ARDUINO BASED HOME APPLIANCE CONTROL

A PROJECT REPORT

Submitted in partial fulfillment of the requirements for the course

EEE 4020 EMBEDDED SYSTEM AND DESIGN

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Arduino based Home Appliance Control

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Abstract*—Life getting easier and simpler in nearly all aspects with the advancement of automation technology. With lighting increase in the number of users who are using Internet over the past decade, this has made Internet now a daily part of life and emerging technology. The project puts forward an efficient and easy implementation of IOT (Internet Of Things) which is used for monitoring and controlling home appliances with the use of a smartphone. This home automation will be using a portable smartphone as its user interface. The purpose of this is to save electric power and also human effort. The home automation system differs than most other systems in such a way that one can control the appliances and operate the system from anywhere around the world as long as they have access to internet connection. The*

application made in this project will be featuring voice recognition that would take commands from user in order to control different home appliances that would be connected via IOT.

Keywords— *Internet of Things, IOT, Home Automation, Smartphone, Voice Recognition, Arduino*

I. INTRODUCTION

As Internet of Things (IOT) is still its very early stage of emergence hence there is not a specific definition which can be embraced. However, the most easy and simplistic way to explain is the connection of various devices to Internet and make the communication of machine-to-machine happen. There are many existing and also well-established home automation systems but these ones take advanced planning which has to be carried while the construction of the building, but as for the already constructed buildings the cost of implementing such system is very high. Hence using wireless communication for the implementation of home automation will be of great help, not only it will reduce the installation cost but also manual labor.

II. EASE OF USE

A. Advantages

Nowadays the use of wireless systems like Wi-Fi has become an absolute necessity and also is now more common in building automation and house. There are quite a few plus points when it comes to wireless networking.

i) **Cost: -** The installation cost is reduced considerably when compared to wired networking as that would need cabling, labor and the materials, which can cost quite a lot.

ii) **Scalability: -** As the IOT industry growing as we speak, extension of the network system is necessary. Here wireless installations takes the upper hand, as extending wired installations is tedious and also the cost will be higher.

iii) **Aesthetics: -** Lying around cables can attract dust and also does not give a clean smart home feel. Since in wireless network systems wires are almost eliminated, this issue is out of question.

iv) **Integration of smartphones: -** Thou can connect smartphones to the wireless network from anywhere as the physical location of smartphone isn't necessary because of internet connection.

So looking at the above points and considering them, wireless technology is a fascinating choice in renovation and for new installations.

B. Previous Work

Home automation or Smart home isn't a new term for the society however, it is still far more away from people's vision and its implementation. The field of home automation is growing rapidly as the electronic based technologies are converging day by day. Variety of home automation systems have been constructed where the control is through Bluetooth, internet, short message service (SMS).

The objective of this paper is to help and assist handicapped and old aged people. It gives us the basic idea on how to control various home appliances and provide a security using Smartphone. The design consists of Android phone with home automation application, Arduino Mega ADK. User can interact with the android phone and send control signal to the Arduino ADK which in turn will control other embedded devices/sensors.

The prime objective of this paper is to design and implement a control and monitor system for smart house. Smart home automation system which consists of many systems that controlled by the LabVIEW software as the main controlling system in this paper. Also, the smart home system is supported by remote control system as a sub-controlling system. The system is also connected to the internet to monitor and control the house appliances from anywhere in the world using LabVIEW.

III. SYSTEM DESIGN

A low-cost smart home system for remotely controlling also for monitoring the smart home environment is presented. The system consists of an app which is developed using MIT app developer and by using Arduino micro-controller The Arduino micro-controller acts as a main controller that hosts and performs the actions which are necessary to be carried out.

A. Components Used

MIT App Developer, Bluetooth module (HC-05), Arduino Uno, Diode (IN4007), Transistor (2N2222), DC & AC voltage source, Resistor.

