# Project Report: Bluetooth-Controlled Home Automation System

Home automation systems are revolutionizing the way we interact with our living spaces. With Bluetooth technology, it is now possible to wirelessly control household devices such as lights, fans, and appliances using smartphones. This project aims to design and implement a Bluetooth-based home automation system using an Arduino microcontroller and a mobile app to control home devices.

## Objectives

- Design a system that enables wireless control of electrical appliances using Bluetooth.
- Use an Android smartphone to send commands to the system.
- Implement Arduino-based control with relay switching.
- Ensure safety, reliability, and ease of use.

## Components Required

Arduino Uno

Bluetooth Module HC-05

4-Channel Relay Module

Jumper Wires

Smartphone (Android)

Electrical Devices (Bulbs/Fans)

Power Supply (5V for Arduino)

Breadboard (optional)

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## System Overview

The smartphone communicates with the Arduino via the HC-05 Bluetooth module. Based on the received command, the Arduino switches the respective relay channel ON or OFF, which in turn controls the connected electrical appliances.

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## Circuit Diagram

- **HC-05 Bluetooth Module**:
  - VCC → 5V on Arduino
  - GND → GND
  - TX → RX (Pin 10 via voltage divider)
  - RX → TX (Pin 9)
- **Relay Module**:
  - IN1-IN4 → Arduino Pins 4, 5, 6, 7
  - VCC → 5V
  - GND → GND
- **Power Supply**:
  - Arduino powered by USB or 5V adapter
  - Relays connected to 220V appliances via normally open (NO) contacts

(You can request a visual circuit diagram image if needed.)

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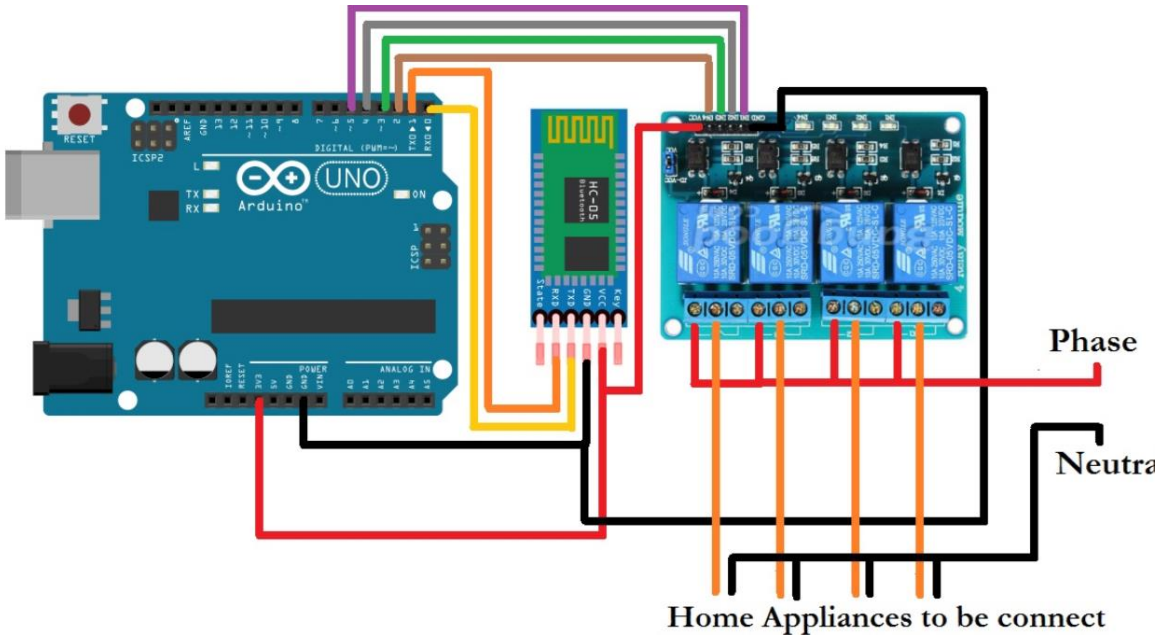
## Arduino Code

```
#include <SoftwareSerial.h>
SoftwareSerial BTSerial(10, 9); // RX | TX
```

```
int relay1 = 4;
int relay2 = 5;
int relay3 = 6;
int relay4 = 7;

void setup() {
  BTSerial.begin(9600);
  Serial.begin(9600);

  pinMode(relay1, OUTPUT);
  pinMode(relay2, OUTPUT);
  pinMode(relay3, OUTPUT);
  pinMode(relay4, OUTPUT);

  digitalWrite(relay1, HIGH);
  digitalWrite(relay2, HIGH);
  digitalWrite(relay3, HIGH);
  digitalWrite(relay4, HIGH);
}

void loop() {
  if (BTSerial.available()) {
    char command = BTSerial.read();
    Serial.println(command);

    switch(command) {
      case 'A': digitalWrite(relay1, LOW); break;  // ON
      case 'a': digitalWrite(relay1, HIGH); break; // OFF
      case 'B': digitalWrite(relay2, LOW); break;
      case 'b': digitalWrite(relay2, HIGH); break;
      case 'C': digitalWrite(relay3, LOW); break;
      case 'c': digitalWrite(relay3, HIGH); break;
      case 'D': digitalWrite(relay4, LOW); break;
      case 'd': digitalWrite(relay4, HIGH); break;
    }
  }
}
```



## Operation

1. Upload the code to Arduino using the Arduino IDE.
2. Pair the smartphone with the HC-05 Bluetooth module (default password: `1234` or `0000`).
3. Use a Bluetooth Terminal app (e.g., "Bluetooth Terminal HC-05") to send commands:
    - `A` = Turn ON Device 1
    - `a` = Turn OFF Device 1
    - `B` = Turn ON Device 2
    - `b` = Turn OFF Device 2
    - and so on.
4. Arduino receives the command and triggers the corresponding relay.

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## Conclusion

This Bluetooth-based home automation system offers a practical and efficient solution to modern living needs. It demonstrates how microcontrollers and wireless communication can be used to enhance comfort and control in daily life.

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