A Project On

Android Base Home Automation System Using Arduino and Bluetooth.

Project For Fulfilment

Laboratory Work-II (First Unit), Second Year.

Submitted by

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ABSTRACT

Automation is a demand in this era of electronic engineering, where a smart control system is used to reduce or replace human operators in the industry, offices or homes to produce some goods or services. Home automation system is the subset of automation system that allows us to control household appliances like light, door, fan, air-conditioner etc. In an intelligent way. It also includes those of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, and the use of domestic robots. Home automation system provides home security and emergency systems to be activated while necessary. It helps handicapped and old aged people which will enable them to control home appliances and alert them in critical situations. It not only refers to reduce human efforts but also energy efficiency and time saving. There are different types of home automation systems in the market. They are generally proprietary and closed, expensive and not very customizable by the end user. To overcome this limitation, there are scopes of research in this area.

INTRODUCTION

Home/office automation is the control of any or all electrical devices in our home or office, whether we are there or away. Home/office automation is one of the most exciting developments in technology for the home that has come along in decades. There are hundreds of products available today that allow us control over the devices automatically, either by remote control; or even by voice command. Home automation is the residential extension of "building automation". It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. Disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

Objective With Specific Aims and Possible Outcome

The aim of this project is to develop a low cost home automation system. The following objectives will be achieved:

- To design the circuit for the proposed system
- To design the firmware of the system
- To simulate the design
- To implement the system in the PCB
- To test the functionality of the system in the laboratory

1.0 AUTOMATION SYSTEM

Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated. The biggest benefit of automation is that it saves labor, however, it is also used to save energy and materials and to improve quality, accuracy and precision.

1.1 METHODOLOGY

- Comparison among three controllers i.e. PLC, microcontroller and Arduino. Selection of Arduino over PLC and microcontroller for it's overall advantages.
- Designing of the circuit diagram for desired output.
- Selection of HC-05 Bluetooth module as receiver.
- Collection of Android application to communicate with Arduino.
- Designing the Arduino program code to implement the project.
- Finally, assembling the equipment according to circuit design.
- Besides, we have theoretically designed an automated motor pump system for a building which can be switched ON/OFF by smart phone via Bluetooth and is automated by PLC.

1.2 COMPONENTS

The main components are:

- Arduino Uno
- Bluetooth – HC05
- Relay Board
- Breadboard
- Tungsten Bulb
- Connecting Wires
- AC power supply

The Arduino Board

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the

"Arduino language". In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool (Arduino-cli) developed in Go.

Bluetooth – HC05

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This 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 Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection toother devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc. Just go through the datasheet for more details

Hardware Features:

- ✓ Typical -80dbm sensitivity
- ✓ Up to +4dbm RF transmit power.
- ✓ 3.3 to 5 V I/O.
- ✓ PIO(Programmable Input/Output) control.
- ✓ UART interface with programmable baud rate
- ✓ With integrated antenna.
- ✓ With edge connector.

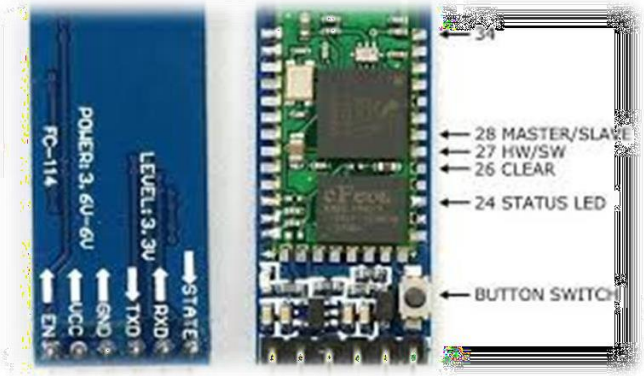


Fig 3.2: Bluetooth – HC05

The HC-05 Bluetooth Module has 6pins. They are as follows:

- **ENABLE:** When enable is pulled LOW, the module is disabled which means the module will not turn on and it fails to communicate. When enable is left open or connected to 3.3V, the module is enabled i.e. the module remains on and communication also takes place.
- **VCC:** Supply Voltage 3.3V to 5V
- **GND:** Ground pin
- **TXD & RXD:** These two pins acts as an UART interface for communication
- **STATE:** It acts as a status indicator. When the module is not connected to / paired with any other Bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with other device. When this module is connected to/paired with any other Bluetooth device, the signal goes High. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.
- **BUTTON SWITCH:** This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only when the module is not paired with any other BT device.

RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled

by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Fig 3.3: Relay Board

2.0 Flowchart of the Designed Project

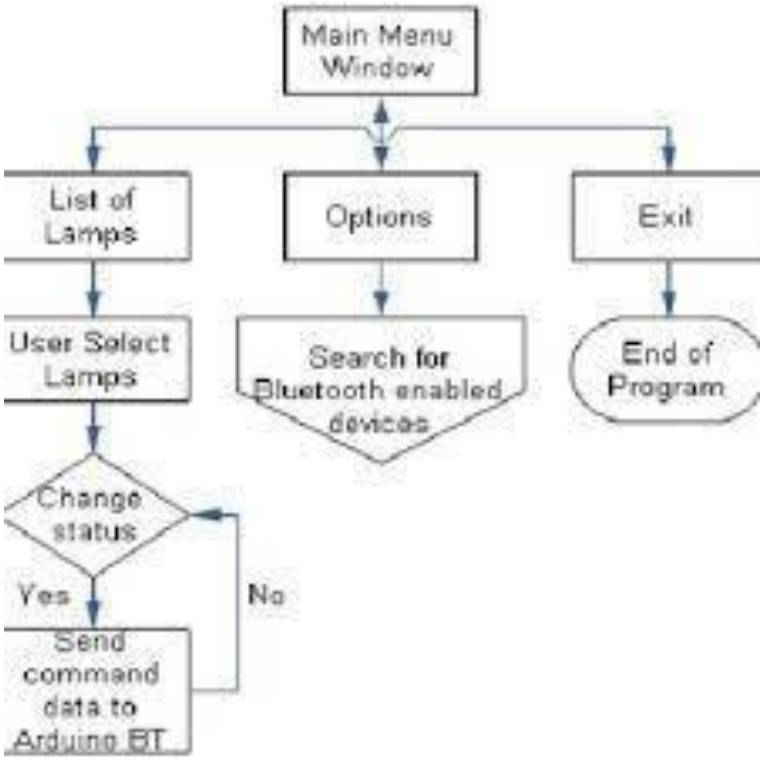
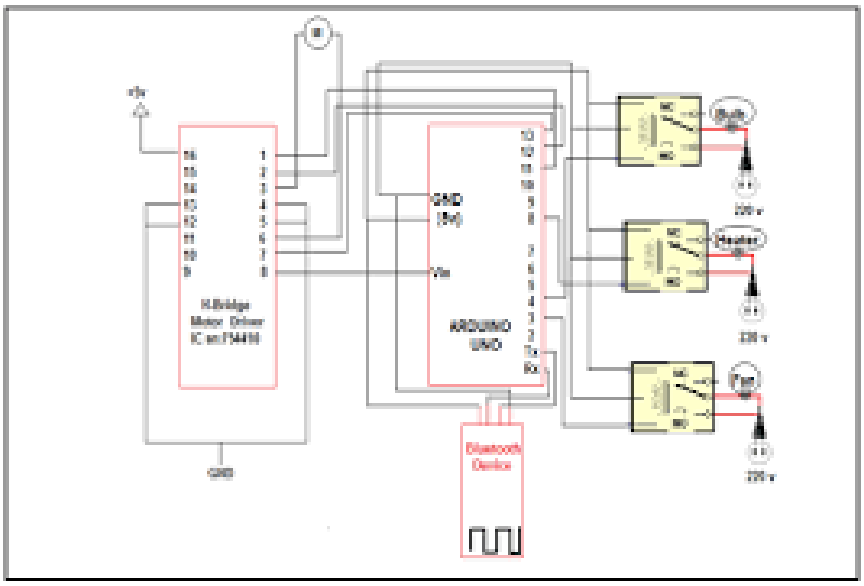
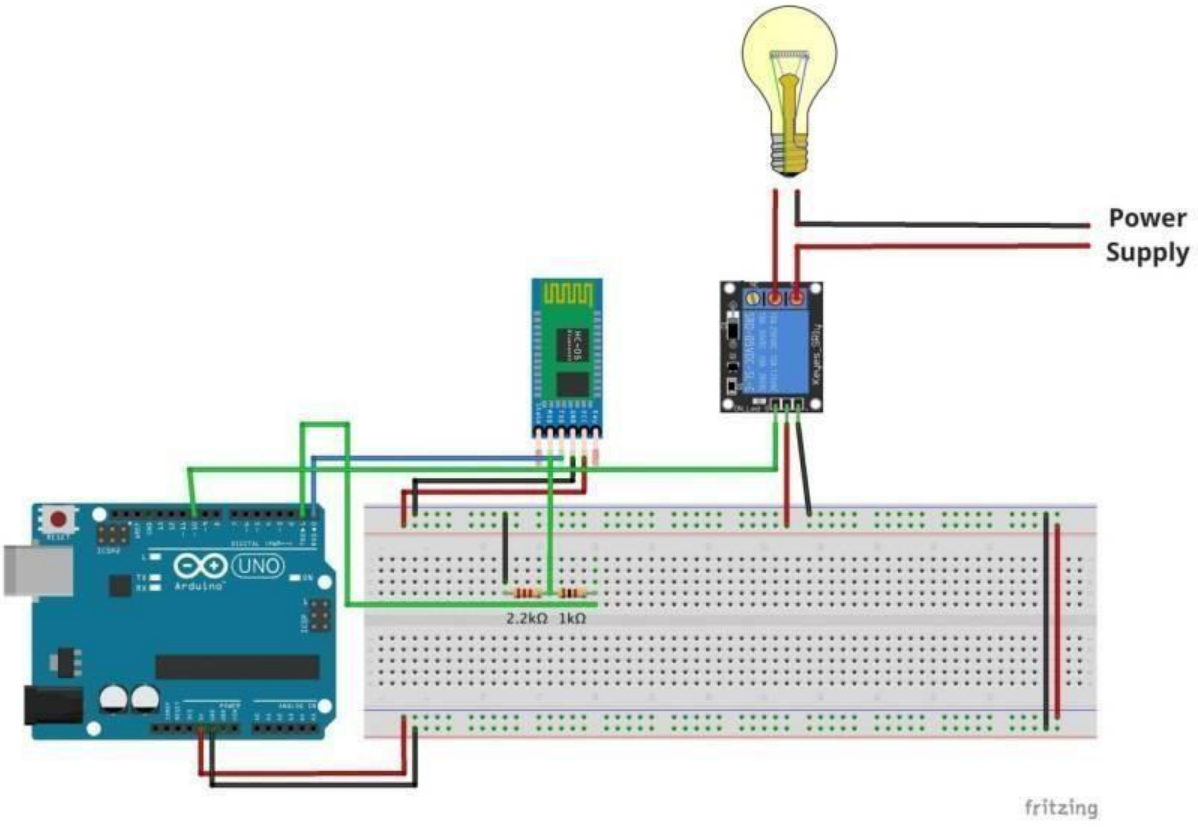


