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Textile and Engineering Institute, Ichalkaranji

(An Autonomous Institute Affiliated to Shivaji University
Kolhapur)

Department of Electronics Engineering

A Mini Project Report on

Bluetooth Voice Controlled Appliances with 'OK Google'

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CERTIFICATE

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Has completed Mini-Project-II Titled

“Bluetooth Voice Controlled Appliances with 'OK Google'

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Introduction

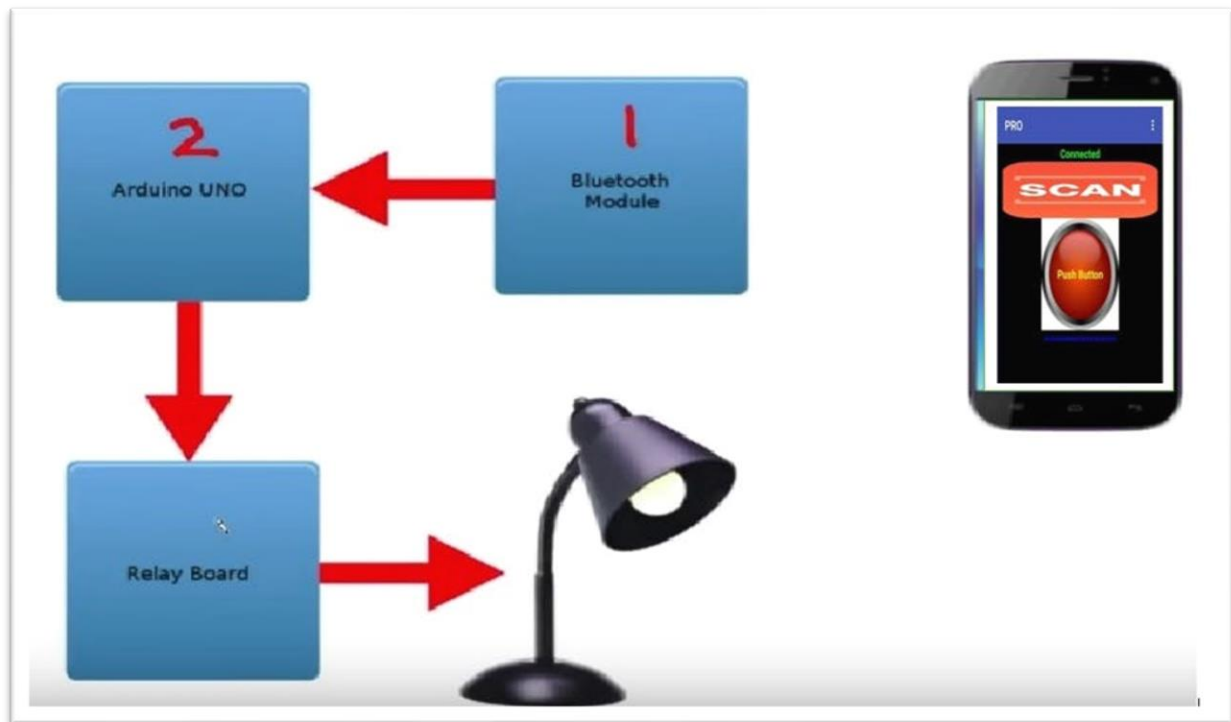
The project is to build a Voice Control Home Automation System Using Arduino and HC-05. This project utilizes a microcontroller and Bluetooth module. A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. So in this system the microcontroller controls the function of the lights. HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. This way the lights can be controlled wirelessly with Bluetooth.

Here we will control three different home appliances by voice Command. The key components of this project are Arduino, Bluetooth module, Relay module, a smartphone, and Android App. At first, we need to install the app on our smartphone, which is easily available in the play store. This app receives our Voice command and sends it to the Bluetooth module wirelessly. The Arduino decodes this command from the Bluetooth module. Then Arduino sends a command to the Relays to control the home appliances. These four home appliances are switched on/off by eight different voice commands.

