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# Modified Android Base Improved Automation App (ABiAA)

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## *Abstract*

Automation systems are required for energy savings for home Appliances, safety, protection and convenience use of appliances in any developing economy. This system invented to keep home appliances safe against current fluctuations on the load, reduce energy wastage and protections of life and properties of the owner or user. In this current work, we proposed suitable technique known as modified Android Base Improved Automation App (ABiAA) for design and application of GSM-based home-automations system using Android Application that consumed very low power with a user-friendly SIM slot. This system comprises of wireless home-network that contains GSM modem along with magnet followed by relay that act as "load protective device". The system can response faster when power is restored and GSM module would alert home owner via SMS with recorded voice that Electricity is restored for the owner to POWER (ON) the loads. This Home/Office automation system use in alerting house/offices owner wherever he is; at any given time so that he can power ON the required loads that are necessary supposed to be ON as required. The default mode is such that once the Electricity is interrupted, the loads are switched OFF thereby providing energy savings to the owner and safeguarded the connected appliances as well as safety of life and properties that would have resulted from fire outbreak. In this arrangement, a magnet and relay positioned at point of entry produce signal via telecom network and relay message that gives information concerning update at home or pre-

defined and detailed messages that are stored in micro-controller. Suspected set of activities are moved to local-user via SMS. This design reduces the energy wastage and inefficiencies. The different results obtained show that the project worked based on specification of the design. But every system has its pros and cons. Our proposed system is easy to implement and understand.

**Key Words:** GSM, SMS, ABiAA, WIFI, REFID, RAM, ROM, MTN, AIRTEL, PSC, LED.

## *Introduction*

In this part of the world, electricity is epileptic and there is need to save the quantity of electricity being consumed on the daily bases, protect the appliances and safeguard the life and property of the user. Energy can be saved if a user doesn't need energy at a particular time to power his equipment; he can turn off the equipment that is not needed at that time to allow other user to us the electricity. By so doing energy is saved. Also, there is need to use advance technology to control the usage of electricity so that the appliances can be automatically put off

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when the utility is interrupted so that the appliance can be safeguarded and life and property can be protected against any forgetfulness that would have resulted to fire outbreak. So, many researchers have done projects on home/offices automation using Wi-Fi, Bluetooth, Internet of Things etc.

[1] designed home automation will send an SMS to the owner of the house that electricity has been restored to the house and the user will have to send a code to check the status of the load and upon receiving the notification on the status of the load he can then send a code back to put ON/OFF the appliances based on demand at that particular time.

Smart/intelligent home also called Home-automation is a home in which the daily activities of electrical devices and appliances are automated [2]. Automated homes are fortified with specialized appliances to help occupants in controlling and programing their electronic appliances for instance, an owner of a house trying to go for holiday could design system for home security, controlled temperature system, on/off switch appliances, control light system, programed home-theater and entertainment gadgets and perform several tasks. Smart-homes are generally designed to build an environment that is conscious of things that are happening in it. Before now, automated gadgets are independent and sectioned in smaller independent structures and the concept of providing them with interoperability with usual "language"

continues to grow. Therefore, first structure of home automation originated from idea of house networking which has several possibilities, but included novel factors to consider and some of these factors are interoperability, scale-ability, acceptability, security and limited services. House automations are considered as smarter when the controlling is carried out efficiently from localized or remote locations. The technology available for this isolated interaction is Internet, Mobile-phone, and Bluetooth [3].

With the rising increase in population and its attendant rise in energy usage, there is massive need for energy conservation in all means possible. Not having the capacity to contact and control home-devices from localized locations is among the key reasons while developing nation like Nigeria involve in massive energy wastage. This current work proposed developing and implementing GSM-based localized control structure for electrical devices and lighting that helps for total control of the interface with Android apps contained in GSM Modem. GSM is used in receiving SMS from owner's mobile-phone which automatically helps micro-controller in taking needed actions such as switch OFF or ON electrical gadgets. It basically decodes this SMS and responds based on the message. Products which are available commercially depend on Internet and therefore lack the actual concept of security and mobility. However, this current GSM-based localized control structure allows people to control their gadgets from anywhere with their phone apps and equally restricts illegal access to the gadgets. This current structure is crucial because they provide security to detect intrusion through SMS using GSM. [3].

The Office/Home automation involves application of Electrical/Electronic semiconductor gadgets and other materials to control electrical appliances at home/Offices. There are various devices today that allow the use of control and consequently manage the electricity utilization efficiently through localized control or voice command [4]. One of the control devices is GSM which GSM module is used for Home/Office load automation that smartly remote lighting points, air-condition system, Refrigerators, switches and as many other loads connected to this designed system. This Home/Office automation is needed because residential occupants usually leave the appliances ON unconsciously at the closure of the day or when leaving their home for work due to epileptic power supply mostly in upcoming nations like Nigeria. This leads to wastage of energy and can also, cause fire outbreak. Because in most cases, people are not always present in the home and offices, there is need to automation of residences and offices to remotely switch OFF devices and turn ON, when necessary, demand electronically. With this, there will be reduction in the rate of electricity consumption, decrees in electricity bill, increase in safety and on life span of these appliances [3], in developing nation like Nigeria, wastage of electricity is common. To control this wastage, the use of centrally control device is advisable.

This concept of central automation has existed for several years now. The use of GSM module has so many applications. Such as in the homes or offices central control lighting,

security locks systems to give conducive environment and energy efficiency [5]. This GSM base module system is also considered beneficial especially in disability persons and elderly people too to reduce the stress they are likely to encounter and energy that can be lost when power is restored in their home or office. There are several wireless ICTs that uses some kind of isolated control and sensing gadgets as well as localized data transfer example "Wireless Fidelity (WiFi), Radio Frequency Identification (RFID), Internet of Things (IoT)".

All these detectors and sensors are interrelated or interlinked to micro-controller using several forms of circuits [6]. These micro-controllers would monitor the entire sensors continuously and when it notices power supply, it would send SMS to mobile-phone of the user via GSM modem. This Micro-controller equally turns ON or OFF electrical gadgets in offices or home based on information or massage from end user's Android-apps.

GSM is cellular network and its network operates based on four different ranges of frequencies. Most networks used by GSM work in "900 MHz or 1800 MHz bands". The transmission energy and power in mobile-phones is controlled at 2 watts maximum, GSM and 1-watt in 1800/1900 and long distance which GSM requirement allows in practical application is 35Km. In this work we employed SIM-300-based modem for receiving and sending short message to HA structures and user [7].

