



## Home automation using Arduino

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### **Abstract:**

*Automation is a recent trend in technology. The field of automation has experienced tremendous development in residential, commercial, industrial, transportation, defense and many more fields. A simple example of home automation is electrical appliances controlled by a smartphone. This project demonstrates the use of Arduino UNO board, Bluetooth module HC-05 and Relay for remotely controlling various electrical appliances with the help of a smartphone. The Arduino UNO board uses the microcontroller ATMEGA 328P for this purpose which is programmed through the Arduino software which is an open source software. This project is useful for elderly and handicapped people as they can control the appliances remotely.*

### **Keywords:**

Home Automation, Arduino UNO, Bluetooth module HC-05, Relay.

### **Introduction**

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino UNO board contains 14 Digital I/O pins and 6 Analog Input pins. The pins 0/1 are RX (Receiver) and TX (Transmitter) pins respectively. The Arduino uses serial communication. Several sensors & devices can be interfaced using Arduino as per requirement. The S1 (dark blue) button is a Reset button used to Reset the program in case any error occurs. The program is uploaded to the Arduino board using an USB cable. The Arduino board is powered through a 9-12 Volt DC supply and 40mA current. The Arduino board contains a 32kb Flash memory. The Bluetooth module has been interfaced to the Arduino board. The program is made in the Arduino IDE and uploaded through the USB cable. The Bluetooth module works on 2.4 GHz frequency. The Bluetooth module requires 3.3V power supply which is provided by connecting the Bluetooth module Vcc to 3.3V power pin on Arduino. The Bluetooth module receives signal through the smartphone. The relay module is powered by connecting its Vcc to 5V power pin on Arduino. The Relay Card contains of 4 Relays which act as a switch and isolate the Arduino circuit and High Voltage AC load circuit. The Relay is operated when the winding in the relay is powered which causes the switch to turn ON. The Relay module contains of 3 terminals i.e. COM (Common), NC (Normally Closed) and NO (Normally Open). This is the complete assembly of the project.

### Working

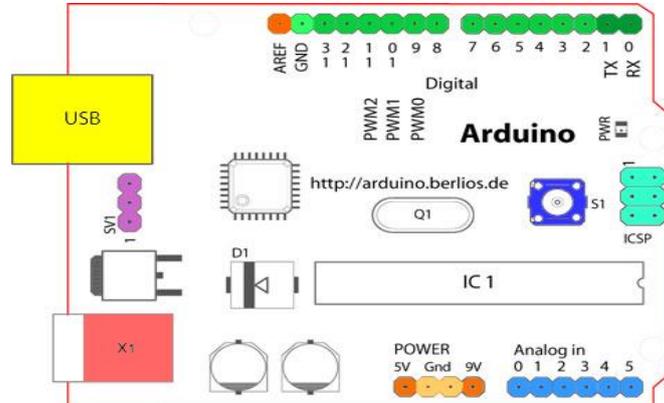


Figure 1fig(a)

The structure of the Arduino board is as shown in fig(a). The program is typed in the Arduino IDE software and uploaded through the USB port. The RS232 is used for serial communication with the Arduino as the Arduino board accepts serial input. The board is protected from varying voltage by using a Voltage regulator. The layout of the IDE & The program for the project is as shown in fig(b).

```
File Edit Sketch Tools Help
sketch_mar01a $
String inputs;
#define relay1 2 //Connect relay1 to pin 9
#define relay2 3 //Connect relay2 to pin 8
#define relay3 4 //Connect relay3 to pin 7
#define relay4 5 //Connect relay4 to pin 6
#define relay5 6 //Connect relay5 to pin 5
#define relay6 7 //Connect relay6 to pin 4
#define relay7 8 //Connect relay7 to pin 3
#define relay8 9 //Connect relay8 to pin 2
void setup()
{
  Serial.begin(9600); //Set rate for communicating with phone
  pinMode(relay1, OUTPUT); //Set relay1 as an output
  pinMode(relay2, OUTPUT); //Set relay2 as an output
  pinMode(relay3, OUTPUT); //Set relay1 as an output
  pinMode(relay4, OUTPUT); //Set relay2 as an output
  pinMode(relay5, OUTPUT); //Set relay1 as an output
  pinMode(relay6, OUTPUT); //Set relay2 as an output
  pinMode(relay7, OUTPUT); //Set relay1 as an output
  pinMode(relay8, OUTPUT); //Set relay1 as an output
}
```

Figure 2 fig(b)

The basic representation of the project using LED is as shown in fig(c).

