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(An Autonomous Institution, Affiliated to Anna University. Chennai)

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TAMILNADU

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

MINI PROJECT

IoT BASED HEALTH MONITORING AND LOCATION TRACKING SYSTEM FOR SOLDIERS

Guided by

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BONAFIDE CERTIFICATE

Certified that this project report **"IoT based health monitoring and location tracking system for soldiers"** is the bonafide work of **"NANDHINI M(19EC064), PRIYADHARSHINI P(19EC078), SALAISUYANJOTHI S(19EC085)"** who carried out the project under my supervision .

Signature of the Supervisor

Head of the Department

Submitted for the project viva-voce held on……

INTERNAL EXAMINER

EXTERNAL EXAMINER

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ABSTRACT

This project is to design and develop IoT based health monitoring and location tracking system that suitable for Soldiers. This system is used to track the current GPS position of soldier and also checks the health status including body temperature and heartbeats of soldier. The System also consists extra feature with the help of that soldier can ask for help manually or send a distress signal to military if he is in need. The GPS modem sends the latitude and longitude position with link pattern with the help of that military can track the current position of the soldier. The system is very helpful for getting health status information of soldier and providing them instant help.

CHAPTER 1
INTRODUCTION

The soldiers play an essential role in nation security, but in critical situations majority of soldiers are losing life due to lack of information regarding real time health status and not able to communicate with control room. The proposed IoT based health monitoring and location tracking system continuously records the health status of soldiers and their location and there by send the information to control room. If any abnormalities are identified in the health condition of the soldier, immediate action can be taken within a short duration. The proposed system has 2 units one of which is soldiers unit (wearable one) which includes heartbeat sensor, temperature sensor which monitors health conditions and tracks soldiers location using GPS technology thereby transmit data to other unit which is control room unit, the control room unit will receive the soldier's data through IoT and checks for any abnormalities in the data received and thus helps soldiers to get proper medical aid within a short time.

1.1 HISTORY

A low cost IOT based health monitoring and location tracking system is to be developed which continuously monitor the real time health parameter and location of soldiers by polling sensor and GPS location at fixed interval of time, the monitoring node is Arduino Uno. The sensor utilized here are heartbeat sensor and

temperature sensor, accelerometer sensor, module is Wi-Fi, GPS receiver for tracking the position of soldiers. Wi-Fi module is used to send the monitored real time data of soldiers to the cloud.The sensors, Wi-Fi and GPS receiver are interfaced to the

Arduino Uno microprocessor using wires and is programmed using C language . To know the current location and health parameters, the user can login on cloud

web browser by entering username and password of the user in control room. After entering password, the Thingspeak web application page gives the condition of soldiers

CHAPTER 2
LITERATURE SURVEY

In general there were various kind of wearable, portable, light weighted and small sized sensors that have been developed for monitoring of the 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 human body for health monitoring in real time. In this paper, we propose a methodology to develop a system for real time health monitoring of soldiers, consisting of interconnected BSNs. The authors[4] had introduced a system that gives 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.

The authors[5][6][7][8] had presented an idea for the safety of soldiers using sensors to monitor the health status of soldiers as well as ammunitions on them. GPS module has been used for location tracking and RF module has been used for high speed, short-range data transmission, for wireless communications between soldier-to soldier that will help to provide soldiers health status and location data to control unit[9][16]. The authors[10][15] had investigated for the care of critically ill patients. This paper is based on monitoring the health of remote patients, after they get discharged from hospital. This system enables the doctors to monitor health parameters like body temperature, heartbeat and ECG of patients from their clinic or hospital. The health parameters of patient are measured continuously and transmitted wirelessly through ZigBee[12][13][14] transceiver. The authors [17] have proposed a "Soldier Health and Position Tracking System" using Barometric pressure sensor, GPS, GSM and WBASNs (heartbeat sensor, temperature sensor). Microcontroller ATmega328p has been used for their prototype. Simple conditional statements have been used to identify the health of the soldier without any machine learning or training. GSM has been used as the means of communication which will not be useful at places with high altitude where network connectivity would be a big challenge. A message is sent after regular intervals containing the
Health status of the soldier using GSM.

