**CHAPTER ONE**

**INTRODUCTION**

**Preamble**

This chapter presents preliminary information about the topic, it aims to gain interest in the reader on the topic. The sub section are as follows, background, statement of the problem, aims and objectives, scope and limitations

**1.1 Background of Study**

System automation is a trending research area in the 21st century considering its important role in our daily lives. The main importance of an automated system is the fact that it reduces human stress and error. There has been a sudden shift from the normal switches to the remote based control switches in recent times. Presently, conventional wall switches located in different parts of the house makes it difficult for operation more especially the elderly and physically challenged people. Technological advancement has made it easier and necessary that every human being should own a mobile smart phone. Applications are being developed on Android systems that are useful in various ways. Another upcoming technology is natural language processing which enables the command and control of systems using voice (Krishna et al ,2019). If one can control devices like TV, fan, light or a music system using voice, life will become simpler. Home automation is becoming very common these days as technology advances to reduce manual work. To switch on or off the devices one has to move to the switch board which is inconvenient even for an able person. If all this manual work is replaced by voice activation even the aged and disable person can do the task like a normal person (Chakradha et al, 20201). Multiple home devices and or switches can be controlled with a designed system using microcontroller as heart of the circuit with android based mobile phone. In this work the mode of controlling devices is by sending command wirelessly through voice over Bluetooth (Belgi et al.2012). IR remote control has a very wide application in the field of electronics. IR based remote control for controlling multiple home appliances with microcontroller is also reported for the same function (Egan, et al 2019). Another approach is by GSM based for home automation. Here it has a wider coverage area. So to control any house hold appliances from a distance place within the network area coverage sending a short sms code will either ON or OFF the devices at home (Fairall, et al. 2018). All these work is carried out for the same function in a different way by using different technology. Some use Bluetooth technology other use GSM technology or IR technology. Each technology has its own advantages and disadvantages over the other but they all serve the common purpose to replace manual work. The main objective of this work is to create another system to control multiple appliances by using voice activation technology. One of the main advantages of voice activation based remote control is that it can operate the appliances without the requirement of line of sight within its specified range efficiently.

**1.2 Problem Statement**

A home is significant to its owner and everyone within it, every upright person/family has a home, where is termed as a refuge, where rest and care must be available for occupant(s) for the comfort of living, we all know human wants are insatiable and for this, comfort must be improved on steady base and not only for the consumption of a certain set of people but for all worldwide.. Most of the home appliances is using remotely control system now but there is a disadvantages for the remotely controlling system. Remotely controlling system in home appliances is not that useful for elderly and disable people. This is because they might be illiterate which they don’t understand about the words that label in the remote control. Besides, if someone having eyes sight problem, they not able to read the small label that stick in the remote control. Thus, using voice controlling system will be the best way to solve those people and it able to make them control the home appliance more easily. Due to the physical switching devices being placed at different height or position, the wireless voice controlling system is being implemented.

**1.3 Aim / Objective of The Project**

The major aim of this project is to construct a voice recognition ssystem for controlling home devices using and android phone and a microcontroller.

The objectives of the work are as follows:

1. To realize a block diagram for a voice activated appliance control.
2. To realize system and circuit that would use android, Bluetooth and microcontroller to serve as a voice recognition and control system.
3. To construct and test the realized system above.

**1.4 Motivation**

Any project or idea that is proposed is always intended to make the life more comfortable and relax. The basic ideology behind this project is to make the people more comfortable while they are at home and use basic facilities i.e. light and fan. Instead of going around and finding the power source to use utilities, this project will make them calm staying at the same place and use the smartphone to give the voice order, which will be ultimately processed, and the action will be performed.

The same concept goes for the people with little mobility or maybe with no mobility, all they need to have an android phone with the application installed, give a recognised voice command and rest of the process will be taken care by the IoT technology. Even if this concept is implemented on a larger scale, the hospitals can be truly modified for the patients where they would be able to control the things around in the room just with the voice commands, and that voice will be going to cause the action of their requirement.

**1.5 Significance of The Project**

Home Appliance Control using voice activation can be used to turn ON / OFF the devices and various appliances in our home. It can prove very useful for disabled people. This project can also be used in shop, offices, industry. In this work:

* Quick response is achieved.
* Construction is easy.
* Easy to maintain and repair.
* Comparatively the operation cost is less.
* Design is efficient and low cost.
* Power consumption is low.
* Controlling electrical devices is achieved without physical effort.

