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# Home Automation Using Arduino & Bluetooth Module

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## Project Objective

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The main objective of this project is to implement a low cost, reliable and scalable home automation system that can be used to remotely switch on or off any household appliance, using a microcontroller to achieve hardware simplicity, low cost short messaging service for feedback and voice dial from any phone to toggle the switch state.

This project is to develop a home automation system using an Arduino board with Bluetooth being remotely controlled by any Android OS smart phone. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation system provides a most modern solution with smart phones.

## Introduction

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Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives really easy. Have you ever wondered about home automation which would give the facility of controlling tube lights, fans and other electrical appliances at home using a remote control? Off-course, Yes! But, are the available options cost-effective? If the answer is No, we have found a solution to it. I have come up with a new system called Arduino based home automation using Bluetooth. This system is super-cost effective and can give the user, the ability to control any electronic device without even spending for a remote control. This project helps the user to control all the electronic devices using his/her smartphone.

Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time. To save people's time we are introducing Home Automation system using Bluetooth. With the help of this system you can control your home appliances from your mobile phone. You can turn on/off your home appliances within the range of Bluetooth.

## Description of the Project (Working )

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This project is one of the important Arduino Projects. Arduino based home automation using Bluetooth project helps the user to control any electronic device using Device Control app on their Android Smartphone. The android app sends commands to the controller – Arduino, through wireless communication, namely, Bluetooth. The Arduino is connected to the four relays Module. These relays can be connected to different electronic devices.

When the user presses on the 'On' button displayed on the app for the device 1 known as Switch 1, the Buzzer is switched on. This Buzzer can be switched off, by pressing the same button again.

Similarly, when the user presses on the 'On' button displayed on the app for the device 2 known as Switch 2, the fan is switched on. The fan can be switched off, by pressing the same button again. Similarly, for other 2 Devices.

We can control devices by Voice, by speaking Bulb On and Bulb Off. Similar for other devices.

Also we can control all devices with typing commands for each device.

This project of home automation using Bluetooth and Arduino can be used for controlling any AC or DC devices. In the demonstration, we have used different LEDs.

## Hardware & Software Requirements

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The list of components mentioned here are specifically for controlling 4 different loads.

- Arduino Uno with Atmega 328P microcontroller
- HC – 05 Bluetooth Module
- 5 V Relay X 4
- Bread board
- Jumper wires
- Smartphone or tablet (Bluetooth enabled)
- Android application

# Description of Hardware Required

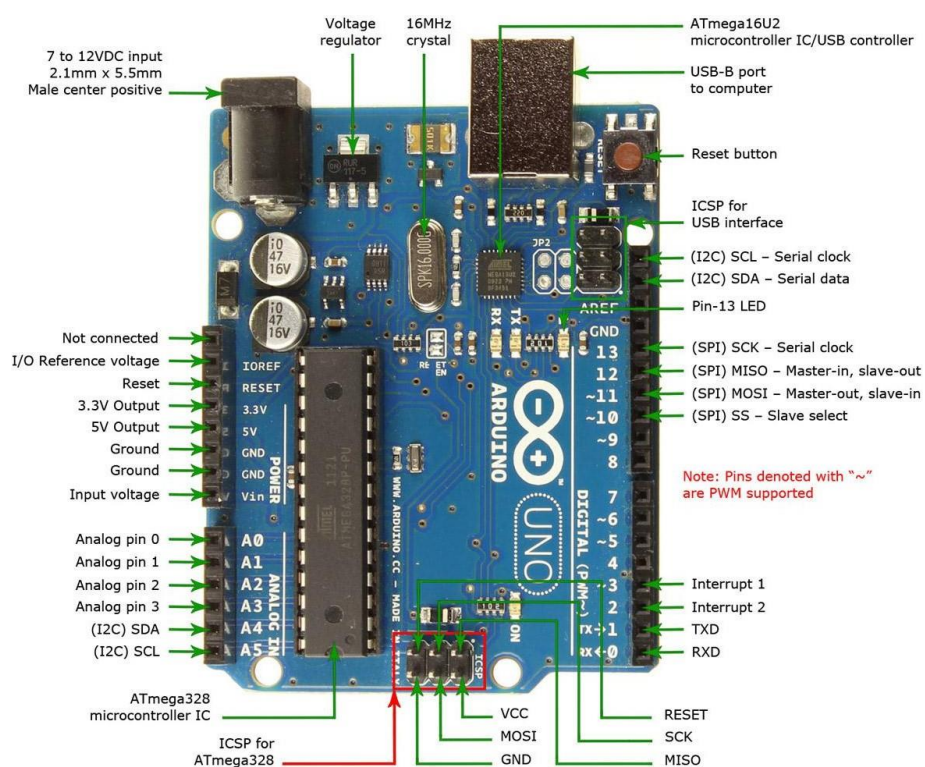
## Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