The authors[18] have proposed "IoT-based Health Monitoring via LoRaWAN" in which collected medical sensor data is sent to an analysis module via low-cost, low-power and secure communication using a LoRaWAN (Long Range Wide Area Network) network infrastructure. Blood pressure, glucose and temperature has been measured in rural areas where cellular network coverage is either absent or does not allow data transmission. The average area covered by LoRaWAN is found to be around 33 km 2 when the LoRaWAN Gateway is placed outdoor on a 12 meter altitude.

Power consumption of this monitoring system is claimed to be at least ten times lower than other long range cellular solutions, such as GPRS/3G/4G.

2.1 Proposed System

The detailed working had introduced a system that gives ability to track the soldiers at any moment. The soldiers will be able to communicate with controlunit using GPS coordinate information in their distress. It is able to send the sensed and processed parameters of soldiers 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.

2.2 Implementation

In this project we have implemented the sensors and the microcontroller along with the Wi-Fi module. These are connect with the Arduino uno microcontroller to give the output. The accelerometer sensor used in this project is able to give the current position of the soldier and the humidity sensor gives the temperature of the soil.

2.3 Health monitoring and location tracking system using microcontroller

Hardware used here are Arduino, ultrasonic sensor, relay, solenoid valve, power supply. Arduino which triggers the ultrasonic sensor to propagate ultrasonic waves by which it detect the motion of object and give input to Arduino. So that it turns the relay HIGH which makes the solenoid valve open by making it closed circuit with power supply.

CHAPTER 3
METHODOLOGY

To meet the objectives, a low cost IoT based health monitoring and location tracking system is to be developed which continuously monitor the real time health parameter and location of soldiers by polling sensor and GPS location at fixed interval of time, the monitoring node is Arduino uno. The sensor utilized here are heartbeat sensor and temperature sensor, IoT module is Wi-Fi, GPS receiver for tracking the position of soldiers. Wi-Fi module is used to send the monitored real time data of soldiers to the cloud. The sensors, Wi-Fi and GPS receiver are interfaced to the Arduino Uno microprocessor using jumper wires and is programmed using C language. To know the current location and health parameters, the user can login on ThingSpeak web browser by entering username and password of the user in control room. After entering password, the web application page opens with the output in graphical representation manner.