In the previous work done, [1] a home/automation system was design using Arduino that will send a notification when utility restores electricity in the buildings then the user has to send a code to first know the status of the load before taken a decision to send another code to turn OFF/ON the appliances but the problem with this is that people can forget codes which makes this design not user friendly. Again, the design is such that some appliances will still maintain their ON state before the interruption of power supply which means that appliances that are not needed to be ON; is likely to be ON when its use is not required at a particular time and this is a waist of energy. Let us assume assumed that what was ON before the interruption of the electricity was an electric iron or kettle, when the power is restored, there is every tendency that network might fail and the user's life and property might face fire outbreak. Hence, there is need to design a system that will put OFF all load as soon as utility interrupts electricity and then the owner can use an Android Application to ON any load that is required to be ON and any particular time. Again, because people can easily forget code, the use of a designed application which is an Android base with ON/OFF button makes the usage very flexible. Again, [29] tried to improve on the work done by [1] by providing an android App to the interface to make it user friendly, however, its limitation is that the android app has a fixed phone number and the system has a designated fixed terminal for each appliance. Hence, the reason for the designing of the modified Android Base Improved Automation App (ABiAA).

This paper focuses on designing an Android Base Home Automation system using GSM module that has the ability to put OFF all connected loads to it and the user can use the Android designed Application to put ON/OFF any connected system or load at any given time. Also, the user can change the phone number with provided SIM slot.

Since electricity loads can lead to fire outbreak, it is very important to use the advance technology for the remotely control the load appliances in the house/offices. One of the ways of achieving this is to design an android base home automation that can put OFF the entire system when electricity of interrupted. With the, the loads are protected, energy is saved and the possibility for a fire outbreak is eliminated.

This paper looks is significantly designed to benefit both the Owner of the house or residences, protect the life of the equipment/loads connected to it, save the cost of utility, for the safety of life and properties and reduces energy wastage.

This paper is arranged in the following procedure: section I covers the introduction, section II talks about the theoretical background, section III the methodology and the operating principles as well as the complete circuit diagram for the designed system, section IV is the result and discussion, section V is the recommendation and conclusion, the next after section V is the reference.

**History of Home Automations**

This is not the first time a home automation system will be designed, so many people have worked on this system and so many technological methods have been applied to achieve safety, security and remotely controlled the loads or appliances connected to designed systems. But in all this designed, there are two major areas that they have not been able to marge together. That is the ability for the designed system to put OFF all connected devices when electricity is interrupted and to use an app that has ON/OFF pads for easy and flexibility in usage [1] tried to reduce energy wastage by developing an advance technology device with GSM module using Arduino; that will send an SMS to the user when electricity is restored to the house/office, then the user will have to send a code again to know the status of the connected load to the control device before sending another code to switch ON/OFF appliances. The problem with this kind of design is that people can easily forget code as they have a lot in mind to think about; also, it is not a user friendly because an illiterate who doesn't know how to send a code might find it very difficult to use it. In addition, if a load like electric iron or kettle is connected to it and electricity is restored and there is a network failure, the connected loads can cause fire outbreak this might lead to loss of life and property.

[29] provided an android App to the interface to make it user friendly, however, its limitation is that the android app has a fixed phone number and the system has a designated fixed terminal for each appliance. This means that for you to make use of your purchased product you will have to contact the producer to configure your phone with the ABiAA to be able to use it. This is stressful and increases cost.

Several research works have been carried out using different types advance technology as elaborated below. These technologies have their strength and shortcomings. But I have been able to put these merit and demerit together to be able to come up with a more advance home automation system that can protect the loads connected to it, reduce energy wastage and safety of lives and properties of the user.

**Bluetooth Technology System**

Bluetooth, mobile device, these are all used to realize several degrees of intelligence in offices and home. The chances of using Bluetooth tech in offices and homes automation along with Android smart-phones without using internet control are already reported, it was revealed that these gadgets were connected to sub-controller access that was controlled using smart-phone via mobile apps using inherent Bluetooth connections [8]. These technologies are geographical limit as concerned their application.

**Wireless fidelity WiFi technology system**

The WiFi tech was applied in designing Home/Office automation, this arrangement comprises of three key parts namely web-server, which contain systems core saddled with function of controlling and monitoring home/offices interface module for users like "Adriano PCB ready-made) WIFI protected PCB, 3 input alarms-PCB and 3 output actuators-PCB" which provides suitable interface for actuators and sensors home/office automation structure [9]. This work was well done in same manner that users could use this same tech to assess server web-based apps. It could be attained using availability facilities like internet connectivity, suitable browsers, suitable hardware like computer set which serve as server and Android-phone that has internet compatibility.

[10] WiFi techs are used as integration with mobile-phone networks like 3 and 4 G to access and control Home/office automation when WiFi is unavailable, mobile-phone network such as 3 and 4G could be employed for home automation apps.

**Internet of Things (IoT)**

[11] proposed the use of Internet-of-Things (IoT) based using Arduino-Mega for home/office automation system. The IoT-based structure provides better suppleness communication. This proposed technique is applicable in several different area and environments like in hospital as system to monitor patient, for security and control intruder, control traffic signal or control several devices. The IoT systems gives dominant and suitable study for all sensible mechanisms thus several procedures are employed in designing IoT procedures. The issues concerning this technology is fixed on fact that inter-linkage problem could happen between different IoTs apps in such case information of users become in unsecured resulting to cyber-hack exposing possible user to numerous

cyber-frauds, also hardware parts are not forthright. The home/office automation proposed by [12] are confirm to be easy to install.

**Arduino controller**

The Arduino Controller was used to control it. This technology has the ability to alert the user through the buzzer sound system and will record activities i.e., happenings within vicinity via H.D spy camera. Although the home/office automation system proposed by [12] is very good, but the problem is that it could just monitor activities in premises which it is installed, but can't give feedback to user for fast actions taken. Also, the system can only operate where there are internet facilities and it cost inefficiency.