B. Details of components

i. MIT app developer

MIT App Inventor is a web application integrated development environment originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create application software(apps) for two operating systems (OS): Android, and iOS

It uses a graphical user interface (GUI) very similar to the programming languages Scratch (programming language) and the Star Logo, which allows users to drag and drop visual objects to create an application that can run on Android devices, while a App-Inventor Companion (The program that allows the app to run and debug on) that works on iOS running devices are still under development.

ii. Bluetooth module (HC-05)

Bluetooth is a short-range wireless technology standard that is used for exchanging data between fixed and mobile devices over short distances using UHF radio waves in the ISM bands, from 2.402 GHz to 2.48 GHz, and building personal area networks (PANs)

The HC-05 is a popular Bluetooth module which can add two-way (full-duplex) wireless functionality to your projects.

iii. Arduino Uno

Arduino Uno is a micro-controller board based on the ATmega328P (data-sheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the micro-controller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can make projects and tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

iv. Diode (IN4007)

The 1N400x (or 1N4001 or 1N4000) series is a family of popular one-ampere general-purpose silicon rectifier diodes commonly used in AC adapters for common household appliances. Its blocking voltage varies from 50 volts (1N4001) to 1000 volts (1N4007)

v. Transistor (2N2222)

The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds. It was originally made in the TO-18 metal can as shown in the picture.

The 2N2222 is considered a very common transistor, and is used as an exemplar of an NPN transistor. It is frequently used as a small-signal transistor, and it remains a small general-purpose transistor of enduring popularity.

Other components include.

vi. DC voltage source

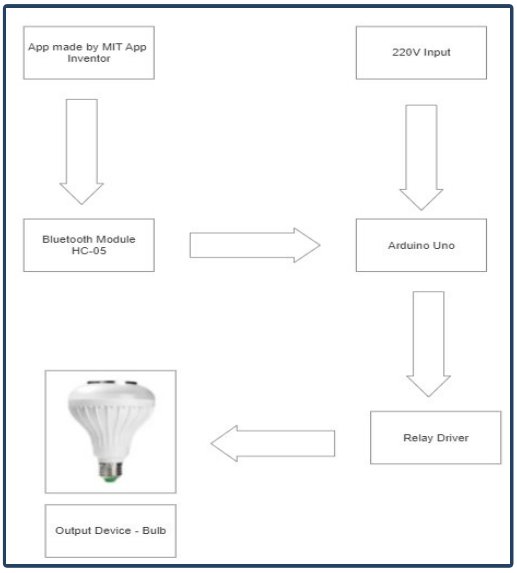
vii. AC voltage source

viii. Resistors

The software we used for simulation was **Proteus** which is used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

IV. WORKING

So, to explain the working of the project we will take snippets of the Simulation that we made so that we can easily explain each part of our project. we will explain the working of the project by taking each component individually first and explaining their role in the project and at the end we will explain how all these components work together to bring forth the results of our project



A. *Circuit diagram*

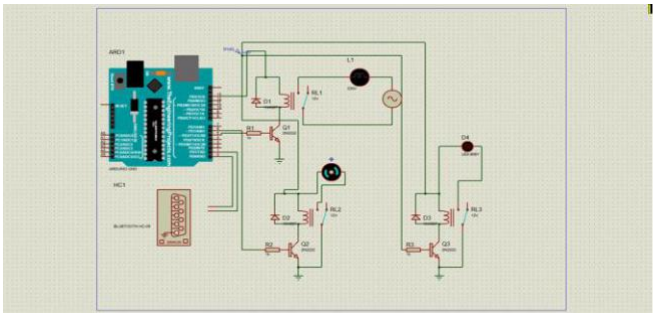


Figure 4.1

V. EXPLANATION OF COMPONENTS

A. *MIT app developer*

Figure 5.1

The Figure 5.1 gives a layout of the app we developed for the working of our projects where we have different programmable buttons for switching components on and off according to our needs we also have a voice recognizing button which helps us control the Components using our voice commands these include the turning on and off of each components individually or Switching all of them on and off together We made this app using MIT's app developer site and to explain the working of the app itself we will take a look into its block diagram.