Home automation is the use of one or more computerized remote to control basic home appliances remotely and sometimes automatically [7]. It is designed to control lighting points, entertainment systems, and home security such as access control as well as alarm systems. Automation and wireless technology have become a key technology in the twenty-first century. It helps communication between one point to another without the use of cables, and this makes the system to be more secure [1]. The attractiveness of controlling electrical devices through a phone has been increasing because of its high performance and availability. Connecting appliances through smartphone is useful for the elderly and physically disabled persons, who can access and control the appliances from where they are located and access them remotely without the help of others. Time is a precious thing; everybody wants to save time as much as they can (Kannapiran and Arvind, [6, 2]).

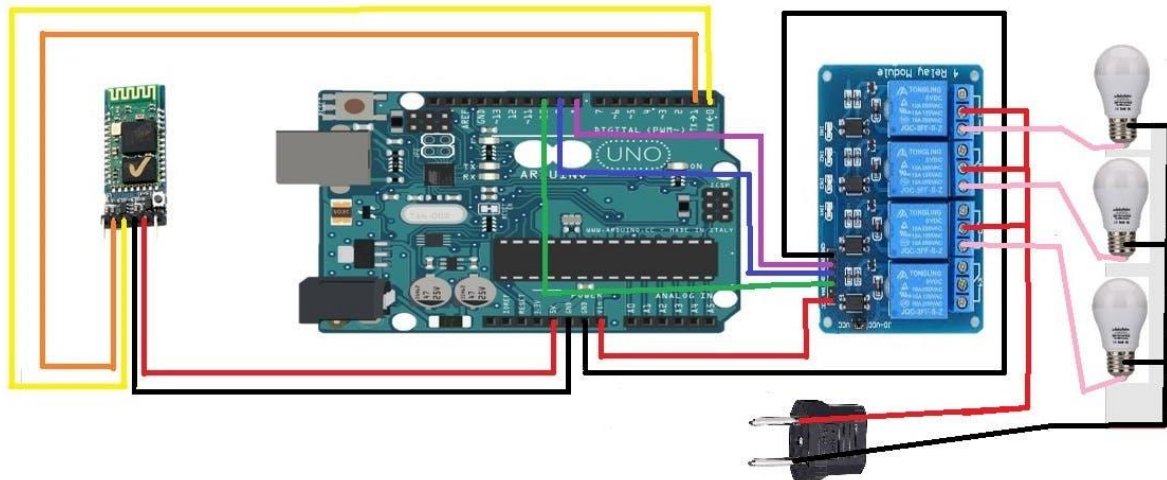
Android, a vivid operating system, has 76.24% usage worldwide, and 78.05% of Nigeria's total smartphone market share [9]. Android has become the topmost used mobile gadget operating system (OS) on the market today. The Android smartphone has become the most popular and commonly used Operating System in our world, especially in Nigeria. This had made us base the control terminal of the home automated system on an android application as it has been shown that majority cannot do without their phone with them almost all the time

Block Diagram



This article describes the implementation of a Bluetooth technology and an android application with voice prompts based home-automated system using an Arduino microcontroller. The system is aimed at designing an automated appliance control that is user-friendly and convenient to use. The design comprised an Arduino ATMEGA328 microcontroller board, Bluetooth module (HC-06), and an android application (MIT App Inventor 2). The Arduino controls any connected component and was programmed with C++ programming language by using Integrated Development Environment (IDE). Relays and Triacs are used for the switching mechanism. Once the system is connected, the user controls the electrical appliances connected to the home-automated system, which can also be controlled using voice prompt with the help of a Google assistant inbuilt with the android smartphone. The system switches the home appliances ON and OFF using the android app, Bluetooth module, and voiced prompt. It can also be timed to switch off appliances for a pre-time of 12 h, thus making the application easy and convenient to operate via a smartphone.