## **1.6 Scope and Limitation of the Study**

This project is limited to the construction of a voice activated home appliance control system only. Designing or constructing the individual components is not a not a part of the work

The work has the following limitations:

### The controlled appliances will have to have an electrical interface in order to be controlled by microcontroller.

* The RF Transmitter, Receiver and the microcontroller unit must be separately powered for better operation.
* It has limited life time due to use of battery for powering the circuit.
* The deaf and dump are excluded from list of users of the system as they cannot clearly speak.

**CHAPTER TWO**

**LITEARTURE REVIEW**

**Preamble**

This chapter gives an overview of past work and theories related to the present work. The chapter attempts to establish the gap in research that necessitated the present work. Credits are duly given to all cited work by different authors.

**2.1 Review of Related Work**

Potamitis et al (2018) suggested the use of speech to interact remotely with the home appliances to perform a particular action on behalf of the user. The approach is inclined for people with disability to perform real-life operations at home by directing appliances through speech. Voice separation strategy is selected to take appropriate decision by speech recognition. (Zena, 2019)

Anamul et al 2019 proposed a system entitled “A System for Smart-Home Control of Appliances Based on Time and Speech Interaction” that controls the home appliances using the personal computer. This system is developed by using the Visual Basic 6.0 as programming language and Microsoft voice engine tools for speech recognition purpose. Appliances can be either controlled by timer or by voice command.

According to the published study “Online Automatic Switch of Appliances” in Journal of Information Engineering and Applications with ISSN 2224-5782, ISSN 2225-0506 (online) Vol.4, No.1, 2014 2019 of Batangas State University, Nasugbu Batangas, enhances the traditional way of plugging and unplugging of appliances in certain location where the user can access the appliances online. It is composed of a desktop or laptop computer that were used by the user in accessing the project, relay switches –which were used to convert small amount of current to trigger a large amount of current, router or modem- which were used to transfer internet signals. The researcher used Arduino Board, to connect the switch to the server and the extension cord with sockets as the primary outlet. The study aimed to a better way to turn on or off the appliances. The project yielded from the different findings, for the development and completion. The study revealed that the project is much better compared to the traditional way of plugging and unplugging of appliances. With the proper instruction, guidance and setting up the project, two hundred sixty-four respondents were selected to evaluate the project. The overall impression of the respondents as evaluated that result to very satisfactory in terms of acceptability.

In 2019, Jagadeeswari and Eli developed a home automation system is being designed to control home appliances via voice command and the command send through by using mobile phone. The main objective of this home automation is to provide a wireless communication link of home appliances to remote user. In this system, it consists of two methods to control the home appliances which are use voice to text SMS (Short Message Service) and use mobile phone acts as remote control. This benefit of this system will provide to elderly, disabled people and those who are unaware of typing SMS (Short Message Service). The system is controlled via an android OS (Operating System) based mobile phone which giving a voice command, then use mobile application to convert the voice into text using android intent API 2.01. After conversion, the commands generated are appended in SMS (Short Message Service) and send through GSM (Global System for Mobile Communication) network. Table 2.3 shows the voice commands that set by user and its related SMS (Short Message Service) that received. On the received end, the SMS (Short Message Service) command will be received by the PIC 16D877A Microcontroller through Bluetooth channel. After the microcontroller received the SMS (Short Message Service), it will send the pulse to the switching circuit which used to check the status of the appliances and send feedback to the user. The limitation of this system are the SMS (Short Message Service) not able to be sent where there is no network coverage at certain area and not able to connect Bluetooth caused the SMS (Short Message Service) from the user not able to be received by the microcontroller itself.

