

WALCHAND COLLEGE OF ENGINEERING, SANGLI
(Government-Aided Autonomous Institute)



Department of Electronics Engineering
Third Year B. Tech. Project Synopsis
(Mini Project-2)

**“HOME AUTOMATION USING BLUETOOTH
MODULE AND ARDUINO”**

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INDEX

SR.NO.	CONTENT	PAGE NO.
1.	Abstract	3
2.	INTRODUCTION 2.1 Introduction 2.2 Work Objective 2.3 Bnefits of Home Automation 2.4 Overview	4 4 4 5
3.	LITERATURE SURVEY 3.1 Introduction to Literature Survey 3.2 Literature Review	6 6
4.	COMPONENTS 4.1 Software Components 4.2 Hardware Components	7 8
5.	DIAGRAMS 5.1 Block Diagram 5.2 Pin Diagram 5.3 Circuit Diagram	15 16 17
6.	CODE 6.1 Arduino IDE code	18
7.	PROCEDURE	19
8.	ADVANTAGES AND DISADVANTAGES 8.1 Advantages 8.2Disadvantages	20 21
9.	CONCLUSION 9.1 Conclusion 9.2 Future Scope	22
10.	REFERANCES	23

ABSTRACT

Now a days, with the rapid growth of technologies in the developing countries as well as developed countries, a smart home automation system is being adopted in many places. The developed system is very easy to operate by using smartphone and it is especially recommended for its low installation and maintenance cost. This new System has wide application and much more advantages compared to traditional method. Also home automation has very good future scope considering the development taking place in “Cloud Based Technology”, by which we can control the whole System from any where in the world. Earlier all electrical appliances was manually controlled through Switches and relays, but by using this technology we can automatically control these system through our smartphones as mentioned above. Generally for the home automation we use microcontroller such as Arduino and 8051 which can be programmed virtually in a software and hardware both for demonstration purpose by using software like Proteus and Arduino ide. Home Automation can not only be used for the control of the Appliances in houses, but also can be used to monitor various sensors, which can make our day to day life tasks easy.

INTRODUCTION

2.1 Need for Home Automation System:

a) Keep Your Home Safe:

With smart home devices, you can remotely monitor your home appliances and ensure that all devices are safely switched off. One of the biggest advantages of home automation is that it keeps your family safe, and prevents accidental fires, water leaks, gas leaks, and other disasters.

b) Keep Your Home Secure:

As mentioned above, Home automation can also monitor the sensors, hence smart door lock becomes the main highlight of home automation, for smart home system. Smart door lock allows us to control remotely unlock the doors for our family members or for visitors even if we aren't present in home.

c) Enhance the surveillance & security of cameras:

With a home automation system, you can quickly track what's happening – both inside and outside – the home, even while you aren't there. With video recordings of your home, you can keep an eye on who is arriving at your home.

Additionally, these security cameras also record footage of suspicious onlookers lurking around your property. This way, you can alert concerned security authorities and prevent potential break-ins and robberies.

d) Saves Your Energy Bills:

Smart homes also help you in saving money. Your energy bills are reduced as you can remotely turn off devices, that you aren't using. This is a huge convenience, and you have complete control of household appliances and devices, without any extra effort.

2.2 Work Objective:

The Main objective of the Project is to demonstrate the implementation of home automation system on Proteus Software by using arduino microcontroller and Bluetooth Module HC-05 through Smartphone App

2.3 Benefits of Home Automation System:

a) Makes Life Easier and can lessen our work Load

- b) Will Save our valuable time and Increase our work efficiency.
- c) System is easy to implement and is Cost Effective
- d) Simplifies Various Daily Life Tasks from opening of water tap & pump to controlling the switching mechanism of electrical & electronic products.

2.4 Overview:

This project demonstrates a low cost and user friendly remote controlled home automation system using Arduino Board, Bluetooth module & Smartphone. A smartphone application is used in the system which allows us to control various appliances in the house like fan, bulb, night lamp.

The software used for implementation of the components is Proteus where the design of the system is based on Arduino Board, Bluetooth Module & smartphone Application. Bluetooth module HC-05 is interfaced with Arduino Board and home appliances are connected to the Arduino board via relay. Smartphone application is used to establish Serial communication between smartphone and Bluetooth module which is further connected with Arduino board.

Once the Bluetooth Connections are done, then by simply giving command through Smartphone we can control the operation of relay to further control the operation of electrical appliances. The code used to program the Arduino is written in 'Arduino IDE' software. As Arduino IDE provides addons for Arduino UNO board and we can write, compile and run Program required for Arduino UNO in Arduino IDE.