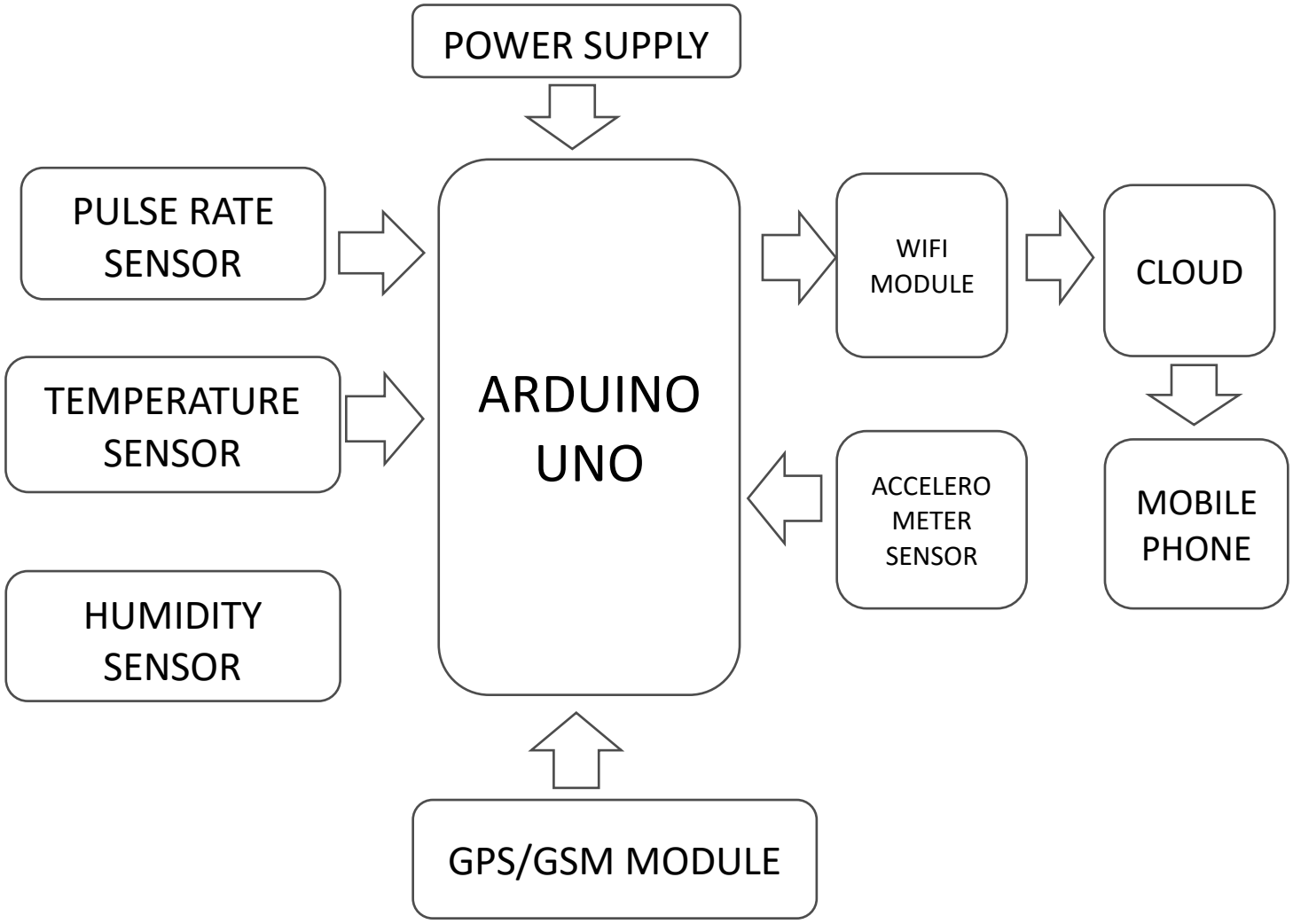


Fig 3.1: Block diagram of Health monitoring and location tracking

Hardware used here are Arduino, GSM, GPS, ESP Module, DHT 11, LCD. Arduino sends the command to the ESP, GPS, and GSM. The LCD and the Cloud page shows the health condition of the soldiers. The Pulse Sensor, DHT 11 are input devices.

CHAPTER 4

DESIGN AND IMPLEMENTATION

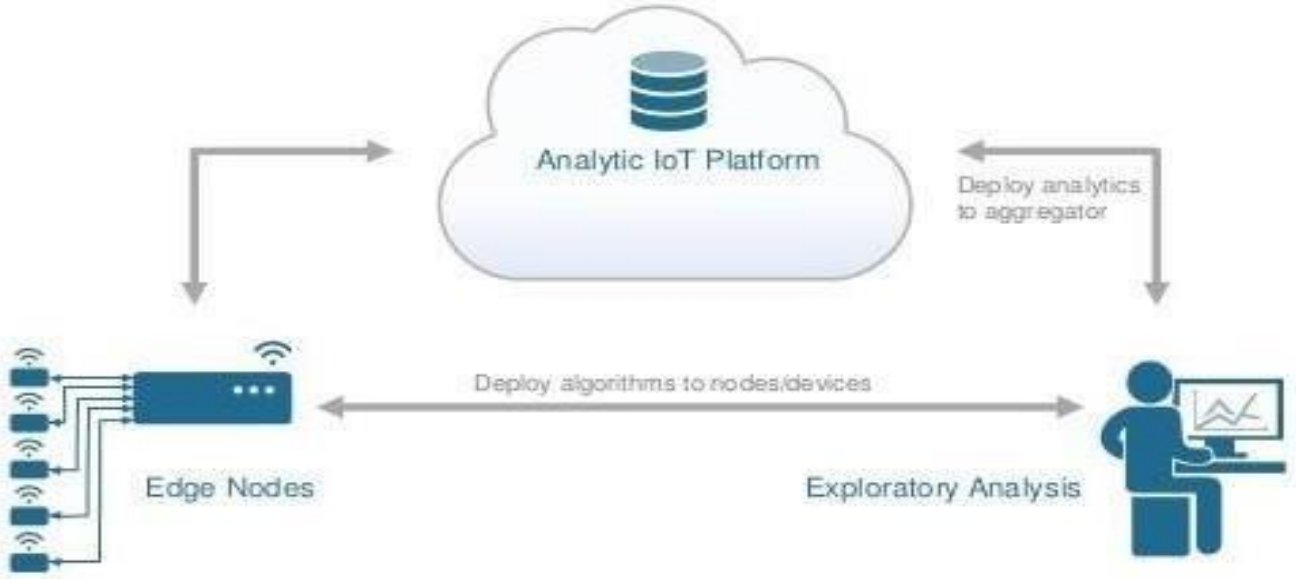
INTRODUCTION TO HEALTH MONITORING SYSTEM:

