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MCU based Automated Home Security system

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Abstract: Security and safety are two intertwined terms. It is a common belief that when a place or system is secure, it is safe. Security has becoming an important issue everywhere. Home security is becoming necessary nowadays as the possibilities of intrusion are increasing day by day. Safety from theft is the most important requirements of home security system for people. Home security system gives an extra peace of mind and security in everybody's house while they are sleeping or even away from their home. From the moment the system is armed it will automatically keep everybody up-to-date for unexpected movements within his/her property. A traditional home security has been protected still, where people were using their animals to need protected. But the evolution of technology has allowed the use of electrical circuits and micro-controllers which made the system even more accurate and systems for every need. Furthermore, the GSM based security system provides enhanced security when a signal from sensor comes, SMS/text message is sent to the owner to take necessary action to avoid risk. However, expenditure evolution of the internet and smart phones allowed the home security systems to be controlled remotely at any time, which previously the only way to control them was through the central control panel embedded on the system. This project examines the process of the production of a conceptual home security system for a client, which can secure and monitor a desired room. Also, this project has been involved research of the home security systems, which currently on the market as-well as the hardware and software will be used, that lead into the project's requirements determination. The main aim of this project is to find alternative ways to design and develop a low-cost system which will be easy to configure and expendable in the future. The development of the system has been started with requirement analysis and ended with the testing of the system, and then it is documented. The entire project is then evaluated and concluded, discussing possibilities of future development.

Keywords: Security; Safety; Intrusion; Detection; Arduino, Sensor, SMS, GSM Modem etc.

I. INTRODUCTION

Literature review is needed before any project is begun. The review will help to understanding the scope of the project and also the need to build the project. The review comes from the reading on the journal and also from the books. The information from there view will be used to start the project with an excellent idea. The review is also coming from the sample of the existing project in the Journal.

II. REVIEW OF RELATED LITERATURE

Literature review is needed before any project is begun. The review will help to understanding the scope of the project and also the need to build the project. The review comes from the reading on the journal and also from the books. The information from there view will be used to start the project with an excellent idea. The review is also coming from the sample of the existing project in the Journal. Home security system project is open project for engineering students or electronics hobbies, so it is very difficult to say about the fixed no. of works on home security system project. But in this section, we are present main idea/abstract of some research papers on home security system from which we are motivated.

2.1 Laser security system: Suman Singha, Debasis Majiet [2] presented Laser security system a person moves in front of the sensor, that person triggers the system's alarm by cutting the laser. And the alarm signals the security monitoringcompanyandlocallawenforcement.Thebasicalarmunitwillalsosounda loud alarm.

2.2 Home security sensor system using Atmel AVR microcontroller: This project is submitted by LIMBOONHOI[2] in partial fulfilment to the requirements for the degree of Bachelor of Computer Science. The AVR Flash Microcontroller based Home Security Sensor System is an automated home alarm system with built-in centralized security monitoring system prototyped using the Atmel STK500 starter kit.

2.3 Home automation and security system using Android ADK: Deepali Javale [3] presented the design of home automation and security system using Android ADK which is based on a stand able embedded system board Android ADK (Accessory Development Kit) at home.

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2.4 Home Automation system using Android and Wi-Fi technology: Prof. R.SSuryavanshi. [4] Discussedan approach in which a model of home Automation system using Android and Wi-Fi technology. Which really offers easy and really much awaited Home Automation System (HAS).

2.5 Home automation system interface is established through Bluetooth: Sadeque Reza Khan[5]explained the paper where the proposed system can maintain the security of home main entrance and also the cardoor lock. It can control the appliance in a room. The mobile to security system or home automation system interface is established through Bluetooth.

2.6 Microcontroller Based Home Automation System with Security: Written by Interpret Kaur (Asstt. Prof.) His work is advancement of technology that controls home security by automatic systems. things are becoming simpler and easier for us. Automatic systems are being preferred over manual system. This unit talks about the basic definitions needed to understand the Project better and further defines the technical criteria to be implemented as a part of this project.