Literature Survey

3.1 Introduction to literature Survey:

When people think about home automation, most of them may imagine living in a smart home: One remote controller for every household appliance, cooking the rice automatically, starting air conditioner automatically, heating water for bath automatically and shading the window automatically when night coming. To some extent home automation equals to smart home. They both bring out smart living condition and make our life more convenient and fast.

3.2 Literature Review:

- Faculty of Department of Computer & Electrical Engineering, Rajshahi University had published paper on “Cost Effective Bluetooth Technology Based Home Automation System Using Smart-phone Application”, which briefly gives idea about the circuit construction home automation.
- Muhammad Asadullah proposed paper on “Smart Home Automation Using Bluetooth Technology” which was used for reference.
- S. M. Anamul Haque, S. M. Kamruzzaman and Md. Ashraful Islam 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 briefs about the automation part using of the project using software.

COMPONENTS

4.1 SOFTWARE COMPONENTS:

1. PROTEUS SOFTWARE:



The Proteus Design Suite is a proprietary software tool suite 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](#). The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the micro-controller part on the schematic. The PCB Layout module is automatically given connectivity information in the form of a [netlist](#) from the schematic capture module.

2. ARDUINO IDE:



The [Arduino Integrated Development Environment \(IDE\)](#) is a [cross-platform](#) application (for [Windows](#), [macOS](#), [Linux](#)) that is written in functions from [C](#) and [C++](#). It is used to write and upload programs to [Arduino](#) compatible boards, but also, with the help of third-party cores, other vendor development boards.. The Arduino IDE supplies a [software library](#) from the [Wiring](#) project, which provides many common input and output procedures.

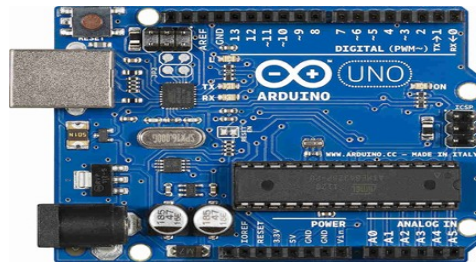
3. BLUETOOTH MODULE:



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). It was originally conceived as a wireless alternative to [RS-232](#) data cables. It is mainly used as an alternative to wire connections, to exchange files between nearby portable devices and connect [cell phones](#) and music players with [wireless headphones](#). Here we used DT_bluetooth.

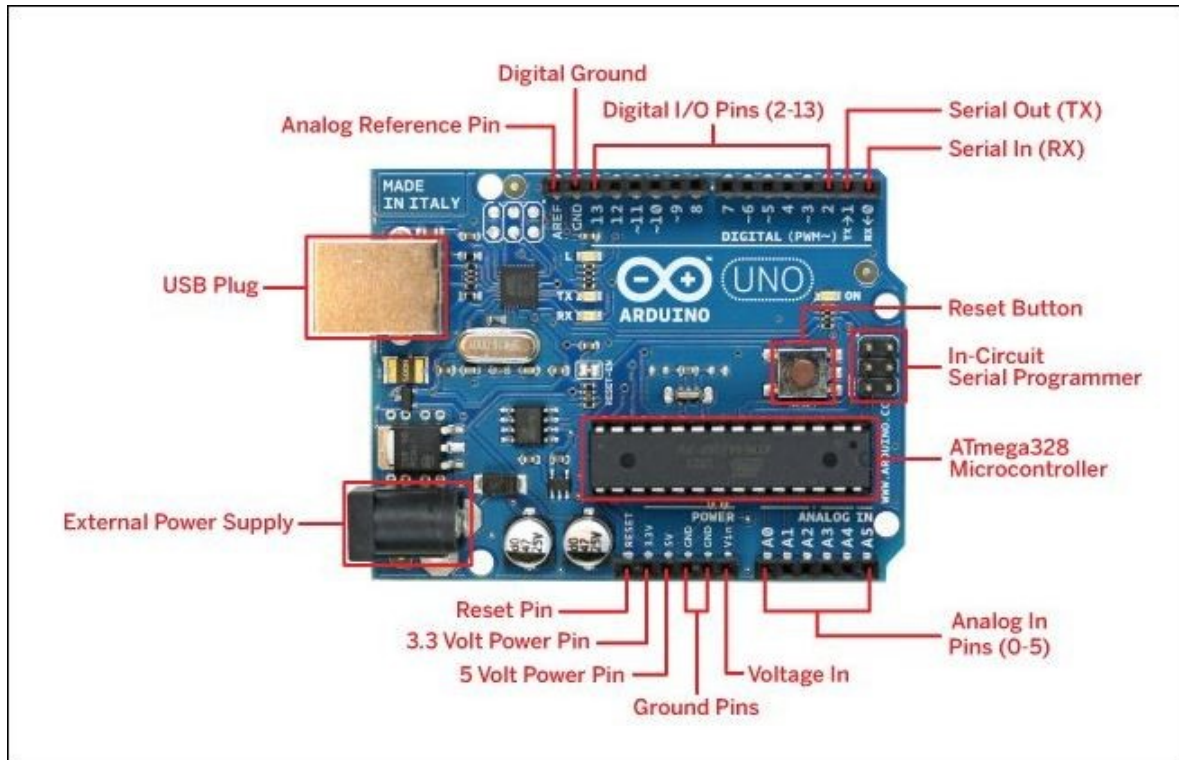
4.2 HARDWARE COMPONENTS:

1. ARDUINO UNO:



Arduino Uno is a microcontroller chip dependent on the Atmega328(datasheet) with 14 computerized I/o pins, in which 6 pins can be utilized as yields, 6 pins are utilized as simple information sources. It has 16 MHz clay resonator ,a USB association, a power jack and a reset button. The microcontroller has 32kB of ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides serial communication capability via UART, SPI and 12C.Because of well design in the form of arduino it is easy to understand. In Arduino we use high level of programming language like C language, C++ language ect. It is easy to understand and user friendly language. It has much advantage like multitasking, automation, time domain etc.

PIN DESCRIPTION OF ARDUINO UNO:



The power pins of an Arduino board include the following :

Vin:

The input voltage or Vin to the Arduino while it is using an exterior power supply opposite to volts from the connection of USB or else RPS (regulated power supply). By using this pin, one can supply the voltage.

5Volts:

The RPS can be used to give the power supply to the microcontroller as well as components which are used on the Arduino board. This can approach from the input voltage through a regulator.

3V3:

A 3.3 supply voltage can be generated with the onboard regulator, and the highest draw current will be 50 mA.

GND:

GND (ground) pins

Memory:

The memory of an ATmega328 microcontroller includes 32 KB and 0.5 KB memory is utilized for the Boot loader), and also it includes SRAM-2 KB as well as EEPROM-1KB.

Input and Output:

We know that an arduino Uno R3 includes 14-digital pins which can be used as an input otherwise output by using the functions like pin Mode (), digital Read(), and digital Write(). These pins can operate with 5V, and every digital pin can give or receive 20mA, & includes a 20k to 50k ohm pull up resistor. The maximum current on any pin is 40mA which cannot surpass for avoiding the microcontroller from the damage. Additionally, some of the pins of an Arduino include specific functions.

Serial Pins:

The serial pins of an Arduino board are TX (1) and RX (0) pins and these pins can be used to transfer the TTL serial data. The connection of these pins can be done with the equivalent pins of the ATmega8 U2 USB to TTL chip.

External Interrupt Pins:

The external interrupt pins of the board are 2 & 3, and these pins can be arranged to activate an interrupt on a rising otherwise falling edge, a low-value otherwise a modify in value

PWM Pins:

The PWM pins of an Arduino are 3, 5, 6, 9, 10, & 11, and gives an output of an 8-bit PWM with the function analog Write ().

SPI (Serial Peripheral Interface) Pins:

The SPI pins are 10, 11, 12, 13 namely SS, MOSI, MISO, SCK, and these will maintain the SPI communication with the help of the SPI library.

LED Pin:

An arguing board is inbuilt with a LED using digital pin-13. Whenever the digital pin is high, the LED will glow otherwise it will not glow.

TWI (2-Wire Interface) Pins:

The TWI pins are SDA or A4, & SCL or A5, which can support the communication of TWI with the help of Wire library.

AREF (Analog Reference) Pin:

An analog reference pin is the reference voltage to the inputs of an analog i/ps using the function like analog Reference().

Reset (RST) Pin:

This pin brings a low line for resetting the microcontroller, and it is very useful for using an RST button toward shields which can block the one over the Arduino R3 board.

Communication:

The communication protocols of an Arduino Uno include SPI, I2C, and UART serial communication.

UART:

An Arduino Uno uses the two functions like the transmitter digital pin1 and the receiver digital pin0. These pins are mainly used in UART TTL serial communication.

