UNIVERSITY OF BUEA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

SPECIALITY: TELECOMMUNICATION ENGINEERING

PROJECT REPORT ON:

SMART SECURITY ENVIRONMENT WITH REMOTE AUTOMATION THROUGH SMS

Done by:

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In partial fulfilment of the requirements of the Bachelor of Engineering Degree Program in Computer Engineering

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DECLARATION

I, Yikwenmein Victor Magheng, declares that this project report pertains to practical academic research by me and this is in partial fulfilment of the Bachelor of Engineering program at the Faculty of Engineering and Technology of the university of Buea. This report has been written by me and has not received previous academic credit.

Student's Name:.....Signature.....

ACKNOLEDGEMENT

First of all, I want to thank GOD ALMIGHTY for making me withstand all odds on this project task . Secondly, I thank my supervisor Mr NOUADJEP Serge for his technical guidance and advice rendered to me during this project . I also wish to thank the Faculty of Engineering and Technology for having included this the in their curriculum for it has given me the opportunity to acquire a lot of experience during this project

Lastly, I thank all friends and family members who contributed in one way or the other in helping me realize this project.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
CCTV	Closed- circuit Television
GND	Ground
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
IR	Infrared
IP	Internet Protocol
RFID	Radio Frequency Identification
SMS	Short Message Service
USART	Universal Synchronous/Asynchronous Receiver/Transmitter

ABSTRACT

This project presents a prototype security environment that can be remotely controlled by a GSM phone set. The prototype consist of a GSM module, two infrared obstacle proximity sensors, arduino microcontroller, alarm buzzer and of course a mobile phone. Sensors are placed around the door both inside and outside of the house which monitors and detect persons within their sensitivity range. Whenever persons are detected, a message is triggered and sent to the security agent's phone so that the person can be authenticated and then access can either be given or denied based on whether the person around the door is a valid user or not. Access granting or denial is also through a message sent to the system by the security agent in charge. If the replied message to the system is one that grants access, the door will automatically opens and closes after a delay of five seconds and if reply is one that denies access, a security alarm will start ringing immediately with a red blinking light to indicate danger.

The sensor around the door inside performs the same action as the one around the door outside whenever it also senses someone around it's sensitivity range. This second sensor is to ensure that persons are not just authenticated when getting in but also when going out. The idea that the door opens and closes after a given delay is to provide the system with the possibility to be able to tract traitors inside, say they even attempted to get in. The system has also been designed in such a way that the agent in charge gets informed of all happenings on the system through a messages. For example there are messages like "Requesting access into" whenever outside door sensor detects someone wanting to go in, " The door has opened and closed" whenever door opens and closes, "alarm is ringing" whenever security alarm starts to ring and "Requesting access out of" whenever inside door sensor detects someone wanting to go out.

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CHAPTER 1 - INTRODUCTION

1.1 General Introduction

Security is the degree of protection against danger, damage, loss or any criminal activity or in other words security describes protection of life and property and involves keeping watch of desired environment, tracking, reporting, preventing disasters of various kinds, unauthorized access and consequently theft. Security can also be seen as a condition so that one can develop and progress freely. An important aspect of security includes **Home Security**, **Office Security, Company Security, Business Place Security, Store Room** or **Warehouse Security** and so on. It is very important, because crime rate is increasing day by day. The advancement of technology has increased and so too, the safety and security of people along with their belongings also needs to advance with these advancement of technology. One of the reasons for the rise of the smart home or smart environment is the increasing risk of burglary and robbery and the busy lifestyle.

The busy lifestyle of people is leading to the necessity of controlling the devices at home, office, company, market or business place remotely and increasing the necessity of keeping surveillance over these areas. Mobile phones today are not just used to make calls. The use of mobile phones is changing with the development of technology and they can be used for different purposes. They can be used as clocks, calendars or controllers instead of being used just as phones. With the help of the GSM network, a mobile can be used to implement a smart home or environment by controlling devices and getting alerts on robbery and burglary. Security systems are mainly used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, as well as personal protection against intruders. Traditional household, office, warehouse or equipment room security systems often require installation and detect based on opening of doors and windows. The increasing number of the stealing and breaking cases especially when people are not around need a system that can tell them if anyone has attempted or trying to break into their place. Therefore the idea of a smart environment system has been proposed, to overcome the limitations of the systems already available in the market. The user can choose the number of sensors, types of sensors, the area of coverage of the systems along with the number. The case of remote control capability and the possibility of achieving it at a reasonably low cost have motivated the need to research into it not only for industrial application but also for domestic use.

Recently, great demands have been placed on working and performance of most security systems. They span from those that detect, authenticate and give access to its reliable users to those that incorporate Hi-tect cameras for CCTV footage and smoke, fire, heat detection sensor that connects automatic water tank system for fire accident detection and treatment. A smart security environment is one that provides its home its users comfort, security, energy efficiency (low operating cost) and convenience at all times, regardless of whether anyone is home or out side.

This project "**Smart Security Environment with Remote Automation Through SMS**" focuses attention on enhancing security awareness issues via detection, verification and access granting or denial controlled by a GSM short message service (SMS).

Motivation for this Project

According to local experience or statistics around us here in Cameroon, the increasing number of the stealing and house breaking cases especially when the people are not at home or a protected area need a system that can tell them if anyone has attempted or trying to break into their home. So, there is need be to define a security system as to detect intrusion, unauthorized entry into a building or a protected area and deny such unauthorized access to protect personnel and property from damage or harm

1.2 General Overview of this Project

This project titled **Smart Security Environment with Remote Automation Through SMS** is aimed at optimizing security awareness and security management issues of a home, office, business warehouses or any other place where security is at the premium. The project incorporates the following;

- Infrared (IR) Obstacle Proximity Sensor to sense the presence a body within its sensing range.
- An arduino microcontroller to program this sensor and other hardware components interfaced to it
- A GSM module to send signals to the security agent whenever there is a security threat
- A speaker to set an alarm ringing whenever the system deems there is a security threat on the system.

- A stepper motor and its driver to drive open a door or close it when necessary
- A mobile phone to receive and reply to messages from the GSM module

1.3 The Objectives of this Project

- The goal of the project is to implement a smart environment system and control devices (alarm, door or gate) at it remotely with the help of a mobile device and getting alerts on intrusion or movement around the restricted premises. The SIM900-GPRS module and the arduino microcontroller are used to communicate between the mobile phone and the devices and the sensors installed. The mobile phone can be used as a controller from anywhere in the world if the GSM network is available. The system is limited to the area with the GSM network available and the whole system does not work without the network.
- The main aim of the project is to make use of the GSM technology and Arduino based embedded system to make any environment where security needs is at a premium smarter and wireless.
- The objective of this project as most as most security systems demand is to develop a system that allows a user to remotely monitor and control multiple home appliances using a cellular phone. This proposed system will be a powerful and flexible tool that will offer this service at any time leading to overall cost reduction and energy saving.
- As earlier mentioned, this project is aimed at optimizing the security awareness of any environment (can be a warehouse for goods, equipment room or even at the gate to a building) where security is at the premium and movement of persons is highly restricted around it.
- It aims to make the system to be self-intelligent in order to reduce cost of operation and also to reduce human influence and effort on the operation of the system in the course of achieving its goals.
- To automatically open a door/ closes according to desired conditions.
- To effectively monitor the environment, identify unwanted persons and alerts security via an alarm.
- To eliminate the need to be physically present at a particular location in order to effect security control.