Fig3.4: Flowchart of the Designed Project

2.1 Circuit Diagram of the project



2.2 DESIGNED PROJECT



3.0 PROGRAM CODE

```
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 relay2 as an output
digitalWrite(relay1, LOW); //Switch relay1 off
digitalWrite(relay2, LOW); //Swtich relay2 off
digitalWrite(relay3, LOW); //Switch relay1 off
digitalWrite(relay4, LOW); //Swtich relay2 off
digitalWrite(relay5, LOW); //Switch relay1 off
digitalWrite(relay6, LOW); //Swtich relay2 off
digitalWrite(relay7, LOW); //Switch relay1 off
digitalWrite(relay8, LOW); //Swtich relay2 off
}
void loop()
{
while(Serial.available()) //Check if there are available bytes to read
{
delay(10); //Delay to make it stable
char c = Serial.read(); //Conduct a serial read
if (c == '#'){

break; //Stop the loop once # is detected after a word
}
inputs += c; //Means inputs = inputs + c
}
if (inputs.length() >0)
{
Serial.println(inputs);
```

```
if(inputs == "A")
{
digitalWrite(relay1, LOW);
}
else if(inputs == "a")
{
digitalWrite(relay1, HIGH);
}
else if(inputs == "B")
{
digitalWrite(relay2, LOW);
}
else if(inputs == "b")
{
digitalWrite(relay2, HIGH);
}
else if(inputs == "C")
{
digitalWrite(relay3, LOW);
}
else if(inputs == "c")
{
digitalWrite(relay3, HIGH);
}
else if(inputs == "D")
{
digitalWrite(relay4, LOW);
}
else if(inputs == "d")
{
digitalWrite(relay4, HIGH);
}
else if(inputs == "E")
{

digitalWrite(relay5, LOW);
}
else if(inputs == "e")
{
digitalWrite(relay5, HIGH);
}
else if(inputs == "F")
{
digitalWrite(relay6, LOW);
}
```