**Password Protection Technology for Home Security**

[13] employed technology that involves using password to protect door in HAS. The door padlock is password covered using LED-based screen using panel that work by detecting disparities in intensity of light shown by photo-diode that is produced by surrounding LED and reflected through their finger. The scream is 16 by 2 LCD frame. IR-Laser sensors were utilized in detecting obstacle when monitoring. Fire-alarm employs temperature sensor which notices faster appreciable rise in temperature triggers alarm and they employ these components in their automation structure "IR sensors, LCD Display, Temperature Sensor, Microcontroller, Relay, Power Supply, and GSM Modem". [14] stated that "constructs his security system for car protection. In that concept if thief tries to rob a car it automatically demobilizes the car by disconnecting the ignition key supply from the car battery. This now makes it impossible for anybody so start the car, let alone moving with it. In an attempt of theft through the car doors or boot, the system sends the message to the car owner and at the same time starts the alarm. This design popped out due to the increasing rate at which packed cars are stolen especially in our country, but with this design this packed car is being monitored irrespective of where it is packed, provided there is GSM network coverage". [15] stated that "Automated home or intelligent home which indicates the automation of daily tasks with electrical appliances used in homes and security is an important aspect or feature in smart home applications. The new and emerging concept of smart homes offers a comfortable, convenient, and safe environment for occupants. Conventional security systems keep homeowners, and their property, safe from intruders by giving the indication in terms of alarm. However, a smart home security system offers many more benefits. He proposed Two system in his project i.e., one is based on GSM technology and other uses web camera to detect the intruder. First security system uses a web camera, installed in house premises, which is operated by software installed on the PC and it uses Internet for communication. It detects motion of any intruder in front of the camera dimension and camera range. The second security system

is SMS based and uses GSM technology to send the SMS to the owner". This presented platform is targeted at securing homes against thieves and fire.

**Wireless Sensor-Networks and GSM technology**

[16] developed WSN and GSM-based localized HSS by joining advantages from WSN and GSM techs are proposed. It could detect thieves, fire and inform user locally about occurrence with distance play no-barrier. In these system thieves are detect when they are noticed under WSN dimension. [17] stated that "they have tried to increase the standard by combining new design techniques and developed a low-cost home and industrial automated security systems. They aim to overcome the flaws made by many other security devices as it is most effective in security purpose. It is cheaper and can be maintained easily than any other security device" and such gadget could work on two-way mode namely.

a) "Internal mode

b) External mode"

such that if internal mode is chosen by home-owner and they are in wireless-security, the whole sensor is activated and buzzer linked to micro-controller would give alarm thus reason for not being secured are revealed in LCD linked to micro-controller. When external-mode is chosen by home-user meaning when out of wireless-security, all sensor would become active and security position address that are pre-arranged along with issues are sent as massage to police station, fire-service, security-room at insecurity times, fire-accident, unwanted personal movement that are sensed by these sensors.

The integration of IOTs and wireless tech fueled several studies in HAS. Many wireless communication techs that could support certain kind of localized and control, localized data transfer like Wi-Fi, RFID, Bluetooth, GSM were used in actualizing several unending home intelligence levels. There are other worked on feasibility of Bluetooth-tech in HAS using Android-phone with no internet-control. Gadgets were linked to Bluetooth and sub-controller controlled using smart-phone through mobile app using inbuilt Bluetooth connection but this tech is geographically hindered in this app. [18] presented work on mobile IP-based procedure and succeed in designing smart HSS with no actual home and test. Recent works have employed Web-services, SOAP and REST as interoperable app layer to locally access HAS. [19] developed and implemented massage-based control systems which possess 3 modules namely, sensing unit to monitor complex apps, processing-unit and interconnection part that employs GPR-modem or cell-phone through RS-232. SMSs were employed for reporting status like power-failure. If this system could be employed in industry, then, it has localized usages. [20] perceived HASs as MAS and using HACS tech appear promising and main issues of enhancing performance attracted several researches. This scheme involves using phone massage and cell-phone tech for handling information, transaction exchange and personal interaction. [21&22] presented

localized monitoring via cell-phones involve using spoken commands. These commands are created and sent like massage to control scheme and micro-controller based on massage received make decision to fulfill certain specific task. Other scheme includes introducing smart home controlling scheme over Ethernet-network that is based on EML, SOAP standards [23]. HACS is dependent on data movement via internet that is not universal or generally accepted and entire region. Using commands requires training voice for this purpose. But most Africa people are pronunciation dominated and individuality of this scheme is revealed in using GSM with independent apps that are user-friendly on smart-phones.

**GSM and Communication Systems (Mobile Telephony)**

GSM is mobile and digital telephone system which is commonly used globally. It employs several TDMAs and considered as most commonly used among the three wireless phone technologies which are CDMA. TDMA and GSM it digitizes and bandages data transfer them through channel using two user data streams, each having their time period. In telecom technology, telephone comprises of general equipment usage to present voice communication within longer distances, by linking telephones. The term "mobile telephone" is obtained from formal telephone which denotes communication that simplifies mobility with wireless techs. Mobile phones offer services such as data and voice transfer. Data-transfers are carried out using SMS and other improved data rate such as EDGE and GPRS. This work harness SMS transfer from GSM. SMSs are telecom protocol which allows sending short-text messages along terminal equipped. [24] SMSs are sent from one device to SMS-platform which interacts with phone-networks to ascertain location of subscriber. Then, this message is advanced as smaller data-packet to terminus device. Following messages moved by original device would undergo similar process called "store and forward". SMSs are used in controlling and monitoring systems because they are easier and more available. The massive population rise and poor facilities in several nations made IP and voice unreliable unless massive investment are made to enhance existing networks [25]. SMSs usually deliver even when network is eventful and control and monitoring using SMS is also used in industries, car-parking procedures, weather-monitoring and alerting scheme, market communication service, fire-detection and security scheme, agriculture irrigation scheme and smart interaction systems for patients.

**SMS, GSM & Android Application Technology Systems**

This project uses SMS-data transfer GSM service according to Android app to send SMS notification when electricity is restored to the house provided the user is around area of network coverage. It gives conditions of appliances such that user could take suitable actions in controlling load thereby reduce energy losses and reduce utilities in

home/offices. The GSM is used for this project because of its wide area coverage [26&27], stated that with high shielded system, optimum accuracy and ability to stop people from viewing information transmitted or received. Therefore, GSM is employed as monitor and control means in designing house/office structures because it is easiest and efficient tech with low cost to install [28].

