Visvesvaraya Technological University
Jnana Sangama, Belagavi –590018

MINI PROJECT REPORT

ON

BLUETOOTH CONTROLLED HOME AUTOMATION

Submitted By

1. GANESH P R   4SM20EC002
2. KARTHIK N D L   4SM20EC006
3. SUDARSHAN S R   4SM20EC020
4. YATHISH B   4SM21EC406

PROJECT GUIDE
Name of the Guide with Designation

PROJECT COORDINATOR
Prof. Farzana Parveen B A M.Tech
Asst. Prof, Dept of ECE, SJMI,
Chitradurga

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CERTIFICATE

This is to certify that the Mini-Project work entitled **"BLUETOOTH CONTROL HOME AUTOMATION"** is a bonafide work carried out by **GANESH P R (4SM20EC002), KARTHIK N D L (4SM20EC006), SUDARSHAN S R (USN), and YATHISH B (4SM21EC406)** in partial fulfillment for the award of VI Semester of **Bachelor of Engineering in Electronics and Communication Engineering** of the Visvesvaraya Technological University, Belagavi during the year 2022-23. It is certified that all corrections / suggestions indicated for the internal assessment have been incorporated in the report deposited in the department library. The Mini-Project report has been approved as it satisfies the academic requirement in respect of the Mini-Project prescribed for the VI Semester of **Bachelor of Engineering**.

_____
Signature of the Guide
Name & Designation

_____
Signature of the Coordinator
Prof. Farzana Parveen B A M.Tech
Asst. Prof, Dept of ECE,
SJMIT, Chitradurga

_____
Signature of the HOD
Dr. Siddesh K B M.Tech, Ph.D
HOD, Dept. of ECE, SJMIT,
Chitradurga

External Viva

Name of the Examiner

1._____

2._____

Signature with Date

1. _____

2. _____

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PROJECT ASSOCIATES:

1. Ganesh P R

2. Karthik N D L

3. Sudarshan S R

4. Yathish B

ABSTRACT

The advent of wireless communication technologies has revolutionized the field of home automation. Bluetooth, a widely used wireless communication protocol, provides a convenient and reliable solution for controlling various devices within a home environment. This project proposes a Bluetooth-controlled home automation system that allows users to remotely monitor and control their home appliances and devices using a mobile application.

The system consists of two main components: the hardware and the software. The hardware component includes Bluetooth-enabled modules connected to the appliances and devices to be controlled, as well as a central control unit that serves as the bridge between the mobile application and the appliances. The software component consists of a mobile application that communicates with the central control unit over Bluetooth.

The mobile application provides a user-friendly interface through which users can interact with their home appliances and devices. It allows users to turn appliances on or off, adjust settings, and receive real-time information about the status of the devices. The application also supports scheduling functionality, enabling users to automate certain tasks based on preset schedules.

The Bluetooth communication protocol ensures secure and reliable communication between the mobile application and the central control unit. It offers a relatively short-range wireless connection, making it suitable for home automation applications. The system can be easily customized and expanded to accommodate a wide range of devices and appliances.

Overall, the Bluetooth-controlled home automation system presented in this project provides a convenient and efficient way for users to control and monitor their home appliances and devices remotely. With the increasing popularity of smart homes and the widespread use of Bluetooth-enabled devices, this system offers an accessible solution for creating a smart and interconnected home environment.

Bluetooth Controlled Home Automation is a smart home technology that enables users to control various home appliances and devices using their smartphones or tablets. This technology uses Bluetooth connectivity to communicate with the devices and appliances in the home, allowing users to remotely control them from anywhere. The system allows users to control lights, fans, air conditioners, security systems, and other devices with just a few taps on their smartphones. It also enables users to set schedules and timers for their appliances, so they turn on and off automatically at specific times.

CONTENT

INTRODUCTION

In the modern day's everyone uses smartphones and the internet. Therefore, Every smartphone has Bluetooth System. In this project, we will design a simple Arduino Bluetooth Control Home Automation using the HC-05 Bluetooth module, which is used to switch ON or OFF different electrical appliances remotely. Home Automation systems can make our life easy and secure. Here we will control 4 different home appliances using Smartphone App through Bluetooth communication.

