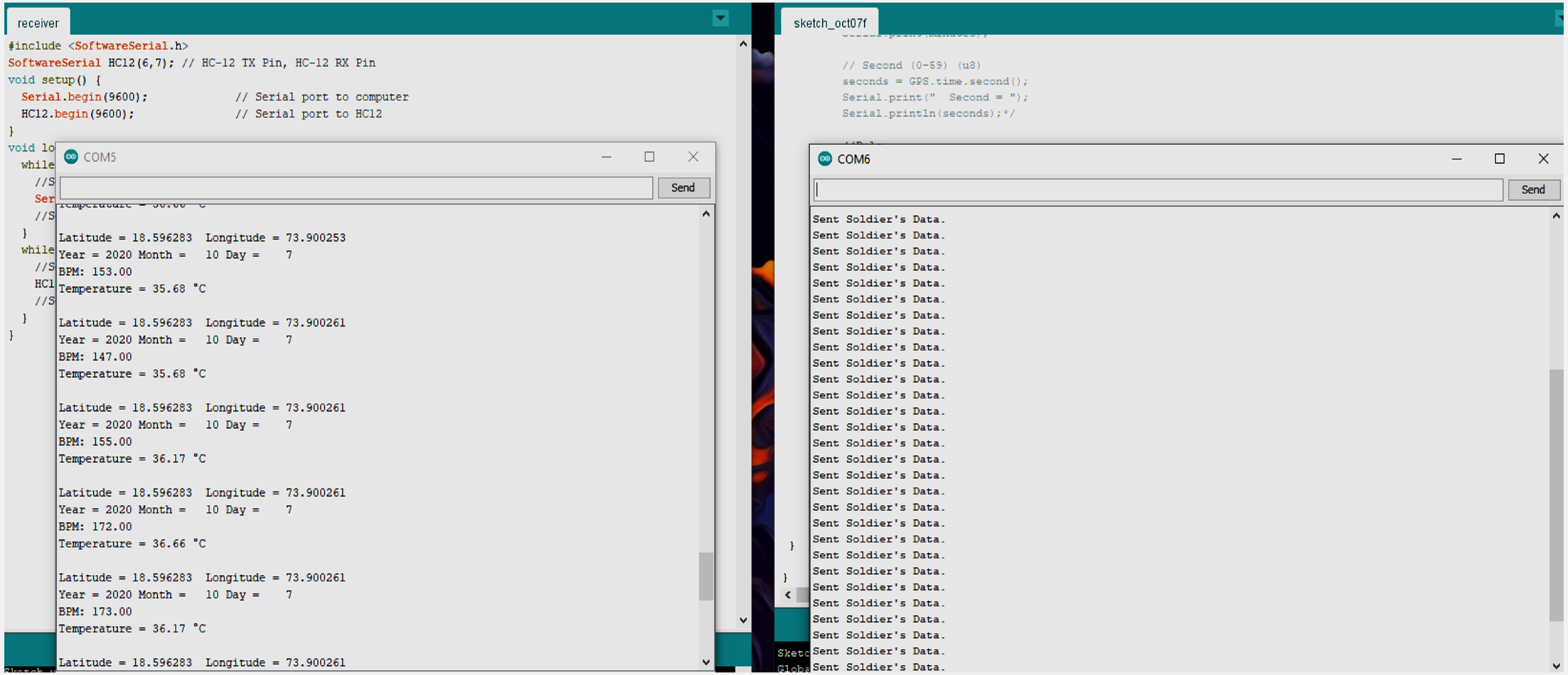
Block diagram

Soldiers unit (Health and Position data) **Squadron unit**

HARDWARE IMPLEMENTATION



HARDWARE IMPLEMENTATION

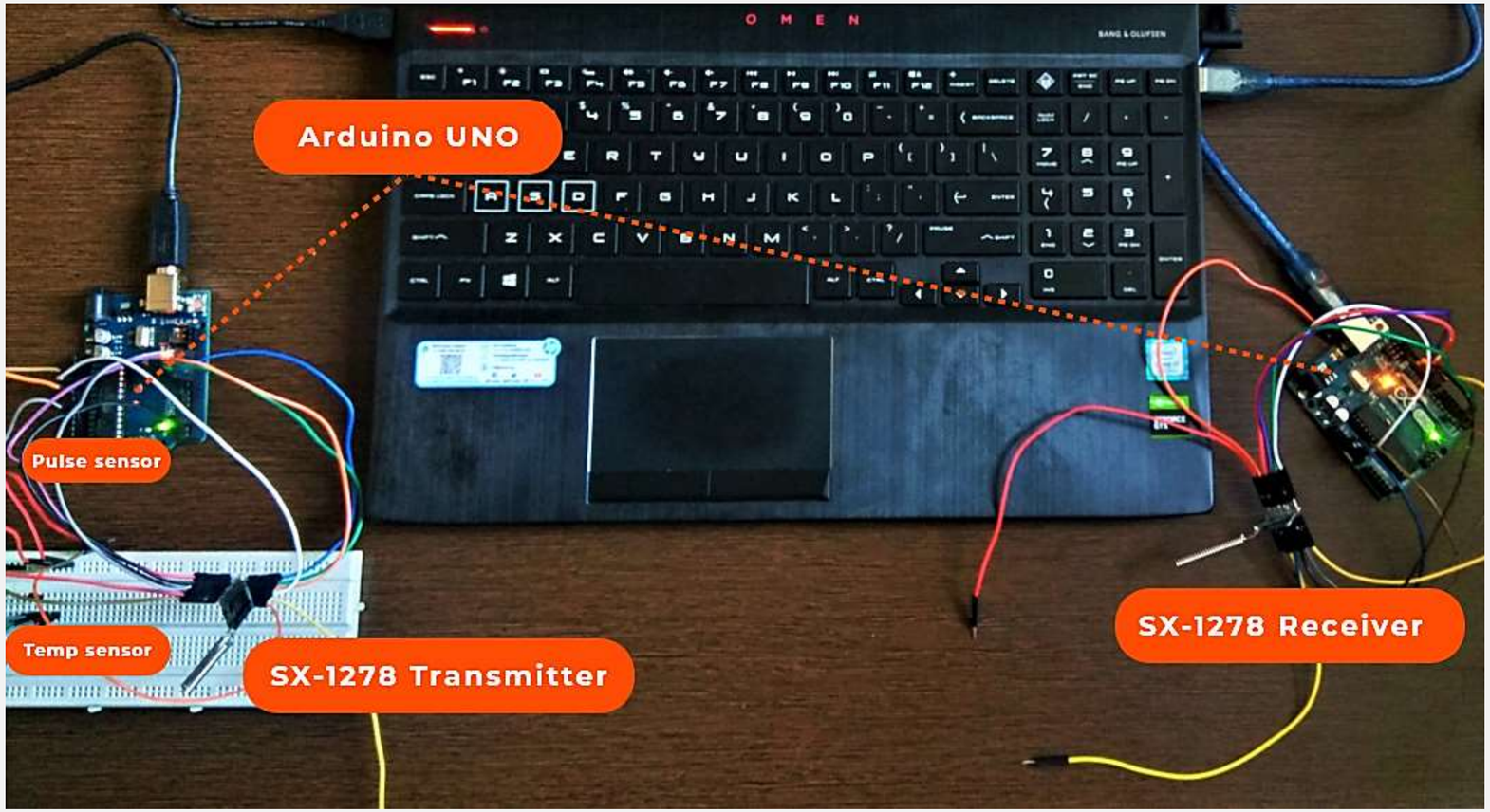


HARDWARE IMPLEMENTATION

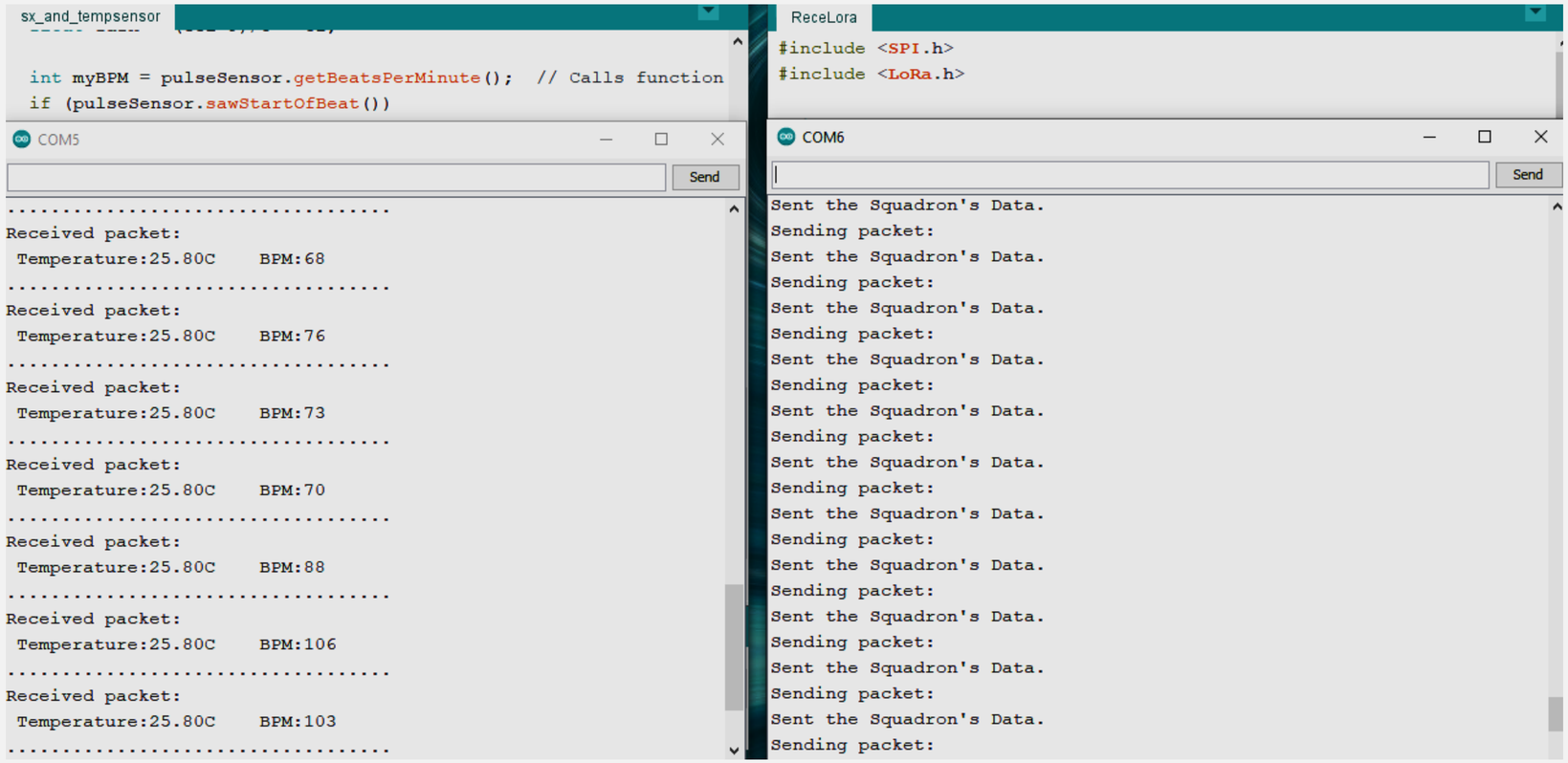
Block diagram

Squadron unit (Health data) → **Control Room**

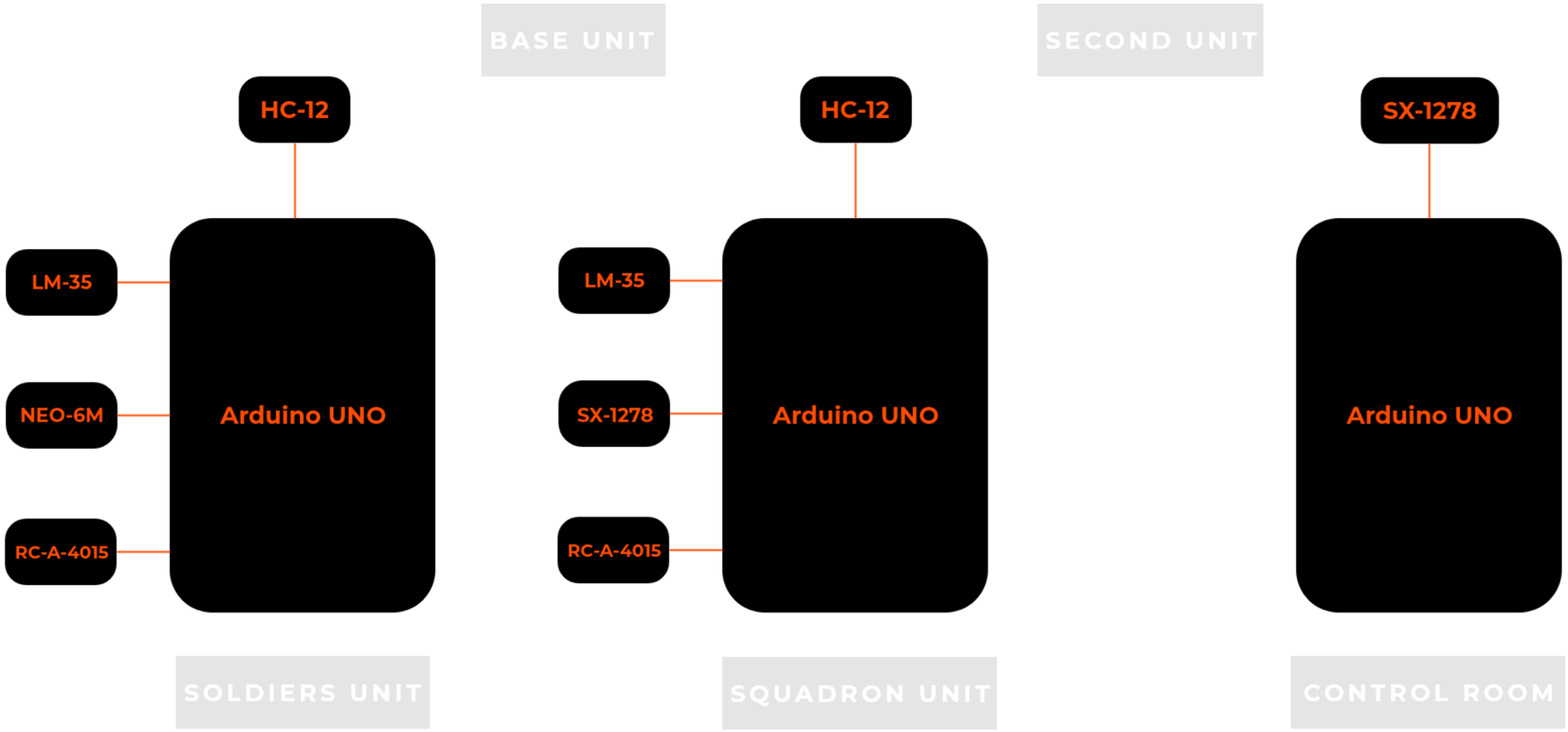
FINAL IMPLEMENTATION



HARDWARE IMPLEMENTATION



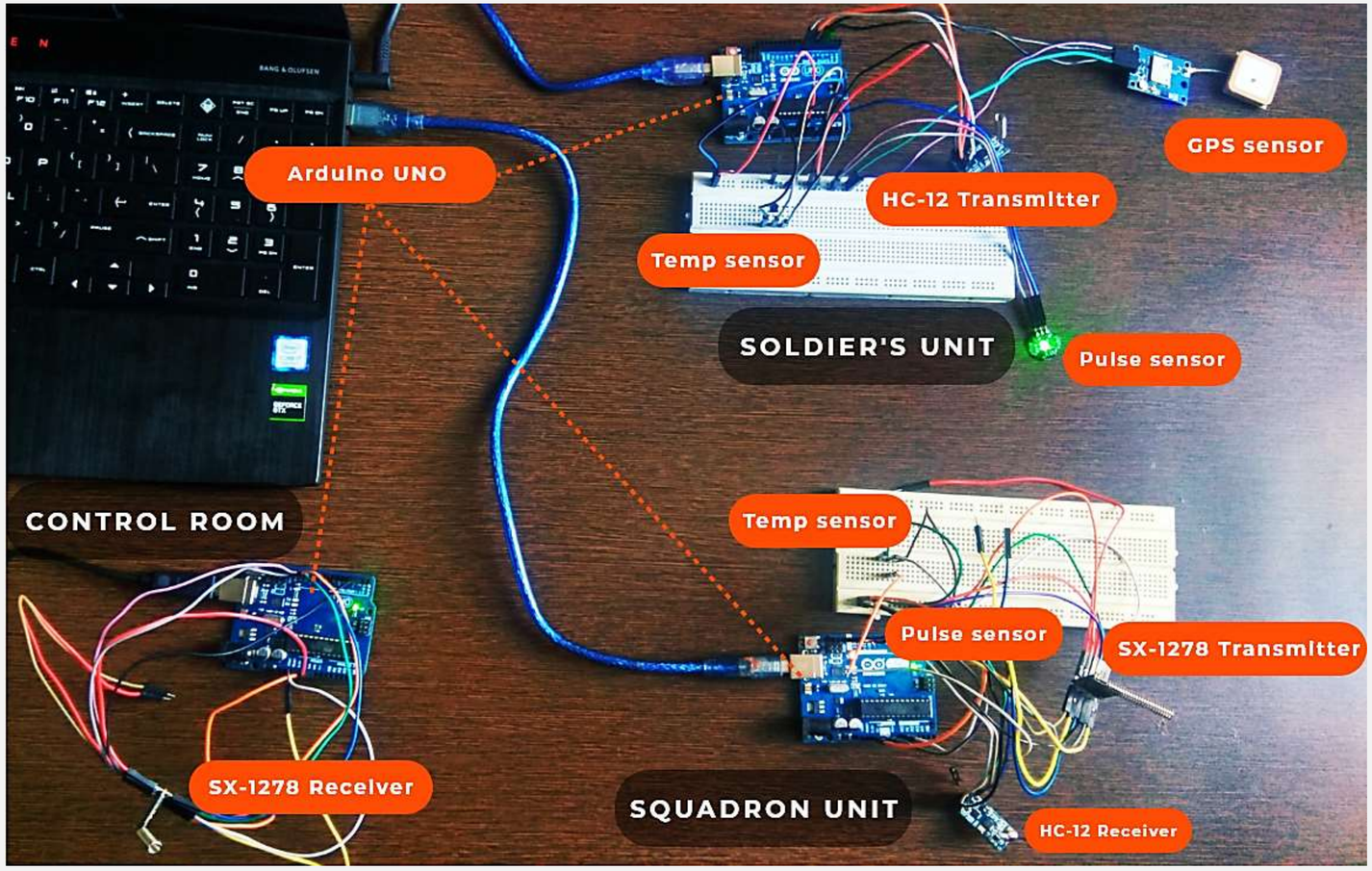
FINAL IMPLEMENTATION