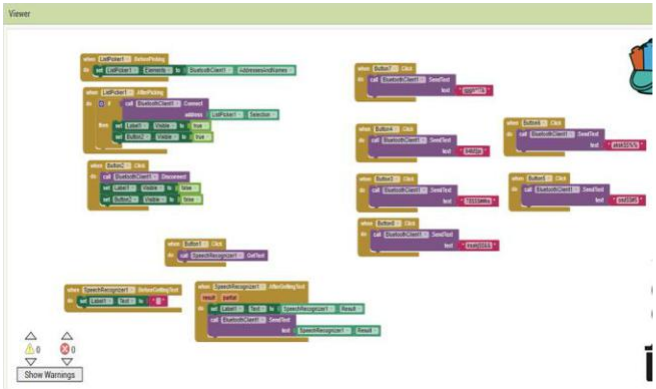


Figure 5.2

In the figure we can see that each button when pressed gives a text command to the Bluetooth module which is latter going to be recognized by the Arduino the speech recognizer sends our speech as a text output to the Bluetooth module and similarly Arduino recognizes it.

B. *Bluetooth Module*

The Bluetooth module helps transferring data from the app to the Arduino to be processed this acts as our major component for iot as it is the component that helps us interconnect between devices seamlessly and makes our project possible.

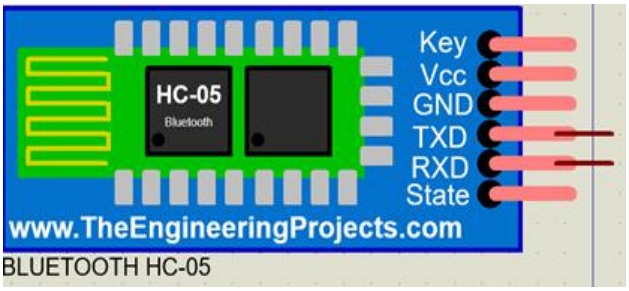


Figure 5.3

We can see that the Bluetooth module gives signal from the RXD and TXD ports and these are the same ports of the Arduino we will use to receive input.

C. *Arduino*

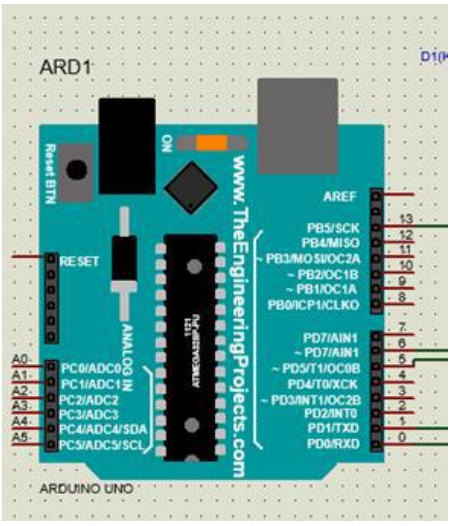


Figure 5.4

We use the Arduino to take the commands from the Bluetooth module from TXD and RXD pin represented in Figure 5.4 These commands are then processed by the Arduino module with the help of hex file loaded inside of it shown in figure 5.5.