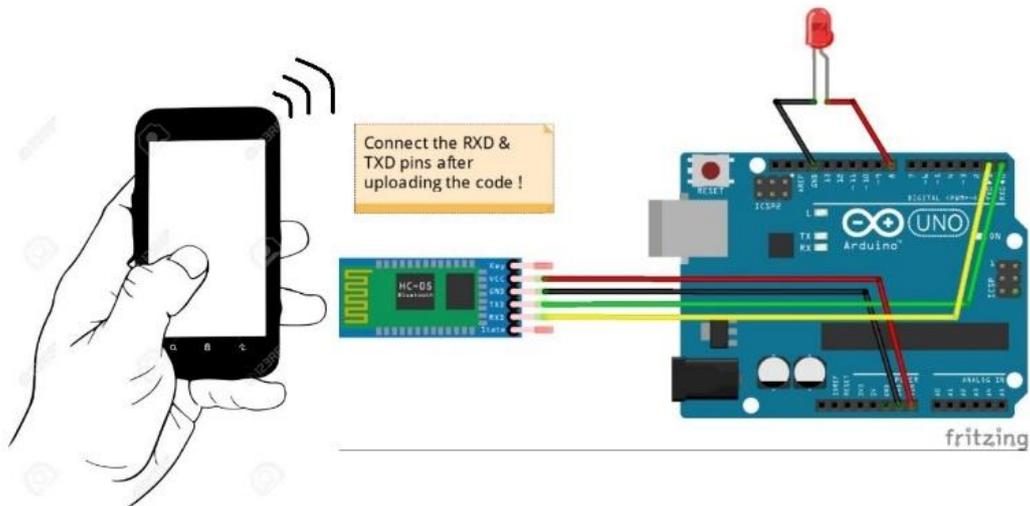


Figure 3 fig(c)

The circuit diagram for the actual project is as shown in fig(d).