This Section briefs about health monitoring system, it measures parameters like blood pressure, heartbeat and oxygen level etc. The body parameters are measured by using sensors which involves in continuously monitoring the body parameter of soldiers.

After turning ON the device, it will start the network connecting diagnosis. Once the device get connected to our wifi it will starts to check the temperature and humidity of the surrounding space of the soldier using DHT 11. The heart beat of the soldier will get monitored using Pulse sensor. The stability and the position of the soldier is monitor using Accelerometer sensor.

The ongoing or working process will be shown on the lcd display.

The Temperature, humidity and pulse sensor readings shown on thingspeak website. The cloud page will be refreshed for certain delay.


Analytic IoT Platform
Deploy analytics
to aggregator
Deploy algorithms to nodes/devices
Edge Nodes
Exploratory Analysis

CHAPTER 5

HARDWARE DISCRIPTION

5.1 ARDUINO UNO

Arduino is an open source, PC paraphernalia and programming organization, endeavour, and client group that plans and produce microcontroller packs for constructing programmed devices and intelligent object that can detect and control questions in the real world. The inception of the Arduino extend began at the Interaction Design Institute in Ivrea, Italy. The equipment reference plans are appropriated under a Creative Commons Attribution Share.

Fig 5.1 Arduino

5.2 HUMIDITY AND TEMPERATURE SENSOR

Temperatureand humidity sensor(or rh temp sensor) is devices that can convert temperature and humidity into electrical signals that can easily measure temperature and humidity. Temperature humidity transmitters generally measure the amount of temperature and relative humidity in the air, and convert it into electrical signals or other signal forms according to certain rules and output the device to the instrument or software to meet the environmental monitoring needs of users.

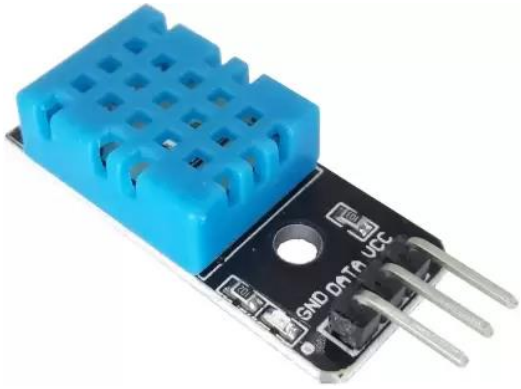


Fig 5.2 Humidity and Temperature sensor

5.3. HEARTBEAT SENSOR

The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of applications where the heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by the blood, the signal pulses are equivalent to the heartbeat pulses

Fig 5.3: heart beat sensor

5.4. GPS RECEIVER

A GPS Receiver is a L-band radio processor capable of solving the navigation equations in order to determine the user position, velocity and precise time (PVT), by processing the signal broadcasted by GPS satellites. Once the signal is acquired and tracked ,the receiver application decodes the navigation message and estimates the user position

Fig 6: GPS Receiver

5.5. ACCELEROMETER SENSOR

An accelerometer is an electronic sensor that measures the acceleration forces acting on an object, in order to determine the object's position in space and monitor the object's movement. Acceleration, which is a vector quantity, is the rate of change of an object's velocity (velocity being the displacement of the object divided by the change in time).

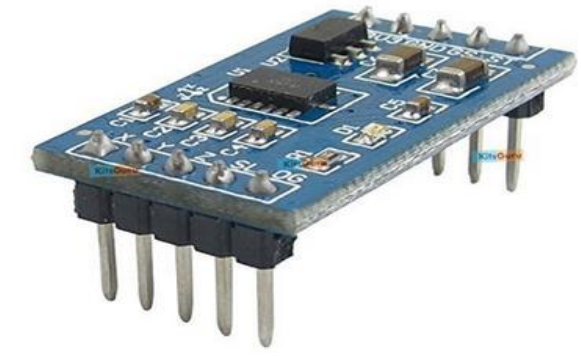


Fig 6. Accelerometer sensor

5.6. WIFI MODULE

An ESP8266 Wi-Fi module was introduced and developed by third-party manufacturers like AI thinkers, which is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor.