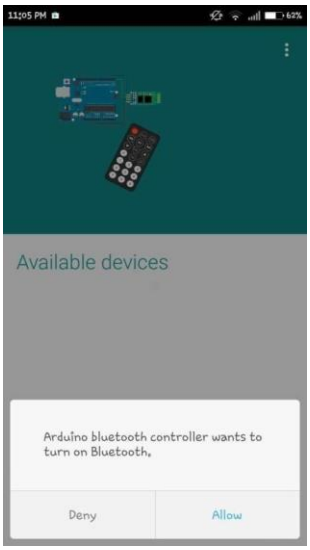
```
else if(inputs == "f")
{
digitalWrite(relay6, HIGH);
}
else if(inputs == "G")
{
digitalWrite(relay7, LOW);
}
else if(inputs == "g")
{
digitalWrite(relay7, HIGH);
}
else if(inputs == "H")
{
digitalWrite(relay8, LOW);
}
else if(inputs == "h")
{
digitalWrite(relay8, HIGH);
}
inputs="";
}
}
```

4.0 Controlling the bulb from my Android device

Now that we have setup the hardware and successfully uploaded the code, the next step is to control the setup from a smartphone. In order to that, you'll need to download the Arduino Bluetooth Controller app on your Android device.

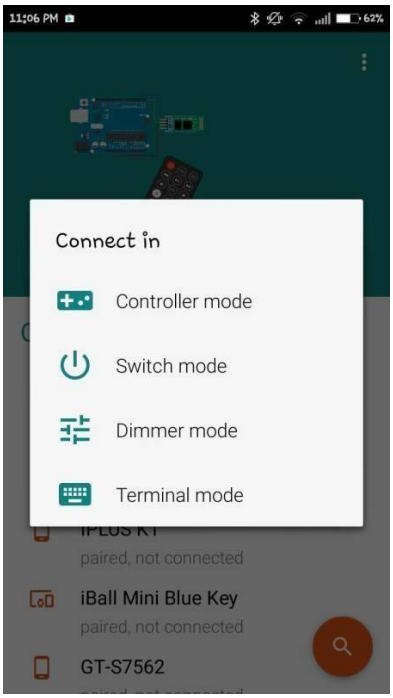
Here's how to configure your Android device to send commands to the Arduino:

1. Open the app on my smartphone. It will ask for Bluetooth permissions. Click 'Allow'.

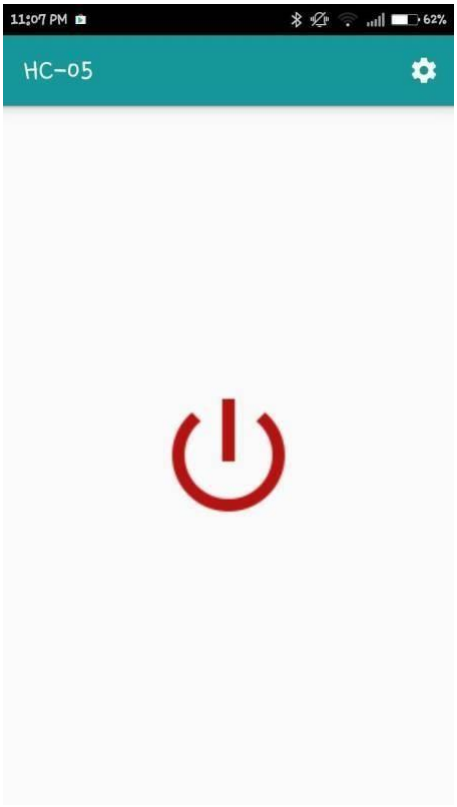


2. Next, it will list all the available devices in your vicinity. Select HC-05.

3. Once select the device, it'll be connected to the HC-05 transceiver. The app will now prompt me to enter the mode that i wish to use.



