

Intelligent Home Automation System using Arduino Uno with HC05 Bluetooth Module

G. Neelavathi

Assistant Professor

Department of Electronic and Communication Engineering
Mahendra Engineering College, Namakkal, India

Abstract— Nowadays, the most of the people are like to prefer automation. Because more time save when the automation is successfully implemented. In this 21st century, already the most of the industries like to prefer automation. Now the engineer’s focus turns into develop the home automation systems. Day by day as the technology get to advancing, so the houses also get smarter. The smart house conventional Switches are shifting to remote controlled switches with centralized control system. This system is very helpful for elderly and physically handicapped people. Because the remote control switches are controlled by the smart phones.

Keywords: Intelligent Home Automation System, Arduino Uno, HC05 Bluetooth Module

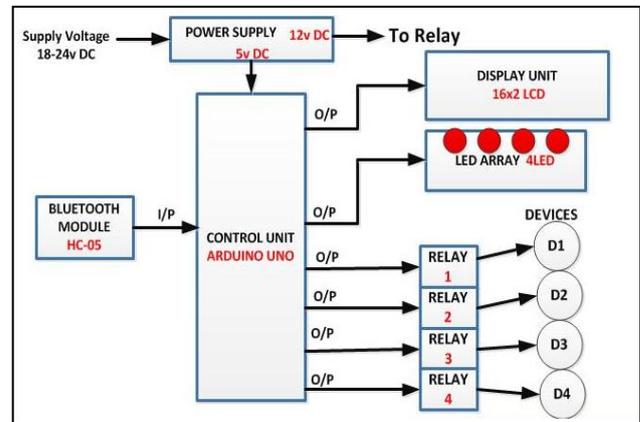


Fig. 1.2: Block Diagram

I. INTRODUCTION

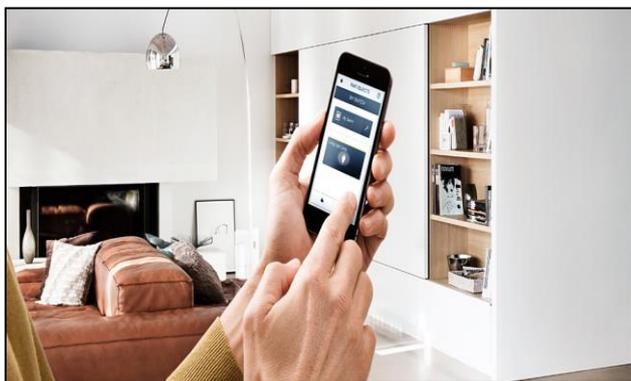


Fig. 1.1: home automation system

Our main objective is control all the home appliances by using the smart phones. In order to achieve this, a Bluetooth module is interfaced to the Arduino at the receiver end while on the transmitter end, GUI application on the smart phones sends ON/OFF commands to the receiver where the loads are connected. It is a low cost and effective and also this project helps to control all the electronic devices by their smart phones.

A. Block diagram

1) Components

- Microcontroller
- Bluetooth module
- Relay module
- 5v Power supply board or 9v battery

B. Microcontroller

Arduino uno is a one of the open source and low cost hardware community. It is cheap and best microcontroller IC which is namely ATMEGA328P. Nowadays Arduino is the mostly trending microcontroller used by the most of the electronics hobbyists’ for all embedded projects. The one of the advantage of the arduino platform is , it is very easy to writing the code based on the simple basic C programs.



Fig. 1.3: Arduino pin diagram

The arduino basically consists of 13 digital I/O pins and 6 analog input pins. Power pins and a USB port also present in it. Minimum operating voltage for the arduino is 5 volt and maximum 12volt.The arduino community have a separate compiler namely arduino ide 1.8.9

If you wish to create your own custom PCB, please use the above schematic. You just have to insert an Arduino bootloader ATmega 168/328 chip in the socket to get it working. All the supporting circuitry for the Arduino is included.

