

## **SIM300 GSM Module Controller For Smart Home**

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### **ABSTRACT**

Advancement in technology has made things simpler and easier for mankind. Automatic systems are being preferred over manual system. This research work presents the development of SIM300 GSM-module controller for smart homes. The system allows the user to monitor electrical equipment via the mobile phone set by sending commands in the form of SMS messages and receiving the appliance status, as the feedback. The main aim of this prototype is to reduce electricity wastage, provide security and replace human work force, which is prone to errors to automated system. The system will be integrated with microcontroller and SIM300 GSM module network interface using assembly language. It is activated when a user sends the SMS to the controller, on receiving the SMS command, the microcontroller unit then automatically controls the electrical appliances by switching “ON” or “OFF” the device according to the user instruction. The design technique used in this research is top down decomposition; the approach is best-suited when the problem and its environment are well defined.

**Keywords:** E-EPROM, SIM300GSM module, Microcontroller, Embedded system.

### **1.0 INTRODUCTION**

Throughout the developing world, there is a strong focus on improving information technology. In this view, many believe that the use of Information and Communication Technology (ICT) is a key that can help to address certain problems that required constant attention, like monitoring, controls, security and other commercial businesses. In early 1940’s computers were used only to solve problem such as calculation and finding of trigonometric problems: As time went on the use of computer extended to things like data processing applications and result oriented programs.

Today Information technology has advanced so much in the last decade or two that it has made life more comfortable and efficient. The comfort of being able to control devices from one particular location has become vital as it saves a lot of time and effort. With the adoption of this system, control can be gained over certain things that required constant attention. Their existing technologies that are widely used for such transfer of information/control from one place to another are as followed:-

Bluetooth Technology, Zigbee Technology, Wi-Fi Technology, GPRS (General Packet Radio Service). SIM300 GSM Module implementation of Smart Home is based on application of the GSM technology. Using GSM Network, a control system has been proposed that will act as an embedded system which can monitor and control appliances and enable home security against intrusion in the absence of home owner.

Communication and networking technologies have advanced tremendously over the past decade. The application of mobile phone cannot be restricted to sending SMS or starting conversations. The following are the goals of the researchers:

- i. To co-ordinate appliances and other devices required for fighting fire during fire outbreak case without risking life at very high temperature through short message services (SMS) send by ordinary mobile phone.
- ii. There is no way; power consumption can be minimized specifically now prepaid meter is used in various homes and offices.
- iii. The life span of electrical home and office appliance are reduced to the lack of devices that will help in the monitoring and controlling of the electrical devices on weather change while in office or market.
- iv. Human power are been wasted, in monitoring and control appliance in home and industries where usage of electrical appliance are highly required just to ON or OFF the equipment.
- v. It is difficult to operate machine and gadget that are hazardous to operate, so many people lost their lives in performing task that are beyond human capability size and speed in the existing system (example, the work of the fire services people)

The main aim of this research is to develop an interface between the GSM and remote electrical appliances that will be able to:

- i. Co-ordinate appliances and other devices through short message services (SMS).
- ii. Effectively receive and transmit data via SMS.
- iii. Design a circuit that can automatically switch 'ON' and 'OFF' the home appliances.

## 2.0 BODY

In order to come up with the best design of the control process of the project, the researchers review previous articles, book and journal on the subject matter. The information gathered from the literature will