Circuit Diagram with Explanation



An adapter of 12V output power supply is used as an input to the voice controlled arduino system. Relays are connected to the output pins of Arduino Uno, these are used as switches to the loads.

Android is a mobile operating system based on Linux kernel and currently developed by Google. We prefer android platform because of its huge market globally and it is easy to use user interface. The voice recognizer which is an inbuilt feature of android phones is used to build an application which the user can operate to automate the appliances at his house. 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.

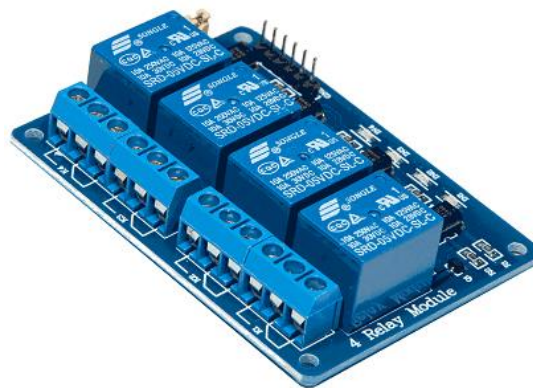
The microcontroller device with the Bluetooth module and relay circuit needs to be connected to the switch board. Through the application we can instruct the microcontroller to switch ON/OFF an appliance. After getting the instruction through the Bluetooth module, the microcontroller gives the signal to the relay board.

The application first searches for the Bluetooth device. If it is available then it launches the voice recognizer. It reads the voice and converts the audio signal into string. It provides a value for each appliance which will be fed to the microcontroller device. The microcontroller uses the port in serial mode. After reading the data it decodes the input value and sends a signal to the parallel port through which the relay circuit will be activated

Hardware Components

- **Relay driver**

The relay driver circuit is powered by Darlington IC ULN2003A that has seven pairs of a transistor with seven inputs and output pins. The Darlington IC used eliminates the use of multiple components. The relay is powered by 12 V from the power supply and it has two terminals, one terminal is connected to the 12 V supply while the other terminal is connected to 5 V from the Arduino board which acts like a neutral that activates the relays. The Darlington IC has the circuitry inside it that can increase the current to the relays and it has seven transistorized output pins, which eliminate the use of several single transistors, but the output is only activated when the input pin of the IC is supplied with lower voltage. The Darlington IC ULN2003A is shown in Fig. 2.



- **Bluetooth**

The Bluetooth module used in this design is HC-06 as shown in Fig. 3. It receives the command and passes it onto the Arduino microcontroller. The microcontroller reads the command through a serial port and therefore the Arduino microcontroller compares the command from the android phone to the code written on the Arduino Uno. If it matches the command, the corresponding output pin goes high. The relay driver receives the signal from the microcontroller and activates the corresponding appliance (load). The HC-06 works with a supply voltage of 3.6VDC to 6VDC, however, the logic level of RXD pin is 3.3 V and is not 5 V tolerant.



Connecting the Bluetooth module to the Arduino-Uno board

The process of connecting the Arduino-Uno and the Bluetooth module followed the steps 1–3 to enable the android application to control the Arduino-Uno (microcontroller).

Step 1: The Bluetooth module and microcontroller was connected through their respective VCC pins.

Step 2: The Bluetooth module and microcontroller was connected through their respective GND pins.

Step 3: Similarly, the transmitter (Tx pin) of the Bluetooth module to the receiver (Rx pin) of the microcontroller and the receiver (Rx pin) of the Bluetooth module to the transmitter (Tx pin) of the microcontroller.

- **Arduino microcontroller**

This is the processing brain behind the work of this home automation, and it was used to interface the entire system together. The Arduino board contains sets of both digital and analog input/output (I/o) pins that were interfaced to various expansion boards or breadboards (shields) and other circuits. It was programmed using C++ programming language.