For some years now, security of homes is a crucial need of several household to secure home from activities of intruders. Therefore, scholars and firms attempted to design procedure and gradates that could keep home secured from interlopers. This resulted to developed tech that could make home secure and modern known as HAS. Using this tech house-owner could handle other gadget and also light system. Now this wireless tech is employed in controlling gadgets rather than wired connection. GSM tech uses to link input indication from gadgets to output device which implies that after detecting interruption GSM-Modem sends suitable message to phone of house-owner. This signals which comes from equipment or sensor are made digital by GSM modular and send them to receiver. HAS also called security system of home gives several benefits. After several researches they gave concentration on GSM home-security being that they are easily install and have lower cost. They are basically positioned over entry position or doors that contain magnet that is linked to relay and this relay separated from magnet, indication obtained through this relay sends through 8051 micro-controllers along with action that occur in accordance to code placed in chip and GSM-module sending message to phone of owners. There are several researches on several forms of HSS such as Sensor-based HSS, Figure-print, Palm-print and key-pad for confirmation and others. All form of Security schemes uses GSM modular technique. In this work focuses is placed on securing home when home-user is not available. GSM-based tech proposed to update home-owner concerning their house-security. In such system SMS along with GSM tech are used in sending SMS to home-owner which is normally aimed at keeping home secure from thieves.

To elevate performances of smart-house, several researches are done example like "**Aware Home Research Initiative" (AHRI) from "**Georgia Institute of Technology" is interdisciplinary research procedure targeted at resolving main technical and design issues for home people

**Materials and Methods**

The modified Android Base Improved Automation App (ABiAA) project using GSM Module designed with low cost, effective, simple and smart system has two major modules. The hardware interfaces and software module.

**Hardware Interface Module**

The hardware used in modified Android Base Improved Automation App (ABiAA) designed is SIM-module, 12-V, 10A moveable or Magnetic relay single pole double throw

(SPDT), 8051 Micro-controller, transistors, resistors-diodes and power unit. Inter-connection of hardware achieves general project purpose.

A GSM SIM800l module Fig. 6 is special form of module that accepts SIM-card and function over subscription to mobile operation. The micro-controller interacts with mobile network through GSM-module and a SIM slot.

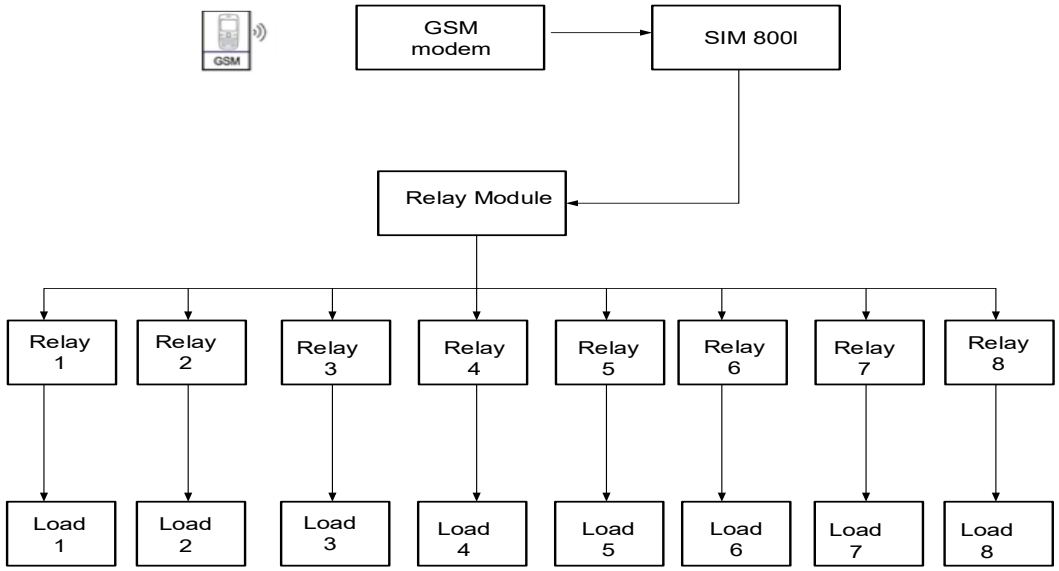



**Figure 5 Block diagram of the** modified Android Base Improved Automation App (ABiAA)



**Figure 6 GSM SIM Modules**

Relay, fundamentally, is electromagnetic link or switch which is employed in turning electrical loads either On or OFF by using voltage within these contacts. 12 V 8-channel relay used for this project is as shown in Fig. 7 a&b.