go a long way not only in shaping the direction of the project but also in sharpening. *Faisal et.al, 2012* develop a system that uses Android OS based mobile giving voice command, the mobile application convert the voice into text to control the electrical device. *Amit, et.al, 2011* sign remote control based on GSM mobile technology, using SMS message that is generated by the web. It is implemented based on micro-controller that receives SMS and commands from a cellular phone over the network. The microcontroller then carries out the issued commands and then communicate the status of a given applicant or device back to the cellular. *Yuan Xin Lin et.al, 2014* implemented smart home using ZigBee technology, the system used a low power cost CC2430 processor as central controller. Touch screen interface allows the ZigBee technology to achieve wireless monitor-ing of home device. *Pandikumar et.al, 2013* proposes architecture to enable the users to control and monitor smart devices through Internet. It creates an interface between users and smart home by using GSM and Internet technologies. In this architecture the users give commands through web then the users inputs are converted into GSM-SMS commands. These commands are sent to embedded system module (embedded system directly connect with devices) through GSM network, and finally the user commands are executed by microcontroller to control any electronic objects like home appliances and lights and it sends the acknowledgement. The embedded system module can place anywhere in the world and it will controlled by IoT, (Internet of Things) Agent through GSM network. *Jayashri et.al, 2013* developed two methods for home security system. The first system uses web camera, whenever there is a motion in front of the camera it gives security alert in terms of sound and a mail is sends to the owner. The second methods send, SMS which uses GSM GPS Module (Sim 548c) and Atmega664p microcontroller, relays and buzzers. *Das. C. K et.al*, proposed a method which enables users to control their home appliances and system from anywhere using cell phone. To access the control unit, then user should send an authentication code (DTMF) along with the required /desired function to his/her home control system via GSM.

## 2.1 The Proposed System.

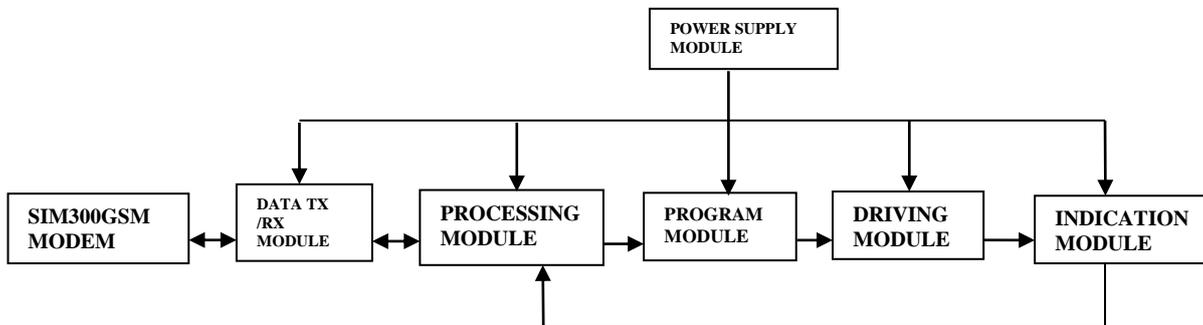
In our proposed system, we developed a software module that can control many ports, send back report on the condition of the appliances to the owner through the user's phone, provides security to the user electrical appliances and it strictly can be controlled by only person with password. This system can be monitored or controlled using any type of phone.

## 3.0 RESULT AND DISCUSSION

This section expresses the actual design analysis and the construction of this project. Design has to do with plans, sketching of circuit diagram that will suit the desired specification of the project.

### 3.1 The Block Diagram of the System Designed

At this point each block was developed into circuits to achieve the respective peculiar function of each of them. This project circuit diagram has seven modules.



**Fig 1: The System Block Diagram of the System**

### 3.2 Detail Design

This section of this work expresses the detailed entire modules with the respective components and devices that make up the module.

#### 3.2.1 Power Supply Module

This module is very important part, which none of the remaining module cannot do without. The moment this module is off, every other parts of the entire system will turn off. The power supply module has two current form, the alternate current (AC) and direct current (DC). The alternate current is used to power and monitor devices under control by the project furthermore, it is also used to power the power supply unit of the designed system while the direct current is the output power from the power supply unit that rectify and regulate to specified DC voltage level from the AC input of the system. This module consists of transformer, Capacitor, bridge rectifier, voltage regulators and other components.

#### 3.2.2 Data Trans-Receiver Module (TX/RX Module)

This is the unit that serves as the gateway of the system. It receives information from the user mobile phone station and feed into Data processing module on control mode; it also receives feedback information from the processing module back to user mobile phone station on monitoring mode that it has full duplex function. This module is made up of Phone Fbus and Mbus, SIM card reader, registered and MTN SIM card.

