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Vellore Institute of Technology

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CONTROL SYSTEMS
ECE2010

TOPIC: Emergency Tracking System for Women Using Body Sensors and Arduino

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ABSTRACT

Women is the inside society part and her security is the essential and to a great degree critical for the strong society, in the present years we are seeing the various women incitements reports, shockingly women being centered around and irritated conventionally in the pubic zone and moreover in the day time, After the NIRBHAYA case in Delhi, various real changes are recognized by the Indian vote based framework and besides various real walks have taken to ensure the women prosperity.
India which searches for itself as a promising super power and a money related focus can fulfill its target if and just if a far reaching amount of women get themselves included and appreciate the change strategy. The main objective of this project is to design an IOT Product which belongs to wearable devices. This device consists of the sensor layer which is able to measure the biological parameters of the women at tensed situation and triggers the messages to care takers. She can secure herself in the emergency condition by enumerating about the administrators or nearest police base camp by means of actually initiating messages. We are using Arduino Uno, HC05 Bluetooth Module, Trigger Switch, Pulse Rate Sensor, Piezoelectric Sensor, and an Infrared Sensor.

OBJECTIVE

The main objective of this project is to design an IOT Product which belongs to wearable devices. This device consists of the sensor layer which is able to measure the biological parameters of the women at tensed situation and triggers the messages to care takers.

INTRODUCTION

Even today in India, women can't move around night time in many places and even at day time swarmed places countless of physical/sexual maul happens to women reliably. Among various wrongdoings, attack is the fastest creating wrongdoing in the country today.

This project focuses on a security system that is designed merely to serve the purpose of providing security to women so that they never feel helpless while facing such social challenges. An advanced system can be built that can detect the location and health condition of person that will enable us to take action accordingly based on electronic gadgets like Pulse rate sensor. We can make use of number of sensors to precisely detect the real time situation of the women in critical abusive situations. The heartbeat of a person in such situations is normally higher which helps make decisions.
The idea to develop a smart device for women is that it's completely comfortable and easy to use as compared with already existing women security solutions such as a separate garment, bulky belts and infamous mobile apps that are just very abstract and obsolete.

PROBLEM STATEMENT

- To design an embedded system for women protection with capabilities to sense pulse rate and body temperature and to track their motion in case of emergencies and take required actions.
- To be a wearable device that can be carried easily.

LITERATURE REVIEW

[1] Dongare Uma, Vyavahare Vishakha and Raut Ravina proposed a voice keyword recognizing app to recognize the user and activate the app functionality even when the mobile keypad locked. The GPS module tracks the longitude and latitude to trace an exact location of a user and sends the pre-stored emergency message including location to the registered contact numbers. The Audio Recording module starts the recording of the conversation for five minutes and stored as evidences. The message goes in queue if network problem and send when network gets available. A notification is generated for successful deliver message. Also user can select contact through voice based contact list and make a call. Note: The spoken keyword converted into a text to compare with the registered keyword.

[2] Bhaskar Kamal Baishya proposed an android app to provide security different situations as follows. The module provide security to Women at Emergency Situations propose a Save Our Souls (SOS) app to provides the security on a single click of SOS button for the women travelling at night

or alone. No need to unlock the screen, instead by just pressing the power button it directly triggers the application to run at the background, to send the emergency message including the location in the form of latitude and longitude to the registered contacts.

[3] Archana Naik et al. proposed an app, in which a single click of SOS sends a message containing the location and/ or audio- video call to the guardian number. At receiver touch the location URL in the message to view it in the Google Map. It also provides different help tools like First-Aid help, Fake Call Help and video call. The First-Aid help tool provides the help on various health issue problems occurred at an accidental or emergency situation during the night time. First aid help for various problems are as: unconscious and not breathing, choking, bleeding heavily, burns, heart attack, diabetes etc. The Fake call help to escape from the meetings- parties at a time when women start feeling uncomfortable and think that, if someone calls me then I can leave this place‖. Fake call rings tone same as that of normal incoming call ring and once call accepted it stop ringing. It also supports Fake Hang Up option. The guardian contacts are by-default for this app, but it able to search the cops, firemen, hospitals contacts nearby to your location. It also sends the audio-video recording via Email-Gmail of emergency situation taken by the user where user unable to speak or tell the circumstances.

