

Low Cost Android Based Electrical Appliance Control

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ABSTRACT

In today's world automation is one of the main key factors that has played an important role in human life's development and safety and security protocol enhancing. Mobile phones especially smartphones are easily available to common people nowadays. Everyday works like switching ON/OFF the lights and fans can be easily done using smartphone. This process of individual involvement in such daily household works can be eliminated with the help of home automation using android platform thus making it easier and faster. The main control system of the device uses wireless technology of Bluetooth to provide remote access from smartphone. This automation system is designed with 8bit micro controller that is Arduino to control the home appliances with the help of relay. And Bluetooth is used as the most efficient and reliable connection in a short distance. This provides us with a low cost and wireless home automation system with user friendly interface and ease of installation. It is also designed to assist and support the needs of disabled or elderly people. This paper provides a report on enhancing home automation system by eliminating the method of traditional switching

Keywords: Android phone, GSM, Bluetooth, WIFI, Operating System, Electrical Appliances

1. INTRODUCTION

The concept of "Home Automation" has been existed for many years now. And many other terms like "Smart Home" has also been used to refer to the same. It refers to the automation of house work by the help of interaction between network appliances and household appliances. It helps in the centralized control of lights and other electrical appliances and also in security locks of doors and gates. Providing energy efficiency, comfort and security. However elderly people don't always accept these systems due to their complexity.

Home automation became viable for the first time in the 1900s. In 1975, the first home automation network technology was developed. It mainly used electric power transmission wiring for sending signals and controlling by bursting radio frequency of digital data [1].

As the wireless technology has been advancing with time, we are introduced with several new type of connections such as WIFI, Bluetooth, Radio Frequency, Infrared and GSM. And each one of the different connections comes with their own unique applications and specifications. Among all of the above mentioned popular wireless connections for home automation system Bluetooth and WIFI are mostly preferred. As most of the electronic devices such as Smartphones and Laptops comes with pre built WIFI and Bluetooth so almost anyone can get access to that [2].

In this system we are applying the concept of Home Automation of Electronic appliance with the help of Android devices and using Bluetooth as the main wireless connection. We used an Arduino board having Bluetooth connected to it which is controlled by a Smartphone with Android Operating System. The home appliances are connected to the device with the help of a relay circuit which receives signals from the Arduino board.

2. CONCEPT OF ANDROID BASED ELECTRICAL APPLIANCE CONTROL

A. Block Diagram of Android Based Electrical Appliance Control

An android smartphone sends Bluetooth signals to the Bluetooth module which then process that signal and sends it to the Arduino board as shown in Fig. 1 where the board does its function according to the code given by the user and sends the desired triggering signal to the relay whether to turn on or off the load.

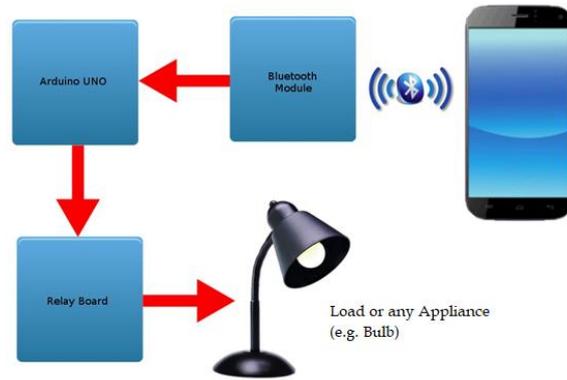


Figure 1. Block Diagram of Android Based Electrical Appliance Control

B. Circuit Diagram of Android Based Electrical Appliance Control

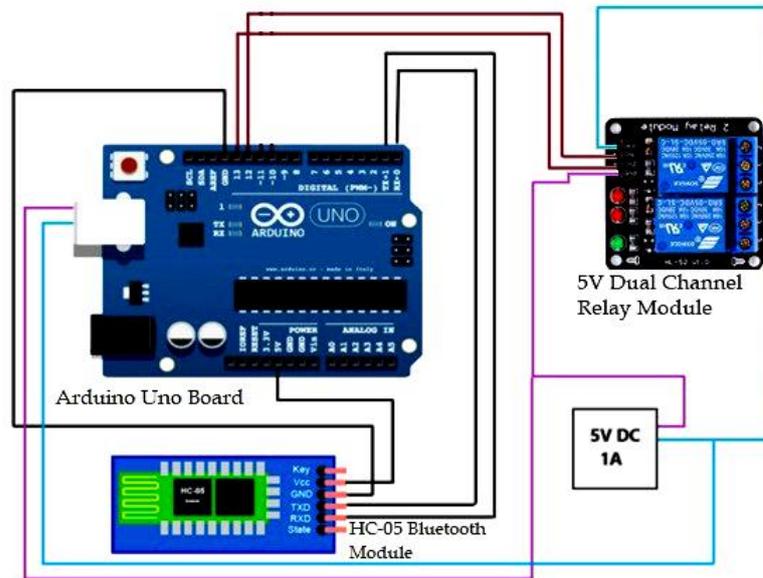


Figure 2. Circuit Diagram of Android Based Electrical Appliance Control

Fig. 2 shows the Circuit Diagram of Android Based Electrical Appliance Control system. At first a 5V DC 1A power source is taken and connected to the Arduino Board USB port with an Arduino USB cord. Then 5V and GND pin of the Arduino board is connected to the Vcc and GND pin of the HC-05 Bluetooth module respectively. Then the TXD pin of the HC-05 Bluetooth module is connected to the RX-0 pin of the Arduino Uno board and the RXD pin of the HC-05 Bluetooth module is connected to the TX-1 pin of the Arduino Uno board. Now coming to the 5V Dual-channel relay module, the Vcc and the GND is connected to the +ve and ground terminals of the 5V power source that was taken at first. Now the IN1 and IN2 are connected to pin 12 and pin 13 of the Arduino Uno board.