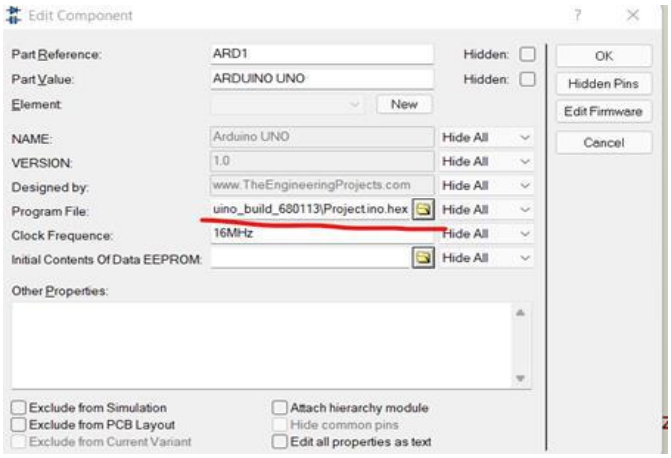


Figure 5.5

The hex file is generated inside the Arduino ide software that commands the Arduino to Provide signals to pin 13,6,5 which are our output nodes as seen in figure 5.4. According to the user input given by the app to the Bluetooth module to the Arduino. The Code is given bellow: -

Coding

```
String readString;
void setup(){
  Serial.begin(9600);
  pinMode(6,OUTPUT);
  pinMode(5,OUTPUT);
  pinMode(13,OUTPUT);
}
void loop(){
while(Serial.available()){
    delay(3);
    char c=Serial.read();
    readString+=c;
  }
if(readString.length() >0)
{
  Serial.println(readString);
  if(readString == "turn on LED")
  {digitalWrite(13,HIGH);}
  else if(readString == "turn off LED")
 {digitalWrite(13,LOW);}
 else if(readString == "jgjgh**7&")
 {digitalWrite(13,HIGH);}
 else if(readString == "ksakj$$&&")
 {digitalWrite(13,LOW);}
 else if(readString == "turn on fan")
 {digitalWrite(6,HIGH);}
 else if(readString == "turn off fan")
 {digitalWrite(6,LOW);}
 else if(readString == "78$$$##ks")
 {digitalWrite(6,HIGH);}
 else if(readString == "94M$js")
 {digitalWrite(6,LOW);}
 else if(readString == "turn on light")
 {digitalWrite(5,HIGH);}
 else if(readString == "osd$$#5")
 {digitalWrite(5,HIGH);}
 else if(readString == "turn off light")
 {digitalWrite(5,LOW);}
 else if(readString == "aksk$$%%")
 {digitalWrite(5,LOW);}
 else if(readString == "turn on all")
 {digitalWrite(6,HIGH);
 digitalWrite(5,HIGH);
 digitalWrite(13,HIGH);}
 else if(readString == "turn off all")
 {digitalWrite(6,LOW);
 digitalWrite(5,LOW);
 digitalWrite(13,LOW);}
 readString = "";
}}
```

If we do the analysis of this code we realize that the Different pins get activated according to the text input they receive from the Bluetooth module to Arduino and the Arduino decides pins functions accordingly.

The Arduino acts as the brain of our project which tells different project parts to work accordingly.

D. ***DC voltage***

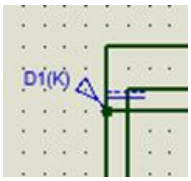


Figure 5.6

We take a DC voltage of 12 V to provide Voltage to each component can be seen from Circuit Diagram Figure given above.

E. ***Light***

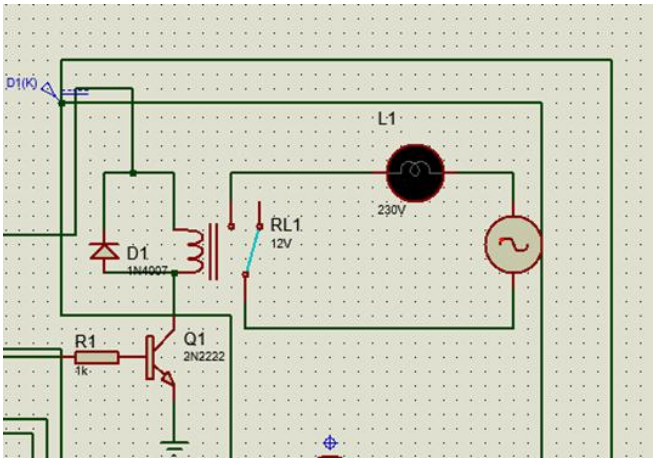


Figure 5.7

We have a 230 V AC source voltage connected to the light to provide it with sufficient voltage as shown in Figure 5.7. A relay of 12v which act as a turn on and off switch is connected to the light and source loop which commands circuit to work or not to work. For this relay to work we also needs some Voltage this is provided by the DC voltage we connected before. A Diode is connected the voltage only flows one way from D1 and not when the relay works.