METHODOLOGY

- The 5 sensors namely PIR Motion Sensor, Infrared Sensor, Pulse Rate Sensor, Piezoelectric Sensor and GPS along with GSM are used to sense activity of the user after which it sends the signal to Arduino.
- Arduino then interprets the signal received.
- If the signal received has a value greater than that of the threshold value, a buzzer goes off and sends a message to family members via blue tooth.

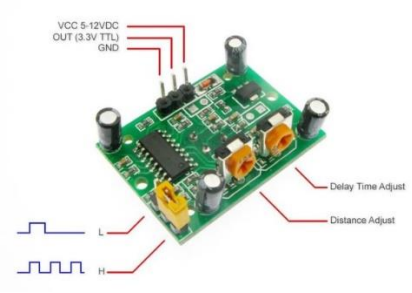
WORKING

- All sensors have been assigned a threshold value depending upon the data sets.
- If any incident takes place either of the sensors gets triggered or if the threshold limit is crossed, it indicates danger.
- The carrier is also given an emergency switch that can be triggered in case of any faults.
- If any of the sensors or the switch is triggered, it indicated DANGER.
- A buzzer will start beeping on the spot asking for help.
- In addition, a SMS indicating help or danger along with the location and Google maps link will be sent to the close relatives on the spot through GPS and GSM module.

COMPONENTS USED

1. **PIR Motion Sensor:**

   Is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They detect general movement. PIRs are basically made of a pyro electric sensor (which you can see below as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. Along with the pyro electric sensor is a bunch of supporting circuitry, resistors and capacitors.

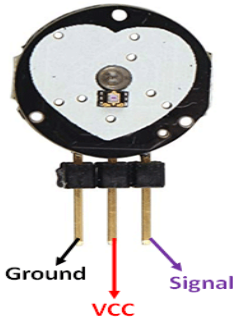


2. **Infrared Sensor:**

   Is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a Passive Infrared Sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

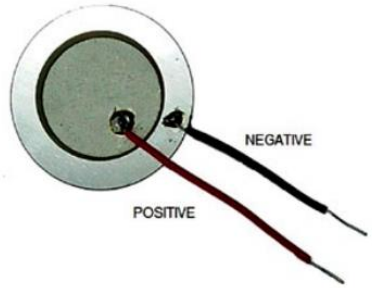
3. **Pulse Rate Sensor:**

Is a well-designed plug-and-play heart-rate sensor for Arduino. Heart beat sensor gives digital output of heart beat. When heart beat detector is working the led flashes for every heartbeat. This digital output will be connected to microcontroller directly to calculate the beats per minute (BPM) rate. It works on the principle of light modulation of networked satellites and is tracked to uplinks data for synchronization. The system uses four frequencies in the L-band which ranges from 1.2-1.6 GHz.



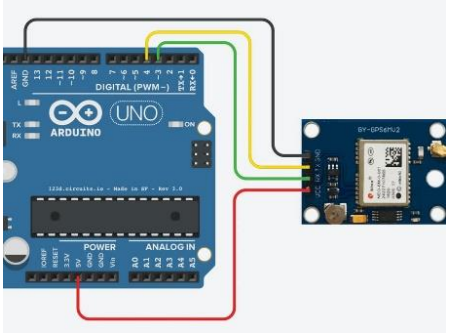
4. **Piezoelectric Sensor:**

A sensor which works on the principle of piezoelectricity is known as a piezoelectric sensor. Where piezoelectricity is a phenomenon where electricity is generated if mechanical stress is applied to a material. It is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.



5. **GPS-NE06M:**

Global positioning system (GPS) is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from various satellites to reach the receiver. In six different orbits approximately 12,500 miles above the earth, 24 MEO (Medium-Earth Orbit) satellites revolve around the earth 24 hours and transmit location every second as well as present time from atomic clocks and by monitoring blood flow through skin. The NEO-6M GPS module is a well performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module.