➤ Some Technical Specification of Arduino Uno are:

|                                |  |
|--------------------------------|--|
| 1. Microcontroller             | ATmega328P                               |
| 2. Operating Voltage           | 5V                                       |
| 3. Input Voltage (recommended) | 7-12V                                    |
| 4. Input Voltage (limits)      | 6-20V                                    |
| 5. Digital I/O Pins            | 14                                       |
| 6. Analog Input Pins           | 6  |
| 7. DC Current per I/O Pin      | 40 mA                                    |
| 8. DC Current for 3.3V Pin     | 50 mA                                    |
| 9. Flash Memory                | 32 KB of which 0.5 KB used by bootloader |
| 10. SRAM                       | 2 KB                                     |
| 11. EEPROM                     | 1 KB                                     |
| 12. Clock Speed                | 16 MHz                                   |

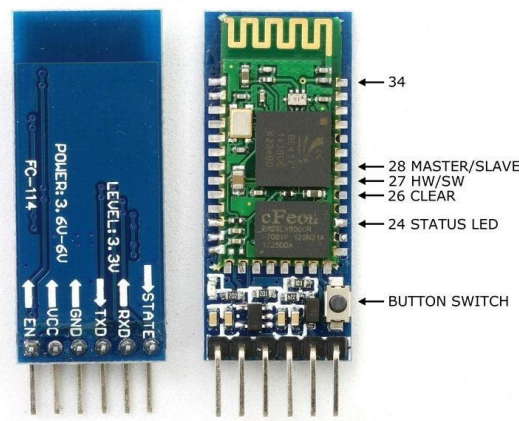
## Circuit Diagram



## HC-05 Bluetooth Module

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

Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

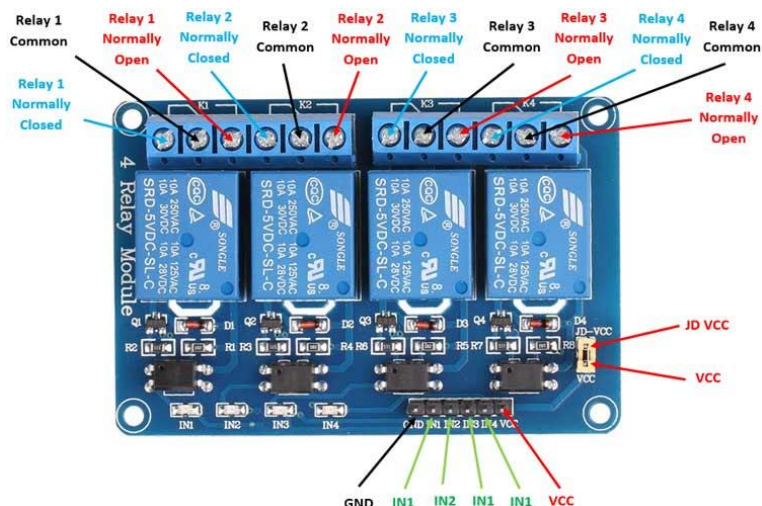


## Relay Module

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening or closing the connections.

