Android Phone Operated Home Appliances Using Bluetooth Technology

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Abstract-- Many household devices operate with alternating current. These devices are switched by using switches or keys that are considered as a component of the electric circuit. All home appliances such as fans, tubelights, TVs, refrigerators, washing machines, etc. have become a part of the daily life of a normal human being. These devices are driven by alternating current supplied to every house from the energy station. Taking into consideration the different advancements in the field of electronics and robotics we can develop a method for operating all home appliances by using an android phone with the help of Bluetooth technology. In this paper, I shall discuss about the means of using Bluetooth technology for controlling any AC or DC machine by a single tap on the Android phone, using it as a remote control.

Index terms-- Android phone, Bluetooth, Bluetooth module, Arduino, Serial data, Alternating current

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1   INTRODUCTION

Electrical energy is the source of energy for many day to day devices and machines. The electric current has been classified as direct current and alternating current. Many home appliances work using alternating current as the source of energy. With the rapid increase in development of different technologies around the globe human beings have always developed a tendency of getting lazier than before with the use of several modern gadgets and systems. Mobile phones were originally conceived as a wireless alternative to the wired telephones of the olden days. Modern day's mobile phones with operating systems such as the Apple's iphone, Google's android and Microsoft's windows have become very much common among the users. The android software was created by the Google Company. This software is being used by several mobile phone manufacturing companies as their operating system since it provides a wider platform for workspace, entertainment and many more. Many mobile phones come with an inbuilt application, the Bluetooth. Bluetooth technology uses ultra high frequency radio waves (UHF) with a frequency range of 2.4 to 2.485 GHz for the purpose of wireless data transmission. Bluetooth is based on the transmission of serial type data. By the help of Bluetooth via an android phone we can use this technology to send data wirelessly inorder to operate any AC or DC machine.

2   DESCRIPTION OF THE PROCESS

This mechanism uses the transmission of serial data through Bluetooth. There are in general two types of data transmission viz. serial data and parallel data. In case of serial data transmission the data is transmitted over a single stream consisting of a number of bits in discrete manner, which is in form of small packets of data. In case of parallel data transmission, several streams of data are transmitted along multiple parallel channels. In earlier days serial data was transmitted using RS232 DB9 cable. These days USB (Universal Serial Bus) cables serve the purpose of serial data transmission. For the transmission of serial data wirelessly Bluetooth technology was developed by telecom vendor Ericsson in 1994 to overcome the problems of synchronization. It was initiated originally as a wireless alternative to RS232 data cables.

Many electronic devices like mobile phones, tablets and laptops possess Bluetooth technology within them for the transmission of different files and data. A Bluetooth receiver is otherwise called a Bluetooth module. It is a special type of Bluetooth device that receives data through serial communication using two specific pins present in the module. This module finds ease when used with an Arduino microprocessor. Arduino is an open source hardware and software company that builds microcontrollers along with processors for creating interactive platforms to communicate with the physical world. Arduino has a wide range of applications in the field of robotics and research. It creates a user-friendly platform for the user that makes the user to easily handle the microcontroller and use it efficiently. Bluetooth module communicates with Arduino via serial data transmission through the two specific pins (RXD and TXD pins) without finding any difficulty. Programming of serial transmission through Bluetooth is quite easier with Arduino rather than any other microcontroller.

The serial data transmission is advantageous over the parallel data transmission system because they can be clocked considerably faster than parallel data in order to achieve a higher data rate. Also serial communication is less expensive as compared to parallel communication. There might be a chance of signal interference taking place within the transmission of several streams of data transmission which can be avoided in case of transmission of a single stream of data. The normal RF module (radio frequency) is based on the system of parallel data transmission. Hence there lie some faults with this module. So a Bluetooth module is preferable because it is based on the system of serial data transmission.

3   DIFFERENT REQUIREMENTS

3.1   Android Phone: As mentioned earlier these days android mobile phones have become very useful to mankind. They have an inbuilt Bluetooth application for transmission of different files and data. Apart from the original application an additional application namely the Bluetooth controller can be developed whose main purpose shall be to transmit serial data wirelessly in the form of UHF radio waves.