**Figure 7a The SPDT circuit Board of the 8-channel relay**

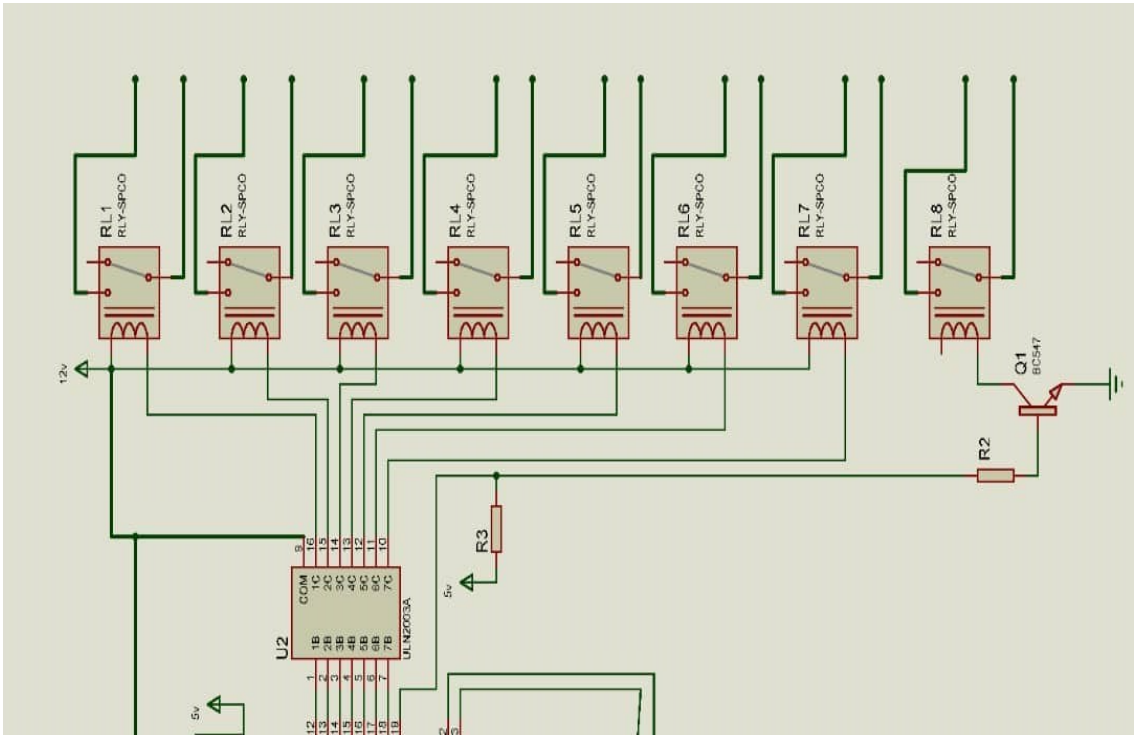



**Figure 7b Schematic diagram of SPDT the 8-channel relay**

The moveable relay i.e., SPDT is used because the static relays used in some of the previous work done are not good on inductive loads. The moveable magnetic relays are very suitable for all kinds of loads. The relay is used to drive both relay circuit that

switches different gadget linked to interface; ON and OFF and protect micro-controller from relay kick-back using integrated clamp diodes. It contains seven high-current Darlington pairs that has standard emitters [1].

Microcontroller needs a program that involves integration of instructions and such program informs micro-controller on how to carry out certain tasks. Hence, the programs need memory where these programs are saved and accessed by Micro-controller to carry-out certain operations specific function. The memory used in storing these programs for micro-controller is called "code-memory or Program-memory". It is called ROM-memory and is needed for storing data for micro-controller.

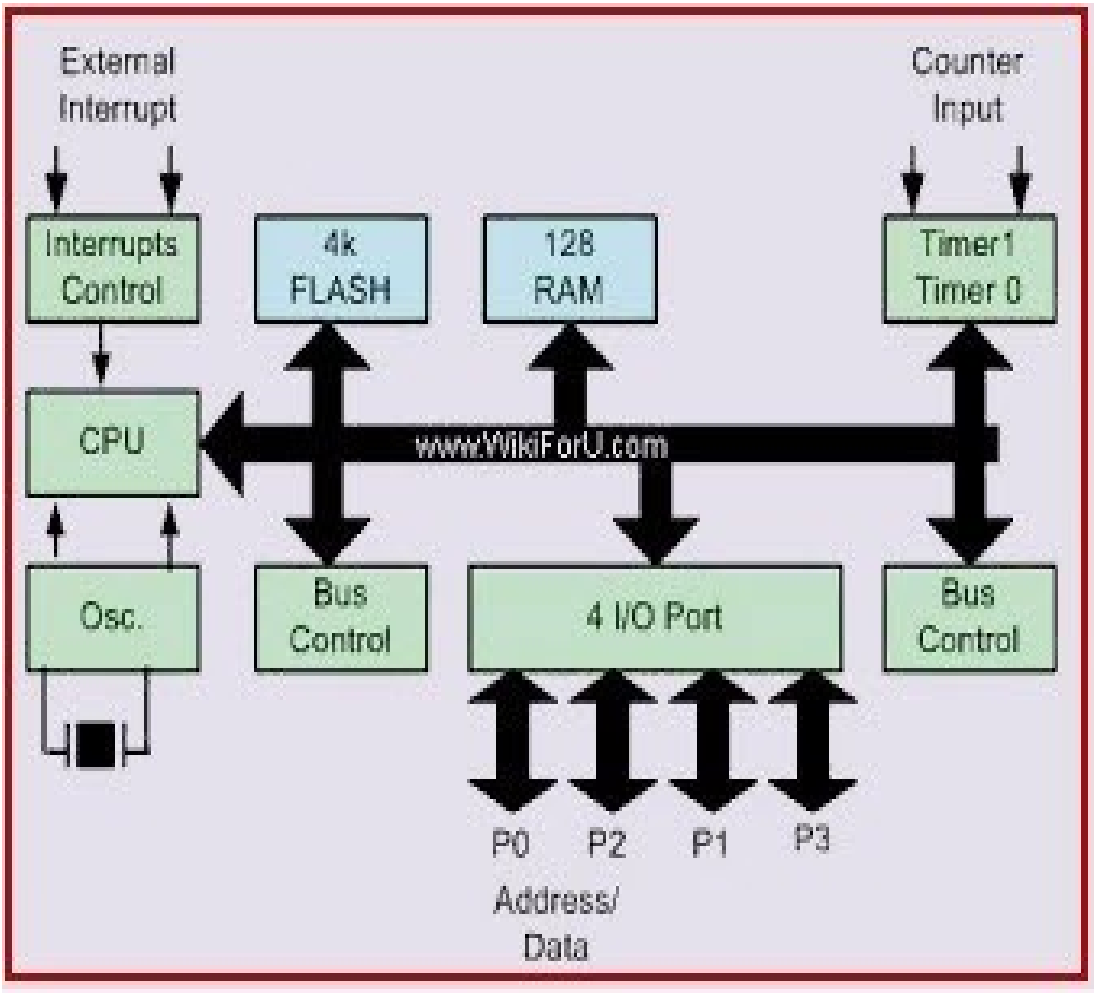



**Figure 8 8051 Microcontroller Architecture**

The data-memory used in storing data for operation temporarily is called RAM-memory. 8051 micro-controllers have "4K of code-memory or program-memory" which has 4KB ROM and 128 bytes of data-memory for RAM.