#### 3.2.3 Processing Module

This module is the brain behind the operation of this system. It controls both the input and output information of the entire system, processes it and gives out instruction to appropriate module for action. When the system is in control mode it receives information from the trans-receiver module, process it and

send instruction to the appropriate device the information is made for through driving module then indicating module, process it and send SMS message to the user mobile phone via trans-receivers module. This module is made up microcontroller, capacitors, crystal oscillator and resistors.

### **3.2.4 Programming Language Platform**

It is most important to select the best platform that suits a particular application. The program that makes up this system is design using an assembly programming language. The choice of assembles programming language in this research work implement is due to its enormous advantage over other identified programming languages such as it is easier to understand and saves a lot of time and effort of the programmer, easier to correct errors and modify program instructions. Assembly language has the same efficiency of execution as the machine level language; it is one to one translator between assembly language program and its corresponding machine language program. Lastly it reduces size of the code, increase speed; use tricks to prevent disassembling debugging.

### **3.2.5 Driving Module**

This module drives the device connected to this system; it receives information from the processing module as instruction and turns the connected device on/off depending on the processing module instruction. This module is made up of NPN transistor, relays, diodes and resistors.

### **3.2.6 Indication Module**

This unit serves as the output unit of the system; it is made up of bulbs, device under control and also the user mobile phone. It is on to indicate that the appliance is “ON” and “off” to indicate the appliance status. Another indication component the appliance itself goes “ON” /“off” to indicate its operation state.

### **3.2.7 Software/ Hardware Integration Module**

This is the combination of software and hardware part required for the system to work. After the programming, compiling, simulation and debugging of the software part, the researcher integrate the software into machine language and transfer machine language into the microcontroller with the help of E-EPROM (Electrically Erasable Programmable Read-Only Memory) it is a type of non-volatile memory used in computers and other electronic devices to store information into devices. Fig 2 and fig 3 displays the hardware internal integration and external integrated part of the system respectively



**Fig 2: Hardware Internal Integrated of the system**



**Fig 3: The External Integrate Gadget.**

### **3.3 Object-Oriented Analysis of the System.**

The UML (Unified Modeling Language) is the most widely known and used notation for object-oriented analysis and design. To be an analysis or design method it must include guidelines for using the notation and methodological principles. The most useful standard UML diagrams are: - Use Case Diagram, class diagram, sequence diagram, state-chart diagram activity diagram, component diagram and deployment diagram. But the researchers explain only Use Case Diagram and state diagram.

#### **3.3.1 State Chart Diagram**

The state chart diagram defines the states of a component and these state changes are dynamic in nature, so its specific purpose is to define state changes triggered by events. State chart diagram are used to model states and also events operation on the system. When implementing a system it is very important to clarify different states of an object during its life time and state chart diagrams are used for this purpose. Therefore, the main usage of state chart diagram is: to model object states of a system, to model reactive system, to identify events responsible for state changes.