Fig 5.7. Wifi module

5.7. JUMPER WIRE

A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), 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. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Fig.5.7Jumper wire

CHAPTER 6

SOFTWARE DESCRIPTION

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. A range of Arduino modules available including the Arduino Mega, Arduino Leonardo, **Arduino Micro** and many more. Each of them contains a microcontroller on the board that is programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. This environment supports both C and C++ languages.

PROGRAM

```
 #include <SoftwareSerial.h>

#include <Wire.h>
#include <DHT.h>
#define Type DHT11
int sensePin=A0;
DHT HT(sensePin,Type);

int pulse1 = A1;
int beat_value1;
int beat1;

#include "ThingSpeak.h"
#include "WiFiEsp.h"
//#include "secrets.h"

#include <LiquidCrystal.h>
const int rs = 13, en = 12, d4 = 11, d5 = 10, d6 = 9, d7 = 8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

int RXPin = 6;
int TXPin = 7;

int GPSBaud = 9600;

SoftwareSerial gpsSerial(RXPin, TXPin);
```

```
#define SECRET_SSID "Soldier"     // replace MySSID with your WiFi network name
#define SECRET_PASS "yyyy1111" // replace MyPassword with your WiFi password

#define SECRET_CH_ID 1160646        // replace 0000000 with your channel number
#define SECRET_WRITE_APIKEY "532PHNDQUH6AF2AA"      // replace XYZ with your channel write API Key

char ssid[] = SECRET_SSID;   // your network SSID (name)
char pass[] = SECRET_PASS;   // your network password
int keyIndex = 0;            // your network key Index number (needed only for WEP)
WiFiEspClient  client;

// Emulate Serial1 on pins 6/7 if not present
#ifndef HAVE_HWSERIAL1
#include "SoftwareSerial.h"
SoftwareSerial Serial1(4, 5); // RX, TX
#define ESP_BAUDRATE  19200
#else
#define ESP_BAUDRATE  115200
#endif

unsigned long myChannelNumber = SECRET_CH_ID;
const char * myWriteAPIKey = SECRET_WRITE_APIKEY;

// Initialize our values
int number1 = 0;
int number2 = 0; // random(0,100);
int number3 = 0;
String myStatus = "";

void setup() {
```

```
  lcd.begin(16,2);
  lcd.print("IOT BASED SOLDIER");
  lcd.setCursor(0,1);
  lcd.print("MONITORING SYSTEM ");
  delay(10000);
  lcd.clear();
  //Initialize serial and wait for port to open
  Serial.begin(115200);  // Initialize serial
  HT.begin();
gpsSerial.begin(GPSBaud);
  // initialize serial for ESP module
  setEspBaudRate(ESP_BAUDRATE);

  while (!Serial) {
    ; // wait for serial port to connect. Needed for Leonardo native USB
port only
  }

  Serial.print("Searching for ESP8266...");
  // initialize ESP module
  WiFi.init(&Serial1);
    lcd.print("Searching for...");
    lcd.setCursor(0, 1);
    lcd.print("ESP8266-WI-FI.  ");
  // check for the presence of the shield
  if (WiFi.status() == WL_NO_SHIELD) {
    Serial.println("WiFi shield not present");
    // don't continue
    while (true);
  }
  Serial.println("found it!");

  ThingSpeak.begin(client);  // Initialize ThingSpeak
}
```

```
void loop() {

  while (gpsSerial.available() > 0)
    Serial.write(gpsSerial.read());

      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("soldiers location");
      lcd.setCursor(0, 1);
      lcd.print("send message");