Bluetooth Controlled Home Automation is a system that allows you to control various aspects of your home using Bluetooth technology. It enables you to remotely manage and monitor devices such as lights, appliances, security systems, and more, using your smartphone or other Bluetooth-enabled devices.

The system typically consists of two main components: a central control unit and individual devices or appliances equipped with Bluetooth modules. The central control unit acts as a hub or gateway, connecting to the various Bluetooth-enabled devices throughout your home.

The Bluetooth Controlled Home Automation, you can conveniently control and automate various functions within your home. For example, you can turn on or off lights, adjust the temperature of your thermostat, open or close curtains, control home entertainment systems, and even monitor security cameras and sensors.

One of the key advantages of Bluetooth Controlled Home Automation is its simplicity and ease of use. Bluetooth technology is widely available and built into many modern smartphones and tablets, making it accessible to a large number of users. Additionally, Bluetooth offers a reliable and secure connection between devices within a short range.

Bluetooth Controlled Home Automation also offers the flexibility to expand and add new devices to your system as needed. You can easily integrate additional Bluetooth-enabled devices into your existing setup without requiring complex installations or extensive wiring.

Bluetooth controlled home automation using Arduino Nano is a popular and cost-effective way to automate your home. Arduino Nano is a small and powerful microcontroller board that can be programmed to control various devices and appliances in your home through Bluetooth communication. With this technology, you can easily turn on or off lights, fans, air conditioners, and other appliances from your smartphone or tablet, providing a high level of convenience. Additionally, Arduino Nano can be used to monitor and control security systems, smoke detectors, and other safety systems, making your home safer and more secure. Overall, Bluetooth controlled home automation using Arduino Nano offers a wide range of benefits that can improve the quality of life for homeowners.

BLOCK DIAGRAM OF BLUETOOTH CONTROL HOME AUTOMATION

The key components of the project are Arduino, HC-05 Bluetooth module, 4 Channel Relay Module, 16×2 LCD display, and "Bluetooth Controller" app. Where Arduino is the main microcontroller of the project that's controlled all other components. The HC-05 Bluetooth module is used to receive data from a smartphone. The relay module is used to control AC devices. The 16×2 LCD module is used to display the status (turn ON or turn OFF) of the home appliances. Also, we need to download and install the Bluetooth Controller App on our Smartphone, Which is sending data to the HC-05 Bluetooth Module.