In 2020, Islam, M. M., & Chowdhury, M. H. developed a system which operated by an electronic device known as dual tone multi-frequency (DTMF) technology. Duel Tone Multi Frequency (DTMF) tone is used to identify which key is pressed in the keypad of cell phone. Keypad is used as password entry device. In this system, the cellular network communication network is used to control all home appliances wirelessly thus it able to control at any places. Once the user has send the command by dialling through their mobile phone, the home appliance can be control easily based on the necessity. The control of the home appliances is monitored by the user through their mobile phone. Another mobile phone is needed in the controlling device. First of all, someone has to give a call to the mobile phone near to the controlling device. This signal is received by the headphone jack connected with the mobile phone. When the user presses any key of his cell phone, the DTMF tone corresponding to that key is passed to the DTMF decoder circuit through the headphone jack. The DTMF decoder circuit filters the signal and gives the output to the microcontroller. The output will be send to the microcontroller according to the key pressed by the user. The micro-controller then sends the voltage to the relay and the relay is being switched and drives the different kinds of home appliances. If the user’s mobile phone has no credit, this system cannot be operated due to the user no able to call the controlled mobile phone to perform the system operation.

In 2019, Kaphungkui, N. K. developed a system that controlled the home appliances through RF based remote system. From any places without line of sight (LOS) around the home, the RF based wireless remote control system able to change the state of the electrical appliances either in ON state or OFF state. The main objective of this system is to build the circuit without any programming skill and to make it work without line of sight (LOS) requirement by using RF technology. The home appliances able to control through switch pressing. Once the switch being pressed, the status of the home appliances able to change. For this system, it doesn’t required any programming, it just need do some simple configuration for the decoder and encoder. Configuration is required because needed to setup the input and output channel for the system. With this system, it able to control the home appliances without line of sight (LOS) condition. This RF based home appliances control system is better than infra-red (IR) based control system because RF signal can travel a long range and its coverage area for operation is larger. As the RF signal is strong, it is more reliable than IR transmission.

In 2019, Sen, S., Chakrabarty, S., Toshniwal, R., & Bhaumik, A. developed a system which is microcontroller based voice controlled home automation system by using mobile phone. In this system, it enables users to have control to all appliances in the house with their voice by connecting smart phone and Arduino Uno broad through Bluetooth. Besides, the home appliances will be controlled by using the voice commend that send by the mobile phone via Bluetooth to the Arduino Uno. Before the commands being sent, the mobile phone required to search the Bluetooth of the device and connect it. After connected to Bluetooth, the voice recognizer in the mobile phone will be launched. It helps to read the voice and converts the audio signal into a string. It will have produced different value for each home appliances which will be sent to the Arduino Uno. After reading the received data, the data will be decoded and sends a signal to the parallel port which used to activate the switching circuit. The switching circuit will control the home appliance based on the decoded data. There are two limitations in this system which is the Bluetooth might be not able to be detected if the user is scanning the Bluetooth device in far distance. The Bluetooth device have certain range for detection, it only able to be detected less than 10m. The Bluetooth device is suitable for short transmission thus the closer the distance between the transmitter and receiver, the faster the signal able to transmitted or received. So, if the user is staying far away, the signal that send by user is very slow to receive by the receiver. This limitation can be overcome by using the Zigbee connection because Zigbee connection is more suitable for long distance compared to Bluetooth.

**CHAPTER THREE**

**SYSTEM DESIGN AND ANALYSIS**

**Preamble**

This chapter presents the block diagram of the conceived system, the analysis of the circuit leading to the component value determination and selection.

**3.1 Functional Block Diagram**

The method used in achieving this construction is first to select the block diagram of the system to be followed, then to selected the circuit diagrams and then the components. Finally, the physical assembly follows. The block diagram of the soil moisture detector is given in figure 3.1.

In actualizing this project, the design summarized in the block diagram of figure3.1 was employed.

Android phone with voice Recognition application

Bluetooth module

Microcontroller

Power Supply

Relay Control

To Load

1 & 2

*figure 3.1: block diagram of the system*

**3.2 System Realization**

The choice and estimation of component values and voltage ratings are as explained under the following sub sections.

**3.2.1 Components Description**

**Description of materials**

1. **Electrolyte capacitor:** A capacitor is a two terminal passive component which is made from two conductive plates with an insulator between them. The main function of a capacitor is that it stores electrical energy when an electrical charge is forced unto the terminal from a power source. It maintains the charge even after getting disconnected from the power source. A capacitor can also use as a filter to allow AC signals and block DC signals.

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*Figure 3.2: electrolytic capacitor*

**ii Battey**

To power the light current consuming circuit a 9V battery of PP3 type was selected for use.

****

*Figure 3.3: The battery*

iii. **LED**: (Light emitting diode): The Led is the alternative of diode, when current is applied to a LED it emits light at a particular frequency. LED is used in numerous applications like key board, hard disk, TV remote control and this device are very useful as indicators in computers as well as battery operated electronics transistors.