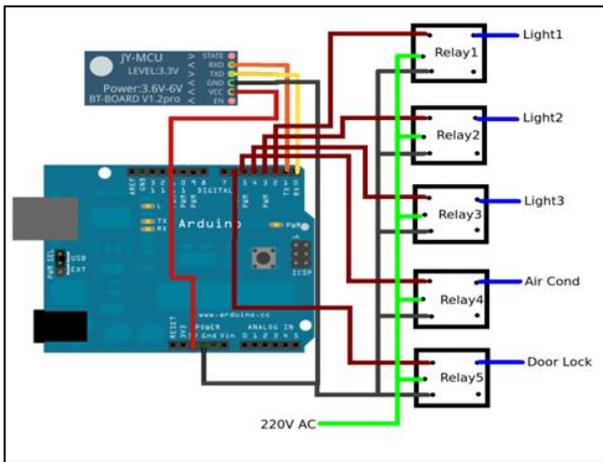


Fig. 1.4: Relay Connection

The connection diagram for Arduino is as shown. For setting up this system, wiring connections have to be made between the Arduino and Bluetooth module, and also with the relays. Here, the Bluetooth Module's Tx is connected to Arduino Rx (digital pin 0) and the module's Rx to Arduino Tx (digital pin 1). The module's 5V and GND are connected to the Arduino's 5V and GND. The relay you're using is SPDT, and it has 5 pins on the underside. As shown above, here pins 1 and 3 are the coil pins. Pin 1 is connected to the Arduino digital pin, and 3 is connected to Arduino GND. Pin 2 is the common contact in the relay to which you have to connect the power for your appliance (AC 230V), and 4 is the pin to which you have to connect your appliance wire.



Fig. 1.5: 5V SPDT relays

In a normal SPDT relay, whose pin out is shown in the above step, pins 2 and 4 act identically to the two terminals of a switch. When a digital HIGH voltage is applied from the Arduino to the relay, the switch turns on, and when the voltage is withdrawn, it turns off. You can attach this system you made to a normal switchboard by extending the wires from behind the switches in the board to your relay. As seen in the connection diagram in the above step, you have to connect a power AC line to the common terminal of all the relays. Then, you have to extend the wires from behind the switchboard of the corresponding lights/lamps you wish to control. Each of these wires is connected to the "NO"(Normally Open) terminal of the relays (pin no. 4 in step no 1's relay pin-out diagram).

C. Bluetooth module

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via

serial communication which makes an easy way to interfaced to controller or PC. The HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

1) Specification:

- Input Voltage: DC 5V
- Communication Method: Serial Communication

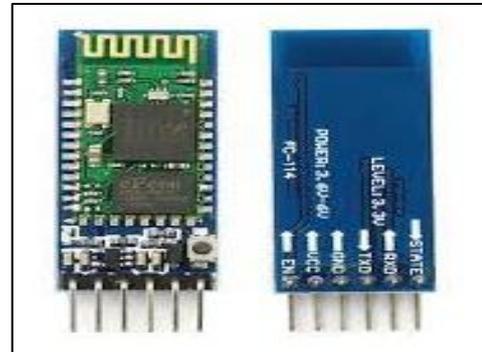


Fig. 1.6: Pin configuration

- VCC » Arduino 5v
- GND » Arduino GND
- TXD » Arduino Pin RX
- RXD » Arduino Pin TX
- KEY » Connect to the air for communication mode

D. Power Supply unit

The Power supply unit is the most important in any projects. For this system the power source we use 9v battery and also develop to 5v power from the domestic power supplies with the help of 5v power supply board. This module consists of step down transformer with rectifier circuit. In this circuit have a bridge rectifier with 5v regulator and fixed with capacitors.