3.2   Bluetooth module: The purpose of this component is to receive the data sent by android phone over serial communication. Two types of modules are available in the market viz. HC-05 and HC-06. We can use either of them for this purpose. However the HC-05 is cheaper than HC-06 module.

3.3   Arduino Nano V3.0: This is the cheapest microprocessor among all other Arduino boards. It is preferable to use this board not only because of cost but also due to its compact size and greater memory and speed than the common board Arduino Uno R3. It is better than other Arduino boards of its range and capability.

3.3   IC L293DNE: This IC consists of four transistors that convert the digital power supply (V_{cc}) to direct current of approximately 12 volts. It is used in building a motor driver circuits especially for the purpose of making robotic equipments and devices.

3.4   Relay switch: A special type of switch is available in the market called the relay switch. This switch is very much effective in controlling AC machines accurately. It works on the application of 12 volts and can be used for switching AC as well as DC. Thus we can operate either an AC or a DC machine using relay just by supplying it a direct current of 12 volts.

3.5   Power source: Any system will not be able to work unless it is provided an energy source which may be either mechanical energy or else electrical energy or any other source of energy. In this system the energy source is electric energy with alternating current. Also a 12 volt adapter is used to supply 12 volts DC to the motor driver circuit by converting AC to DC.
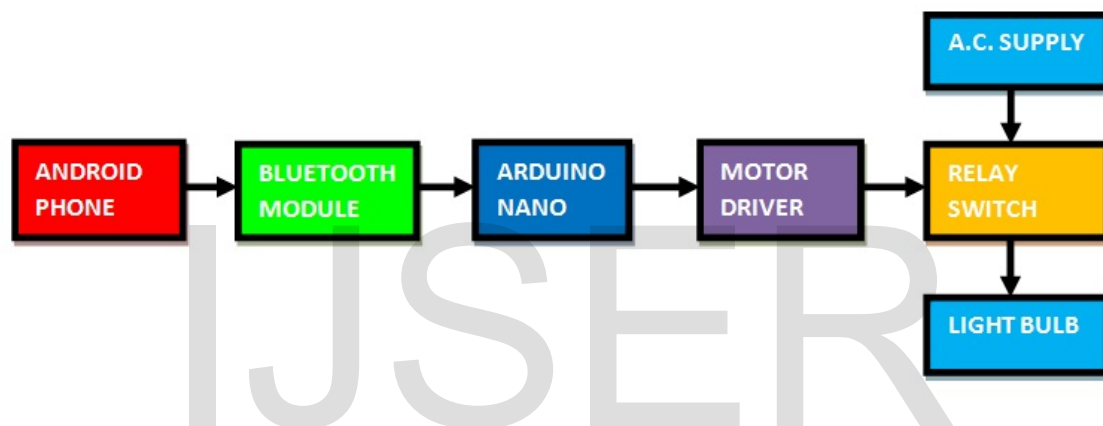
4   WORKING OF THE PROCESS

FIG 1. BLOCK DIAGRAM OF THE PROCESS

The android phone possesses an application the Bluetooth controller. This application could be found in the app store or else it can be built by app developers. The purpose of this application is to transmit serial data wirelessly via Bluetooth. You just need to define a specific character that must be sent which will serve the purpose. For example to turn a light bulb ON a character let say 'B' is sent. Within the electric circuit the Bluetooth module is present whose purpose is to act as the receiver. It receives the serial data transmitted by android phone and decodes them. For the character 'B' (for bulb) the Bluetooth module decodes the character into its binary form (i.e. in terms of 1 and 0). The control unit of the electric circuit is the Arduino Nano V3.0 Processor. The Arduino board and the Bluetooth module are connected with each other through the transmit pin and receive pin. The transmit pin and receive pin are termed as TXD and RXD pins respectively. These two pins are necessary for serial data transmission. Any device working over serial data must possess these two pins. When one pin sends the data the later receives and the process continues.

The entire process works under the mechanism of transmission of serial data and converting them into digital data. This purpose is to be served by the Arduino board where it acts as the converter of

serial data to digital data. For example, the Arduino can be so programmed that when it receives the character 'B' via serial communication it has to provide a positive voltage to one of the pins (let say pin 12) which shall give the output.