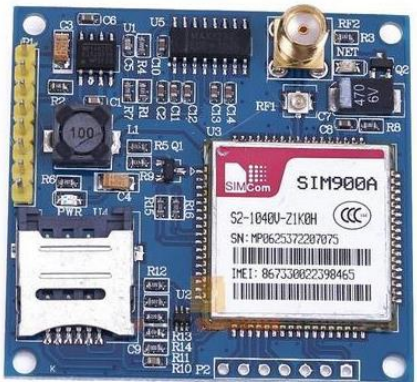


6. **Arduino**:

Is used to control the signal received. The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.[2][3] The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

7. **GSM SIM900A**:

GSM is used to send data from control unit to base unit .We can use GSM 300 which operates at frequency 900MHz. It has up link band of 890MHz to 915MHz and down link Band of 935MHz to 960 MHz GSM takes advantages of both FDMA & TDMA. In 25MHz BW, 124 carriers are generated with channel spacing of 200 KHz (FDMA). Each carrier is split into 8 time slots (TDMA). At any given instance of time 992 speech channels are made available in GSMGPRS module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual band GSM/GPRS module. It can communicate with controllers via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands). This module supports software power on and reset.

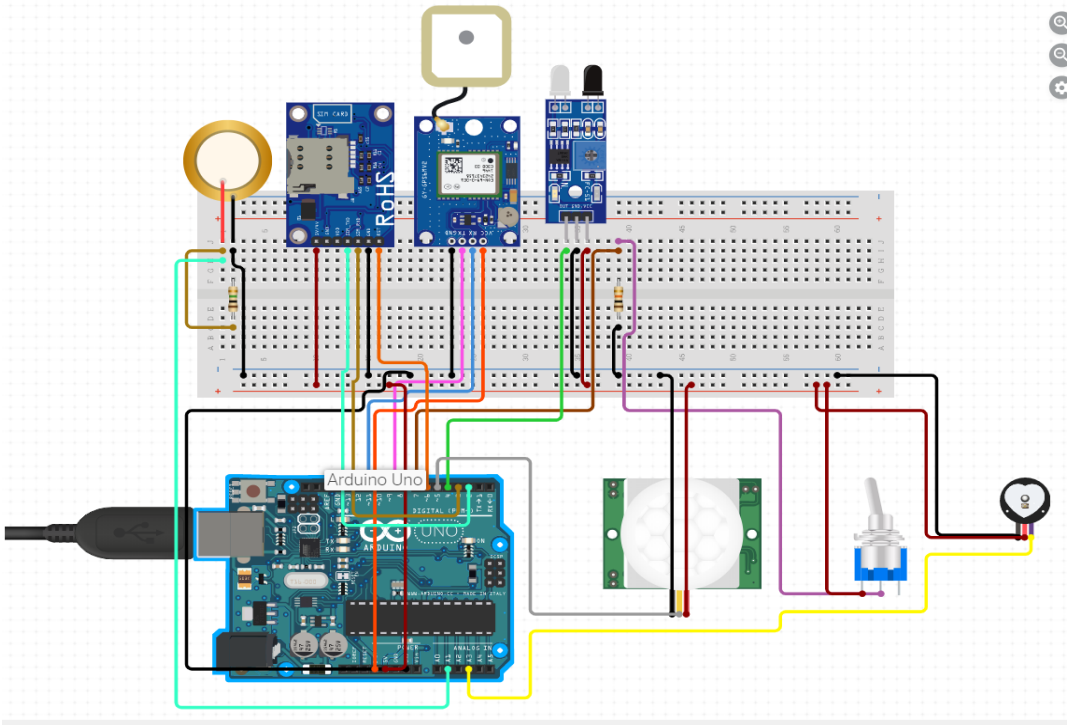


8. **Buzzer:**

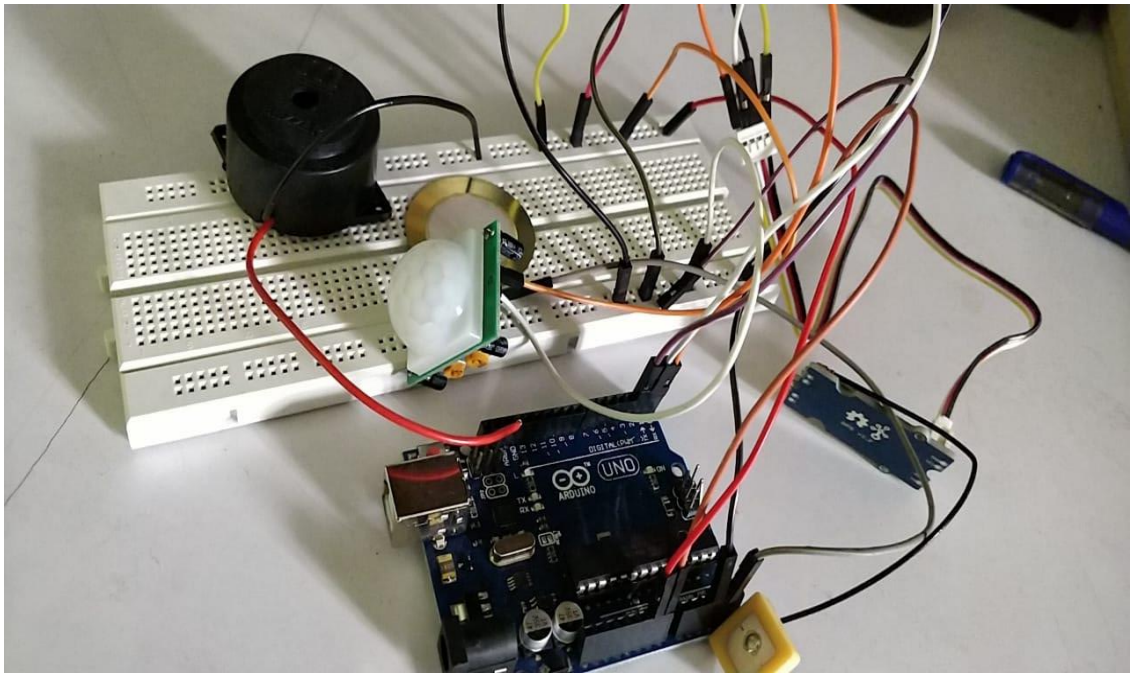
Is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric.

RESULTS

CIRCIT DIAGRAM



PROJECT CIRCUIT



ADVANTAGES OF THE PROPOSED SYSTEM

- Sophisticated security with sudden beeps.
- Mnitors all hazards and threats.
- Alert message to mobile phone for remote information.
- Can be used to prevent incidents.

FUTURE SCOPE

- Safety of women has been an issue in many countries .So, this device can be of great help if we are able to use it in embedded form or singular form
- Used as a legal evidence of crime with exact location information for prosecution.So , it can be of good help for crime branch too.
- Various security appliances can be made using this device , which will further broaden the applications of device.

CONCLUSION

This sort of a thought being the first of its kind assumes an essential part towards guaranteeing Women Safety in the quickest way that is available naturally. The proposed configuration will manage basic issues confronted by ladies in the current past and will help illuminate them through innovatively stable devices. With additionally research and development, this venture can be actualized in various regions of security and reconnaissance. The framework can play out the constant checking of coveted region and recognize the brutality with a decent exactness.

Our effort behind this project is to design and fabricate a gadget which is so compact in itself that provide advantage of personal security system the emergency response system which is helpful for women in the incidents of crime. It is low cost system which can store the data of the members in the particular locality and provide immediate alert in case of crime against women. This provides women security. Being safe and secure is the demand of the day.

REFERENCES

- https://www.irjet.net/archives/V4/i8/IRJET-V4I809.pdf
- https://www.researchgate.net/publication/311252681_Smart_security_solution_for_women_based_on_Internet_Of_ThingsIOT#:~:text=This%20device%20gets%20activated%20and,critical%20abusive%20situation.%20...
- https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor

APPENDIX

ARDUINO CODE:

```
const double IRSENSOR=A0;                  // IR SENSOR OUTPUT TO ANALOG PIN A0
int IRSENSOR_READ;                         //  IR SENSOR VALUE READ
const int IR_THRESHHOLD=100;               // THRESHOLD VALUE FOR IR

const double PIEZOSENSOR = A1;             //PIEZO SENSOR OUTPUT OT ANALOG PIN A1
const int PIEZO_THRESHHOLD = 100;          //THRESHHOLD VALUE FOR PIEZO
int PIEZO_READ;                            //PIEZO SENSOR VALUE READ

const int MOTIONSENSOR = 2;                //MOTION SENSOR OUTPUT TO DIGITAL PIN 2
int MOTION_READ;                           //MOTION SENSOR VALUE READ

const int SWITCH = 3;                      // PUSH BUTTON OUTPUT TO DIGITAL PIN 3
int SWITCH_READ;                           // PUSH BUTTON VALUE READ


#define USE_ARDUINO_INTERRUPTS true        // Set-up low-level interrupts for most acurate BPM math.
#include <PulseSensorPlayground.h>         // Includes the PulseSensorPlayground Library.
const int Pulsewire = A2;                  // PULSE RATE SENSOR OUTPUT TO ANALOG PIN A2
const int Threshold = 800;                 // PULSE RATE SENSOR THRESHHOLD VALUE
PulseSensorPlayground pulseSensor;         // Creates an instance of the PulseSensorPlayground object called "pulseSensor"

#include <TinyGPS.h>                       // GPS LIBRARY
#include <SoftwareSerial.h>                //GPS and GSM MODULE LIBRARY IMPORT
int state = 0;                             //state for GSM
float gpslat, gpslon;                      //ASSIGNING VARIBALES FOR LATTITUDE AND LONGITUDE LOCATION CALCULATION

TinyGPS gps;                               // CONNECTIONS OF GPS AND GSM
SoftwareSerial sgps(4, 5);                 //(Rx,Tx) of ARDUINO [ARDUINO PIN-4(Rx)- Tx of GPS and ARDUINO PIN-5(Tx)- Rx of GPS MODULE]
SoftwareSerial sgsm(6, 7);                 //(Rx,Tx) of ARDUINO [ARDUINO PIN-6(Rx)- Tx of GSM and
```