1.4 Brief Summary on the working of this project

- Infrared (IR) Obstacle Proximity Sensor is installed at the gate or door to the place that needs to be monitored for security purposes.
- The above sensor is interfaced to an arduino microcontroller. This microcontroller is also interfaced with a GSM module, an alarm speaker, and a stepper motor drive
- Infrared (IR) Obstacle Proximity Sensor detects bodies within its sensing range, a check is done on the system via the sending and reply of an SMS and if check is positive door automatically opens and the alarm stays mute otherwise the system will set the alarm ringing.
- Door opens and delays for some few seconds and then automatically closes.
- Same thing happens when moving out from inside

CHAPTER 2 - LITERATURE REVIEW

2.1 Overview of Remote Control of Systems Around The World

The controlling of electrical appliance and instrument remotely have made a profound impact on the 21st century. The appliances that can be incorporated can be anything in the home such as an air conditioner, door locks, set top box, light and so on. The case of remote control capability and the possibility of achieving it at a reasonably low cost have motivated the need to research into it not only for industrial application but also for domestic use. These days, apart from supporting voice calls, a mobile phone can be also used to develop applications for sending predefined text messages with a single click of a button. This project uses this concept to design a system that acts as a platform to receive and send messages, which in fact are commands sent to control different appliances and devices using Arduino Uno as controller. The control system which is based on the GSM technology effectively allows control from a remote area over the appliances which are interfaced with the main microcontroller system.

The application of the proposed system will definitely gain popularity in the ever changing technological world where automation is making its way fast. It provides a greater degree of freedom to an individual for controlling the household appliances or even the office equipment. The need to be physically present in order to control appliances at a certain location is eliminated with the use of the system. Home automation which includes security automation is slowly entering our society. So the main aim of the project is to make use of the GSM technology and Arduino based embedded system to make any environment where security needs is at a premium smarter and wireless. Existing devices like alarm bells, bulbs, door locks etc. which we intend to control will be connected with some relays which can be controlled by the microcontroller.

2.2Related Works

The idea of using the short message service to establish routes in communication networks between receivers and transmitters for the purpose of safety and guaranty of service is not new, but the application, cost, design method and reliability of the system varies

These are some of the existing Smart Security systems that have been implemented.

- ***AyushAgarwal, R.C.Joshi, in " WSN and GSM based Home Security Sytems", IJCA Proceedings on International Conference on Recent Advances and Future***

Trends in Information Technolgy (iRAFIT 2012),Number 2 developed a GSM/GPRS based wireless home security system which includes wireless security sensor nodes and a GSM/GPRS gateway. It has the following features: (a) low cost, (b) low power consumption, (c) simple installation, (d) fast response and (e) simple user interface. In general, GSM modem acts as the interface between the users and the sensors nodes. There are 3 types of sensor nodes applied in the system which include the door security nodes, infrared sensor nodes, and fire alarm nodes. This architecture includes components such as filters, amplifiers, analog to digital converters and communication interfaces. The system used a wireless transceiver module to transfer data between gateway and sensor nodes. Every sensor node comprises a microprocessor and a wireless transceiver module. The function of the microprocessor is to receive and analyze the signal from the sensors' node as well as the current status of the nodes. This system also consists of a sleep timer and switch mode pump circuit, which reduces of the power consumption.

- **Md. Nafiul Hasan, A. Noman, in *"Design and Implementation of Smart Home Security System with Automatic Snapshot" developed smart security system and in their design,*** When there is any motion detection by PIR sensor, then the camera take automatic snapshot and also the security system give an alarm which turns on the light.
- ***I.Syam Krishna, J. Ravindra, in " Design and Implementation of Home Security Sytem based on WSNS and GSM Technology" International Journal of Engineering Science and Technology" Volume 2,Special Issue 1,Page 139-142,*** developed a wireless security system where an alarm system is programmed in a graphical user interface (GUI). The system is used to monitor the RFID reader, RFID tag and the GSM terminal. The information obtained from the tag is sent to the server in a RF link that is exhibited in a GUI. If the laptop is stolen from the covered region, the alarm system will start to draw attention. Meanwhile, the laptop owner will be notified by an alert message. In addition, the alarm system will not be stopped until the laptop is put back in the covered region, or the program is stopped/terminated. RFID have been available for many years for reading bar codes RFID tag located several meters away. It is increasingly being used in other applications ranging from inventory management to anti-counterfeiting protection.
- In a wireless security system (WSS) of ***V. Karri and J. S. Daniel Lim, "Method and Device to Communicate via SMS After a Security Intrusion", 1st***

International Conference on Sensing Technology, Palmerston North, New Zealand, (2005) November 21 -23, a RFID tag is attached to the laptop and RFID reader is connected to server. If the laptop is stolen from the reader, the alarm system will be triggered to draw attention with loud noise. The laptop owner will be notified with short messaging service (SMS) from the server via GSM module system in a few seconds. Alternatively, it can be improved with Bluetooth technology which is embedded in most of mobile laptop today. The GSM terminal is used as the SMS interface to send messages. Generally the notebook acts as the base station to run the program. Usually GSM terminal comes with a RS232 connector to external terminal equipment, and the Subscriber Identity Module (SIM) cardholder and the external connector.

- ***Z. Bing, G. Yunhung, L. Bo, Z. Guangwei and T. Tian, "HomeVideo Security Surveillance", Info-Tech and Infonet, 2001,Proceedings,ICII 2001 -Beijing. 2001 International Conference, vol. 3, pp. 202-208,*** developed a security system against asset theft by using radio frequency identification technology. The system consists of five main parts: (a) RFID reader and tag, (b) GUI, (c) database system, (d) CCTV and (e) wireless transmitter and receiver. The RFID reader is installed at the entrance of the campus and the tags are attached on/in student ID cards and their properties. The program of the developed system has the capabilities of investigating the identification process, database management and controlling function of the hardware. GUI is used in a vehicle security system where the information is controlled via the GUI. The system is activated when the tag is read while the motorcycle is being located within the effective range. The system will automatically record this incident and exhibit the information on the monitor. Any theft occurrence will turn the monitor on automatically with the alarm signal which alerts other systems. When the burglar occurs, the CCTV will also be started for recording is immediately. The motorcycle engine is shut off automatically when the asset theft occurs however this requires a further investigation.