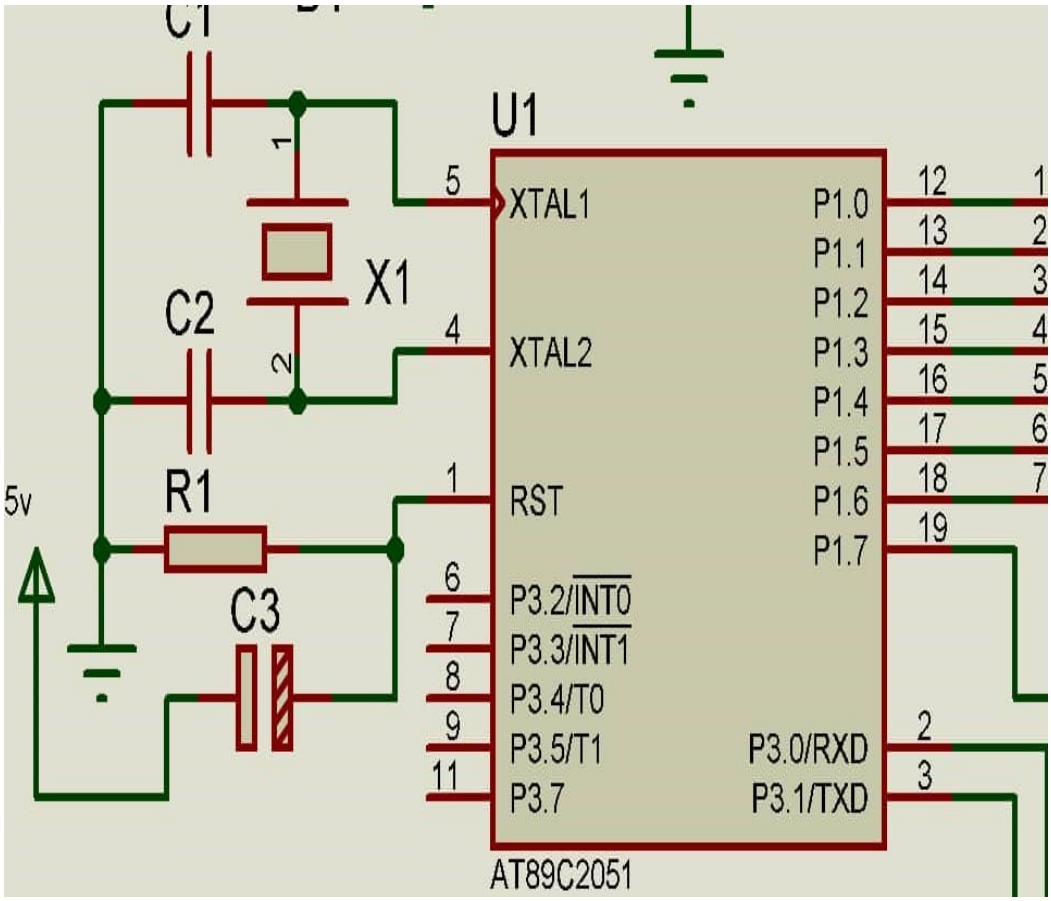



**Figure 9 Schematic Diagram of the microcontroller**

**Power Supply Circuit**

Fig. 10 is PSC and it converts AC signal to DC through the rectifier; the capacitors connected between the rectifier and the Regulator is used as a filtering capacitor. The 7805 regulator is used as a 5 V regulator to supply current to the designed Android-Based HA using GSM module.

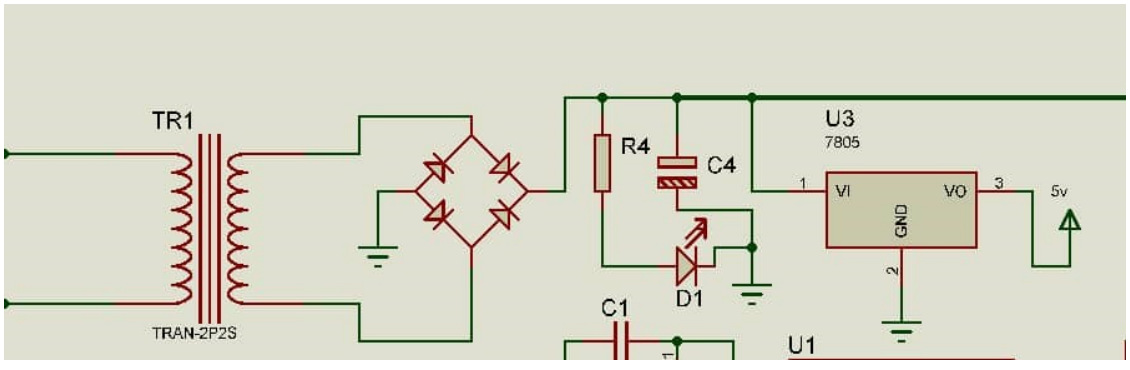



Figure 10 Schematic Diagrams for Power Supply Circuit (PSC)