2.7Security system using GSM technology: Prof.R.A. Kadu[6]He contributes work to monitor the home appliances security by sending SMS with using GSM modem and android mobile application. Security system using GSM technology by using Android application through Android mobile phone. It can control the appliance seven in the absence of Android phone by sending a normal SMS.

2.8 Wireless Home security system with mobile: Written by Prof. (Dr.) Khanna Samrat Vivekanand Omprakash. [7]He provided a work of controlling home appliances security through wireless security system by using GSM modem and mobile network. Wireless security is the prevention of unauthorized access or damage to Mobile using wireless network systematic solution for home. The aim of this paper is to investigate a cost-effective solution that will provide controlling of home appliances remotely and will also enable home security against intrusion in the absence of home owner. The system uses latest wireless communication like Bluetooth, Infrared and Wi-Fi access to the system for security and automated appliance control. Home security has been a major issue where crime is increased and everybody wants to take proper measures to prevent intrusion. System will work on different wireless communications and 3 of 10 mobiles uses for security purpose. The proposed system characteristics involve remote controlling of appliances, intrusion detection, system security and auto-configuration such that system automatically adjust the system settings on running hardware support check.

2.9 Design and Construction of an Automatic Home Security System Based on GSM Technology and Embedded Microcontroller Unit: Written by Iyapo Kamoru Olarewaju1, Odo Ekundare Ayodele2, Fasunla Olukayode Michael1, Egbuwalo Shadrack Alaba1, Raimi Oluwole Abiodun3their work contributed home security system to monitor burglar by alarm systems.In this project we design and construct an automatic home security system based on GSM technology and embedded microcontroller unit. The system consisted of an infrared motion detector and a magnetic sensor as transducers for detecting intruders motion or break in through a door. The signals are then processed by an embedded microcontroller unit which then activate the GSM module and send SMS message to the householder's mobile phone device, an at the same time activating an attached alarm system. Initial testing of this system shows that it worked as expected.

2.10 SMS-based Home Automation System: Written by A. Alheraish, [8] The work of A. Alheraish. He contributes the work of home security system to control intrusion by change the passkey for the door and control lights in the home. Proposes a home automation system using SMS. The proposed system detects illegal intrusions at home and allows legitimate users to change the passkey for the door and control lights in the home. The illegal intrusion into the home is identified by monitoring the state of the home door, which is done using Light Emitting Diode (LED) and infrared sensors. The passkey to the door can be any 4 digits, which can be set either by using the keypad or by using SMS from a registered user's mobile number.

III.OBJECTIVES

3.1 Statement of the Problem: This project is discussed the development of security system for smart home, car, hospital etc. There is a theft event and fatal (people killing) accidents around living home due to lack of modernize automated home security system. Previous a more robust security system had been built around the world. The security system had been developed based on a micro-controller device as a receiver, processor and transmitter of information.

3.2 Design of the project: In the previous alarm security it can work only in the 555 timers but we can improve this we can add the microcontroller (Arduino) we can program in microcontroller (Arduino) to control the buzzer and Relay. And also, it is possible to add the other program the circuit before we done our project.

IV.BLOCK DIAGRAM

Our system model proposes a system from where around a house are collected using PIR sensor, sound sensor, vibration sensor and touch sensor a input for our system. The microcontroller (Arduino Uno) receives the data from the sensors and transmitting to different outputs such as Buzzer, camera, lamp and GSM Modem. Then the GSM modem sends the possessed data to owner and police station. The buzzer gives alarm indicate and the camera record captures

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unauthorized person real images. Also, the lamp emits light radiation. The following figure illustrates thesystem model of our project.

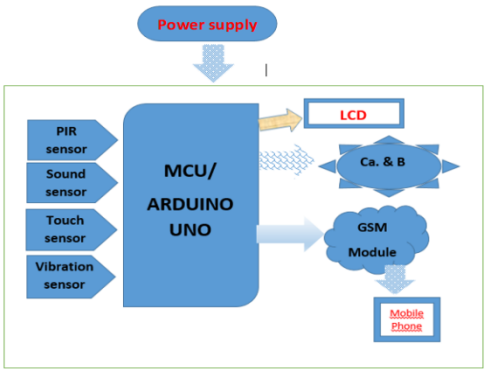

Fig5.1 MCU based security system block diagram model.