1) Main components

- Transformer 1A (+0 to +12V DC)
- Regulator IC (7805,7809, 7812)
- Diode (In4007b)
- Capacitor (570uf, 22uf,0.02f)25v

II. CIRCUIT CONSTRUCTION

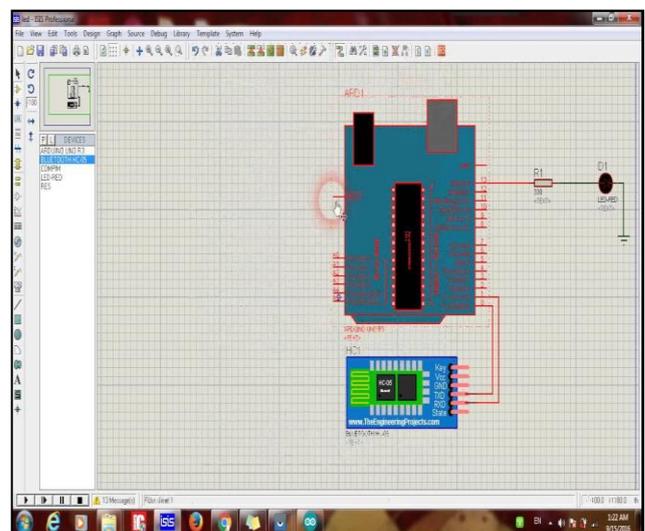


Fig. 3.1: Circuit Design

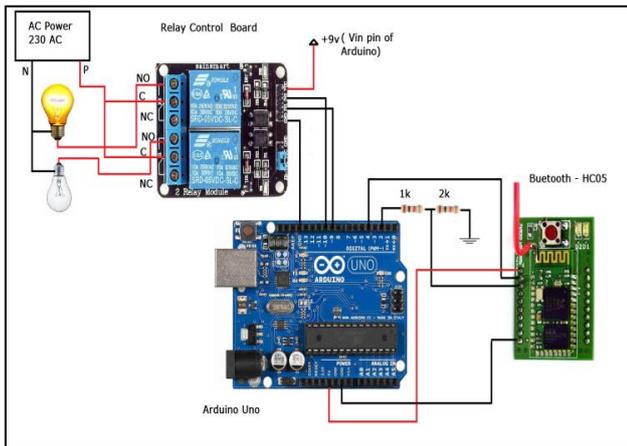


Fig. 3.2: Circuit connection assembly

First start to make the circuit connection as shown in fig.3.1. The 1st Pin(Vcc) of Bluetooth(HC05) is connect to +5v of Arduino Uno and 10th pin(GND) to Arduino Uno Ground. The 2nd pin(Transmitter) and 3rd pin(Receiver) of HC05 is connected to 4th and 2nd of Arduino Uno Board. Make sure that Rx pin of HC05 module is connected to Arduino and pin through voltage divider contains 1k and 2k resistor, because Rx pin of HC05 is 3.3v compatible but Arduino uno GPIO output is 5v. So i decreasing the voltage 5v to 3.3v using voltage divider to make Arduino uno and Bluetooth compatible. Then the 9th and 10th pin of Arduino uno is connected to R1 and R2 of relay board. Vcc and GND pin of relay board is connected to Vin(+9v) and GND pin of Arduino Uno. The other side of relay board 3 pin connector available, named (Normally open), NO, C (common) and NC(Normally closed). Each relay contains separate connector. Phase(P) of 230v AC is connected to C (common) and one end of bulb is connected to NO(normally open). Another end of bulb is connected to Neutral(N) of Alternating Current supply.

A. Working

After designing the circuit connection as per the fig 3.1.compile the arduino code given below in Arduino IDE and upload code to your Arduino Uno using USB B type data cable. Power up your Arduino using 9v DC adapter. After power up your circuit the lrd on Bluetooth start to blink very fast, it means the Bluetooth device olt waiting to be pair. Now connect your mobile phone to HC05 using Bluetooth Controller app. After connecting you're mobile to HC05 turn ON and OFF the lights using corresponding keys.

Once the Bluetooth option in Android phone is turned ON and application is started, the following screen will be opened. now can set the data to be transmitted when a particular key is pressed by selecting "SET KEYS" option. In order to connect Bluetooth module we need to press "SCAN" and list of available Bluetooth device select your Bluetooth device. "Connected" is appeared on top left of screen

Once the setup is completed, we are ready to transmit the data to arduino Board. When Light1 ON is press light1 will glow and if Light1 OFF is pressed Light1 will off. Same to Light2. If we need turn OFF all lights we need no press All Loads turn OFF.