This circuit is also connected to the transistor that receives the signal from the Arduino. When it receives signal from Arduino it transfers it to the relay to on it otherwise it dissipates voltage from D1 Voltage source to the ground. A resistor of 1k is provided from providing only a specific amount of voltage to the transistor preventing it from getting destroyed in the process.

F. ***LED and FAN***

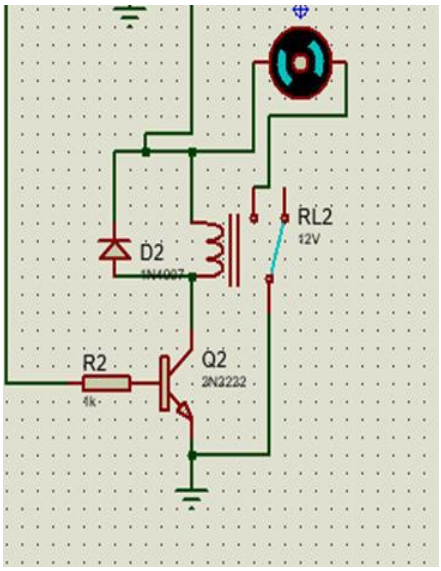


Figure 5.8

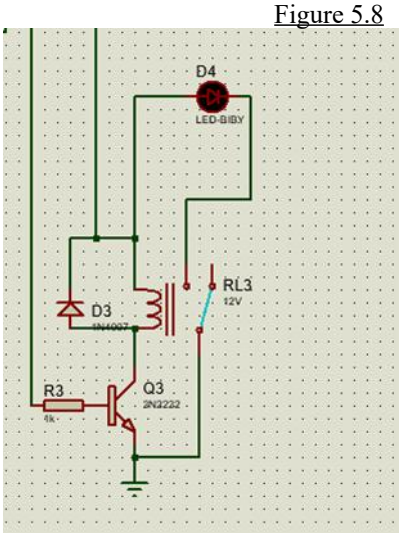


Figure 5.9

These Components also work on the same principle but they take voltage Directly from Voltage source as they don't require large amount of voltage.