I2C :

An Arduino UNO board employs SDA pin otherwise A4 pin & A5 pin otherwise SCL pin is used for I2C communication with wire library. In this, both the SCL and SDA are CLK signal and data signal.

SPI Pins:

The SPI communication includes MOSI, MISO, and SCK.

MOSI (Pin11):

This is the master out slave in the pin, used to transmit the data to the devices

MISO (Pin12):

This pin is a serial CLK, and the CLK pulse will synchronize the transmission of which is produced by the master.

SCK (Pin13):

The CLK pulse synchronizes data transmission that is generated by the master. Equivalent pins with the SPI library is employed for the communication of SPI. ICSP (in-circuit serial programming) headers can be utilized for programming ATmega microcontroller directly with the boot load

TECHNICAL SPECIFICATION OF ARDUINO UNO:

MCU	ATmega382P
Architecture	AVR
Operating Voltage	5V
Input Voltage	6V-20V (Limit) 7V-12V (Recommended)
Clock Speed	16 MHz
Flash Memory	32KB (2 KB of this used by bootloader)
SRAM	2 KB
EEPROM	1 KB

Digital IO Pins	24 (Out of which 6 can produce PWM)
Analog Input Pins	6

2. BLUETOOTH MODULE :

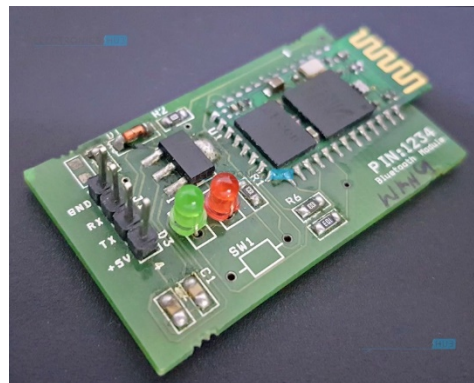


Fig.HC-05 Bluetooth Module

HC-05 Bluetooth module is used to connect the microcontroller with android application. Bluetooth receive the information from user and send to the microcontroller (Arduino Uno). It is simple to use Bluetooth Serial Port Protocol(SSP), designed as wireless serial connection setup. The Bluetooth of serial port module is Advanced Bluetooth v2.0+Enhanced data Rate at 3Mbps modulation with 2.4 GHz radio receiver with BB(base band). The Bluetooth of Rx and Tx pins are connected to the arduino pins of Tx and Rx respectively . HC-05 module is a simple to utilize Bluetooth SPP (Serial Port Protocol) module, intended for straightforward remote sequential association setup. It utilizes CSR Blue canter 04-External single chip Bluetooth framework with CMOS innovation and with AFH (Adaptive Frequency Hopping Feature). It has the impression as little as 12.7mmx27mm. The figure 4(b) of Bluetooth HC-05 module is given below.

TECHNICAL SPECIFICATIONS OF HC-05 BLUETOOTH MODULE :

Operating Voltage: 4V to 6V (Typically +5V)

Operating Current: 30mA

Range: <100m

Works with Serial communication (USART) and TTL compatible

Can be easily interfaced with Laptop or Mobile phones with Bluetooth

3. RELAY DRIVER :

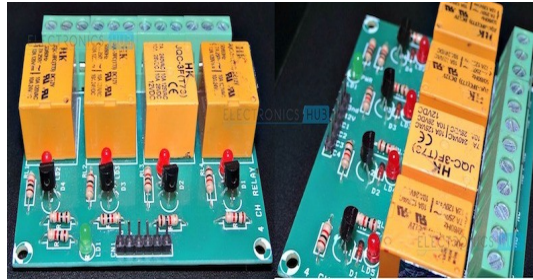


Fig. Relay Driver Circuit

Relay is an electromagnetic switch which is used to defer two circuits electrically and connect magnetically. When arduino transmit the signal then relay driver receive signal and start its work. They are frequently used to interface an electronic circuit (working at low voltage) to an electrical circuit which works at extremely high voltage. For instance, a hand-off can make a 5V DC battery circuit to switch 230V AC mains circuit. In this way a little sensor circuit can drive, say, a fan or an electric knob. A transfer switch can be separated into two sections: information and yield. The info area has a loop which creates attractive field when a little voltage from an electronic circuit is connected to it. This voltage is known as the working voltage. Generally utilized transfers are accessible in various arrangement of working voltages like 6V, 9V, 12v, 24V and so on. In a basic hand-off there are three contactors: ordinarily shut (NC), regularly open (NO) and normal (COM). At no info express, the COM is associated with NC. At the point when the working voltage is connected the transfer curl gets charged and the COM changes contact to NO. Diverse transfer setups are accessible like SPDT and DPDT which have distinctive number of changeover contacts. By utilizing legitimate blend of contactors, the electrical circuit can be turned on and off. Relay circuit shown in fig4(c).