4. It should be redirected to the following screen. Click on the “Settings” icon in the top-right corner of the screen.

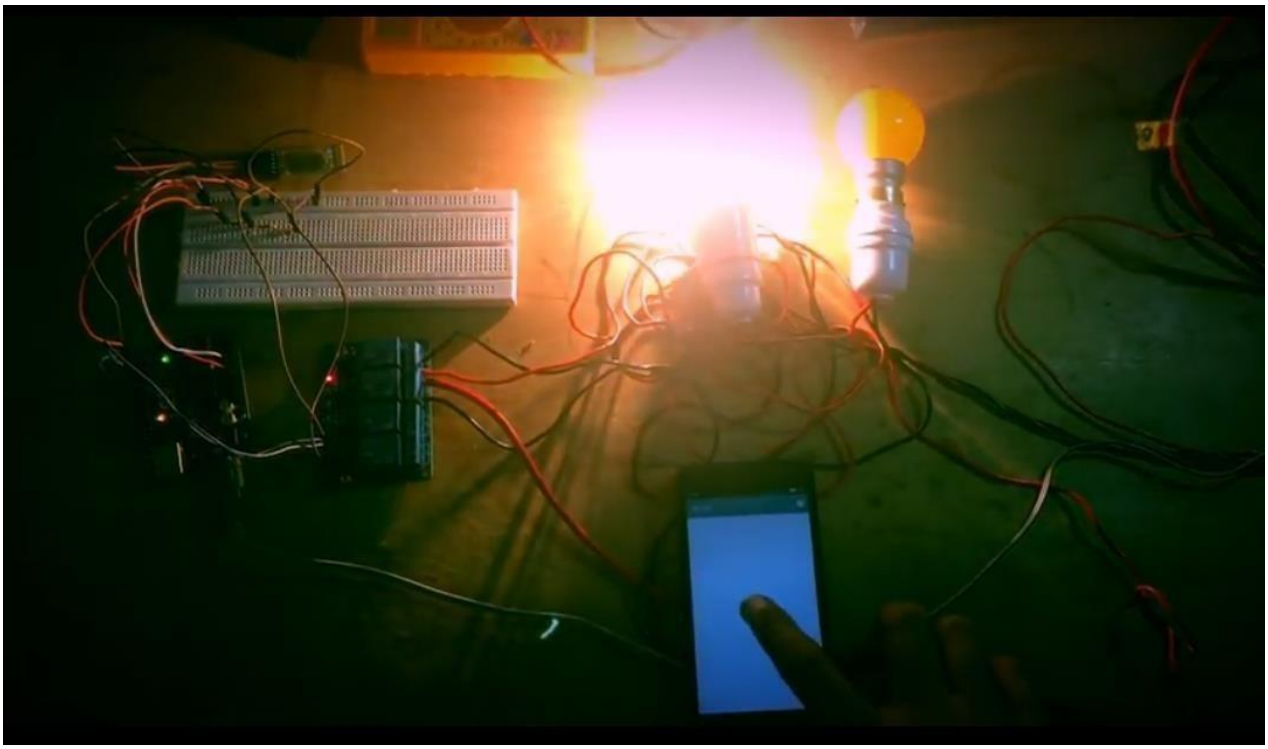


5. It will now ask me to set values for ON and OFF. Enter ‘1’in the ON text box and ‘0’ in the OFF textbox. Click Submit.

4.1 WORKING

After making circuit connection as per the compile the Arduino program given below in Arduino IDE and upload program to your Arduino Uno using USB B type data cable. Power up our Arduino using 9v DC adapter. After power up our circuit the IRD on Bluetooth start to blink very fast, it means the Bluetooth device waiting to be pair. Now connect your mobile to HC05 using Bluetooth Controller app. After connecting your mobile to HC05 turn ON and OFF the lights using respective keys.

4.2 Practical View of Project



CONCLUSION

The project has proposed the idea of smart homes that can support a lot of home automation systems. A smart home contains a connection between wireless communication, sensors, monitoring and tracking. Smart homes area huge system that includes multiple technologies and applications that can be used to provide security and control of the home easily.

This project discussed the designed modules like sensors' circuits, monitoring and tracking of the home through IP camera, mobile notifications and home navigator. Home Automation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these Home Automation devices and set up controlling actions through Mobile. Infuturethisproductmayhavehighpotentialformarketing.Furtheritcanbe demonstrated from computer instead of mobile phone for controlling the appliances of any larger places like industries, hospitals, institutions etc. centrally.
Home Automation is undeniably a resource which can make a home environment automated. People can control their electrical devices via these Home Automation devices and set up the controlling actions in the computer. We think this product have high potential for marketing in the future.

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