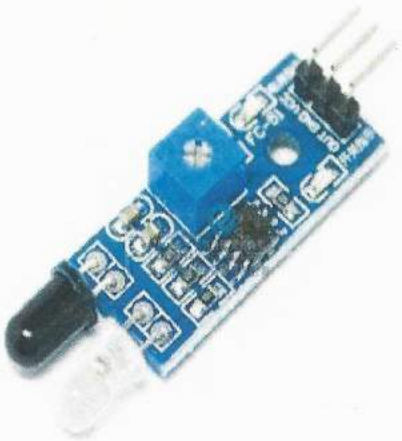
Most of these systems mentioned above are all good for remote security and remote security automation purposes but some have the following loopholes;

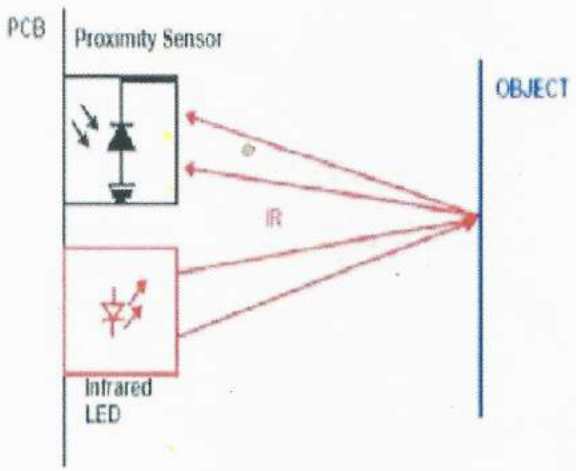
1) Most of their works focused more attention on remote automation of home appliances than home security automation
2) Those distinguish between a normal user and an intruder.

3) Those not provide a means of preventing theft or means of holding the criminal captive at the crime scene.
4) Most of the systems are costly to implement

2.2The Various Building Blocks Of This Project and How They Operate

Infrared (IR) Obstacle Proximity Sensor: This is a multipurpose infrared sensor which can be used for obstacle sensing, color detection (between basic contrasting colors), fire detection, line sensing, etc and also as an encoder sensor. The sensor provides a digital output. The sensor outputs a logic one (+5V) at the digital output when an object is placed in front of the sensor and a logic zero (0V), when there is no object in front of the sensor. An on board LED is used to indicate the presence of an object. This digital output can be directly connected to an Arduino, Raspberry Pi, AVR, PIC, 8051 or any other microcontroller to read the sensor output. IR sensors are highly susceptible to ambient light and the IR sensor on this sensor is suitably covered to reduce effect of ambient light on the sensor. T For maximum, range the on board potentiometer should be used to calibrate the sensor. To set the potentiometer, use a screw driver and turn the potentiometer till the output LED just turns off





Photograph 1:Infrared obstacle proximity sensor

Characteristics of the Sensor;

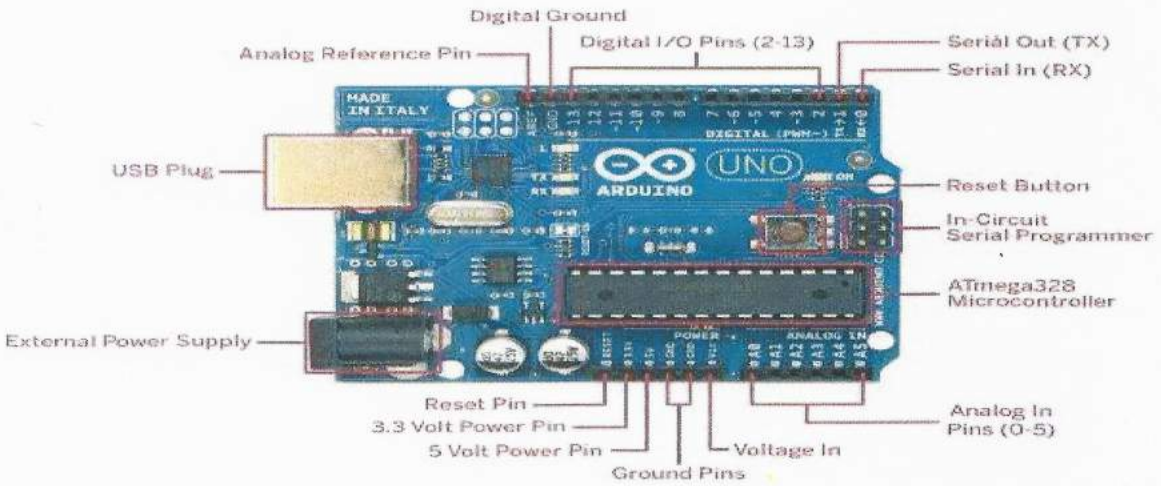
- Can be used for obstacle sensing, color detection(between basic contrasting colors), fire detection, line sensing, etc and also as an encoder sensor
- Input Voltage: 5V DC
- Comes with an easy to use digital output

- Can be used for wireless communication and sensing IR remote signals
- Sensor comes with ambient light protection
- The sensor has 3 output pins(+5V or VCC, GND ,D0 or OUT (Digital Output))

Arduino Microcontroller

First of all, Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware (the microcontroller), open-source software (the programs for controlling the microcontroller), and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

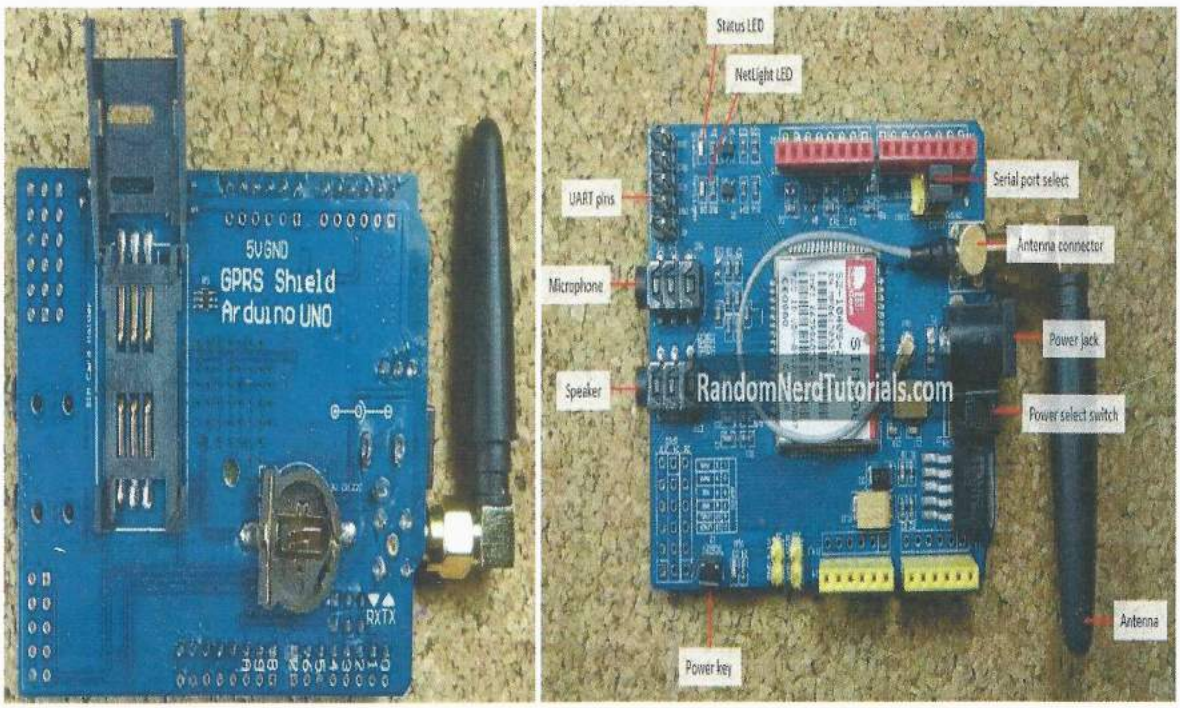
Microcontroller is the key element in all embedded systems, control and automation processes. It behaves like a single chip microcomputer and is coupled with a processing unit, memory, input output devices, timers, data convertors, serial port etc. In this project Arduino Uno microcontroller is used which contains ATmega32 whose pin configuration shown in photograph 2 below. It is a high-performance, low-power Atmel 8-bit AVR RISC(reduced instruction set computer) -based microcontroller which has 32KB of programmable flash memory, 2KB SRAM, 1KB EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts



Photogragh 2:Arduino Microcontroller

SIM900 GSM GPRS Shield

I have used general packet radio service (GPRS) modem SIM900 from SIMCON ltd. Designed for global market; **GSM** stands for Global System for Mobile Communications and is the global while **GPRS** stands for General Packet Radio Service. GPRS is a mobile service on the 2G and 3G cellular communication standard for mobile communications .SIM900 is a GSM/GPRS-compatible Quad-band cell phone chip, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself. The processor is also in charge of a SIM card (3 or 1.8 V) which needs to be attached to the outer wall of the module



Photogragh 3:SIM900 GSM GPRS Shield

Applications:

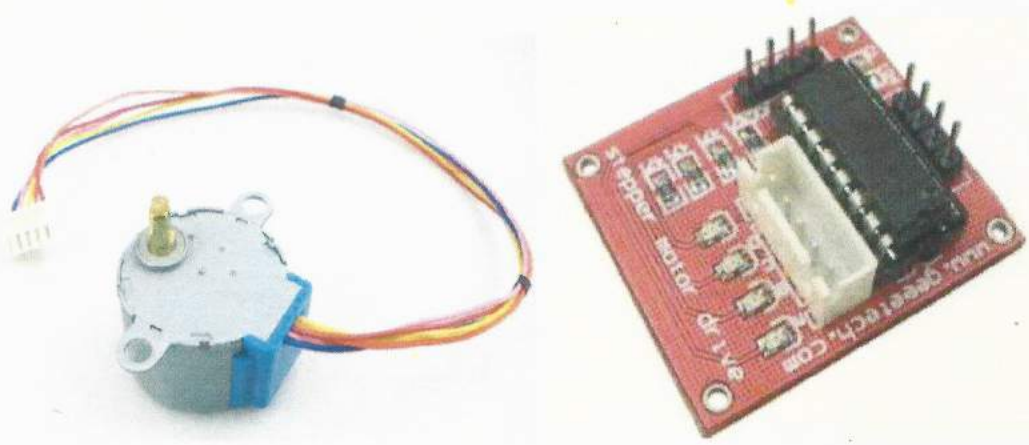
- Connect to the Internet over GPRS network
- Send and receive SMS
- Place and receive phones calls

Its capabilities make it perfect for projects with Arduino like:

- Remote control of electronic appliances – sending an SMS to turn something on
- Receive notifications – send SMS to your cell phone if movement is detected in your house
- Receive sensor data – send periodic SMS to your cell phone with daily weather data

Stepper Motor and its driver to drive open and close the door

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied. One of the most significant advantages of a stepper motor is its ability to be accurately controlled in an open loop system



Photogragh 4: Stepper Motor and its driver

Features

- The rotation angle of the motor is proportional to the input pulse.
- The motor has full torque at standstill(if the windings are energized)
- Precise positioning and repeatability of movement since good stepper motors have an accuracy of – 5% of a step and this error is noncumulative from one step to the next.
- Excellent response to starting/stopping/reversing.

- Very reliable since there are no contact brushes in the motor. Therefore the life of the motor is simply dependent on the life of the bearing.
- The motors response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
- It is possible to achieve very low speed synchronous rotation with a load that is directly coupled to the shaft.
- A wide range of rotational speeds can be realized as the speed is proportional to the frequency of the input pulses.

An Alarm buzzer

A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. [1]

Photogragh 5:An Alarm buzzer

CHAPTER 3 - METHODOLOGY ADOPTED

This section will discuss the design procedure and implementation of a **Smart Security Environment with Remote Automation through SMS.** The design and implementation process can be broadly divided into two parts; *one is hardware design and another part is software design*

The methodology used in the proposed model is to develop a prototype model of a house, in the prototype an interface of the infrared (IR) obstacle proximity sensor, and GSM module, stepper motor and an alarm speaker is being developed with a microcontroller. The communication between the microcontroller and other components of the system takes place serially. The microcontroller continuously receives data or signals from the two infrared (IR) obstacle proximity sensors and takes decision, that is it will trigger the sending of an SMS via the GSM/ GPRS arduino to mobile of security agent that as has programmed in the software. So on intrusion the microcontroller will generate a message to the owner or to a set of predefined numbers stating there is a request for access into the said premises be it home, office, store room or any other place that needs to be secured and protected. Based now on the agent in charge, if access request is authentic then he will reply "yes" to the present SMS and a smooth access is granted and a door or gate automatically opens otherwise access is denied and an alarm starts ringing. The operation of this system is also described by flow chart shown in figure 2

Hardware Design and Implementation

The various hardware components constituting as main building blocks of this project have already been made mentioned on the literature review part and include;

- Two infrared obstacle proximity sensors
- An arduino uno microcontroller
- A GSM/ GPRS shield for arduino
- A stepper motor and its driver
- An alarm speaker
- A mobile phone
- An arduino SD card reader

These components are connected or interfaced together as shown on the system block diagram in figure below.