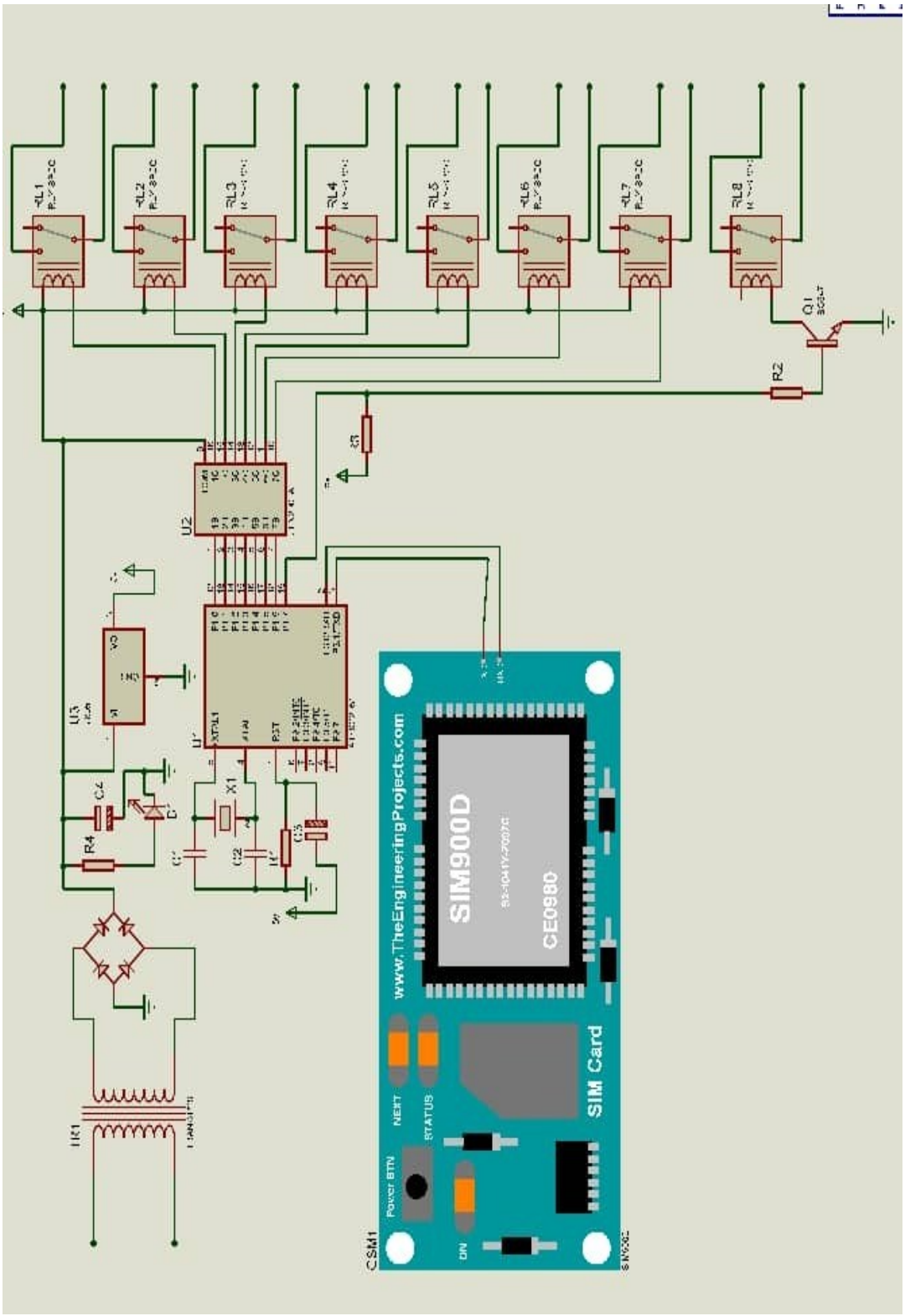



**Figure 11 Schematic diagram of the modified Android Base Improved Automation App (ABiAA)**

The sensor and the buzzer were assigned to two analog-pins on the microcontroller board while the other actuators and the GSM Shield are assigned to the digital pins of the microcontroller Board. The circuit was designed using Proteus circuit designer. Fig. 11 shows the circuit diagram of the prototype.

**Mode of operation**

The GSM-module is linked to microcontroller board with serial interconnected port. The modules have RS232-port and sim 800l which could connect using Transistor-to-Transistor logic. A max-232-IC is employed in making two directional changes between RS232 and this logic and TX-pin of micro-controller is linked to RX-pin of GSM module using max-232 and RX-pin of micro-controller is linked to TX-pin of GSM module using max-232 itself. The code programmed in this micro-controller could interact with GSM modular using AT-command. And AT-command is moved or received from modular using serial interconnected functions provided by micro-controller library. The operation like Serial begins which aids in initializing serial port with specified baud rate, Serial-code to send details to serial-port, Serial-availability and Serial-decode operations to decode data from serial-port. GSM module employs in this process is SIM-800l based modular which could interact with other gadgets using RS-232 serial interaction port. It operates on 5 V power. Mobile-phone modules respond "OK" when they receive intending order "AT" and that's best way to control interaction between module and micro-controller. To work on Rela-1 in ON condition, clack on "TURN ON" gadget grid in HACS-mobile app that send "#a1b0c0d0" though encrypted via SMS to GSM and micro-controller to recollect similar value from HEX via serial-read register that makes "digital-pin 2 high" and made Relay in "OFF condition simply TURNS ON" gadget grid in HACS-mobile app [3].




Figure 10 Phone number interface

Fig. 10, shows the phone number interface where the user will enter his mobile phone number associated with the SIM card. This number will be recognized by the system and when the power is restored, an SMS will be sent to the number. Also, when operating the app, the system will be able to send messages as shown in Fig.17

**Software Modules**

Microcontroller programming has two key sections; set-up function and loop. The initial is function that performs when app runs while second one is performs as look. There

are more functions that were added in segment that aided this program work efficiently. The program functions for every service mode which provides for suitable control loop. The C++ program that runs microcontroller was coded to control or convey orders to microcontroller pin to perform certain duty.

The **Fig.12** shows the flow chart of code for operation micro-controller developed from algorithm [1].

1. Start
2. Configuration of input/output pins
3. Configuration of input/output pins for the microcontroller
4. Input the Receipt Mobile Number
5. Is the mobile phone number, correct? No, Go to 4
6. Configuration of LCD and Relay Drivers
7. Check the energy source to the device
8. Is the device energized? No, Go to 6
9. Yes, send 'Electricity is restored' power is restored to the user's mobile line
10. Define the outlet for each load
11. Is the user interested in knowing the state of loads? No, Go to 13
12. Yes, send the appropriate command, go to 9 and return
13. Display the state of load on LCD and User's mobile line
14. End

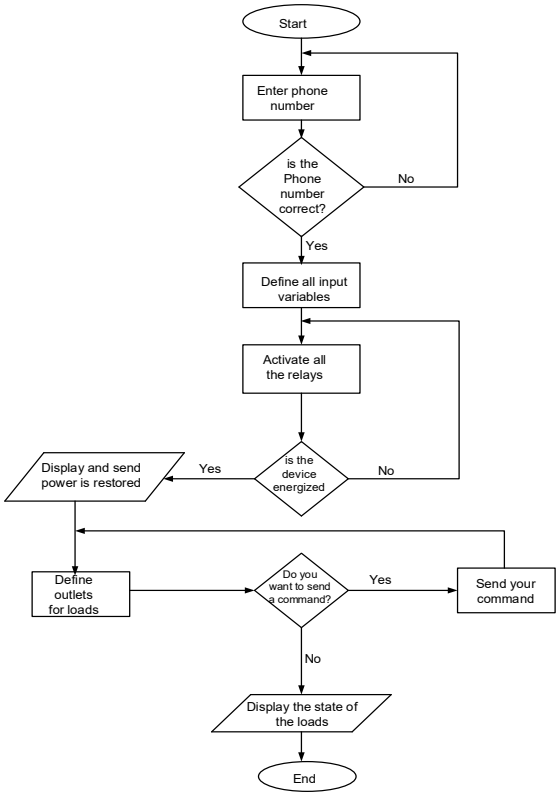


**Figure 12 Flow Chart of microcontroller programming**

The written C++ program code for the software designed to run the system will be available on request.