The Arduino board sends commands that are perceived by a relay switch based on the instruction given by the android phone (either ON or OFF). The relay acts as a switch used for providing AC supply to the electrical appliance. The output obtained from the Arduino is converted to 12 volts by using L293DNE motor driver IC and that is fed to the relay switch as input thus switching the AC supply as output. Thus we are able to switch ON/OFF any electric device or home appliance by a single tap on the android phone.

5   PROGRAMMING PART

The Arduino Nano V3.0 is programmed using Arduino software developed by the Arduino Company. The programming of the Arduino software is based on the C/C++ language. The software provides an open source interactive platform for the user to communicate with the physical world using the C/C++ language for making real life robotic prototypes and electronic gadgets. The

Bluetooth module communicates with the Arduino using serial communication having a baud rate of 9600 bits per second. To initialize serial communication in Arduino the command used is:

```
Serial.begin (9600);
```

This command states that serial communication will initiate with a baud rate of 9600 bits per second. Before beginning the serial communication the output pins are defined and declared. After declaring the output pins and initializing serial communication it is checked for the data coming through serial transmission. When Bluetooth module receives serial data from android phone it gives the data to Arduino for decoding and converting them into digital data for the output. Now it is checked whether the data is greater than 0 or not. After finding out that the data is greater than 0 we go for checking whether we are getting our desired data or not. If we succeed in getting our desired input we go for defining the output. For this the following code has to be written:

```
if (Serial.available()>0)

{
        unsigned char val=Serial.read();
```

If we go for transmitting a character for example 'A' or 'i' we simply need to declare Serial.read() for serial communication. But if we go for transmitting an integer like 1, -2, etc we go for declaring Serial.read()-48 in the program code. This is done because it is defined in the serial data chart that any data sent in serial communication is only a character even if it is an integer. For example the integer 0 is considered as a character '0' whose value is 48. So if we are going to send the number 2 as serial data the actual value transmitted would be 50 (2+48). In that case we can go for the following code:

```
int val=Serial.read()-48;
```

Hence if we want to send the number 2 writing this code the actual value sent would be 50-48 = 2. After obtaining the serial data we go for converting it to digital data based on our requirement using the following code:

```
if (val==1)
{
        digitalWrite(pin1, HIGH);
        Serial.println("BULB IS ON");
}
else if (val==0)
{
        digitalWrite(pin1, LOW);
        Serial.println("DEVICE OFF");
}
```

Thus the program code is written in this manner and it is fed to the Arduino board and the Arduino gives out the output and the process continues as it is to be made.
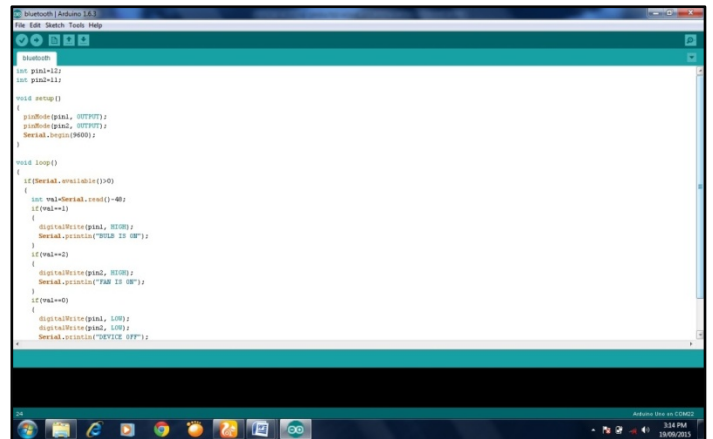

FIG 2. THE ARDUINO PROGRAM CODE

6 CONCLUSIONS

Home automation has become a necessity these days for the common man. The craze of using android phones is also increasing since it provides the user a variety of applications in solving various problems. With the rapid increase in technology human beings have always developed a craze for becoming lazier than before. Hence the operation of home appliances using an android phone from a distance can be a great achievement in serving the society. This is also a cheap mode of operation as a result it will also be effective in serving the common men and their families. Unlike radio waves Bluetooth have a higher frequency and no interference occurs once connected to a device which is advantageous for the purpose. The use of Bluetooth technology in home automation will serve the best using the above mentioned method to the society.

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BIOGRAPHY

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