      delay(1000);
      lcd.clear();
      lcd.setCursor(0, 1);
      lcd.print(" to 9715966077");
      lcd.clear();
      delay(1000);
  Serial.println("AT+CMGF=1");       //Sets the GSM Module in Text Mode
  delay(2000);  // Delay of 1000 milli seconds or 1 second
  Serial.println("AT+CMGS=\"+919715966077\"\r"); // Replace x with mobile number
  delay(1000);
  Serial.print("soldiers location is    ");
  Serial.print("http://maps.google.com/maps?q=loc:");
  //mySerial.print("Latitude = ");
  Serial.print(gpsSerial.read());
    //mySerial.print(" Longitude = ");
  Serial.print(",");
  //Serial.print(flon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flon, 6);
    delay(200);

   Serial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);

  Serial.println("Message sent");
```

```
 delay(20000);

 // Connect or reconnect to WiFi
 if(WiFi.status() != WL_CONNECTED){
   Serial.print("Attempting to connect to SSID: ");
   Serial.println(SECRET_SSID);
   lcd.setCursor(0, 0);
   lcd.print("Attempting to...");
   lcd.setCursor(0, 1);
   lcd.print("connect Network ");
   while(WiFi.status() != WL_CONNECTED){
     WiFi.begin(ssid, pass);  // Connect to WPA/WPA2 network. Change
this line if using open or WEP network
    Serial.print(".");
         delay(5000);
   }
   Serial.println("\nConnected.");
   lcd.setCursor(0, 0);
   lcd.print("connected to....");
   lcd.setCursor(0, 1);
   lcd.print("   Network      ");
   delay(5000);
 }

// put your main code here, to run repeatedly:
  float number1;
  number1=HT.readHumidity();

 float number2;
 number2=HT.readTemperature();

 beat_value1 = analogRead(A4);
 beat1 = ((beat_value1 / 10) * 1.9);
 number3 = beat1;

 Serial.println(number1);
```

```
 Serial.println(number2);
 Serial.println(number3);

// set the fields with the values
ThingSpeak.setField(1,number1);
ThingSpeak.setField(2,number2);
ThingSpeak.setField(3,number3);

// write to the ThingSpeak channel
int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
if(x == 200){
  Serial.println("Channel update successful.");
 lcd.setCursor(0, 0);
lcd.print("channel updated");
lcd.setCursor(0, 1);
lcd.print("successful");
delay(500);
}
else{
  Serial.println("Problem updating channel. HTTP error code " +
String(x));
   lcd.setCursor(0, 0);
lcd.print("Channel updated" );
lcd.setCursor(0, 1);
lcd.print("Error     ");
delay(500);
}

// change the values

/*
number1++;
if(number1 > 99){
  number1 = 0;
}
number2 = random(0,100);
```

```
  number3 = random(0,100);
  number4 = random(0,100);

  */




  delay(20000); // Wait 20 seconds to update the channel again
}

// This function attempts to set the ESP8266 baudrate. Boards with additional hardware serial ports
// can use 115200, otherwise software serial is limited to 19200.
void setEspBaudRate(unsigned long baudrate){
  long rates[6] = {115200,74880,57600,38400,19200,9600};

  Serial.print("Setting ESP8266 baudrate to ");
  Serial.print(baudrate);
  Serial.println("...");

  for(int i = 0; i < 6; i++){
    Serial1.begin(rates[i]);
    delay(100);
    Serial1.print("AT+UART_DEF=");
    Serial1.print(baudrate);
    Serial1.print(",8,1,0,0\r\n");
    delay(100);
  }

  Serial1.begin(baudrate);
}

void gsm_init()
{
```