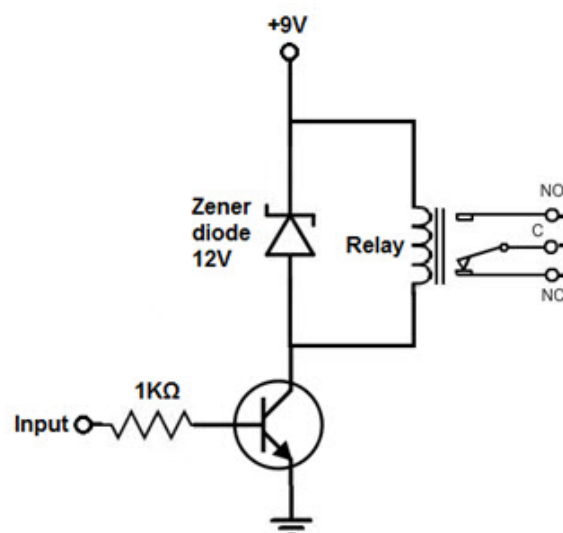
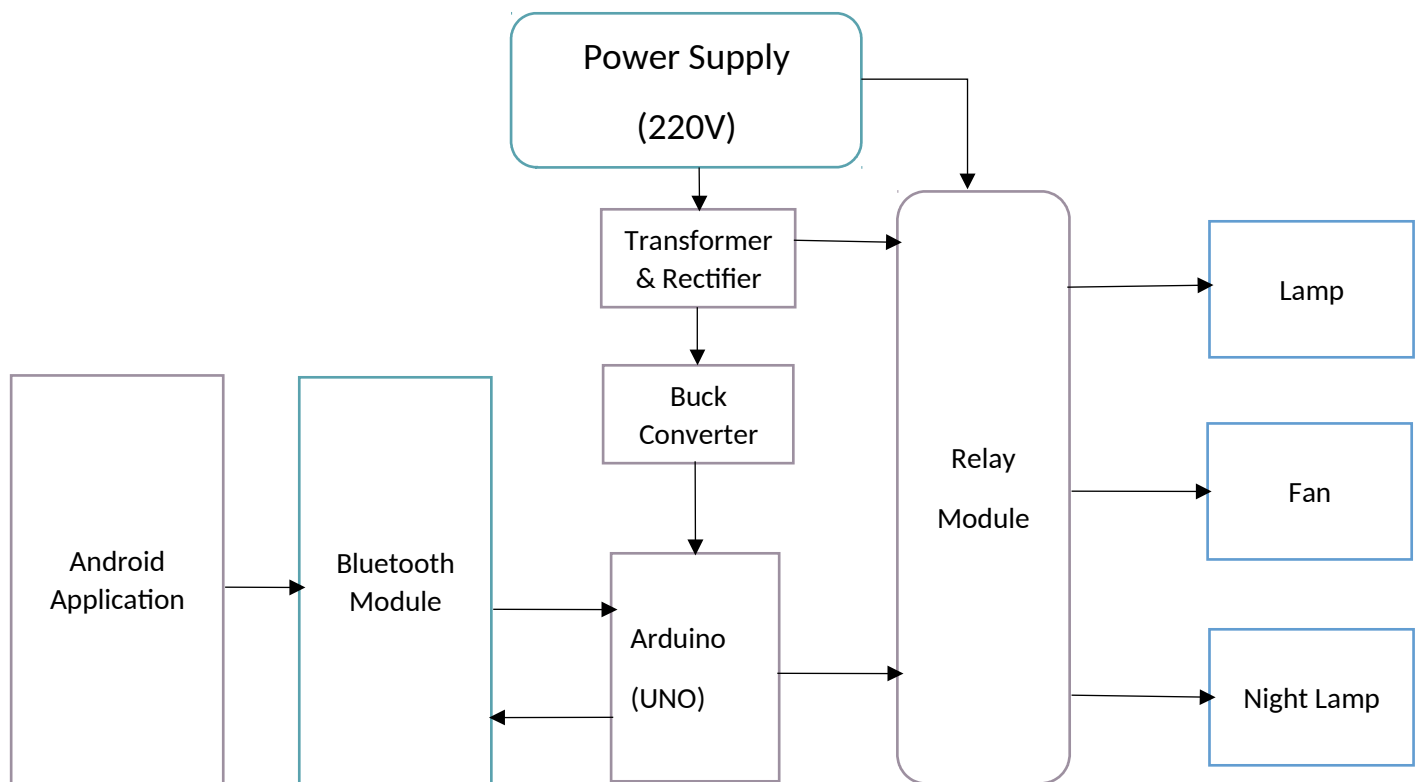