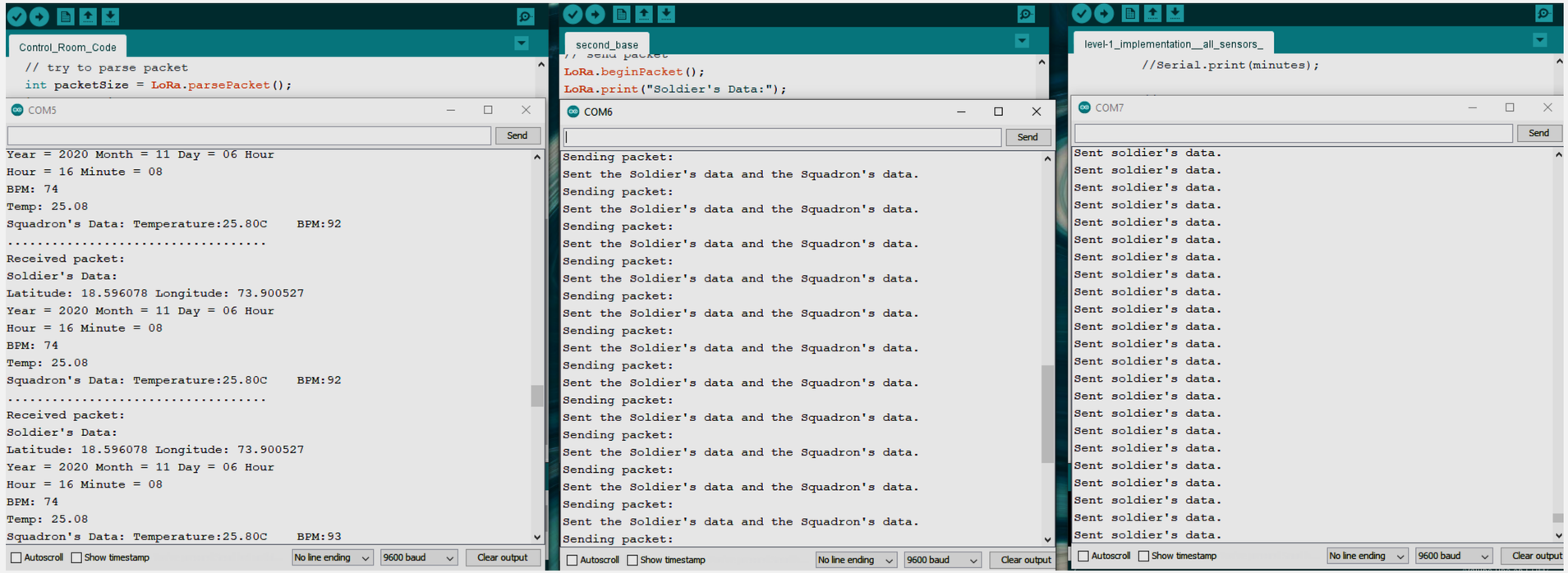
Block diagram

Soldiers unit (Health and Position data) → **Squadron** ~~unit~~ → **Control Room**

HARDWARE IMPLEMENTATION



FINAL IMPLEMENTATION



RESULT

- Successfully designed a model that meets the requirement of my objective.
- Successfully simulated all the acquired components.
- Successfully simulated all the level’s of the design..i.e. sending the data collected from the soldiers S-Health system to the squadron’s unit through