V.SYSTEM SOFTWARE DEVELOPMENT

System software development is divided into two parts. They are Arduino software program and proteus software design. Arduino software program codes the overall our home automation security system by using arduino basic functions such as "Void setup () "function and "Void Loop ()" function. Arduino software programming has two parts. First, we write the Arduino program in Arduino software. Second, we compile/run programmed code into Arduino software. This Arduino program command controls the proteus software design& system hardware assemble with inputs, outputs and other interface circuits connection such as LCD. Proteus software design develops the overall our home automation security system by connecting inputs, outputs and other interfacing device such as LCD to Arduino UNO module of enteral processing unit. This proteus software design contributes for real hardware assembling the overall systems to function as planned.

5.1 Arduino Uno Integrated Development Environment (IDE)

The open-source Arduino Uno environment makes it easy to write code and upload it to the I/O board. It runs on Windows, Mac OSX and Linux. The usage of the software is very easy once plugged, the correct port where the arduino is plugged must be selected and the type of the arduino as well, then, upload the code on the board and read the serial output. The Arduino micro-controller boot-loader calls the setup () function when it is started and it iterates forever over the loop () function.

5.2Flow chart:

Now that we have the Arduino IDE software installed, then we connect the mc board to the computer, load a small program, and verify that all components are working together. First, need to connect the USB cable to our mc board and then plug the other end of the USB cable in to our computer.

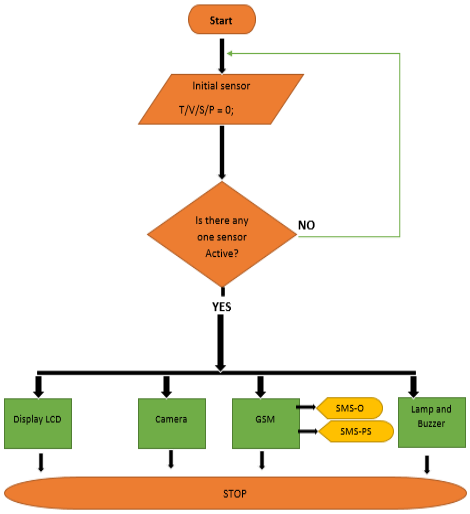

Figure 5.2: Flowchart of system software program

VI.RESULTS AND DISCUSSION

6.1 Testing the system: First of all, all the hardware units of the system were tested and it was ensured that they were in a good working condition. Then, each and every unit were interfaced and implemented individually with the microcontroller board and compile with the software according to the necessity of the application. Rather each unit of the application was tested individually. The second unit was not tested until the first unit gave the expected result and until it was not working according to the necessity of the application. After all of the units were working correctly, the units were kept together and then the whole system was developed and tested. It was easy to figure out the viruses and the problem of the system as the behaviour of each unit was known while testing it. It would be impossible to figure out the problems and the viruses in the system if the system was developed and tested after it was completed. After the hardware units were tested, the communication of the mobile station with the GSM module was tested.

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6.2 Results: The aim of the project was to implement a MCU based home automation security system and the goal was met. The microcontroller unit/Arduino UNO responds to the instructions of any inputs sensor and transfer instruction to all outputs, then the GSM sent SMS to both owner and police Station mobile phone as well as receive SMS respond from mobiles according to the necessity of the application as well as triggers the alarm upon a critical event situation. The aim of the application to monitor the crime events around the living area of society. After making the hardware in proteus simulation connection with their accurate parameter of the component specification and performing the software program that was installed on the Arduino. The first and the main important thing are, to check the program is working or running at the expected standard with free of errors. So that our program is running with free of errors after a lot of try.