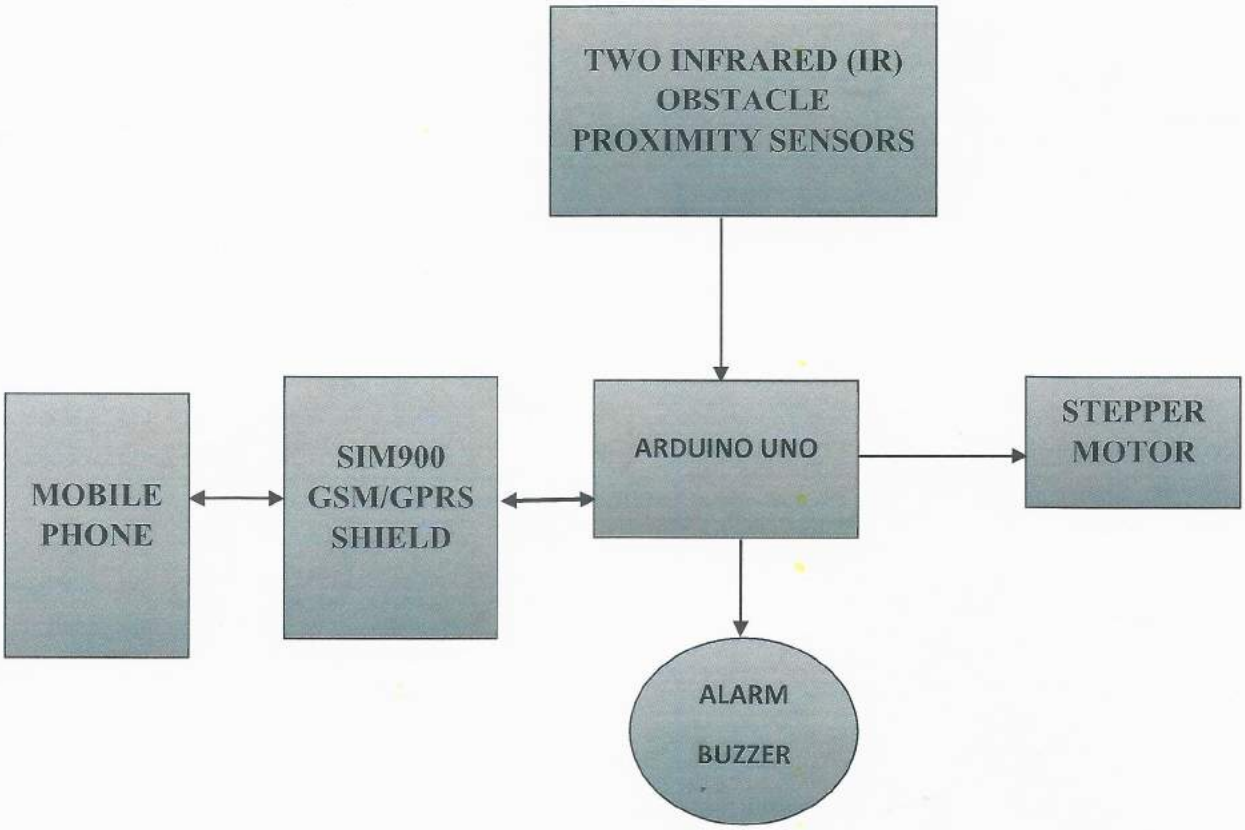
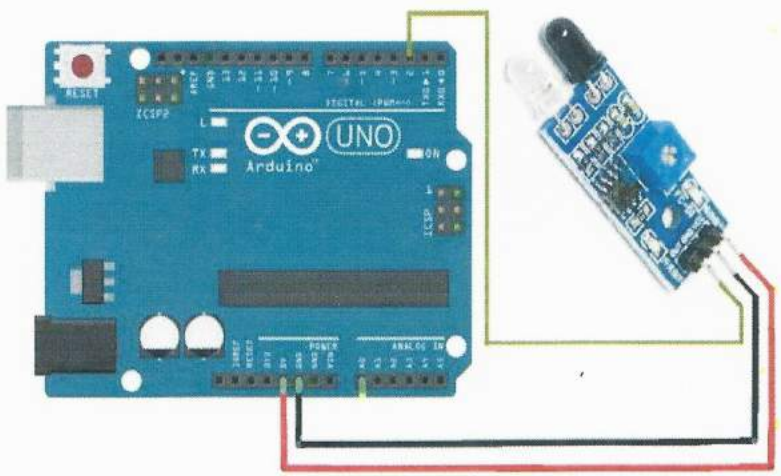


Figure 1:System block diagram

Interfacing of the various Components in the design of this project

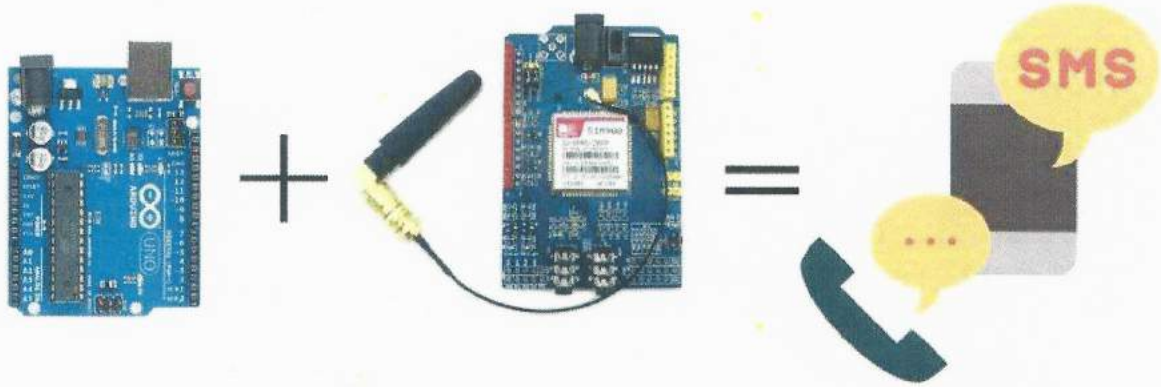
Infrared obstacle proximity sensor and Arduino

Arduino interfacing with IR proximity sensor is very simple like interfacing of Switch with the arduino, The obstacle sensor gives logic 0 as output when there is no obstacle in front of it, and when obstacle is placed in front of it, it will give logic high output i.e. +5V. We need to read these logic changes on the arduino using the digitalRead Command.You can use any pin of arduino to connect to connect the output pin of the sensor. The sensor takes human presence as input sends out signals as output values which in turn serve as inputs to the arduino microcontroller. The interfacing diagram is shown in photogragh 6 below.



Photograph 6:Interfacing Infrared obstacle proximity sensor to Arduino

SIM900 GSM/ GPRS Shield and Arduino



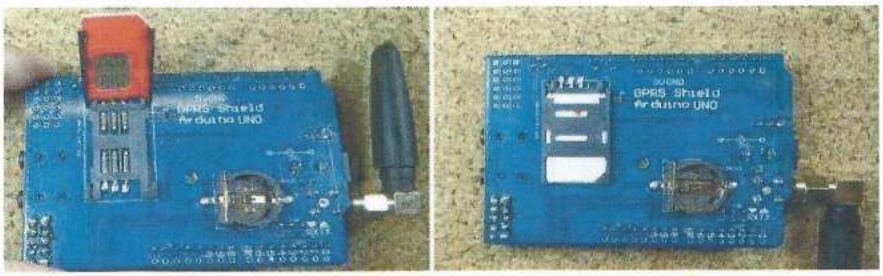
Photograph 7: SMS and call functionalities GSM module when interfaced with arduino

As seen on the schematic above, a GSM module interfaced with arduino microcontroller can send/receive calls to/ from a mobile phone. The capability of being able to send/receive SMS and calls as a feature of this GSM module when programed on arduino microcontroller has provided me with the possibility of being able to remote control my security system through simple SMS services. Through SMS, my system can inform when someone is around the protected environment. Also, through SMS, I can remotely give access to someone by sending a specified SMS to open the door or deny access and set a security alarm ringing by sending another specific SMS to my system. Apart from these, everything which happens on the system (whether it is the detection of persons, opening/ closing of the door or ringing of the alarm), I get informed about it on my mobile thanks to working together of my arduino microcontroller and GSM module.