In our project we use 4 channel relay Module



### Pins:

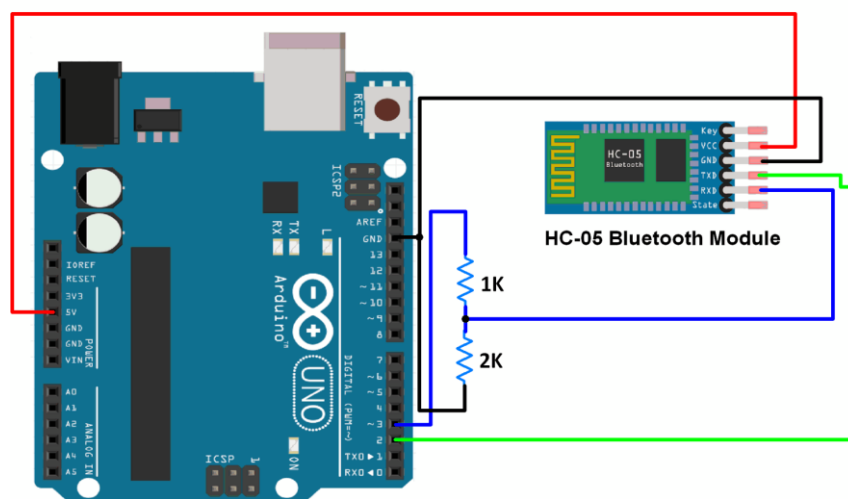
- **COM:** common pin
- **NC (Normally Closed):** the normally closed configuration is used when you want the relay to be closed by default, meaning the current is flowing unless you send a signal from the Arduino to the relay module to open the circuit and stop the current.
- **NO (Normally Open):** the normally open configuration works the other way around: the relay is always open, so the circuit is broken unless you send a signal from the Arduino to close the circuit.

## HC-05 Bluetooth Module Interfacing with Arduino UNO

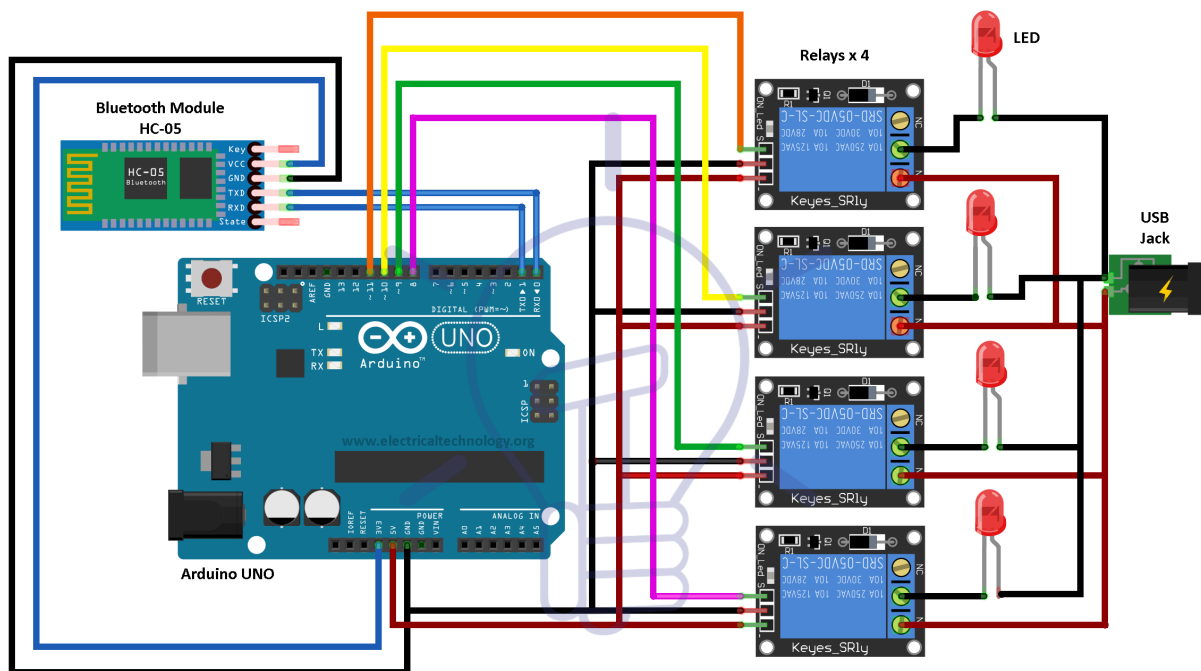
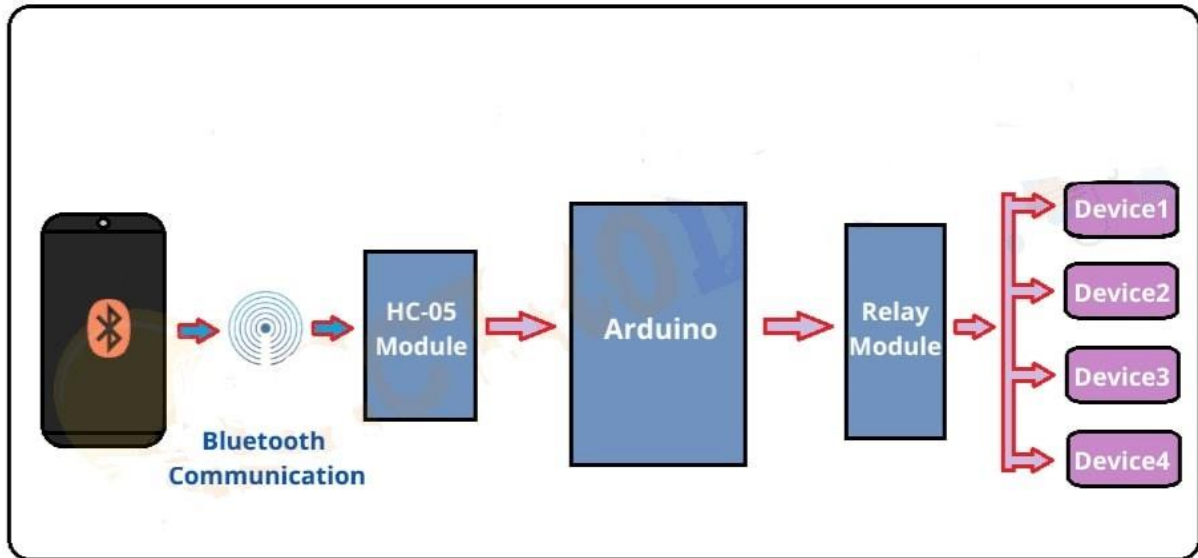
HC-05 is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like smartphone). It communicates with microcontrollers using serial communication (USART).