Fig. Relay circuit diagram

So as to drive the hand-off, we use transistor and just less power can be utilized to get the transfer driven. Since, transistor is an intensifier so the base lead gets adequate current to make increasingly current stream from Emitter of Transistor to Collector. In the event that the base once gets control that is adequate, at that point the transistor lead from Emitter to Collector and power the transfer. When the power is transmit to the relay works as a switch due to electromagnetic effect so that we can switch ON or OFF our home appliances.

5.1 Block Diagram



5.2 Pin Diagram

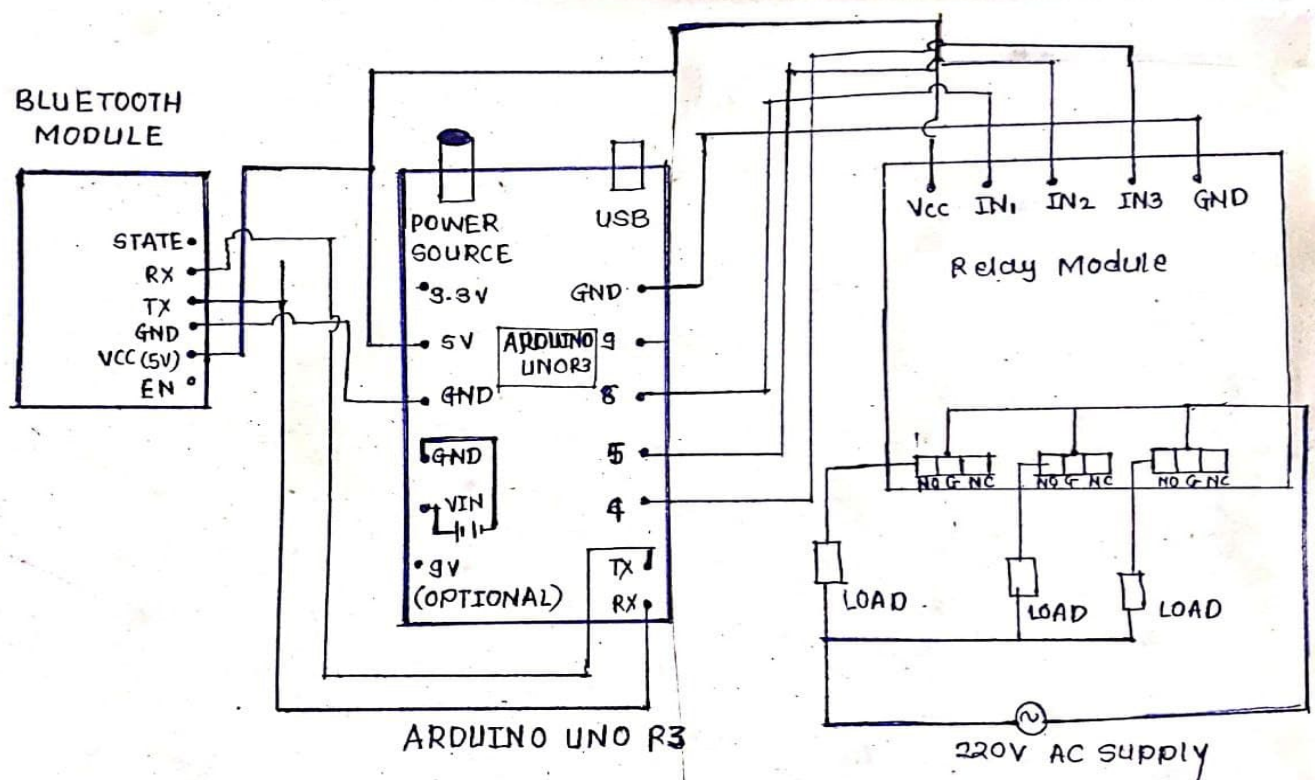
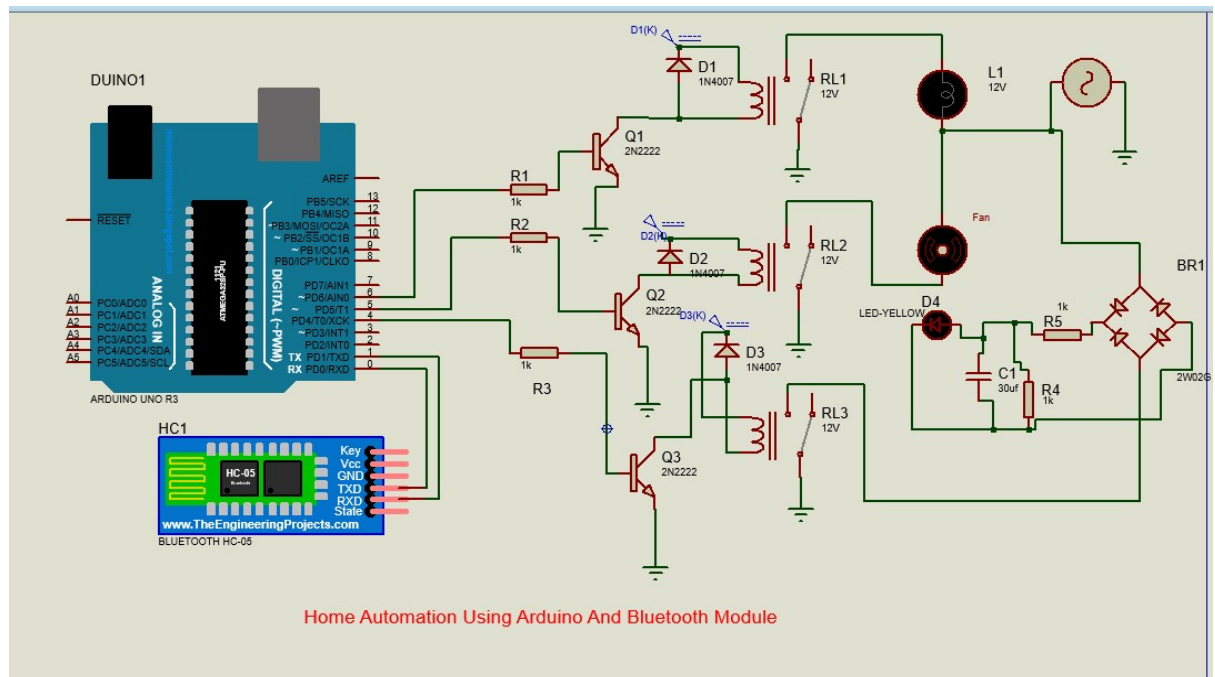