Connecting the GSM module with arduino

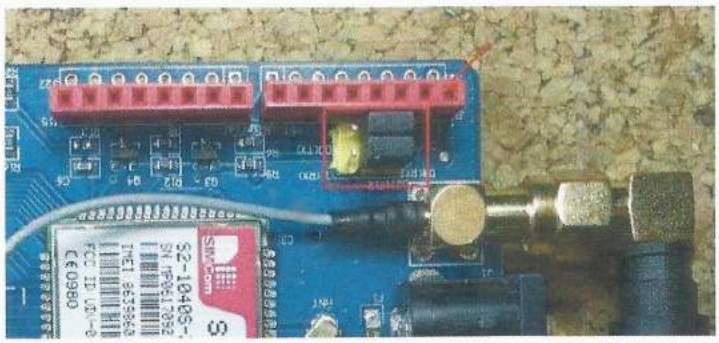
Connecting the GSM module to arduino uno is pretty simple. You can choose whether your connections are going to be in hardware serial or software serial mode. I used the the software serial mode in my implementation. The following are the preliminary steps followed;

- Insert the SIM card into the SIM card holder of the GSM/GPRS shield module while also making sure that the antenna is well connected



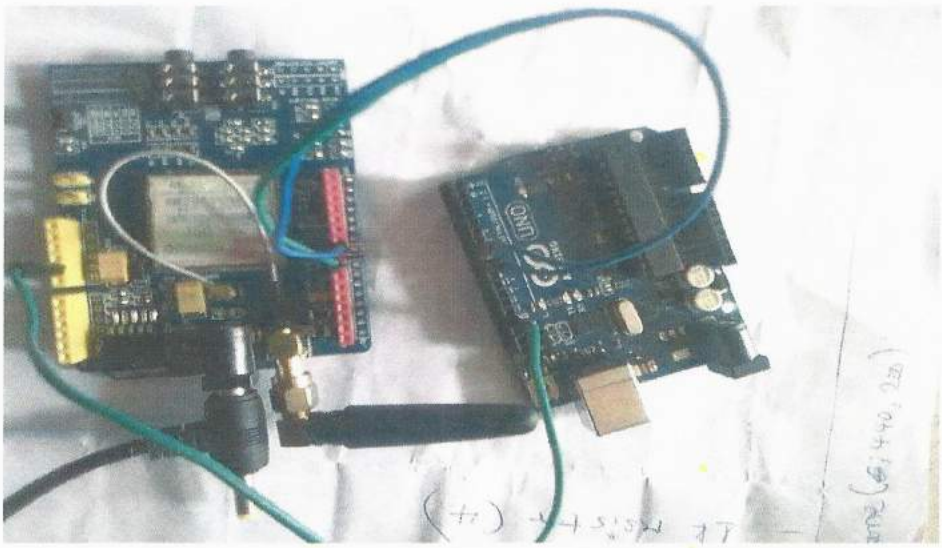
Photogragh 8:SIM card placement in a GSM module

- On the serial port select, make sure the jumper cap is connected as shown in figure below to use software serial



Photogragh 9: Selecting software serial mode

- Power the shield using an external 12V-2A power supply. Make sure you select the external power source with the toggle switch next to the DC jack.
- To power up/down the shield press the power key for about 2 seconds. Then, the Status LED will light up and the NetLight LED will blink every 800 ms until it finds the network. When it finds the network, the NetLight LED will start blinking every three seconds.
- Then finally, connect the GND pin of the module to any GND pin on arduino, pins 7 and 8 of the module to pins 7 and 8 of arduino microcontroller respectively as shown on the diagram below



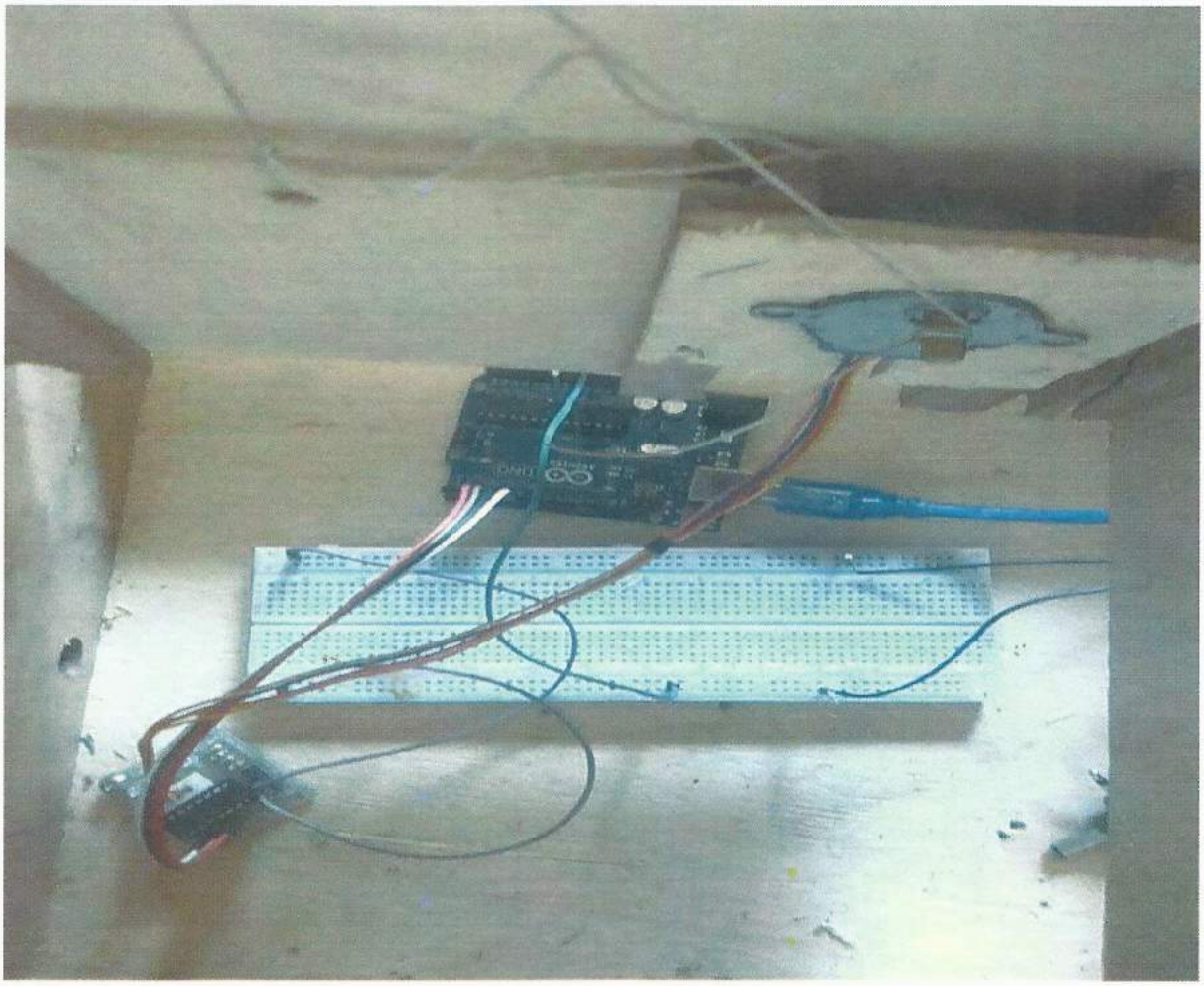
Photogragh 10:Connecting a GSM module to arduino

Stepper motor and Arduino

The purpose of the stepper motor in my project was to implement an automatic door which can open and close automatically based on issued SMS commands coming from a mobile phone so if in case of an attacked, the door can will automatically closes and the intruder will be prevented from escaping. Much has already been said about the this motor and its driver in the literature review part of this work.