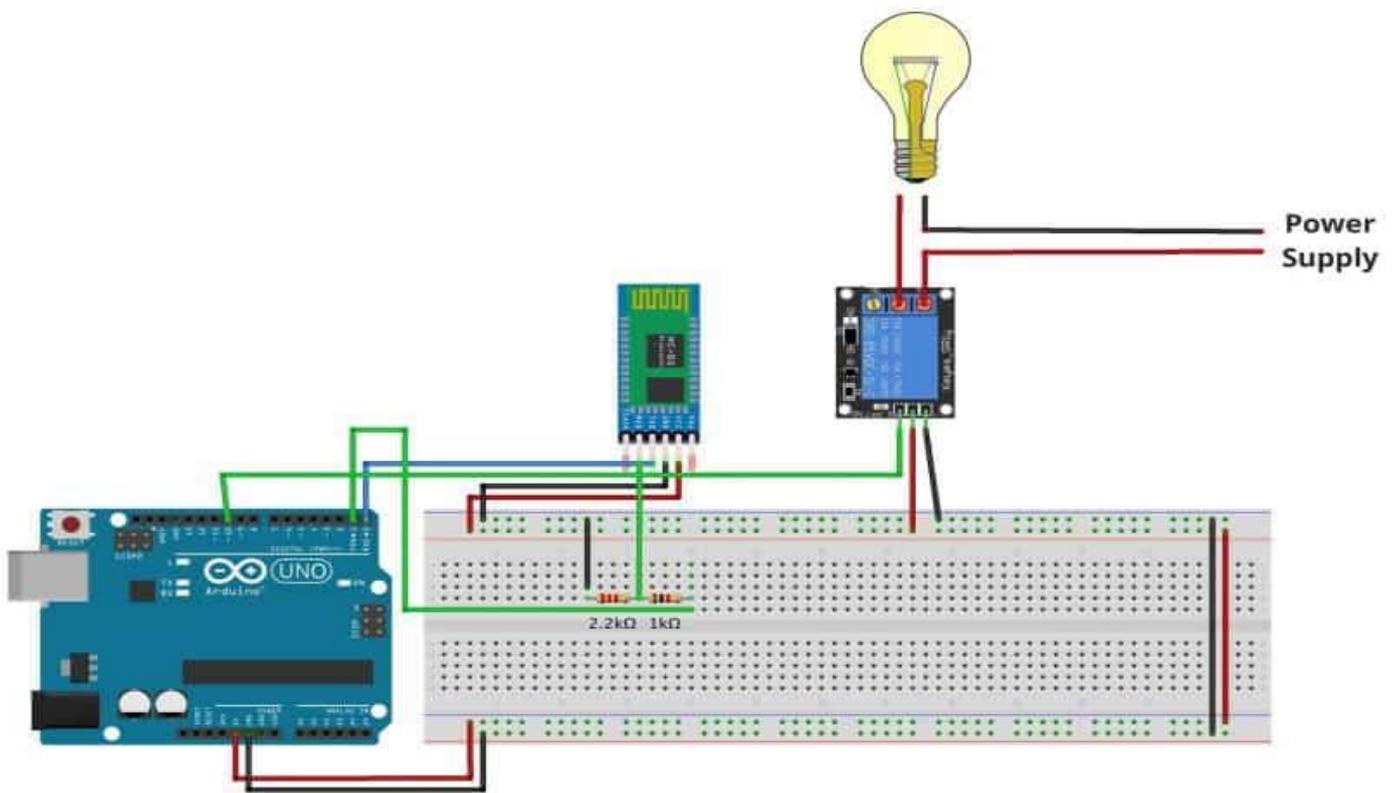


Figure 4 fig(d)

The Android Application is developed using the MIT App Inventor 2 which is an open source android app development website. It is as shown in fig (e) below.

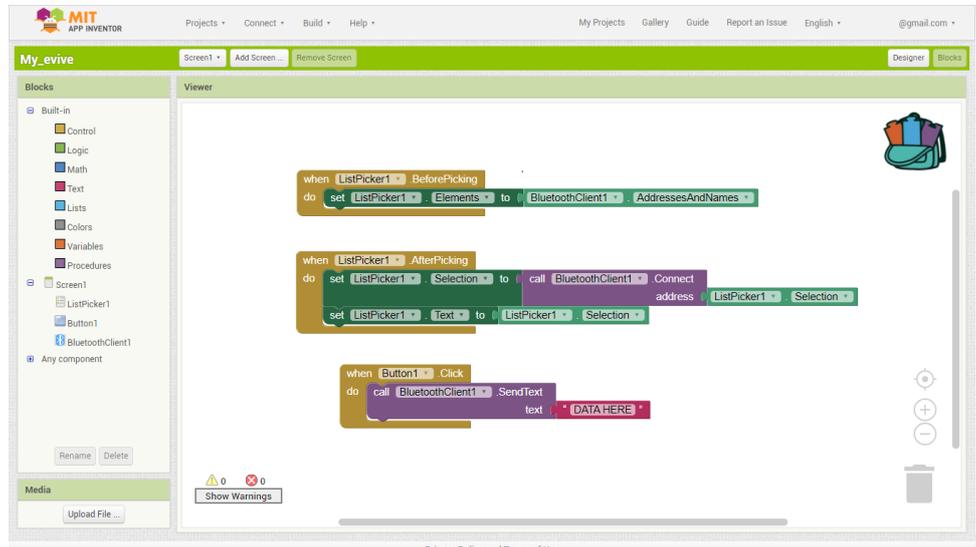


Figure 5 fig(e)

The electrical appliance is turned ON when the Relay coil receives supply and the flap is closed. The Bluetooth Receiver acts as an Input device which receives signal through the smartphone and further gives the signal to the Arduino board. The signal is further given to the Relay board which powers the relay coil and the magnetic field is produced which turns ON the load. Hence, the Lighting can be remotely controlled using this project.

The development board used for this project is Arduino UNO board as shown in fig(f).