These are the connections that were made to build our hardware system. More relays can be added and connected to the respective pins of the Arduino Uno board and the left circuit remains the same.

3. BASIC COMPONENTS USED FOR ANDROID BASED ELECTRICAL APPLIANCE CONTROL

C. Hardware Components:

Arduino UNO: Arduino UNO is an open source micro controller board which is based on the 8-bit microcontroller ATmega328P. It consists of 14 digital input and output pins out of which 6 can provide PWM output and it also has a 16MHz quartz crystal. It also comes with USB connectivity for easy connection to the computer for the input desired code of the program and also a reset button to instant restart in case of any malfunction. It operates on a voltage of 5V which can be provided with the help of an 5V AC to DC adapter or with the USB port. It contains a flash memory of 32KB out of which 0.5KB is used by bootloader and for faster data processing it works on a clock speed of 16MHz.

HC-05 Bluetooth Module: HC-05 Bluetooth is designed as a Bluetooth SPP module, which is used for wireless serial connection setup. It has an easy interface that works with controller or PC and communicates with the help of serial

communication. This Bluetooth module can be switched in two types master and slave mode which makes it able to use both receiving or transmitting data. It works on an input voltage of 5V DC.

5V Relay Dual Channel Module: It is an electro-mechanical device which works with the help of an electric current that opens or closes the contacts of a switch. It is just made of a plain relay and other components that makes connection and switching easier and indicates whether the relay is on or not. In our system we have used a double channel 5V relay which is more or less same as a single channel 5V relay but it comes with some extra features. It can be used to switch powered loads with the help of pins from a microcontroller.

Other used components: Connecting Wires, 5V DC power Source.

D. Software Components:

In software component there are Android Application and Arduino software (IDE) .

4. ARDUINO PROGRAMMING

The following code is written and uploaded to the Arduino Uno using the Arduino software (IDE):

```
//using ports 12, 13
int relay1=12;
int relay2=13;
int val;
void setup() {
  Serial.begin(9600);
  pinMode(relay1,OUTPUT);
  pinMode(relay2,OUTPUT);
  digitalWrite(relay1,HIGH);
  digitalWrite(relay2,HIGH);
}
void loop() {
  //check data serial from bluetooth android App
  while (Serial.available() > 0)
  { val = Serial.read();
    Serial.println(val);
  }
  //Relay is on
  if ( val == 1 )
```

(a)

```
{ digitalWrite(relay1,HIGH); }
else if( val == 2 )
{ digitalWrite(relay2,HIGH); }
//Relay all on
else if( val == 0 )
{ digitalWrite(relay1,HIGH);
  digitalWrite(relay2,HIGH);
}
//relay is off
else if( val == 5 )
{ digitalWrite(relay1,LOW); }
else if( val == 6 )
{ digitalWrite(relay2,LOW); }
//relay all off
else if( val == 10 )
{ digitalWrite(relay1,LOW);
  digitalWrite(relay2,LOW);
}
```

(b)

Figure 3. (a) Arduino Code part 1 (b) Arduino Code part 2

The above code is used to interact with the relays using the Arduino Uno board and the android app. Pin no. 12 and 13 of the Arduino board is used and the code is written according to it. So, when we want to turn on only Device 1 then val==1 is sent to the board and similarly when we want to turn on only Device 2 then val==2 is sent to the board. And when val==5 or val==6 is sent the respective Device 1 or Device 2 turns off. There is also a statement which allows us to turn on or off all devices all together by sending val==0 or val==10 respectively.

5. COST ESTIMATION

Table 1 shows the estimated price of the product which a user has to pay to make or use the device:

Table 1: Approximate cost estimation Table

Sl. no.	Name of the Component	Quantity	Price
1	Arduino UNO(with ATmega328p microcontroller)	1	₹410
2	HC-05 Bluetooth Module	1	₹220
3	5V Dual-channel Relay Module	1	₹90
4	5V DC power source adapter	1	₹100
5	Connecting Wires	-	₹20
		TOTAL:	₹840

6. CONCLUSION AND FUTURE SCOPE

The main objective of our project was to control the home appliances with the help of an Android smartphone. The system has been successfully implemented and tested. This system is very efficient and reliable for old aged people and disabled or paralyzed people who moves on a wheel chair and it is hard for them reach the switch for turning ON/OFF the device. More devices can be connected and used by increasing the number of relays. User can easily interact with

the help of an Android phone/tablet. This is a simple prototype and using this many future expanded programs can be made. We are very much grateful that we were able to learn this topic as our main project and created a small home automation system by our own and glad to explore a topic which has a great area of interest for research and study today and has a large room for improvement in future.

By connecting various sensors, it can be programmed to automatically control appliances for example a temperature sensor can be used to turn a fan or heater ON/OFF. We worked on a single topic having various future potential to be researched on. Future enhancements can be like it can be used on various platforms such as iOS, Windows, etc. The limitation of controlling a limited number of devices can be eliminated with the help of automation to all other appliances. Many security improvements can be done using motion sensors. The project can be implemented to various areas they are not only restricted to home. The connectivity can also be replaced by other wireless systems like SMS, GSM and WIFI.

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