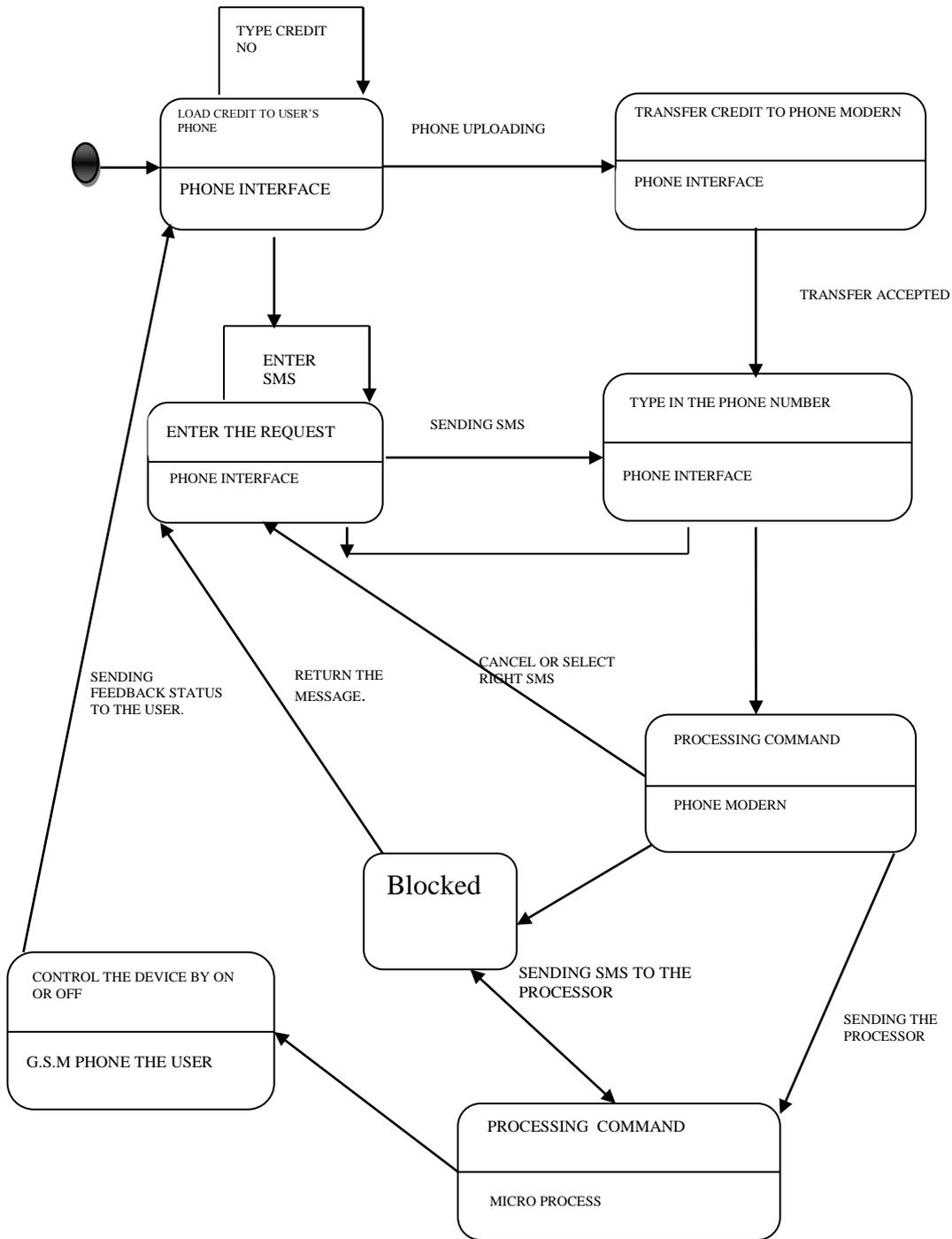