Here we will send data from the smartphone using the Bluetooth controller App, then the Bluetooth module receives this data and pass this data to the Arduino. Now, Arduino is decoding this data, and sending commands to the relay module to control the devices. At the same time, we can see the status (turn ON or turn OFF) of the home appliances on the display.
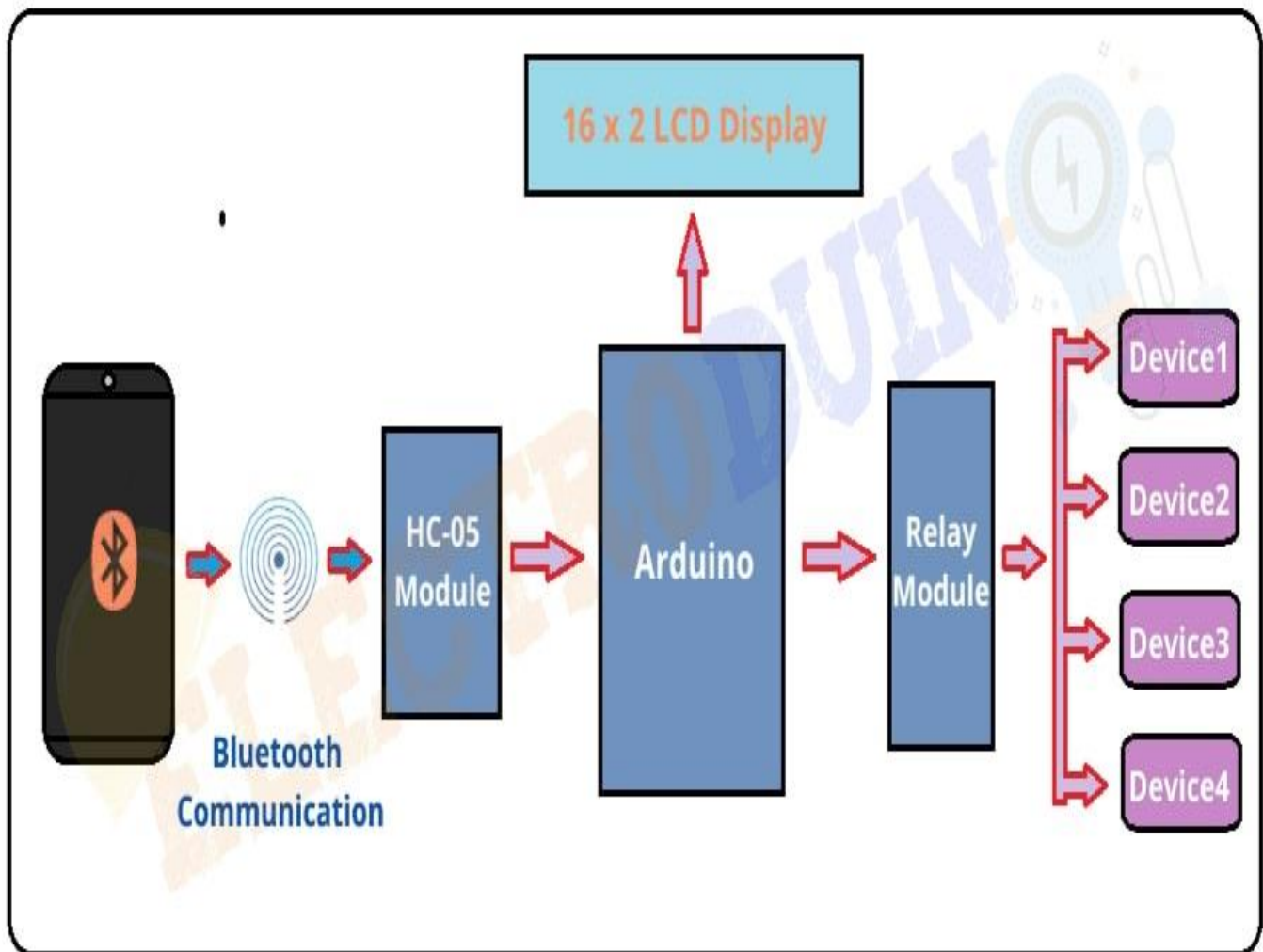

Figure 1

CIRCUIT DIAGRAM

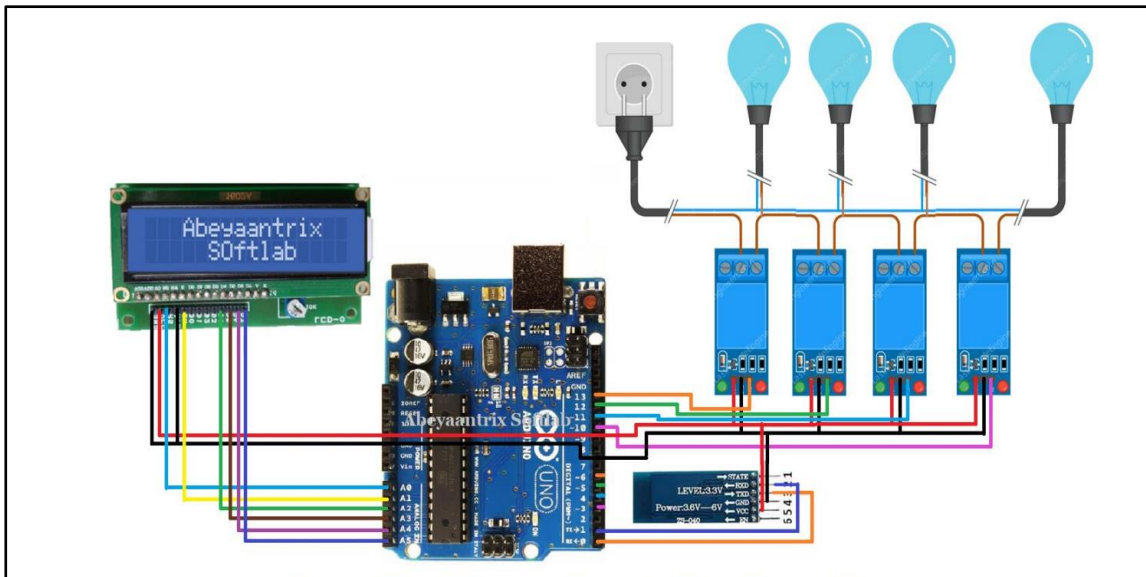Figure 2

METHODOLOGY

The methodology for bluetooth control home automation using Arduino Nano can be broken down into the following steps:

The HC-05 Bluetooth module can communicate two-way wireless. so, it is used to communicate with any device like a Phone or Laptop with Bluetooth functionality. The module communicates with the help of UART at 9600 baud rate and it has a range up to <100m. It works on 3.3V and it has an onboard 5V to 3.3V regulator. The HC-05 has two operating modes, these are, Data mode and AT Command mode. The Data mode can send and receive data from other Bluetooth devices. The AT Command mode can be changed to the default device settings of HC-05.

This is a 6 pin module, but in this project, we will use only 4 pins, these are VCC, GND, TX, and RX. Where the VCC pin is connected to the 5V of the microcontroller, the GND pin is connected to the ground of the microcontroller, the RX pin is connected to the TX of the microcontroller and the TX pin is connected to the RX of the microcontroller.
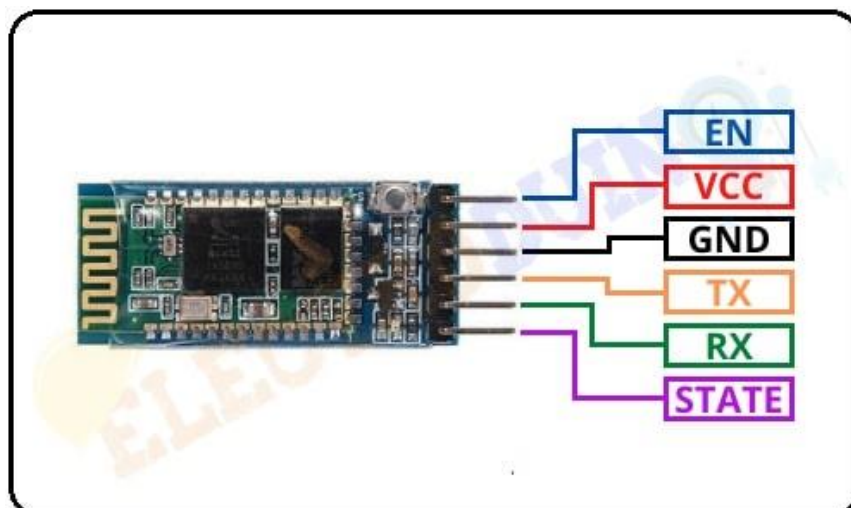

Figure 3: BLUETOOTH CIRCUIT DIAGRAM

First of all, open the Play Store of your Android Smartphone and search for "Bluetooth Control for Arduino". Then you will get this App. Now install this app.

After completing the installation process, open the app and make sure the circuit is connected to the power supply and the Bluetooth module is on. Also, make sure the Bluetooth module pair with your smartphone. You can pair your phone with the HC-05 Bluetooth Module like we normally pair the phone with Bluetooth earphones or speakers. If your smartphone pair with the HC-05 Bluetooth module, then you can see the "HC-05 Bluetooth" name on the top side of the App and select it.

Working Principle of Home Automation using Arduino and Bluetooth HC-05 Module:

After complete the App setup/configuration, now we need to identify the load values of the App button. The app transmits Different **load values** when different buttons are pressed. When we will press a button on the app, the app sends a particular Load value to the Arduino through the Bluetooth module.

These Lode Values are used in Arduino code to control a particular device by a particular app Button. The Load values of the App buttons and their use is described in the below list.

App Buttons	Load Values	Device status	Control Relay (Relay Pin)
Button 1	1	Device1 On	Relay-1 (IN1)
	A	Device1 Off	
Button 2	2	Device2 On	Relay-2 (IN2)
	B	Device2 Off	
Button 3	3	Device3 On	Relay-3 (IN3)
	C	Device3 Off	
Button 4	4	Device4 On	Relay-4 (IN4)
	D	Device4 Off	
on All	9	All Devices (1, & 4) On	Relay-1, Relay-2 Relay-3, Relay-4 (IN1, IN2, IN3, IN4)
off All	I	All Devices (1, & 4) Off	

When we pressed any button of the App, the App sends a unique load value according to the button. The HC-05 Bluetooth Module received this unique load value and send it to the Arduino. Then, the Arduino compares the value with the predefined value of the button. If this value is matching then Arduino sends operating voltage to the relay module. Also, we can see the Device status (on or off) on the 16×2 LCD Display.