*Figure 3.4: Light emitting Diodes*

1. **Resistor**

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

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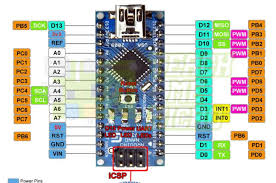
*Figure 3.5: fixed resistor*

1. **Arduino Nano**

According to ATmega semiconductor datasheet the Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. Power

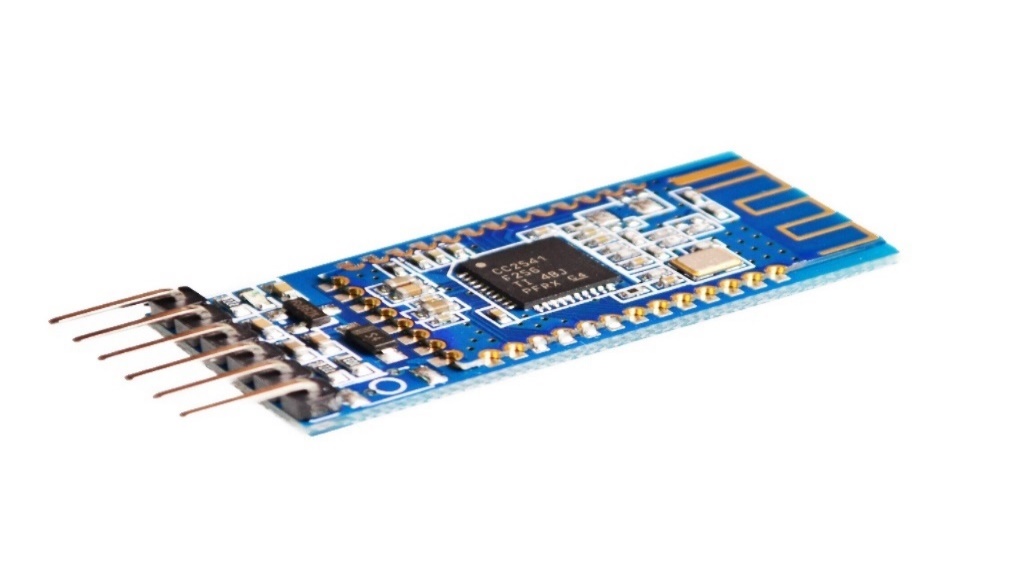
The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

Memory. The ATmega328 has 32 KB, (also with 2 KB used for the bootloader. The ATmega328 has 2 KB of SRAM and 1 KB of EEPROM.



*Figure 3.6: The timer IC*

1. **Bluetooth Module**
2. To obtain input from the cell phone a Bluetooth module is needed as receiver of commands from the phone to the microcontroller. There are several Bluetooth modules available based on the mode of operation needed. For this work the AT-09 CC2541 is chosen.
3. This AT-09 Bluetooth Module is a CC2541-based module with a dedicated breakout board that breaks out the pins and makes the module extremely easy to work with. It is an ultra-low power and highly versatile unit that offers effective wireless Bluetooth Communications with Bluetooth 4.0 and BLE communication capabilities. It can be used for a wide range of projects and applications. As such, it can be used for home automation systems, wireless light switches or plug points, wireless signal transfers between devices. The AT-09 module operates on a low 3.3V input at the wireless frequency of 2.4GHz. It has a maximum efficient distance of around 60 metres, and also features a number of security and privacy features to keep your projects safe from unauthorised access. And if that isn’t enough of a feature set for you, this module can also be used as a slave or master, meaning that it can either be utilised as a main controller for other devices, or can be used to accept commands and react according to a larger control system.



*Figure 3.7: The 741 IC*

**3.3 System Specification**

The characteristic and performance specifications of the system are:

1. Power supply = 9V.
2. Trigger input = voice over Bluetooth commands (LIGHT ON, LIGHT OFF, FAN ON, FAN OFF).
3. Control Outputs = Relay X 2
4. Outputs = 2 (Fan and Light).

**3.4 Method of Component Selection**

The individual sections were actualized separately by calculating or selecting the values of the selected components in the respective sub-circuit.