Connecting the motor to its diver and finally the driver to arduino microcontroller

This motor requires a 5-12V supply of which I used an external charger to supply it. Both the negative terminal of the motor driver and the GND of arduino are taken to a common GND on a bread board which is then supplied by the negative terminal of the external supply charger. Then positive terminal of the charger and that of the motor driver are also taken to a common point on a bread board. This is shown on the picture below



Photograph 11:Connection of stepper motor ,driver to arduino

Alarm subsystem and Arduino

Interfacing this alarm subsystem (a buzzer for alarm alerts and a red bulb to indicate danger during the alarming period) with arduino is very simple. In place of a red bulb, I used a red LED. Both the LED and buzzer has only two terminals each (positive and ground). Connect both grounds to the common GND pin of arduino on the breadboard and each of the positive terminals to a digital pins of arduino that you wish to control as output.

Software Design of the project

The various hardware components listed above had to programed to give the desired project output. The program written to control them is in Arduino language. This program is given in the appendix section of this work and was written while closely following the flow chart diagram below.

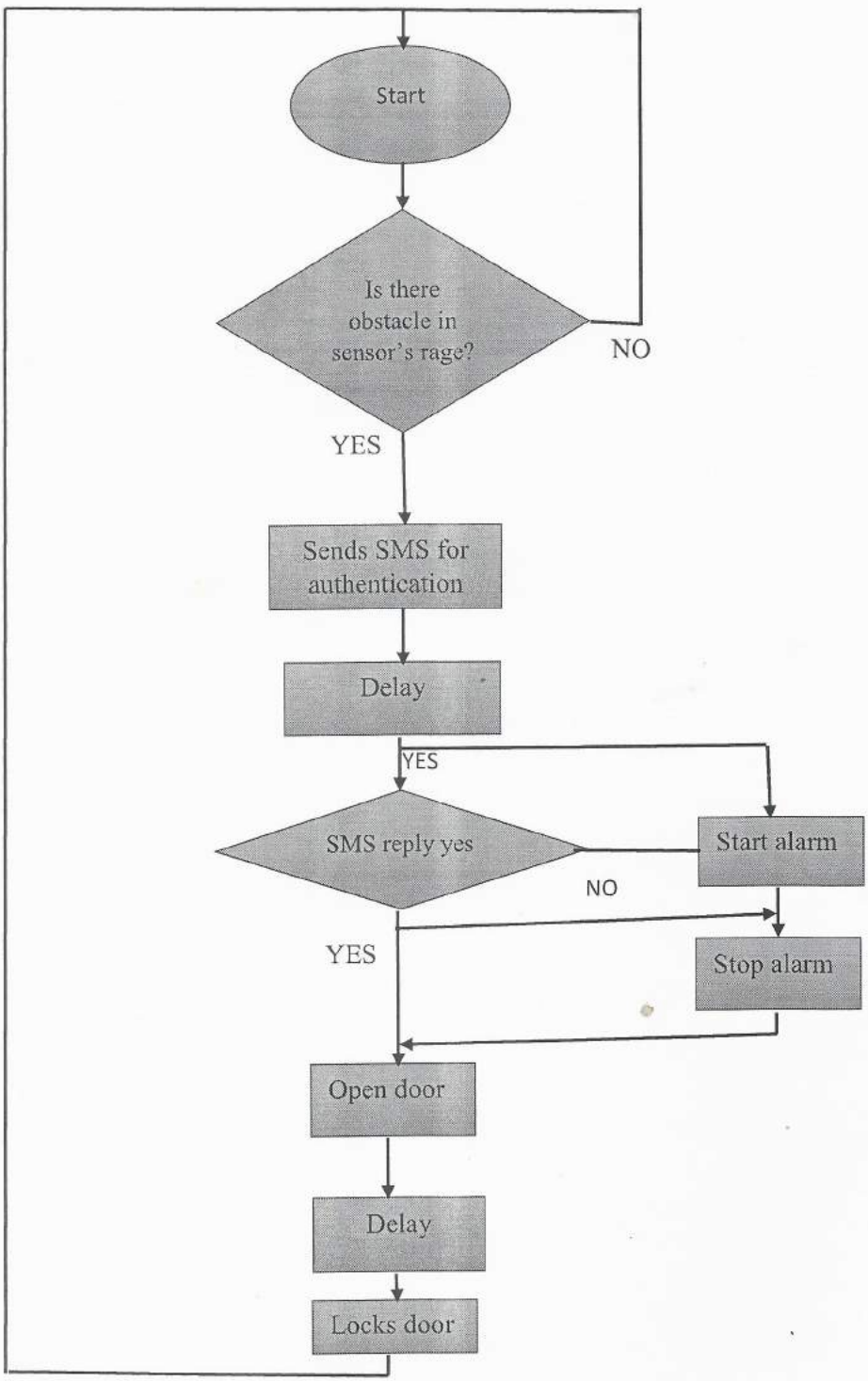


Figure 2: System flow chart diagram

CHAPTER 4-RESULTS AND DISCUSSION

The major striking results of this project has been the realization of a smart security environment which can be remotely control via SMS commands as can be observed on the project physical simulations. Infrared obstacle proximity sensor at the door detects persons and authentication is done through the reply of an SMS automatically sent to the security agent once sensor detects someone at the door. If person is an authentic user (determine by reply of the SMS that was sent for authentication), a door will automatically open to let the person in else access is denied and an alarm starts to ring indicating that there is a potential threat around the environment.

This system can actually assist or replace human effort in security issues as on its own, it is able to monitor reports on happening around the environment.

CONCLUSION AND RECOMMENDATIONS FOR FUTURE SCOPE OF WORK

My predetermined project scope which was to implement a smart security environment with remote automation through SMS has been achieved. The system worked perfectly well but due to time constraint, other aspects which can make the system more secured and smarter could not be implemented

I tried to make a smart environment security system but because of insufficient time, I could not implement some parts which make a home more secured. As future scope of study, I intend add smoke, fire, heat detection sensors and an IP camera to capture the scenes and transmit them through the Internet whenever there are non-authentic users are spotted on the environment. An automatic water tank system can also be added to remedy fire outbreak situations. If an internet connected camera is connected to the system, then the whole environment can be observed even when nobody's around.