For example, when we Press the App "**Button 1**", then the app sends Load value "**1**" to the Bluetooth module. Then the Arduino gets this value through the Bluetooth module. Then the Arduino sends **Low (0)** input voltage to the **Input-1 (IN1)** pin of the relay module. Now the relay is in **On mode**. So the Device1 will also **turn on**, which is connected to the relay-1 of the relay module. At the same time, the "**D1 (Device 1) is ON**" status print on the 16×2 LCD Display Module.

when again Press the App "**Button 1**", but this time the app sends Load value "**A**" to the Bluetooth module. Again the Arduino gets this value through the Bluetooth module. But this time the Arduino sends a **High (5v)** input voltage to the **Input-1 (IN1)** pin of the relay module. Now the relay is in **Off mode**. So the Device1 will also **turn off**, which is connected to the relay-1 of the relay module. At the same time, the "**D1 (Device 1) is Off**" status print on the 16×2 LCD Display Module

HARDWARE & SOFTWARE REQUIREMENT

✓ Hardware :-

1. Arduino Nano.
2. Bluetooth module.
3. 16x2 LCD.
4. Relay module.
5. Bread board.

1) Arduino Nano:-

The Arduino Nano is a small, compact board based on the ATmega328 microcontroller. It is similar to the Arduino Uno, but with a smaller form factor and fewer pins. The Nano is popular for projects where space is limited, such as robotics, home automation, and wearable electronics. It can be programmed using the Arduino IDE and has a wide range of compatible shields and modules available. The Nano also has built-in USB connectivity, making it easy to upload code and communicate with a computer.

2) BLUETOOTH MODULE:-

Bluetooth is a wireless communication technology that uses radio waves to transfer data between devices. Bluetooth technology is used in a wide range of devices, including smartphones, laptops, headphones, speakers, and IOT devices. Bluetooth uses low-power radio waves to communicate over short distances, typically up to 30 feet (10 meters).There are several versions of Bluetooth, including Bluetooth Classic, Bluetooth Low Energy (BLE), and Bluetooth 5.0.Bluetooth Classic is the original version of Bluetooth and is used for high-speed data transfer, such as streaming audio and video.

3) 16x2 LCD:-

A 16x2 LCD (Liquid Crystal Display) is a type of alphanumeric display that can show 16 characters per line and has 2 lines. It is commonly used in electronic devices such as calculators, digital clocks, and small appliances. The display is made up of 16 columns and 2 rows of characters, each character being made up of 5x8 pixels.

The LCD operates by using liquid crystals that change their orientation in response to an electric field, which allows light to pass through or be blocked, creating the characters on the display. The LCD requires a driver circuit to control the display, which typically includes a microcontroller or other digital circuitry. The LCD can be controlled using various communication protocols, including parallel, serial, and I2C.The backlighting of the LCD can be either LED or EL (electroluminescent), which provides illumination for the display. The 16x2 LCD is a popular choice for hobbyists and DIY projects due to its low cost and ease of use. There are various libraries and tutorials available online for programming and interfacing with the 16x2 LCD. The 16x2 LCD can display numbers, letters, and symbols, making it useful for displaying data and messages in a variety of applications.

4) RELAY :-

A relay is an electromechanical device that is used to control the flow of electrical current in a circuit. It consists of a coil, which when energized, creates a magnetic field that attracts a movable armature or contact. The contact is used to open or close a circuit, allowing or blocking the flow of electrical current. Relays are commonly used in industrial control systems, automation systems, and in electronic devices such as computers and appliances. They are available in various types, including electromagnetic relays, solid-state relays, thermal relays, and reed relays. Electromagnetic relays are the most common type of relay and are used in a wide range of applications. Solid-state relays use semiconductor devices such as transistors and thyristors to switch the current on and off.