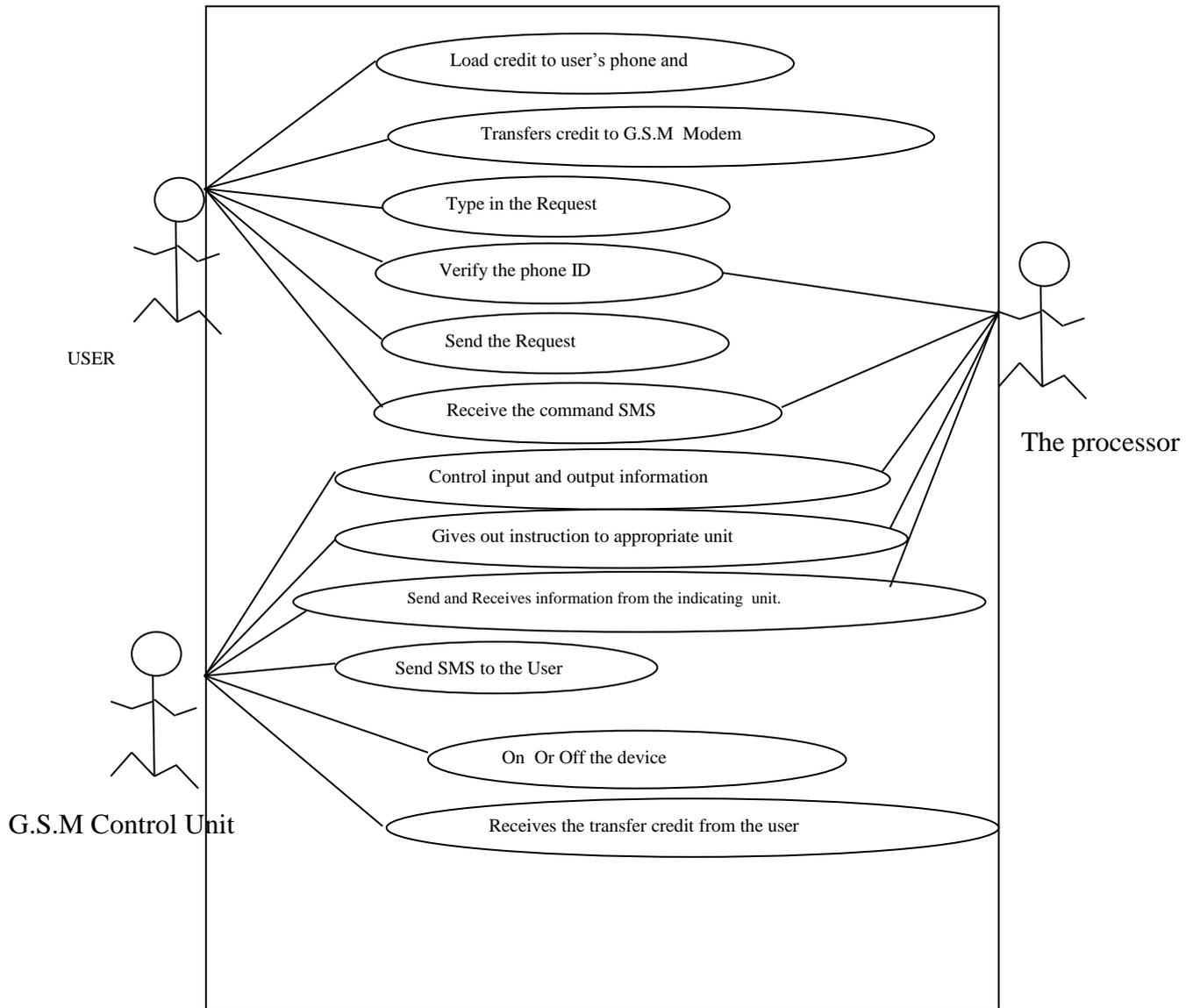