ARDUINO PIN-7(Tx)- Rx of GSM MODULE]

```
const int BUZZER = 13;                    //BUZZER OUTPUT
const int BUZZER_STATE = LOW;             //INITIALLY SET TO LOW

void setup()
{

  pinMode(PIEZOSENSOR, INPUT);            // PIEZO SENSOR OUTPUT TO ARDUINO
  pinMode(IRSENSOR,INPUT);                //IR SENSOR OUTPUT AS INPUT TO ARDUINO
  pinMode(MOTIONSENSOR, INPUT);           // MOTION SENSOR OUTPUT AS INPUT TO ARDUINO
  pinMode(SWITCH, INPUT);                 // PUSH BUTTON OUTPUT AS INPUT TO ARDUINO
  pinMode(BUZZER, OUTPUT);                //OUTPUT PIN TO BUZZER IS 13
  pulseSensor.analogInput(Pulsewire);     //assign variables
  pulseSensor.setThreshold(Threshold);    // ASSIGN THRESHOLD VARIABLE TO PULSESENSOR
  sgsm.begin(9600);                       //GSM BAUD RATE
  sgps.begin(9600);                       //GPS BAUD RATE
  Serial.begin(9600);                     //PROGRAM BAUD RATE

}

void loop()
{
 IRSENSOR_READ = analogRead(IRSENSOR);    //analog input of  infrared sensor
 PIEZO_READ = analogRead(PIEZOSENSOR);    //analog input of piezo sensor
 MOTION_READ = digitalRead(MOTIONSENSOR); //digital input of motion sensor
 SWITCH_READ = digitalRead(SWITCH);       // digital input of push button
 pulseSensor.analogInput(Pulsewire);
 int myBPM = pulseSensor.getBeatsPerMinute(); // Calls function on our pulseSensor object that returns BPM
as an "int".
                                  // "myBPM" hold this BPM value now.

 if(IRSENSOR_READ > IR_THRESHHOLD)        // comparing to the threshhold value set
 {
  digitalWrite(BUZZER, HIGH);             // set the BUZZER on for 1 second
  delay(1000);
  digitalWrite(BUZZER, LOW);
  delay(100);                             // set buzzer off for for milli second

  while (sgps.available())
 {
  int c = sgps.read();
  if (gps.encode(c))
  {
   gps.f_get_position(&gpslat, &gpslon);
  }
 }
  if ((IRSENSOR_READ > IR_THRESHHOLD) && state == 0) {
   sgsm.print("\r");
   delay(1000);
   sgsm.print("AT+CMGF=1\r");
   delay(1000);

   //The number the messege is to be sent to
```

```
    sgsm.print("AT+CMGS=\"+919711600080\"\r");
    delay(1000);

    //The text of the message to be sent.
    sgsm.print("ALERT: YOUR LOVED ONE IS IN DANGER; CLICK THE LINK BELOW TO TRACK THE LOCATION OF VERDICT:");
    sgsm.print("THE EXACT LOCATION IS:");
    sgsm.print("Latitude :");
    sgsm.println(gpslat, 6);
    sgsm.print("Longitude:");
    sgsm.println(gpslon, 6);
    sgsm.print("https://www.google.com/maps/?q=");
    sgsm.print(gpslat, 6);
    sgsm.print(",");
    sgsm.print(gpslon, 6);
    delay(1000);
    sgsm.write(0x1A);
    delay(1000);
    state = 1;
   }
 if (IRSENSOR_READ < IR_THRESHHOLD) {
    state = 0;
   }
 }

 else if(PIEZO_READ > PIEZO_THRESHHOLD)
 {
  digitalWrite(BUZZER, HIGH);             // set the BUZZER on for 1 second
  delay(1000);
  digitalWrite(BUZZER, LOW);
  delay(100);                          // set buzzer off for for milli second

   while (sgps.available())
 {
  int c = sgps.read();
  if (gps.encode(c))
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  if ((PIEZO_READ > PIEZO_THRESHHOLD) && state == 0) {
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```
    sgsm.print("Latitude :");
    sgsm.println(gpslat, 6);
    sgsm.print("Longitude:");
    sgsm.println(gpslon, 6);
    sgsm.print("https://www.google.com/maps/?q=");
    sgsm.print(gpslat, 6);
    sgsm.print(",");
    sgsm.print(gpslon, 6);
    delay(1000);
    sgsm.write(0x1A);
    delay(1000);
    state = 1;
   }
 if (PIEZO_READ < PIEZO_THRESHHOLD) {
    state = 0;
   }
 }

 else if(MOTION_READ == HIGH)
 {
  digitalWrite(BUZZER, HIGH);              // set the BUZZER on for 1 second
  delay(1000);
  digitalWrite(BUZZER, LOW);
  delay(100);                              // set buzzer off for for milli second
  Serial.print("MOTION IS DETECTED hHEREBY.");

   while (sgps.available())
 {
  int c = sgps.read();
  if (gps.encode(c))
  {
   gps.f_get_position(&gpslat, &gpslon);
  }
 }
  if ((MOTION_READ == HIGH) && state == 0) {
   sgsm.print("\r");
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   sgsm.print("Latitude :");
   sgsm.println(gpslat, 6);
   sgsm.print("Longitude:");
   sgsm.println(gpslon, 6);
   sgsm.print("https://www.google.com/maps/?q=");
   sgsm.print(gpslat, 6);
```

```
    sgsm.print(",");
    sgsm.print(gpslon, 6);
    delay(1000);
    sgsm.write(0x1A);
    delay(1000);
    state = 1;
   }
 if (MOTION_READ == LOW) {
    state = 0;
   }
 }

 else if(SWITCH_READ == HIGH)
 {
  digitalWrite(BUZZER, HIGH);              // set the BUZZER on for 1 second
  delay(1000);
  digitalWrite(BUZZER, LOW);
  delay(100);                              // set buzzer off for for milli second

   while (sgps.available())
 {
  int c = sgps.read();
  if (gps.encode(c))
  {
   gps.f_get_position(&gpslat, &gpslon);
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   sgsm.println(gpslat, 6);
   sgsm.print("Longitude:");
   sgsm.println(gpslon, 6);
   sgsm.print("https://www.google.com/maps/?q=");
   sgsm.print(gpslat, 6);
   sgsm.print(",");
   sgsm.print(gpslon, 6);
   delay(1000);
   sgsm.write(0x1A);
   delay(1000);
   state = 1;
  }
```

```
 if (SWITCH_READ == HIGH) {
    state = 0;
  }
 }

 else if(myBPM > Threshold)               // comaring condition of heartbeat
 {
  digitalWrite(BUZZER, HIGH);              // set the BUZZER on for 1 second
  delay(1000);
  digitalWrite(BUZZER, LOW);
  delay(100);                          // set buzzer off for for milli second
  Serial.print("BPM: ");                 // Print phrase "BPM: "
  Serial.println(myBPM);                  // Print the value inside of myBPM.
  delay(1000);

  while (sgps.available())
 {
  int c = sgps.read();
  if (gps.encode(c))
  {
   gps.f_get_position(&gpslat, &gpslon);
  }
 }
  if ((myBPM > Threshold) && state == 0) {
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   sgsm.write(0x1A);
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   state = 1;
  }
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 } }
```