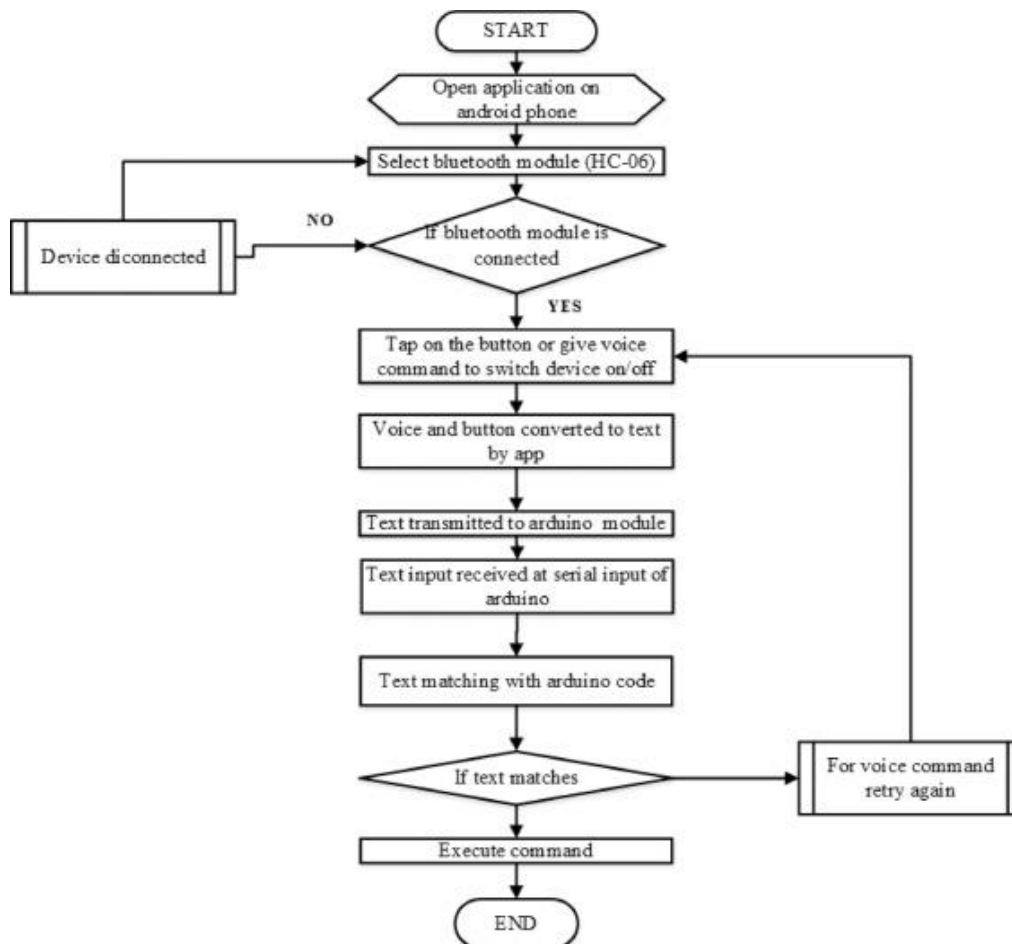


Software Design And Implementation

This section discusses the software and algorithm used in developing the android application and programming of the Arduino board Integrated Development Environment software, namely Arduino IDE and Proteus IDE. show the operational flowchart of the software implementation.

- **Arduino IDE**

The Arduino IDE is an open-source software that writes, compiles, and upload codes directly into the microcontroller. The version used in this paper is version 1.8.9. The Arduino IDE environment is used for writing the desired software code and for compiling, uploading code into the given Arduino board. Its environment supports both C and C++ language. It is also used for debugging, editing, compiling, and uploading code in its environment to physical hardware modules.