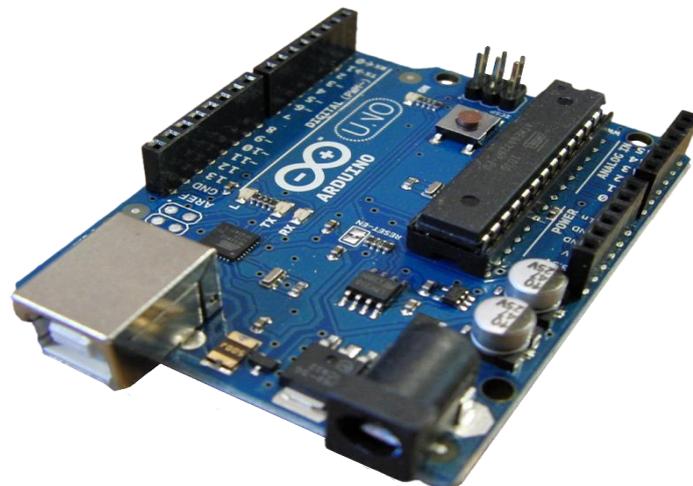


Figure 6 fig(f)

The Bluetooth module used for this project is Bluetooth HC-06 working at 2.4 GHz frequency. The range of this module is 10 meters. The project successfully works in 10m radius without any errors. The module is as shown in fig(g).

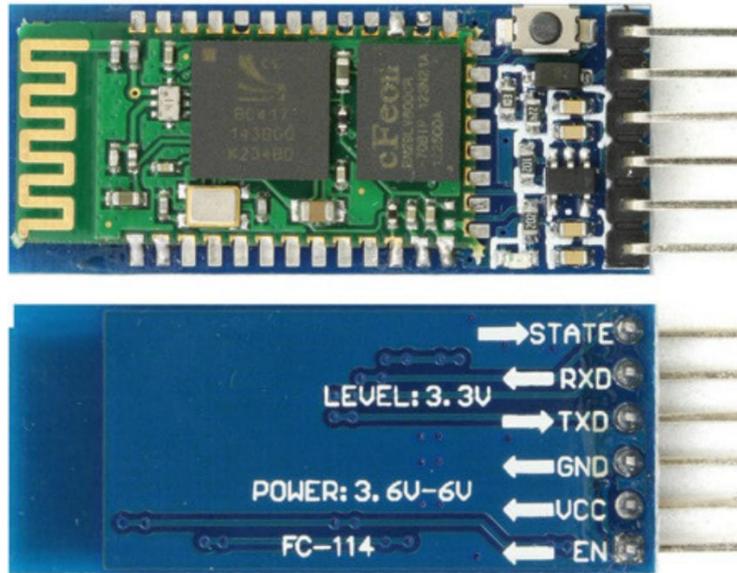


Figure 7 fig(g)

The Relay module is used for the isolation and as a switch as shown in fig(h). The Relay card contains of 4 relays to which 4 different loads can be connected.



Figure 8(h)

The Relay acts as an output device and used to control the load. The rating of the relay is 230V, 5A AC / 5V DC. Hence, using this project, the light electrical loads can be remotely controlled using Smartphone and Arduino.

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## Advantages:

- Cheap and easy automation system.
- Cost is less (up to 900 rupees) where Raspberry pi based automation system costs around 3500 rupees.
- It has better performance than existing Bluetooth based conventional home automation systems.
- It provides a general approach for home automation which is suitable for elderly and handicapped people.
- Proposed system is analyzed and tested within the range of 20 meters and it achieved 100% accuracy.
- Protection from electrical shock as the person is not physically turning ON the switch. Hence electrical accidents can be avoided.

## Disadvantages:

- Its range is limited up to 10 meters.
- It requires continuous 5V power supply for its operation.

## Future Development:

This project can be implemented on a bigger scale by using a long range Bluetooth module. This concept can also be further implemented using a Wi-Fi module and using IOT it can be remotely controlled from any corner of the world.

## Conclusion:

This project helps the elderly and handicapped people to remotely control the electrical appliances without them having to move from their place and hence increase the comfort level. It is an energy and time efficient concept and the various errors can easily be compensated. Any kind of electrical appliance can be operated by using this concept. This concept is hence increases comfort and reliability.