APPENDIX

Programming Code for Whole System

```
#include <SoftwareSerial.h>
#include <unistep.h>
SoftwareSerial mySerial(7, 8);          //Define softwareSerial pin 7as RX, pin 8 as TX
//Declaring variables
int isObstaclePinIn = 12;  // This is our input pin
int isObstaclePinOut = 10;  // This is our input pin
int isObstacleIn = HIGH;  // HIGH MEANS NO OBSTACLE
int isObstacleOut = HIGH;
int ledDelay = 50;
int redPin = 9;
//int bluePin = 10;
unistep stepper2(3, 4, 5, 6, 4096, 900);
char  msg;                                  // declaration of msg used to store character values
String message = "";                        // declaration of message used to store strings of
text; it has initially been made empty
String extract = "";                        // declaration of extract used to store strings of text;
it has initially been made empty
String test = "";
String number; //= "";
//int   LED = 13;                           // LED is connected to digital pin 13 of Arduino
//int count = 0;                            // declaration of count used to store interger values
and it is initialised to 0
char bin;
// define function sendsms to send sms
void sendsmsOne() {


 mySerial.println("AT+CMGF=1\r");   // setting the GSM module to TEXT mode
 delay(1000);
```

```
 mySerial.println("AT+CSCA=\"+237679000002\"\r");     // The AT+CSCA sets the SMS service center of MTN
 delay(1000);
 mySerial.println("AT+CMGS=\"+237678800691\"\r");   // the AT+CMGS command sends the text to the number that has to receive the text
 delay(1000);
 mySerial.println("Requesting access into!");      // the text to be sent
 delay(200);
 mySerial.println((char)26);
}

void sendsmsTwo() {
 mySerial.println("AT+CMGF=1\r");   // setting the GSM module to TEXT mode
 delay(1000);
 mySerial.println("AT+CSCA=\"+237679000002\"\r");     // The AT+CSCA sets the SMS service center of MTN
 delay(1000);
 mySerial.println("AT+CMGS=\"+237678800691\"\r");   // the AT+CMGS command sends the text to the number that has to receive the text
 delay(1000);
 mySerial.println("Requesting access Out of!");      // the text to be sent
 delay(200);
 mySerial.println((char)26);
}
void ReceiveMessage() {
 mySerial.println("AT+CNMI=2,2,0,0,0\r");            // AT command to receive live SMS sent to the GSM module and sends the message to the receive buffer of arduino
 delay(1000);
 Serial.println("Waiting For New Message");
}
void gsmflush() {
 while (mySerial.available()) {
```

```
    bin = mySerial.read();


  }
}
//the folowing lines  remove any unwanted characters from the incoming message
void trash () {
  while (mySerial.available()) {
    bin = mySerial.read();
  }
}
//this function initialises the gsm module and deletes all inbox
void InitGSM() {
  mySerial.println("AT+CMGD=1,4");       //deletes all sms in inbox
  delay(500);
}
//Function to blink LED and sound alarm
void blinkled() {
  for (int counter = 0; counter <= 60; counter++)
  {
    //digitalWrite(bluePin, LOW);
    delay(ledDelay);
    digitalWrite(redPin, HIGH);
    delay(ledDelay);
    digitalWrite(redPin, LOW);
    delay(ledDelay);
    digitalWrite(redPin, HIGH);
    delay(ledDelay);
    digitalWrite(redPin, LOW);
    delay(ledDelay);
    digitalWrite(redPin, HIGH);
```

```
   delay(ledDelay);
   tone(11, 440, 200);
   digitalWrite(redPin, LOW);
   delay(ledDelay);
  noTone(11);
 tone(11, 523, 300);
  }
}
// Function to open and close door
void movedoor() {
 stepper2.moves(4096, 0);
 stepper2.moves(4096, 0);
 stepper2.moves(4096, 0);
 stepper2.moves(4096, 0);
 delay(5000);
 stepper2.moves(4096, 1);
 stepper2.moves(4096, 1);
 stepper2.moves(4096, 1);
 stepper2.moves(4096, 1);
}
void stopalarm() {
 for (int counter = 0; counter <= 60; counter++) {
   digitalWrite(redPin, LOW);
   noTone(11);
  }
}
void setup() {

 Serial.begin(9600);              //setting serial port baudrate to 9600
 mySerial.begin(9600);            //set SoftwareSerial port baud rate
```

```
 delay(100);                    //delay of 100ms
 //pinMode(LED, OUTPUT);
 //  digitalWrite(LED, LOW);          // Initialising the LED to off state
 gsmflush();                    // reads all incoming data from the GSM module to ensure that
there is nothing there in the beginning
 pinMode(isObstaclePinIn, INPUT);    // setting Pin 12 of Arduino as input
 digitalWrite(isObstaclePinIn, HIGH);  // Initialising Pin 12 to HIGH
 pinMode(isObstaclePinOut, INPUT);
 digitalWrite(isObstaclePinOut, HIGH);
 pinMode(redPin, OUTPUT);
 digitalWrite(redPin, LOW);
 mySerial.println("AT+CMGD=4\r");              // issue the delete message command to the
GSM module
 // gsm.println(4);                 // send the ID of the message to be deleted
 delay(1000);


 mySerial.println("AT+CMGF=1\r");              // setting the GSM module to TEXT mode
 delay(1000);


 gsmflush();                        // reads all possible data from the GSM module prior to
calling the ReceiveMessage() function so that only the received message will be available
 ReceiveMessage();                  // calls the receive message function
ReceiveMessage(), to receive live SMS and send to the SoftwareSerial ports
 gsmflush();                    // clears the gsm buffer
}


void loop() {
 if (digitalRead(isObstaclePinIn) == LOW) // Arduino should read if the Pushbutton is
pressed
 {
 sendsmsOne();//  smsOne function executes here
 }
```

```
 if (digitalRead(isObstaclePinOut) == LOW) // Arduino should read if the Pushbutton is
pressed
 {
  sendsmsTwo();// sendsmsTwo function executes here
 }
 // put your main code here, to run repeatedly:
 while (mySerial.available() > 0)            // checks if there is data coming from the GSM
module through the SoftwareSerial ports
 {
  msg = char(mySerial.read());               // reads the incoming data through the
SoftwareSerial ports one byte at a time and stores in msg
  delay(50);                                 // to give enough time to read different bytes from the
SoftwareSerial ports ; very important
  extract += msg;                            // continuously stores the characters read to form a
string of text in extract
  // Serial.print(msg);
 }
 if (extract != "") {                        // executes the following only if extract is not an empty
string
  //  Serial.print(extract);                 // prints on the serial monitor what has been stored in
extract
  message = extract;                         // stores what is in extract into another string called
message
  message.trim();                            // removes leading and trailing white spaces  from the
message
  Serial.println(message);
  Serial.println(message.length());
  Serial.println(message[message.length() - 1]);  // prints the last character of what is stored
in "message"

  for (int i = 49; i < message.length(); i++) { // stores the message content in the string called
test

    test +=  message[i];
```

```
  }

  for (int p = 7; p < 20; p++) {      // stores the phone number of the sender in a string called number

    number += message[p];
  }

  extract = "";                       // initialises extract again to be an empty string so that new message could be stored into it without the previous one
  ReceiveMessage();                   // calls the receive message function to receive another live SMS and send to the SoftwareSerial ports
  gsmflush();                         // clears the gsm buffer
 }

 if (test == "yes") {

  movedoor();
  //digitalWrite(LED, HIGH);          // will ON the LED if the last characters of the string message is FET
  //gsm.print("AT+CMGS=\"");          // the number that has to receive the text
  mySerial.println("AT+CMGS=\"+237678800691\"\r");  // the AT+CMGS command sends the text to the number that has to receive the text
  mySerial.print(number);
  mySerial.println("\"\r");
  delay(1000);
  mySerial.println("The door was opened and has been locked back");   // the SMS to be sent
  delay(200);
  mySerial.println((char)26);         // identifies end of SMS content
  delay(50);
```

```
  gsmflush();
 }

 if (test == "no")

 {
  mySerial.println("AT+CMGS=\"+237678800691\"\r");  // the AT+CMGS command sends the text to the number that has to receive the text
  mySerial.print(number);
  mySerial.println("\"\r");
  delay(1000);
  mySerial.println("alarm is ringing");        // the SMS to be sent
  delay(200);
  mySerial.println((char)26);                 // identifies end of SMS content
  delay(50);
  gsmflush();


  blinkled();


  stopalarm();
 }


 test = "";
 number = "";
}
```

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