IDE Code

```
//voice Controlled Home Automation

#define relay1 2 //Connect relay1 to pin 2

#define relay2 3 //Connect relay2 to pin 3

#define relay3 4 //Connect relay3 to pin 4

#define relay4 5 //Connect relay4 to pin 5

String voice;

void setup()

{

  Serial.begin(9600); //Set rate for communicating with phone

  pinMode(relay1, OUTPUT); //Set relay1 as an output

  pinMode(relay2, OUTPUT); //Set relay2 as an output

  pinMode(relay3, OUTPUT); //Set relay3 as an output

  pinMode(relay4, OUTPUT); //Set relay4 as an output

  digitalWrite(relay1, HIGH); //Switch relay1 off

  digitalWrite(relay2, HIGH); //Swtich relay2 off

  digitalWrite(relay3, HIGH); //Switch relay3 off

  digitalWrite(relay4, HIGH); //Swtich relay4 off

}

void loop()
```

```

{

while (Serial.available()){ //Check if there is an available byte to read

    delay(10); //Delay added to make thing stable

    char c = Serial.read(); //Conduct a serial read

    if (c == '#') {break;} //Exit the loop when the # is detected after the word

    voice += c; //Shorthand for voice = voice + c

}

if (voice.length() > 0)

////////////////////////////////////

{

    if(voice == "*turn on light"){          //Voice Command to ON Relay 01

        digitalWrite(relay1, LOW); //Relay 01 ON

    }

    else if(voice == "*turn on LED"){      //Voice Command to ON Relay 02

        digitalWrite(relay2, LOW); //Relay 02 ON

    }

    else if(voice == "*turn on alarm") {    //Voice Command to ON Relay 03

        digitalWrite(relay3, LOW); //Relay 03 ON

    }

    else if(voice == "*turn on fan") {      //Voice Command to ON Relay 04

        digitalWrite(relay4, LOW); //Relay 04 ON

    }

}

```

```
////////////////////////////////////
```

```
else if(voice == "*turn off light") {    //Voice Command to OFF Relay 01
```

```
    digitalWrite(relay1, HIGH); //Relay 01 OFF
```

```
}
```

```
else if(voice == "*turn off LED") {    //Voice Command to OFF Relay 02
```

```
    digitalWrite(relay2, HIGH); //Relay 02 OFF
```

```
}
```

```
else if(voice == "*turn off buzzer") {    //Voice Command to OFF Relay 02
```

```
    digitalWrite(relay3, HIGH); //Relay 03 OFF
```

```
}
```

```
else if(voice == "*turn off fan") {    //Voice Command to OFF Relay 02
```

```
    digitalWrite(relay4, HIGH); //Relay 04 OFF
```

```
}
```

```
else if(voice == "*turn all devices on") {    //Voice Command to ON all Relays
```

```
    switchallon();          //All Relays ON
```

```
}
```

```
else if(voice == "*turn all devices off") {    //Voice Command to OFF all Relays
```

```
    switchalloff();         //All Relays OFF
```

```
}
```

```
voice=""; //Reset the variable after initiating

}

}

void switchalloff()          //Function for turning OFF all relays
{
    digitalWrite(relay1, HIGH);
    digitalWrite(relay2, HIGH);
    digitalWrite(relay3, HIGH);
    digitalWrite(relay4, HIGH);
}

void switchallon()          //Function for turning ON all relays
{
    digitalWrite(relay1, LOW);
    digitalWrite(relay2, LOW);
    digitalWrite(relay3, LOW);
    digitalWrite(relay4, LOW);
}
```

Conclusion

An Arduino based home automation system using Bluetooth and an android application with voice command has been designed and implemented. The Home automation system used an Android application and a Bluetooth technology in the design; this is because they are easy to use, fast, readily available, and reliable in communications between the remote user and devices.

A low cost and highly reliable home automation system that can assist handicapped/old aged people, as well as a user-friendly device was developed. Other features can be added in the future such as biometrics so that unauthorised persons can not have access to the appliances and an also timing schedule can developed for each appliances connected this will effectively conserve energy

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