6.2.1 Hardware simulation:

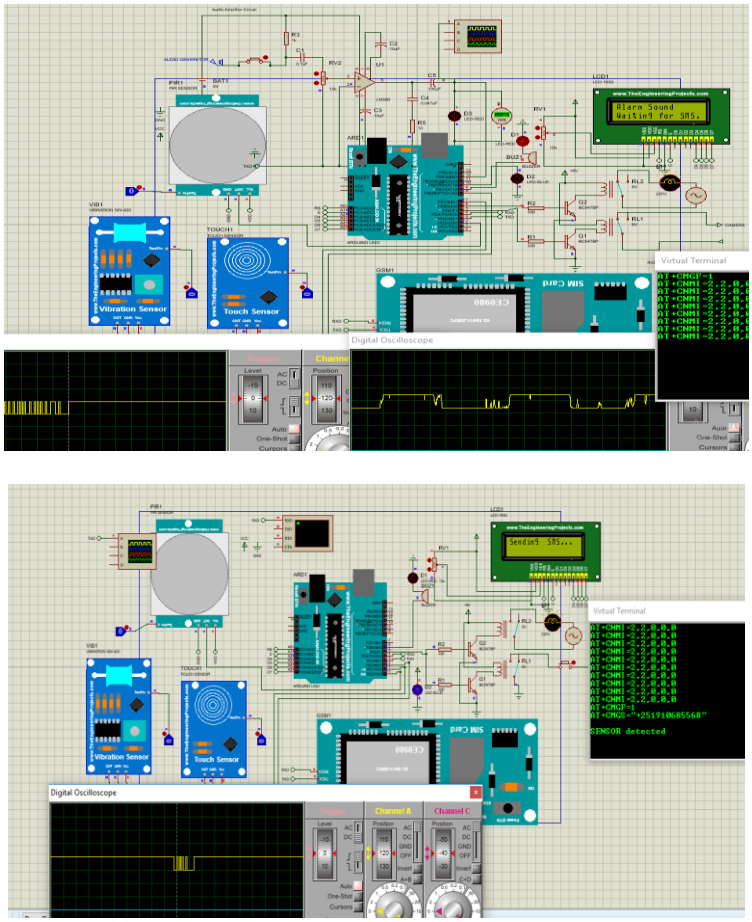

Fig. 6.1: Simulation result for three sensors

6.2.2 Software code

Fig. 6.2: Simulation result for three sensors

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6.2.3 Practical set-up and Result

Afterdesigning the circuit,wesetup the circuitinaboard which is shown in the figure.In the abovefigure, itis shown that a system is setup for securitypurposein ahome. When an object moves, touch, load & vibrate in thesensor range, then an inputsignal is generated in thesystem. When the input signal is generated, theLEDlights arelilt, an alarm is generated and the cameracaptures/record that moving object automatically.Infigure4.10, therewas no moving object and systemis in idle mode, but in figure4.11, amoving object is passes through thesystem and theLEDs arelights. As a result, the alarm is active.Inthis way,auser mayeasilyfind out what happens on his home. So, ithas agreat impact in the securityofahouse.

6.3 Discussion: CU based Automated Home Security System using GSM Modem for transmitting SMS, camerafor record has been designed for ademo version. Weuse 6V Dry cell supplyfor relaycorrection, weusePIR sensor, Touch sensor Vibration sensor & Sound sensor for detection moving object and also useLED (lamp) Light and buzzer. Finally, wehavedesignedand developed thewhole control system and tested using simulation and by using only PIR sensor.Wefixed allthe problem's encountered during the design and testing ofthe system. Finally,wesuccessfully achieved our goals.

S. No	Parameters	Previous project	Current project
1	Complexity	complex depend on design	Simple depend on design
2	Cost	cheap due to material used	Expensive due to material used (GSM, Camera)
3	Efficiency	Less efficiency	Moderate efficiency
4	Reality	Less effective	More effective
5	**Validity**	**Less acceptable depend inputs& outputs (1 i/p; 1o/p)**	**More acceptable depend inputs& outputs (4 i/p ;4o/p)**
6	**security**	**Less secured**	**More secured**
7	**Valuably**	**Marketable (depends on customer)**	**Marketable (depends on customer)**

Table 5.1 results comparison with existing models

6.4For researchpurpose: We can addIPCamerawhich transfer videos through internet systemforusers who may need itforresearch. Wecan also add some sensors likesmoke, fire, heat lightetc. Users may choosewhich ones theyneed, theymaybealimitation on number offeatures depending on the headwear will get uploaded too with better securityand moreexpanded ability. But anyway, this will make up for a decent security system for research purpose.