**3. The Designed Modified Android Base Improved Automation App (ABiAA) Using GSM Module**



**Figure 13 External picture of the Designed Modified Android Base Improved Automation App (ABiAA)Using GSM Module**

In the **Fig.13**, the loads are the 4-bulb with the 4-soucket. At the point, the loads are in the OFF state.

The **Fig.14** shows the state of the designed system when the it was powered ON. The red LED shows that the device is in the ON state although the system is not loaded.



**Figure 14 The Internal Picture of the Designed System**

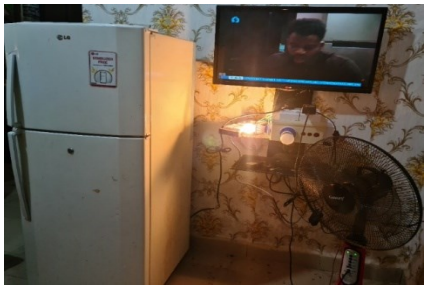


**Figure 15 The Picture of the Designed Modified Android Base Improved Automation App (ABiAA) Using GSM Module in its Functioning State**

**Experimental Set Up**

Experimental arrangement to assess performance of this presented gadget when 4 electric loads are linked to them and power were turned-On as revealed in **Fig.16**




**Figure 16 Devices with the Connected Loads**

This is energies through the flip-flop button; after delay of about three seconds, the SIM800l will blink and keep blinking until there is network on the device after which the sim LED will keep blinking at about a defined frequency to indicate that there is network on the design system. And then the LED at the power source remains steady.

**RESULT**

After the experimental performance, it was satisfied that the designed project worked as proposed and the result shows that appliances can actually be controlled from anywhere provided that the owner is within the network coverage. When the power was switched OFF using the push-pool button as a testing tip, on switching on the button with was seen that the whole system connected to the designed system that they all went OFF on the user uses the designed Android button to switch it ON.

The result from the design project as can be seen from the experimental set shows the performance evaluation of this proposed gadget when operated and corresponding outcome obtained. From the experimental set up, it is evidently clear that when the power is restored at home or office, the modified Android Base Improved Automation App (ABiAA) design system will send an SMS 'the power is restored check your load status' remotely through the GSM-network to owner for prompt action, as show **Fig.17**.

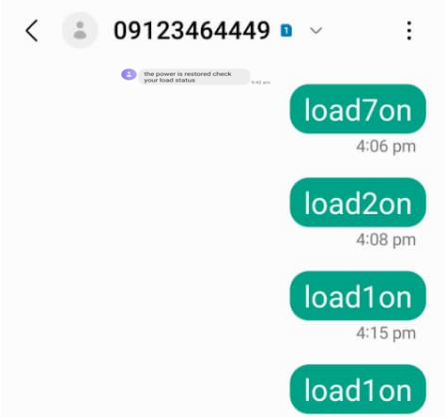



**Figure 17 Screen-shot of SMS on Owners Phone**

When the end user receives the SMS notification, the user has to open the Android Application on the phone to switch ON the required load the needed to be on at that particular time since the default mode is such that the designed system has to switch OFF all connected to as soon as the power is interrupted.

The Android interface is as shown in the **Fig.18** below.

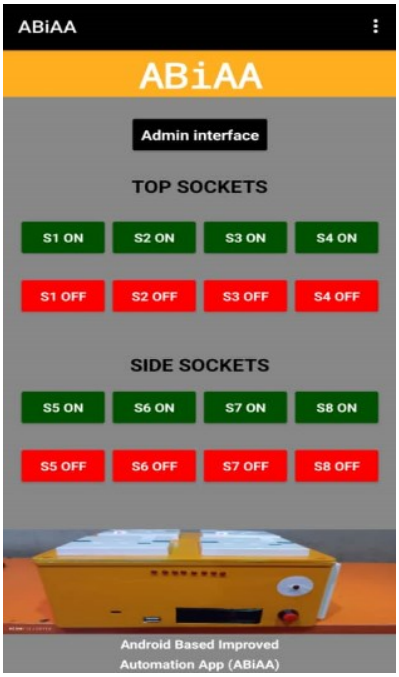



**Figure 18 Screenshot of Android Application Interface in default mode**

In **Fig.18**, the green colour indicates the ON state likewise the while the red colour indicates the OFF state.
However, the owner can put OFF the appliance using the ABiAA and the red colour on the interface shows that the appliance is in the OFF state.

## DISCUSSION

From the result obtained in **Fig.17** through **18**, it is clear that when the Android Base Improved Automation App (ABiAA) Project Using GSM Module was tested, shows that this gadget work based on designed specification. This revealed that all electric gadget linked to this system could be locally controlled by this proposed gadget. That means that all connected appliances can be switch ON and OFF through the Android Apps on the end users' phone; provided these gadgets are linked to power supply via this proposed system provided this system is within area of network coverage. The phone used must be a smart phone.

## CONCLUSION

This project has been able to provide solutions to the envisaged gaps in the previous designs' technologies on ABiAA. These gaps are energy wastage, load or appliances control & protections and safety of lives and properties of the owner that would have resulted from fire outbreak when electricity is restored and some loads like Electric Kettle, Irons or heater are left connected while utility is restored.
This project is a system that can cutoff the loads connected to it when electricity is interrupted and has the ability to inform the owner or user when electricity is restored in home/office on the mobile line and send an SMS to the user to check the state of the loads/gadgets; to reduce energy waste, protect the loads connected to it and prevent possible fire outbreak. The default state of the system is such that the loads connected to the system will all be switch OFF when the power is interrupted in the residences.
The limitation of this work is the inability for the designed ABiAA application to retain the status of the load when the application is close on the user's phone. There is every tendency to decide to switch OFF/ON some load while the utility is still available; if the user mistakenly turns OFF the ABiAA Application, then decides to turn it ON again the application will go into default. Hence there is need to improve on the ABiAA application to be able to retain the status of the load when the application is open and close at any given time. The moment ABiAA apps are closed, all buttons are reset to default mode even when there is power supply in the circuit.
This project modified Android Base Improved Automation App (ABiAA) is recommended for home and offices as another solution to reduce energy wastage, to make sure that the residences are protected against any fire outbreak which often time can be disastrous. It equally reduces amount of utility bills (cost of electricity). The efficiency

and practical application of the designed project for home automation will not just enhance industrialization in upcoming nation like Nigeria. [29] and this would prevent loss of properties and lives that usually result from fire-outbreak in home or offices because of negligent utility users.


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