Thermal relays use a bimetallic strip that bends when heated, opening or closing the circuit. Reed relays use a magnet and a reed switch to control the flow of current. Relays are often used in combination with other components such as timers, sensors, and switches to create complex control systems.

5)   BREAD BOARD:-

A breadboard is a device used to prototype and test electronic circuits without the need for soldering. It consists of a plastic board with rows and columns of interconnected metal clips that allow components to be easily inserted and connected. Breadboards come in various sizes and configurations, with some having multiple power rails and ground connections. The clips on a breadboard are typically arranged in a pattern that matches the pin layout of common electronic components, such as resistors, capacitors, and integrated circuits. Breadboards are commonly used by hobbyists, students, and professionals to quickly test and prototype electronic circuits before they are soldered onto a printed circuit board. Breadboards can be used with a variety of electronic components, including sensors, switches, LEDs, and microcontrollers. When using a breadboard, it is important to follow good wiring practices to avoid loose connections or short circuits. Breadboards are not suitable for high-frequency or high-current applications, as they can introduce unwanted resistance and capacitance into the circuit.

✓ **Software :-** Using Arduino Program

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(A0,A1,A2,A3,A4,A5);
#define bulb 12
#define fan 11
#define AC 10
#define TV 9
int b,f,a,t;
char *bb,*ff,*aa,*tt;
void setup()
{
pinMode(AC, OUTPUT);
pinMode(TV, OUTPUT);
pinMode(fan, OUTPUT);
pinMode(bulb, OUTPUT);
Serial.begin(9600);
lcd.begin(16,2);
lcd.clear();
lcd.print("Home Automation");
lcd.setCursor(0,1);
lcd.print(" With LCD");
delay(2000);
}
```

```
void Display(char *B="OFF",char *A="OFF",char *F="OFF",char *T="OFF")
{
lcd.clear();
lcd.print("bulb:");
lcd.print(B);
lcd.setCursor(10,0);
lcd.print("AC:");
lcd.print(A);
lcd.setCursor(0,1);
lcd.print("fan:");
lcd.print(F);
lcd.setCursor(9,1);
lcd.print("TV:");
lcd.print(T);
delay(500);
}
void loop()
{
Display(bb,aa,ff,tt);
delay(500);
if(Serial.available()>0)
{
char data = Serial.read();
if(data == '1')
{
digitalWrite(bulb, HIGH);
bb="ON";
}
if(data == '2'){
digitalWrite(bulb, LOW);
b=0;
bb="OFF";
}
if(data == '3')
{
digitalWrite(fan, HIGH);
ff="ON";
}
if(data == '4'){
digitalWrite(fan, LOW);
f=0;
ff="OFF";
}
if(data == '5')
{
digitalWrite(AC, HIGH);
aa="ON";
}
if(data == '6'){
digitalWrite(AC, LOW);
a=0;
aa="OFF";
}
if(data == '7')
{
```

```
digitalWrite(TV, HIGH);
tt="ON";
}
if(data == '8'){
digitalWrite(TV, LOW);
t=0;
tt="OFF";
}
}
}
void Display(String B="OFF",String A="OFF",String F="OFF",String T="OFF")
{
lcd.clear();
lcd.print("bulb:");
lcd.print(B);
lcd.setCursor(10,0);
lcd.print("AC:");
lcd.print(A);
lcd.setCursor(0,1);
lcd.print("fan:");
lcd.print(F);
lcd.setCursor(9,1);
lcd.print("TV:");
lcd.print(T);
delay(500);
}
```

APPLICATIONS

1. Energy conservation.

2. Convenience.

3. Security.

4. Accessibility.

5. Customization.

6. Safety.

7. Entertainment.

8. Health and wellness.

9. Productivity.

10. Sustainability.

CONCLUSON

Bluetooth Controlled home automation is a convenient and efficient way to control various home appliances and devices using a smartphone or tablet. It provides the user with the ability to remotely control and monitor their home, making their lives more comfortable and secure. With Bluetooth technology, it is easy to set up and use, and it can be customized to meet the specific needs of the user.

However, there are some limitations to Bluetooth technology, such as its limited range and interference from other devices.Nonetheless, Bluetooth Controlled home automation is an excellent option for those looking for an affordable and straightforward solution to automate their homes.

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