Default settings of HC-05 Bluetooth module can be changed using certain AT commands.

As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.



# Circuit Diagrams



Smart Home Automation System Project

# Program Code

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Project\_Code

```
#include <SoftwareSerial.h>

SoftwareSerial QuartzBT(2, 3); // RX | TX
#define fan 8
#define bulb 9
#define redLed 10
#define RGB 11

String val;

void setup()

{

    Serial.begin(9600);
    QuartzBT.begin(9600);

    pinMode(fan, OUTPUT);
    pinMode(bulb, OUTPUT);
    pinMode(redLed, OUTPUT);
    pinMode(RGB, OUTPUT);
}

void loop()

{

    if (QuartzBT.available()) {

        val = QuartzBT.readString();

        if(val == "fan on" or val == "A")
        {
            digitalWrite(fan, HIGH);
        }
        else if(val == "fan off" or val == "a")
        {
            digitalWrite(fan, LOW);
        }
        else if(val == "bulb on" or val == "B")
        {
            digitalWrite(bulb, HIGH);
        }
        else if(val == "bulb off" or val == "b")
        {
            digitalWrite(bulb, LOW);
        }
        else if(val == "redled on" or val == "C")
        {
            digitalWrite(redLed, HIGH);
        }
        else if(val == "redled off" or val == "c")
        {
            digitalWrite(redLed, LOW);
        }
        else if(val == "rgb on" or val == "D")
        {
            digitalWrite(RGB, HIGH);
        }
        else if(val == "rgb off" or val == "d")
        {
            digitalWrite(RGB, LOW);
        }
        else if(val == "all on" or val == "E")
```