**3.4.1 Bluetooth Module selection**

To obtain input from the cell phone a Bluetooth module is needed as receiver of commands from the phone to the microcontroller. The module has the following specifications:

* Baud Rate: 9600
* Working Frequency: 2.4GHz ISM Band
* Modulation Method: GFSK (Gaussian Frequency Shift Keying)
* RF Power: ≤4dBm, Class 2
* Sensitivity: ≤-84dBm at 0.1% BER
* Bluetooth Protocol: V4.0 & Bluetooth BLE
* Transfer Rate: Synchronous 6kbps / Asynchronous 6kbps
* Flash: 256Kb
* Support Services: Central & Peripheral: UUID / FFE0 / FFE1
* Operating Voltage (DC): 3.3V to 6V

**3.4.2 Arduino Microcontroller Selection**

The main component in this design is the microcontroller with the coordination and control function. The microcontroller chosen for the work is the Arduino nano with the following specifications:

Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions: [ATmega datasheet, 2010]

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.

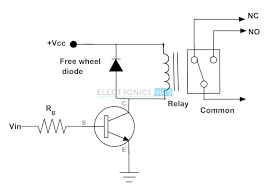
External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino Language.

(Coup, 2012).

**3.4.3 The Relay Section**



*Figure 3.8: The switch circuit*

This unit is made of the transistor and relay in its collector region, the value of the limiting resistor is determined thus:

= 5mA, and β = 100

Therefore, from equation (3.3)

= 0.05mA

……………… (3.4)

= 0.5mA

The base resistance R1 is calculated from the formula below;

R1 = ……………………. (3.5)

Therefore R1 = = 8600Ω = 8.6KΩ

A standard value of 10KΩ is chosen for the value of the limiting resistor R1

**3.4.4 LED Resistors**

The series resistors for the LED are calculated thus:

Voltage across LED = 5V

Forward Current, If

= 10mA @ 2.7V for red LED

= 20mA @ 3V for yellow LED

Therefore R red LED = (5-2.7)/10mA = 230Ω

R yellow LED = (5=3)/20mA = 100Ω

**3.4.5 System Circuit Diagram and Components**

**Software Requirements**

* Keil µVision IDE
* Willar Software
* Proteus (for Circuit Diagram and Simulation)
* Android Application installed on Android Device

**3.4.6 The Program**

The Arduino Nano can be programmed with the Arduino software (download). Select "Arduino Duemilanove or Nano w/ ATmega328" from the Tools > Board menu (according to the microcontroller on your board). The ATmega328 on the Arduino Nano comes pre burned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The bootloader can be bypassed to program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar (ATmega Datasheet, 2013).

* The program is written in C++ language, it is compiled by the Arduino IDE and uploaded into the microcontroller. Part of the program codes is given in Table 3.2.

Table 3.2: Part of the C++ codes

|  |
| --- |
| #include <SoftwareSerial.h>  SoftwareSerial blueTooth(2, 3);//tx = 2, rx = 3  const char IGN = 4, STR = 5, ACC = 6, ALM = 7, TRF = 8, STP = 9;  char BTbuffer[8];  void setup() {  // put your setup code here, to run once:  Serial.begin(9600);  Serial.println( "Enter AT commands: " );  blueTooth.begin(9600);  pinMode( IGN, OUTPUT );  pinMode( STR, OUTPUT );  pinMode( ACC, OUTPUT );  pinMode( ALM, OUTPUT );  pinMode( TRF, OUTPUT );  pinMode( STP, INPUT );  digitalWrite ( IGN, LOW );  digitalWrite ( STR, LOW );  digitalWrite ( ACC, LOW );  digitalWrite ( ALM, LOW );  digitalWrite (TRF ,LOW );  }  void loop() {  // put your main code here, to run repeatedly:  char index = 0,flag = 0;    if ( blueTooth.available () ){  char len = 0;  while (len!=7){  BTbuffer [ index ++ ] = blueTooth.read ();  len ++; |

**3.5 The Complete Diagram**

Figure 3.9: Complete Circuit Diagram

**3.6 Method of Construction**

To ease the construction procedures, the circuitry was segmented into functional blocks. The constriction included a prototype located on a breadboard followed by the final construction located on a Vero board. On completion of the construction, a thorough test and assessment of the component connection were carried out. The following steps were followed:

• The continuity and connectivity were taken using a mustimeter while the circuit was not

powered;

• The construction was tested block by block;

• The measurement of capacitance, current, resistances and voltage were taken and

compared with design values.