FIG. CIRCUIT DIAGRAM OF HOME AUTOMATION SYSTEM USING ARDUINO AND BLUETOOTH MODULE

5.3 CIRCUIT DIAGRAM



The above circuit diagram gives the brief information about our project.

Firstly you can see that the Arduino and Bluetooth module HC-05 are connected by the terminals RX & TX to each other. Here Bluetooth module acts as a master slave device which acts as master here and gives command to the Arduino. Here we can see that from the digital pins of Arduino, from pin number 4,5,6 the digital output is taken and this digital output is provided as input to the relay module circuit. Also here resistors of high value are provided so that to avoid any damage to the components in the Circuit. The Function of diode in the relay driver circuit is that it prevents the damage of the circuit for the back current that is being generated in the circuit.

Also in the circuit diagram you can see that we have used 3 SPDT(Single Pole Double Throw) Relays which operate on the principle of electro-magnetic induction. Speaking about the loads we have light bulb, night lamp and fan connected between NO and ground terminal of relays. Here instead of night lamp we have an LED so to run the LED properly on AC Supply, we have used a bridge circuit, voltage divider Circuit as well as rectifier circuit.

6.1 ARDUINO IDE CODE

```
String voice;
void setup() {
  Serial.begin(9600);
  pinMode(6, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(4, OUTPUT);
}

void loop() {
  while(Serial.available()){
    delay(3);
    char c = Serial.read();
    voice+=c;}

  if(voice.length() >0){
    Serial.println(voice);
    if(voice == "light on")
      {digitalWrite(6, HIGH);}
    else if(voice == "light off")
      {digitalWrite(6, LOW);}
    else if(voice == "fan on")
      {digitalWrite(5, HIGH);}
    else if(voice == "fan off")
      {digitalWrite(5, LOW);}
    else if(voice == "night lamp on")
      {digitalWrite(4, HIGH);}
    else if(voice == "night lamp off")
      {digitalWrite(4, LOW);}
    else if(voice == "all on")
      {digitalWrite(4, HIGH);
       digitalWrite(5, HIGH);
       digitalWrite(6, HIGH);}
    else if(voice == "all off")
      {digitalWrite(4, LOW);
       digitalWrite(5, LOW);
       digitalWrite(6, LOW);}
    voice = "";}
}
```

7.1 PROCEDURE

As explain above first we establish bluetooth connection between the mobile phone and arduino on proteus through Bluetooth Module HC-05. Now we have already written the above code in arduino IDE, but this code is in Human readable form so for the arduino to intercret the code, we will not add this file in it but a file of .hex extension which is obtained after the compilation of the code. Now after this we run the similation in the proteus. While running the simulation make we should make sure that the CPU load on your PC is minimal or else if the load is extensive then the simulation won't run.

Once the simulation is running, we then can give command through our android application since we have alrady established bluetooth connection.

E.g If we give Command 'night lamp on' then digital pin nuber 4 of arduino will be high and the night lamp connected to this will turn on. Thus by giving similar commands 'fan on', & 'light on' , we can make the respective devices on and off.

Hence by mere giving command through your smartphone, we can control various home appliances in the house.

7.2 SIMULATION VIDEO LINK

<https://drive.google.com/file/d/1frhkZe-8DGhfXjcqs-dkQ5ZJilHquKYu/view?usp=drivesdk>

8. ADVANTAGES AND DISADVANTAGES

8.1 Advantages –

- **Managing all of your home devices from one place. -**

The convenience factor here is enormous. Being able to keep all of the technology in your home connected through one interface is a massive step forward for technology and home management. Theoretically, all you'll have to do is learn how to use one app on your smartphone and tablet, and you'll be able to tap into countless functions and devices throughout your home. This cuts way back on the learning curve for new users, makes it easier to access the functionality you truly want for your home.

- **Maximizing home security-**

When you incorporate security and surveillance features in your smart home network, your [home security can skyrocket](#). There are tons of options here -- only a few dozen of which are currently being explored. For example, home automation systems can connect motion detectors, surveillance cameras, automated door locks, and other tangible security measures throughout your home so you can activate them from one mobile device before heading to bed. You can also choose to receive security alerts on your various devices depending on the time of day an alert goes off, and monitor activities in real-time whether you're in the house or halfway around the globe.

- **Saves Time and Money-**

Since we are living in a very fast-paced environment, we don't even have time to worry about our home. With home automation, we can save time going back to our home and make sure everything is order, like if the kids close the door from school or turn on the lights when you get home.

This is the biggest advantage of home automation. With the ability to control the light, whether dimming or turning on/off on specific time will saves homeowner a great ton of money. You can save money through household temperature, with proper automation in window shades and automated thermostat. In addition, you can save gas, by not driving back home if you forgot to turn off appliances or lock the door.

8.2 Disadvantages -

- It can lose connection in certain conditions. Such as bad weather, rainfall, due to thunder, lack of electricity
- It has low bandwidth as compared to Wi-Fi. Just nearly 10-15 meter
- It allows only short range communication between devices. Because of Bluetooth, so to eliminate this disadvantage we used cloud instead of it

CONCLUSION

9.1. Conclusion-

We were successful in developing a system through which the user was given the ability to either control their household appliances through application or by using voice commands. The user is connected to the same network as the module so exchange of signal takes place frequently. This gives users the ability to automate his home without the need to buy expensive smart appliances and sensors.

Home automation system has proven to work satisfactory by connecting sample applications to it were successfully controlled from wireless mobile application thus low cost home automation system was successfully designed, implemented and tested.

9.2 Future scope -

The home automation market is primarily driven by growing need for effective solutions in various domestic applications such as lighting, safety and security, energy management, entertainment (audio and video), and HVAC (heating, ventilation, and air conditioning). High degree of internet connectivity and penetration in developed countries such as the U.S., the U.K., France, and Germany are also contributing to the growth of home automation market globally.

10. REFERENCES:

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- [2] Cost Effective Bluetooth Technology Based Home Automation System Using Smart-phone Application by T M Rubaith Bashir Sezan¹, Munem Shahriar² Mohammad Munem³ and Tasnim Binte Shawkat⁴.
- [3] M. Asadullah and A. Raza "An overview of home automation systems" 2016.
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