Fig 4: State Chart Diagram for Smart Home.



**Fig 5: Use case Diagram for Smart Home**

### 3.3.2 Use-Case Diagram

A Use Case illustrates a unit of functionality provided by the system. The main purpose of the Use-Case diagram is to help development teams visualize the function of the system including the relationship of the “ACTORS” to essential processes, as well as the relationships among different use case. Below is a diagram of use Case for G.S.M control for Home and Office appliance.

### 3.4 Input Specification

In the proposed system, GSM is used to send the message to the gadget, this service's as the user input form, to the system. The input depends on the user request at the particular time. The table 1 shows the type of message that will be sending to the GSM interface to “On” a particular electrical device or electrical equipment.

**Table 1: Input Analysis Table**

Password (the phone number)	Input Message to the system.	Status report to user mobile.
08142788247	A=1	Turn A On
07032193487	B=1	Turn B On
08142788247	C=1	Turn C On
08142788247	D=1	Turn D On
08142788247	E=1	Turn E On
08142788247	F=1	Turn F On
08142788247	G=1	Turn G On
08142788247	H=1	Turn H On
08142788247	I=1	Turn I On
08142788247	J=1	Turn J On
08142788247	K=1	Turn K On

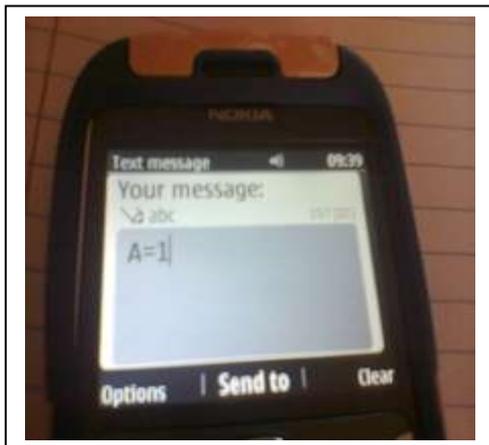
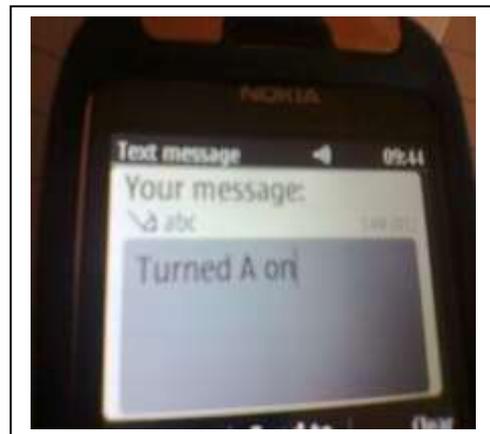
**Fig 6: user Interface to 'ON' Device****Fig 7: Feedback Report to 'ON' Device**

Figure 6 shows the user interface screen. The message which is “A=1” Simple means that device A is being turn “On”. When this message is received by the gadget and processed it will automatically turn the device ON. Fig 7 shows the user, feedback message received from the gadget; on the status of the device this makes the system user friendly.



Fig 8: Input User Interface to ‘OFF’ a Device.



Fig 9: The Feedback on Turning the Device “OFF”

The command in the interface of figure 8 phone screen will be send to the gadget via user phone to ‘off’ the device.

The Feedback Message on Turning the Device OFF The message which is “A=0” Simple means that device A is being turn off. The fig 9 shows the device A is turn “OFF”.

### 3.4.1 Output specification of the system

#### The expected output includes:

- i. The acknowledgement the user gets from a particular request on the condition of the device.
- ii. Action expected to perform on the appliances which may be ‘ON’ or ‘OFF’.

### 3.4.2 Testing of the Individual Component

The testing at this stage is carried out by the use of AVO- meter. In this stage the researchers tested the components in respect to their respective features after necessary inter and intra-module connections as specified in the diagram, (Fig: 1 The System Block Diagram of the System).

Table 2: Input Analysis Table

Password	Output message to the system.	Status report to user mobile.
08142788247	A=0	A Off
08142788247	B=0	B Off
08142788247	C=0	C Off
08142788247	D=0	D Off
08142788247	E=0	E Off
08142788247	F=0	F Off
08142788247	G=0	G Off

08142788247	H=0	H Off
08142788247	I=0	I Off
08142788247	J=0	J Off
08142788247	K=0	K Off

The table 2 shows the type of message that will be sending to the GSM interface to “Off” a particular electrical device or electrical equipment.

### 3.4.1 System Testing.

At this stage all modules were linked together and we SMS are sent command from mobile phone, and the phone network service provider MTN indicates that SMS command is delivered to the system. The particular relay switch which the SMS command is made turn on, the SMS command was repeated by instructing the relay to ‘OFF’ the message delivered again to the processing unit, which in turn, turns off the relay switch. After this confirmation the researcher then integrate the modules by soldering them on the board.

### 3.4.2 Expected Versus Actual Test Result

There was a little variation in the power supply voltage when the test was carried out. The change observations are negligible since it falls between the actual values. The system works perfectly at range of voltages of 3.5 volt and 12 volts.

The fig: 10 shows the expected result at the end of the test, which was represented with electrical bulbs.



**Fig 10: The Expected Result****4.0 CONCLUSION**

This research work that was undertaken has helped to gain a better perspective on various aspects related to our area of study as well as practical knowledge of electronic equipment and communication. The extensive capabilities of this system are what make it so interesting. From the convenience of a simple cell phone, a user is able to control and monitor virtually any electrical devices. This makes it possible for users to rest assured that their belongings are secure and that the television and other electrical appliances was not left running when they left the house to just list a few of the many uses of this system.

Remote operation of weapons in controlling of insurgency is still a difficult task to embark on in many country of the world, thus, many soldiers die daily in North East of Nigeria, hence, this automation system is recommended to soldiers and fire service men for monitoring and controlling gadget that are hazardous in nature.

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