• To operate the circuit, the switch, is held down while pointing the LED at the receiver.

Permanent Construction

After the proto boarding stage and testing the components were all removed and set for permanent construction on a pc board measuring 8cm by 4cm. The construction includes soldering and packaging.

Soldering

Soldering is the process of joining two metals or wires to a metal using a soldering iron. The components are given a more general designated number which is almost consistent from one Vero board to another with soldering lead and care was taken not to use un-necessary long wires.

Care was also taken in soldering of all active components so as to avoid damage due to excessive heat. A soldering iron having a low power rating of 40 watts at 250c was used to avoid dry joint and short circuit.

The following tools were used to accomplish the soldering and de-soldering task

i. Soldering iron

ii. Metal brush and file

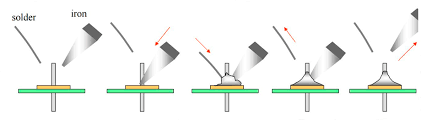
iii. Lead

iv. long nose plier and wire cutter

v. Lead sucker

The Vero-board was cleansed with metal brush and lead of each component was measured and excess was cut off to avoid short circuiting care was taken to ensure that the components were fixed properly as in the schematic diagram. The following precautions taken.

1. Never touch the hot end of the soldering iron (~370 o C) If you do get burnt run your finger under cold water for 5 minutes
2. Don’t burn the table, the power leads, keyboards, your classmates
3. Don’t melt anything except solder When not in use put the soldering iron back on the stand (not on the table)
4. Wear safety glasses, solder can flick into your eye
5. Wash your hands well after soldering (solder is 40% lead)
6. Use the fume extractors and don’t breathe in the solder fumes



*Figure 3.10: Soldering process*

**3.7 Principle of Operation**

This project consists of a microcontroller,2– Channel Relay Module, Loads (Light Bulbs are used in the demonstration) and Bluetooth Module. Here, ATmega328 Microcontroller is used. It is an 8 – bit microcontroller and it requires supply voltage of 5V DC. Use 7805 power supply circuit to provide 5V DC to the microcontroller. We can use 9V DC battery or 12V, 1A adapter to provide the supply to the circuit. The components are used to implement the system. The core component of this system is the Arduino Nano which has a microcontroller that is, Atmega 328p. Atmega 328p has a 32KB flash, it is needed to burn a boot loader and download Arduino sketches. The ISP program controller is used to programmed the boot loader. A 9V adapter power supply serves as input supply to the Arduino voice control system. The relays connected to the Arduino Uno output pin serves as switches to the loads. Android is a Linux kernel based mobile operating system developed by Google. Android phones have an inbuilt feature called ‘voice recognizer’ which the user uses to control an appliance. For wireless communication system, a Bluetooth module HC-05 is used as a remote which is connected to the control unit for sensing the signals sent by the android voice application. The Bluetooth module and relay circuit are connected to the microcontroller while the android based application is launched on the smart phone. The application can orally be instructed by the user to control an appliance either ON/OFF. The microcontroller sends signal to the relay board having received instruction through the Bluetooth module. The application first of all searches for the Bluetooth device to establish wireless connection. The voice recognizer is launched as soon as connection is established. The audio signal read from the voice is converted into string. Value is assigned to each of the appliances and fed to the microcontroller. The microcontroller decodes the sends data signal and activates the relays for appropriate loads switching.

## **3.8 Performance Test**

The following are requirements for testing the constructed project

1. Bluetooth enabled GSM phone for command
2. The voice recognition application on the phone
3. Two different loads
4. 9V battery

The completed system was first tested on a protoboard before transferring unto a strip board. The final system was connected as shown in figure 2.0 and results of the test tabulated on table 2.0

2 x RELAY CONTROL CIRCUIT

GSM PHONE TO COMMANDS

RECEIVING BLUETOOTH MODULE

MICROCOMPUTER

*Fig. 3.7: Block diagram showing performance test scheme*

**3.9 Casing/ Packaging**

A portable box was constructed for casing of the entire system. This casing is made up of plastic of dimensions 12cm x 10cm x 6cm to house all the internal components of the constructed car security system. It is also to provide protection against the mechanical damage of the circuit and to reduce the risk of short circuit between current carrying conductors. It was carefully perforated at the back for adequate ventilation.