6.3.2 Forsecurity purpose**:**With so manycoolfeatures and applications, securitysystemserves manydifferent purposes and provides somegreat benefits. Smart homesystemsprovide exceptional securitysolutions which willmakeyou,andyourfamily, feel moreincontrol ofyour home.

6.3.3 For save energy**:** Automatic securitysystem manageour homeenergyconsumption to help lower the energybills.

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ISO 3297:2007 Certified
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Appendix-A

Programming Code forWhole System

```
#include<LiquidCrystal.h>
#include <SoftwareSerial.h>
char inchar; //
SoftwareSerial SIM900D(3,4);
LiquidCrystallcd (A0, A1, A2, A3, A4, A5);
int sensor_valueV; //variable to hold read sensor value
int sensor_valueT; //variable to hold read sensor value
int sensor_valueP; //variable to hold read sensor value
int soundDetectedVal = 0; // This is where we record our Sound Measurement
int motion= 0;
int tach=0;
int vibrate=0;
int buzzer= 9;
int relay= 5;
int relay1=6;
int led1= 10;
int soundDetectedPin = 12; // Use Pin 12 as our Input
int PIR_sensor= 2;
int TOUCH_sensor=8;
int VIB_sensor=7;
int sms_count=0; //set sms counter to 0
int zone=0;
unsigned long lastSoundDetectTime; // Record the time that we measured a sound
void setup() {
  // put your setup code here, to run once:
lcd.begin(16,2);
pinMode(led1, OUTPUT);
pinMode (relay, OUTPUT);
pinMode(relay1,OUTPUT);
pinMode (buzzer, OUTPUT);
pinMode (soundDetectedPin, INPUT) ; // input from the Sound Detection Module
pinMode (PIR_sensor, INPUT);
pinMode(TOUCH_sensor,INPUT);
pinMode(VIB_sensor,INPUT);
lcd.setCursor(0, 0);
lcd.print("System Triggered");
lcd.setCursor(0, 1);
lcd.print("Project");
delay(700);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("prepared by");
lcd.setCursor(0, 1);
lcd.print("A>D>Y");
delay(700);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("System:");
lcd.setCursor(0, 1);
lcd.print("READY");
digitalWrite(led1, HIGH);
  SIM900D.begin(19200); // turn on serial communication on SIM900D
SIM900D.println("AT+CMGF=1");  // set SMS mode to text mode
delay(700);
}
void loop()
{
Check_SMSReceive(); //subroutine to check if SMS received
soundDetectedVal = digitalRead (soundDetectedPin) ; // read the sound alarm pin 12
sensor_valueV=digitalRead(VIB_sensor); // Reading sensor value from pin 7
sensor_valueT=digitalRead(TOUCH_sensor); // Reading sensor value from pin 8
sensor_valueP=digitalRead(PIR_sensor); // Reading sensor value from pin 2
  if((sensor_valueP==HIGH) && (sms_count< 1)) // Checking if PIR sensor sends a HIGH signal to Arduino
{
  zone = 1;
alarmTriggered();// subroutine to check sensor status and activation of outputs
}
if((sensor_valueT==HIGH) && (sms_count< 1)) // Checking if PIR sensor sends a HIGH signal to Arduino
{
 zone = 2;
alarmTriggered();// subroutine to check sensor status and activation of outputs
}
if((sensor_valueV==HIGH) && (sms_count< 1)) // Checking if PIR sensor sends a HIGH signal to Arduino
```