B. Arduino Programming Guide

First of all the Software Serial library for serial communication with the Bluetooth Module and LCD interfacing are imported. An object of the virtual serial type is declared and mapped to the pins where Bluetooth module is interfaced. An object of Liquid Crystal type is instantiated and mapped with the pins connected to the Liquid Crystal Dispaly module. A variable to hold Bluetooth command is declared and variables tracking status of the appliances are declared. The pins connected to the relays are assigned to variables ONE, TWO, THREE and FOUR.A setup() function is called in which the baud rate for serial communication with the HC05 Bluetooth module and the LCD module is set to 9600 bits per second using begin() method on the respective objects. The pins connecting relays are set digital output and initial messages are printed on the LCD.

The loop() function is called in which first it is tested if any serial data from the Bluetooth module is available. If it is available, it is read and stored in BTData variable. The value is BTData is compared to the numbers assigned to each appliance along with the status tracking variables and the current status of the respective appliance is toggled accordingly in If-else decision making statements. The status of each device is updated on the LCD display by replacing the strings on the screen.

C. Arduino Code for Home automation using Bluetooth

```
#include <SoftwareSerial.h>
const int rxPin = 4; // defining pin4 as a rx(receiver) pin
const int txPin = 2; // defining pin2 as a tx(transmitter) pin
SoftwareSerial mySerial(rxPin , txPin);
const int Loads[] = {9, 10};
int state = 0;
int flag = 0;
void setup()
{
for (int i=0;i<2;i++)
{
pinMode(Loads[i], OUTPUT);
}
mySerial.begin(38400);
for (int i=0;i<2;i++)
{
digitalWrite(Loads[i], LOW);
}
}
void loop()
{
if(mySerial.available() > 0)
{
state = mySerial.read(); // Reading Input From "Bluetooth Controller" app
flag=0;
}
switch(state)
{
case '0':digitalWrite(Loads[0], HIGH); // turn ON light1
flag=1;
break;
case '1':digitalWrite(Loads[0], LOW); // turn OFF light1
```

```

flag=1;
break;
case '2':digitalWrite(Loads[1], HIGH); // turn ON light2
flag=1;
break;
case '3':digitalWrite(Loads[1], LOW); // turn OFF light2
flag=1;
break;
case '4':digitalWrite(Loads[0], LOW); // turn OFF light1
digitalWrite(Loads[1], LOW); // turn OFF light
flag=1;
break;
}
}
}