10cm

12cm

6cm

*Figure 3.11: Casing/ Packaging of voice activated appliance control*

**CHAPTER FOUR**

**RESULT AND DISCUSSION**

**4.1 Results**

Results obtained from the testing procedure are tabulated in table 4.1 and table 4.2

Table 4.1: Static Test results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| s/n | Test points | Test tool | Result | Comment |
| 1 | Power supply | D.C voltmeter | 12.0v | good |
| 2 | Regulated dc output of 7805 ic | Dc voltmeter | 5.0v | ok |
| 3 | Unregulated output of transformer | Dc voltmeter | 13.5v | ok |
| 4 | Relay coil | ohmmeter | 320Ω | ok |
| 5 | 2N2222 pins | e, b, c | No short circuit | ok |

Table 4.2: Performance test result

|  |  |  |  |
| --- | --- | --- | --- |
| s/n | Voice Command | Load Status | Comment |
| 1 | “FAN ON” command Sent | TV Relay, LED ON | As expected, |
| 2 | “FAN OFF” command Sent | TV Relay, LED OFF | As expected, |
| 3 | “LIGHT ON” command Sent | LIGHT Relay, LED ON | o.k |
| 4 | “LIGHT OFF” command Sent | LIGHT Relay, LED OFF | o.k |

**4.5 Discussion**

The results of test in table 4.1 show that the major components of the system are in working condition, that adequate power is being supplied to the circuit. The result also means that the system is expected to work normally as designed.

Results from the system performance test given in table 4.2 show that the system is quite capable of operating the control relays in accordance with the input voice command sent from the connected Bluetooth enabled GSM phone with voice recognition application.

**4.6 Bill of Engineering Measurement**

Below is the BEME of the designed project presented in this work.

Table iv. BEME table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/N | Component | Unit Cost (#) | Quantity | Amount (#) |
| 1 | Microcontroller | 6000 | 1 | 6000 |
| 2 | Fixed resistor | 100 | 3 | 300 |
| 3 | Capacitor | 100 | 2 | 200 |
| 4 | Fixed Voltage Regulator | 500 | 1 | 500 |
| 5 | Bluetooth module | 5000 | 1 | 5000 |
| 6 | Light emitting diode | 100 | 2 | 200 |
| 7 | Relay | 250 | 2 | 500 |
| 9 | Transistor | 250 | 2 | 500 |
| 12 | Fixed resistor | 100 | 2 | 200 |
|  |  |  | Total (#) = | 12, 500 |

**CHAPTER FIVE**

**SUMMARY, CONCLUSION AND RECOMMENDATIONS**

**5.1 Preamble**

In this concluding chapter, the work is summarized by stating the objectives again, giving the results obtained, problems encountered and recommendations for future work

**5.2 Summary**

Controlling the home utilities via voice is just an amazing step forward towards the development in IoT sector, as this involves totally a wireless medium to create the connection. There are many Android-based applications which have been developed to initiate the working on this technology which also includes voice-controlled wheelchair etc. All the previous experiments and trials which are done before, we have utilized the same concept to implement it in an efficient manner, so that more people can be benefited which involves just a say of word to make the things work i.e. home utilities. Without a doubt, this technology will bring revolution in the people’s life if that is implemented on the larger scale.

Controlling the utilities like fan, light and heater in the wireless medium is absolutely an outstanding progress in this century, vulnerabilities and security issues are still under concern to make this technology even better than ever before.

**5.3 Conclusion**

The gift of technology to mankind is to make life simpler. In this work, a remote control for multiple home appliances is constructed, presented and implemented. The design is durable, robust and sturdy which is built with an available compact IC’s and RF module. From any place around the house any four appliances can be control at will without the requirement of line of sight. The relay action which is connected to the load to be controlled is operated with voice commands. Multiple devices can be control using different output

**5.3 Recommendations**

This project work is recommended to be further developed for manufacture in Nigeria as it has economic potential as a technology for this modern world which can be expanded for many other applications apart from home appliances.

It is also recommended that:

1. The casing and finishing be improved probably by the use of three D printing technology.
2. The testing should be extended to digital logic ics.
3. Use of microcontroller to make the tester user friendly by the use of lcd displays.

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