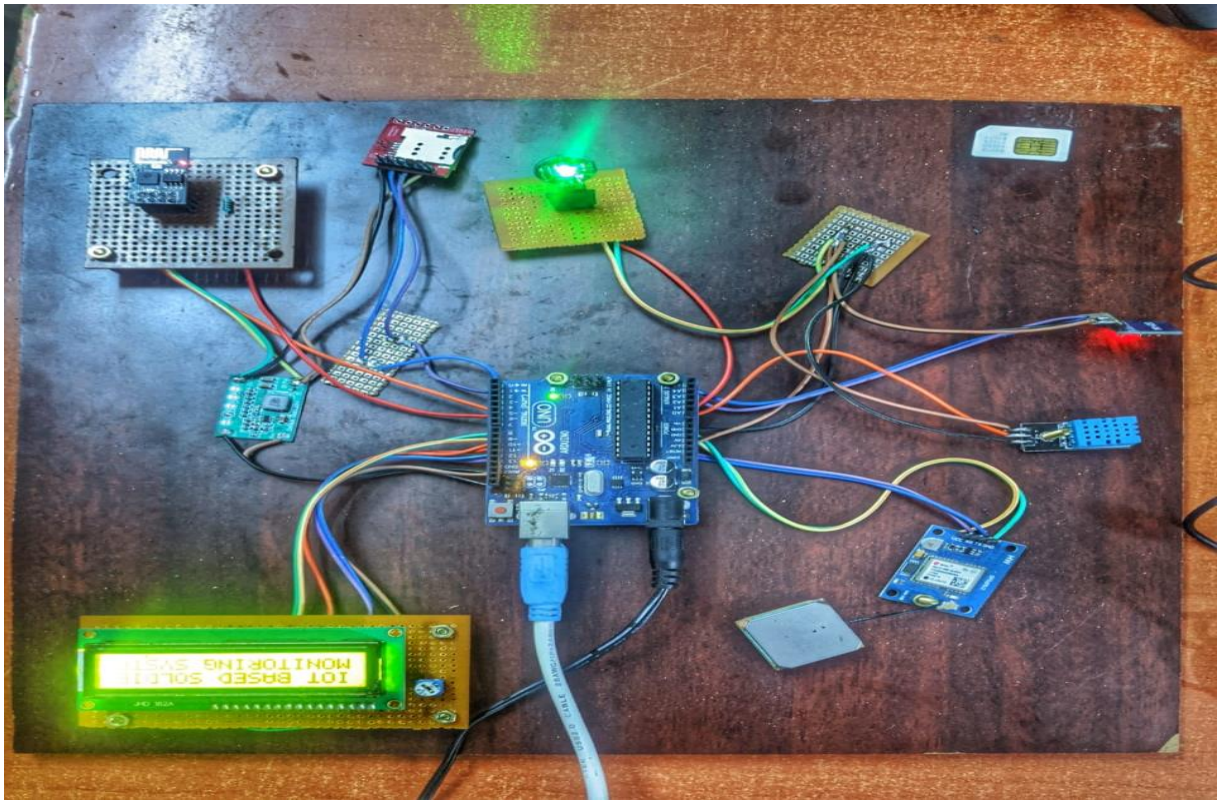
```
lcd.clear();
lcd.print("Finding Module..");
boolean at_flag=1;
while(at_flag)
{
  Serial.println("AT");
  while(Serial.available()>0)
  {
    if(Serial.find("OK"))
    at_flag=0;
  }
  delay(1000);
}

lcd.clear();
lcd.print("Module Connected..");
delay(1000);
lcd.clear();
lcd.print("Disabling ECHO");
boolean echo_flag=1;
while(echo_flag)
{
  Serial.println("ATE0");
  while(Serial.available()>0)
  {
    if(Serial.find("OK"))
    echo_flag=0;
  }
  delay(1000);
}

lcd.clear();
lcd.print("Echo OFF");
delay(1000);
lcd.clear();
lcd.print("Finding Network..");
```

```
  boolean net_flag=1;
  while(net_flag)
  {
    Serial.println("AT+CPIN?");
    while(Serial.available()>0)
    {
      if(Serial.find("+CPIN: READY"))
      net_flag=0;
    }
    delay(1000);
  }
  lcd.clear();
  lcd.print("Network Found..");
  delay(1000);
  lcd.clear();
}
```

CHAPTER 7

OUTPUT AND DISCUSSION

OUTPUT:



DISCUSSION

Model has been simulated by using Proteus software to monitor the soldier's health parameters using different sensors. The change in temperature, heartbeat and location will be detected by respective sensors this will be displayed in virtual terminal that connected to TX pin of Arduino board.

CHAPTER 8

CONCLUSION

This project reports an IoT based system for the health monitoring and tracking of the soldiers. Biomedical sensors provide heartbeat, body temperature, and environmental parameters of every soldier to control room. This technology can be helpful to provide the accurate location of missing soldier in critical condition and overcome the drawback of soldiers missing in action. The addressing system is also helpful to improve the communication between soldier to soldier in emergency situation and provide proper navigation to control room.

Thus we can conclude that this system will act as a lifeguard to the army personnel of all over the globe. In future, a portable handheld sensor device with more sensing options may be developed to aid soldiers.

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