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```
{
  zone = 3;
alarmTriggered();// subroutine to check sensor status and activation of outputs
}
if ((soundDetectedVal == HIGH) && (sms_count< 1)) // If we hear a sound
  {
      zone = 4;
alarmTriggered();// subroutine to check sensor status and activation of outputs
  }
Check_Reset(); // subroutine to check if alarm reset switch pressed or not
}
void Check_SMSReceive()  //Check to see if a character comes in from the cellular module...
{
SIM900D.println("AT+CNMI=2,2,0,0,0"); // read contents of new SMS upon receipt to the GSM shield's serial out
delay(200);
Serial.println("Waiting for SMS...");
delay(200);
{
if(SIM900D.available() >0) //If a character comes in from the cellular module...
 {
inchar=SIM900D.read();
   if (inchar=='*')
   {
delay(10);
inchar=SIM900D.read();
   if (inchar=='o')
   {
delay(10);
inchar=SIM900D.read();
   if (inchar=='n')
      {
       }
Serial.println( "Message received to Activate Alarm" );
       SIM900D.println("AT+CMGD=1,4"); // delete all SMS
       }
       }
    }
   }
}
void alarmTriggered()
{
digitalWrite(buzzer,HIGH); // Activating the buzzer
digitalWrite(relay,HIGH);
digitalWrite(relay1,HIGH);
digitalWrite(led1, LOW);
lcd.clear();
   if (zone == 1){
lcd.setCursor(0, 0);
lcd.print("Alarm PIR");
lcd.setCursor(0, 1);
lcd.print("Waiting for SMS...");
SendTextMessageP();//Function to send AT Commands to GSM module
}
  if (zone == 2){
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Alarm TOUCH");
lcd.setCursor(0, 1);
lcd.print("Waiting for SMS...");
SendTextMessageT();//Function to send AT Commands to GSM module
}
else if (zone == 3){
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Alarm VIBRATION");
lcd.setCursor(0, 1);
lcd.print("Waiting for SMS...");
SendTextMessageV();//Function to send AT Commands to GSM module
}
else if (zone == 4){
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Alarm Sound");
lcd.setCursor(0, 1);
lcd.print("Waiting for SMS...");
```

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```
delay(2000);
SendTextMessageS(); // Function to send AT Commands to GSM module
    }
  else
{
  if((soundDetectedVal==LOW)&& (sms_count>= 1))
  {
digitalWrite(buzzer,LOW); // turning OFF the buzzer
digitalWrite(relay,LOW);
digitalWrite(relay1,LOW);
digitalWrite(led1, HIGH);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Sending  SMS...");
delay(700);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("System:");
lcd.setCursor(0, 1);
lcd.print("READY");
sms_count = 0; // Reactivating the SMS Alert Facility
 }}
}
void SendTextMessageP ()
{
  SIM900D.println("AT+CMGF=1");    //To send SMS in Text Mode
delay(1000);
  SIM900D.println("AT+CMGS=\"+251910685568\"\r"); // change to the phone number you using
delay(200);
  SIM900D.println("Movement detected");//the content of the message
Serial.println( "Movement detected" ); // print to serial monitor
delay(200);
  SIM900D.println((char)26);//the stopping character
delay(200);
   SIM900D.println("AT+CMGS=\"+251914475792\"\r"); // change to the phone number you using
delay(200);
   SIM900D.println("detected Movement");//the content of the message
Serial.println( "detected Movement" ); // print to serial monitor
  SIM900D.println((char)26);//the stopping character
delay(200);
sms_count++; // advance sms_count by +1
}
void SendTextMessageT()
{
  SIM900D.println("AT+CMGF=1");    //To send SMS in Text Mode
delay(1000);
  SIM900D.println("AT+CMGS=\"+251910685568\"\r"); // change to the phone number you using
delay(200);
  SIM900D.println("TOUCH detected");//the content of the message
Serial.println( "TOUCH detected" ); // print to serial monitor
delay(200);
  SIM900D.println((char)26);//the stopping character
delay(200);
   SIM900D.println("AT+CMGS=\"+251914475792\"\r"); // change to the phone number you using
delay(200);
   SIM900D.println("detected TOUCH");//the content of the message
Serial.println( "detected TOUCH" ); // print to serial monitor
  SIM900D.println((char)26);//the stopping character
delay(200);
sms_count++; // advance sms_count by +1
}
void SendTextMessageV ()
{
  SIM900D.println("AT+CMGF=1");    //To send SMS in Text Mode
delay(1000);
  SIM900D.println("AT+CMGS=\"+251910685568\"\r"); // change to the phone number you using
delay(200);
  SIM900D.println("VIBRATION detected");//the content of the message
Serial.println( "VIBRATION detected" ); // print to serial monitor
delay(200);
  SIM900D.println((char)26);//the stopping character
delay(200);
   SIM900D.println("AT+CMGS=\"+251914475792\"\r"); // change to the phone number you using
delay(200);
   SIM900D.println("detected VIBRATION");//the content of the message
```