RF module(HC-12) and simultaneously sending the data received from soldiers unit combined with the data of the squadron unit to the control room through the LoRa module(SX-1278).

REFERENCES

- Hock Beng Lim, Di Ma, Bang Wang, Zbigniew Kalbarczyk, Ravishankar K. Iyer, Kenneth L. Watkin (2010); “A Soldier Health Monitoring System for Military Applications”.
- William Walker, A. L. Praveen Aroul, Dinesh Bhatia; “Mobile health monitoring system”.
- Shweta Shelar, Nikhil Patil, Manish Jain, Sayali Chaudhari, Smita Hande; “Soldier Tracking And Health Monitoring Systems”.
- P.S. Kurhe, S.S. Agrawal (2013); “Real Time Tracking and Health Monitoring System of Remote Soldier Using ARM 7”.
- www.allaboutcircuits.com/projects/understanding-and-implementing-the-hc-12-wireless-transceiver-module
- https://circuitdigest.com/microcontroller-projects/arduino-lora-sx1278-interfacing-tutorial

PROJECT SCHEDULE

Information Gathering
Study of different areas along with problem statements.

AUGUST 13,2020

Literature Survey
Gathering and studying of papers with in depth research on the topic.

AUGUST 20,2020

Component Selection
Selection of components on the basis of the required specifications.

SEPTEMBER 03,2020

Analyse Components
Analysis of all the selected components and in depth study of the components.

SEPTEMBER 13,2020

Designing
Designing of the model.

SEPTEMBER 24,2020

Simulation
Simulation of the project based on the first draft of the design.

SEPTEMBER 28,2020

Hardware Implementation
Implementing the whole project with hardware components.

OCTOBER 03,2020

Testing/Improvements
Testing of the designed hardware model, and if any improvements required adding it accordingly.

NOVEMBER 01,2020

Final Implementation
Simulation of the whole project based on the final draft of the design.

NOVEMBER 15,2020

Project Report Writing
Preparation of the final report for the capstone.

NOVEMBER 27,2020

THANK YOU

ANY QUESTIONS ?