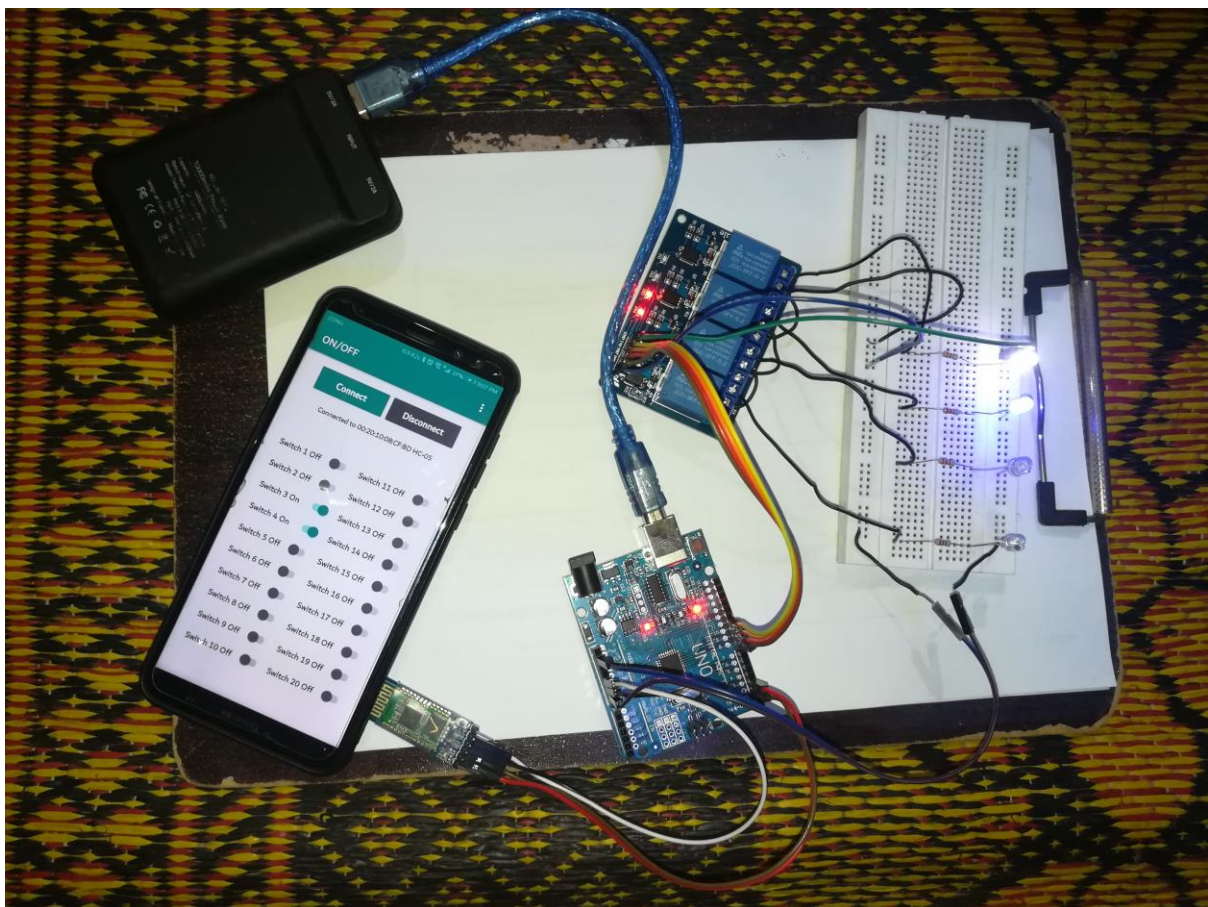
```

else if(val == "all on" or val == "E")
{
    digitalWrite(fan, HIGH);
    digitalWrite(bulb, HIGH);
    digitalWrite(redLed, HIGH);
    digitalWrite(RED, HIGH);
}
else if(val == "all off" or val == "e")
{
    digitalWrite(bulb, LOW);
    digitalWrite(fan, LOW);
    digitalWrite(redLed, LOW);
    digitalWrite(RED, LOW);
}
}
}

```

Done Saving.

## Final Hardware Circuit / Picture





## Application

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- Using this project, we can turn on or off appliances remotely i.e. using a phone or tablet.
- The project can be further expanded to a smart home automation system by including some sensors like light sensors, temperature sensors, safety sensors etc. and automatically adjust different parameters like room lighting, air conditioning (room temperature), door locks etc. and transmit the information to our phone.
- Additionally, we can connect to internet and control the home from remote location over internet and also monitor the safety.

## Future Development of the Project

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- Arduino based device control using Bluetooth on Smartphone project can be enhanced to control the speed of the fan or volume of the buzzer etc.
- Home automation and Device controlling can be done using Internet of Things – IOT technology.
- We can replace Bluetooth by GSM modem so that we can achieve device controlling by sending SMS using GSM modem.

## Conclusion

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The home automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device.

We learned many skills such as soldering, wiring the circuit and other tools that we use for this project and was able to work together as a team during this project.

The Bluetooth client was successfully tested on a multitude of different mobile phones from different manufacturers, thus proving its portability and wide compatibility. Thus a low-cost home automation system was successfully designed, implemented and tested.