```

D. Output

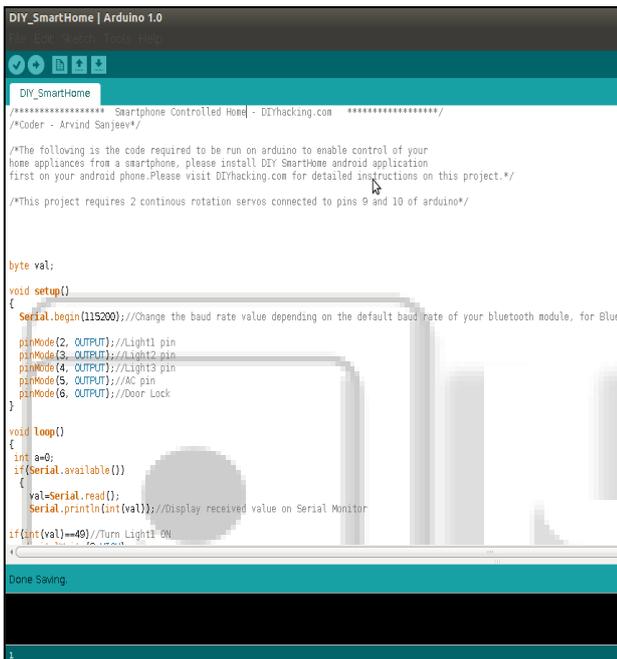


Fig. 3.3: Arduino IDE



Fig. 3.4: Arduino IDE connected to PC

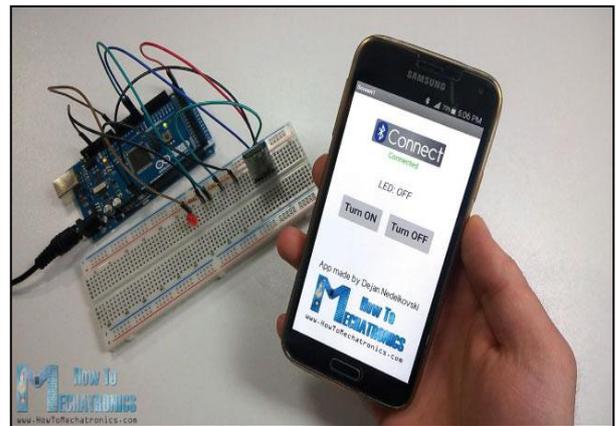


Fig. 3.5: Devices controlled by mobile

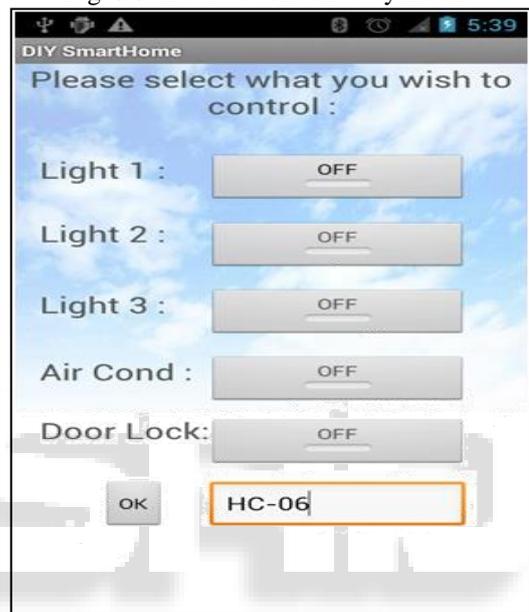


Fig. 3.6: Android Application



Fig. 3.7: Devices Control Checking

1) Advantages

- It is a robust and easy to use system.
- There is no need for extra training of that person who is using it.
- All the control would be in your hands by using this home automation system.

- This project can provide the facility of monitoring all the appliances within the communication range through Bluetooth.
- The schematic of Arduino is open source, for the future enhancement of the project board can be extended to add more hardware features.

III. CONCLUSION & FUTURE ENHANCEMENT

The home automation system has been practically proved by connected with some home appliances controlled by wireless through the mobile. This home automation system is low cost and simple to design. It is very useful for difficult peoples. short range, for future research work it is recommended to increase the range and interface more sensors and it should be a low cost and user friendly system. Moreover home automation system can be interfaced with biomedical (EMG) signals. It will be beneficial for amputees, they will be able to control the appliances using their muscle's movement. Proposed system is only able to control the appliances with in short range, for future work it is recommended to increase the range and interface more sensors and it should be a low cost and user friendly system. Moreover home automation system can be interfaced with GSM modules and the appliances are controlled by sending SMS and it can be controlled by anywhere. They will be able to control the appliances using sending the SMS to the GSM.

REFERENCES

- [1] <https://electronicsforu.com/electronics-projects/hardware-diy/arduino-home-automation-system-android>
- [2] <https://smartify.in/knowledgebase/build-bluetooth-controlled-home-automation-setup-using-arduino/>
- [3] https://www.researchgate.net/publication/316688934_Smart_home_automation_system_using_Bluetooth_technology
- [4] <https://www.pantechsolutions.net/arduino-based-home-automation>
- [5] <https://microcontrollerslab.com/bluetooth-based-home-automation-project/>
- [6] www.atmel.com
- [7] www.arduino.org
- [8] www.beyondlogic.org
- [9] www.wikipedia.org
- [10] www.elementzonline.com