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ISO 3297:2007 Certified
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```
Serial.println( "detected VIBRATION" ); // print to serial monitor
  SIM900D.println((char)26);//the stopping character
delay(200);
sms_count++; // advance sms_count by +1
}
void SendTextMessageS()
{
  SIM900D.println("AT+CMGF=1");    //To send SMS in Text Mode
delay(1000);
  SIM900D.println("AT+CMGS=\"+251910685568\"\r"); // change to the phone number you using
delay(200);
  SIM900D.println("Sound detected");//the content of the message
Serial.println( "Sound detected" ); // print to serial monitor
delay(200);
  SIM900D.println((char)26);//the stopping character
delay(200);
   SIM900D.println("AT+CMGS=\"+251914475792\"\r"); // change to the phone number you using
delay(200);
   SIM900D.println("detected Sound");//the content of the message
Serial.println( "detected Sound" ); // print to serial monitor
  SIM900D.println((char)26);//the stopping character
delay(200);
sms_count++; // advance sms_count by +1
}
void Check Reset ()
{
  motion=digitalRead(PIR_sensor); // Reading sensor value from pin 12
  tach=digitalRead (TOUCH sensor); // Reading sensor value from pin 12
  vibrate=digitalRead(VIB_sensor); // Reading sensor value from pin 12
if ((motion==LOW) && (sms_count>= 1))
{
digital Write (buzzer, LOW); // turning OFF the buzzer
digital Write (relay, LOW);
digital Write (relay1, LOW);
digital Write (led1, HIGH);
LCD. Clear ();
LCD. set Cursor (0, 0);
LCD. Print ("Sending SMS...");
delay (700);
LCD. Clear ();
LCD. set Cursor (0, 0);
LCD. Print("System:");
LCD. set Cursor (0, 1);
LCD. Print("READY");
sms_count = 0; // Reactivating the SMS Alert Facility
}
if ((tach==LOW) && (sms_count>= 1))
{
digital Write (buzzer, LOW); // turning OFF the buzzer
digital Write (relay, LOW);
digital Write (relay1, LOW);
digital Write (led1, HIGH);
LCD. Clear ();
LCD. set Cursor (0, 0);
LCD. Print ("Sending SMS...");
delay (700);
LCD. Clear ();
LCD. set Cursor (0, 0);
LCD. Print("System:");
LCD. set Cursor (0, 1);
LCD. Print("READY");
sms_count = 0; // Reactivating the SMS Alert Facility
}
if ((vibrate==LOW) && (sms_count>= 1))
{
digital Write (buzzer, LOW); // turning OFF the buzzer
digital Write (relay, LOW);
digital Write (relay1, LOW);
digital Write (led1, HIGH);
LCD. Clear ();
LCD. set Cursor (0, 0);
LCD. Print ("Sending SMS...");
delay (700);
LCD. Clear ();
LCD. set Cursor (0, 0);
```

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```
LCD. Print("System:");
LCD. set Cursor (0, 1);
LCD. Print("READY");
sms_count = 0; // Reactivating the SMS Alert Facility
}
}
```

BIOGRAPHIES

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[3]**Mr. Alexander.Leakemariam, Mr. Desalgn.Ediga, Mr. Yibeltal.kinde** are the PG students in branch of ECTM, EET Department, FTVTI, AA, Ethiopia. This is the PG thesis of them. We implemented hardware as well as software parts for use of Ethiopians.