VI. SIMULATION

A. ***Proteus Circulation***

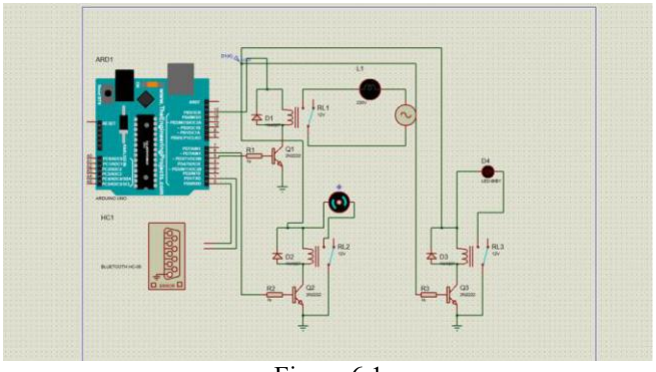


Figure 6.1

B. ***Giving commands through app***

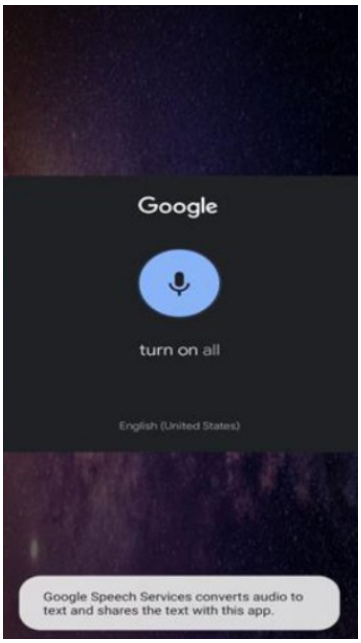


Figure 6.2

C. ***Working simulation***

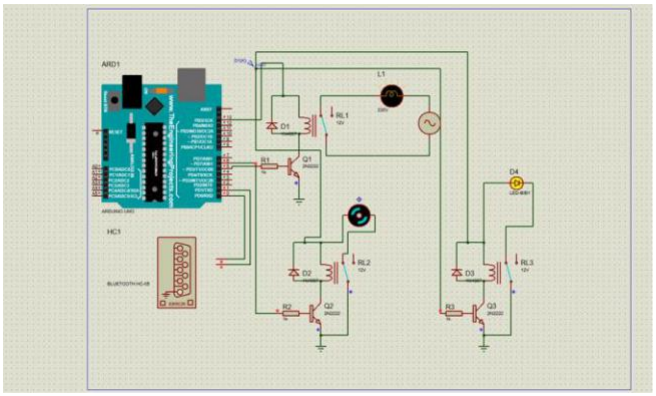
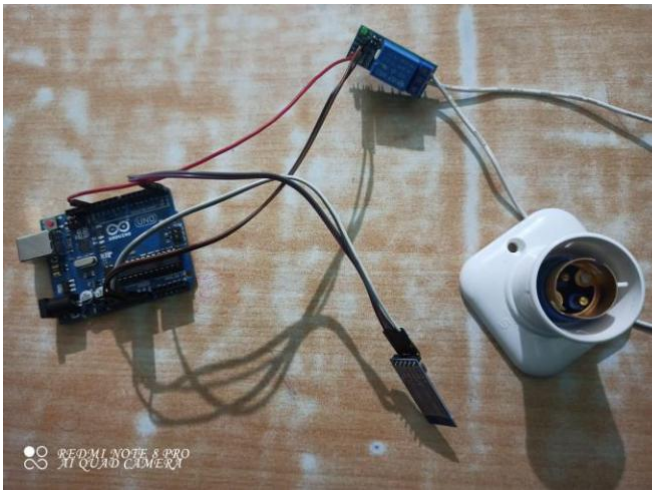
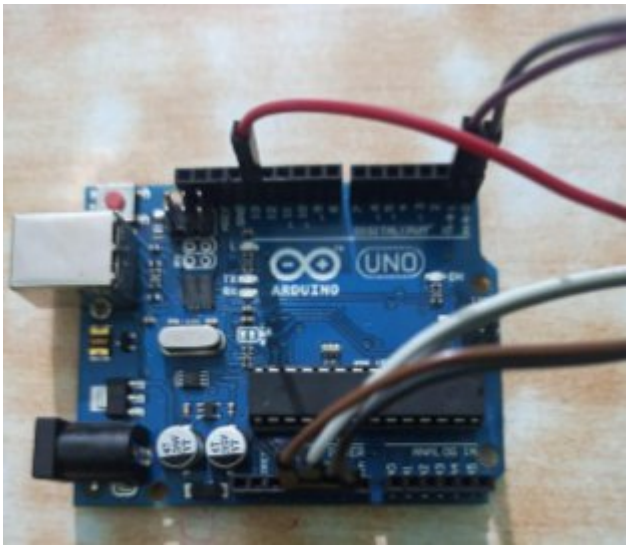


Figure 6.3

VII. HARDWARE

We also did a hardware simulation of the project using the same concepts and circuit diagram that we have used in our simulation. here we have included some snippets of our working project through hardware means





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