# ARDUINO BASED HOME AUTOMATION USING BLUETOOTH ANDROID SMARTPHONE

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## ABSTRACT

*The world is moving faster towards automation. Home automation isn't more an idea rather it's grown to be a necessity. Just imagine, to regulate everything around your home with one click of your phone is nothing but fascinating. This paper has presented an approach for smart home automation using Arduino with Bluetooth module. The aim was to develop and design a Home automation using Arduino with Bluetooth module with Android application. The Bluetooth module based Home Automation will enable the user to use a Home Automation System via Bluetooth using their android smartphones. The trendy homes are automated through Bluetooth and therefore the home appliances are controlled. Home appliances such as LED lights, Bulbs, Fans, Refrigerator, etc. can be controlled using Arduino UNO with the help of Bluetooth module. The paper's main aim was to make a smart home control system which monitors and controls the appliances and devices, so as to provide a smart home which would be secure, easy to access and energy & cost efficient. Android phones are used to provide an interface between the smart home and the user which can be used for monitoring the system too.*

***KEYWORDS:*** *Arduino, Home Automation, Bluetooth, Smart Phone, Security*

## INTRODUCTION

Automatic frameworks are being favoured over manual frameworks. No wonder, home automation is already an exciting word, especially because the wave of second-generation homeowners is growing, they need quite a lot of shelter, water, and electricity. The primary and most evident advantage of Smart Homes is comfort and convenience, as more gadgets can cope with more operations (lighting, temperature, then on) which successively frees up the resident to perform other tasks. Almost everyone carries a smartphone nowadays, which can be used to control every appliance in their day to day life easily. Everyone knows how to use a smartphone due to their easy to understand interface. Appliances (such as lights, fans, Home Monitoring Systems, AC etc.) can be controlled using a Bluetooth module based remote application in the smartphone using Arduino. The smart home gadgets interact, seamlessly and securely. Smart homes stuffed with connected products are loaded with possibilities to create our lives easier, more convenient, and lighter.

In this system we use Arduino, which is the most commonly used component for automation. Arduino can be said to be a piece of hardware which is used as an interface between the computer (in our case an android smartphone) and the model which performs tasks based on the Arduino code and the data provided by the computer. Arduino is a device known as a microcontroller which is a small computer on an integrated circuit chip. It acts like a human brain which processes information (received by sensory parts) and then performs any logical, mathematical or both the operations based on the information provided. The Bluetooth module acts as the sensory part in our case, which receives the information from the

user and sends it to Arduino, in the form of wireless radio transmissions over a short distance providing the necessary means for controllability. Arduino after performing the data processing provides the output device with the processed information, which receives it and performs the operation in our case as a relay which is a switch used to switch the devices on/off. This system generates a personal network area inside our home, where all the appliances which have been connected to the system to be monitored and controlled using a smartphone. The greatest perk of the home Automation system is the accessibility to all the features of the house from anywhere.
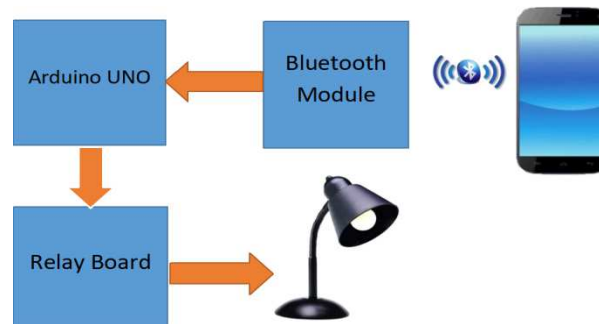
## BLOCK DIAGRAM



**Figure 1: Block Diagram of Arduino Based Home
automation Using Bluetooth.**

## COMPONENT USED

This project consists of 2 main parts i.e. Hardware part and Software part.

The hardware part mainly consists of Arduino UNO, HC – 05 Bluetooth module and a 4 channel Relay module.

**Table 1: List of Main Components Used in This Project**

| Hardware Components | Software Components |
|---|---|
| Arduino UNO<br>HC-05 Bluetooth Module<br>5 V Power Source<br>4 Channel Relays<br>Breadboard & Connecting wires<br>Bluetooth enabled smart phone | Bluetooth Terminal Android Application<br>Arduino IDE |

## ARDUINO UNO

The Arduino UNO is one of the best boards which can be used to get started with electronics and coding. The UNO is a microcontroller based on ATmega328. It consists of 14 digital I/O pins, a 16 MHz quartz crystal, 6 analog inputs, an ICSP header, a USB connection, a reset button and a power jack.

**Specifications**

- Microcontroller: ATmega328

- Operating Voltage: 5V

- Input Voltage (recommended): 7-12V

- Input Voltage (limits): 6-20V

- Digital I/O Pins: 14 (of which 6 provide PWM output)

- Analog Input Pins: 6

- DC Current per I/O Pin: 40 mA

- DC Current for 3.3V Pin: 50 mA

- Flash Memory: 32 KB of which 0.5 KB used by bootloader

- SRAM: 2 KB (ATmega328)

- EEPROM: 1 KB (ATmega328)

- Clock Speed: 16 MHz

- Forward Current (If): 30mA

- Forward voltage (Vf): 1.8-2.4V

- Operation Temperature: -30°C~85°C

- Superior weather resistance

- UV Resistant Epoxy

## HC-05 BLUETOOTH MODULE

The Bluetooth Module HC- 05 consists of 4 – pins for +VCC (+5V), GND (Ground), TX (Transmit bit) and RX (Receive Bit). This module can be used with any Bluetooth enabled phone or tablet or laptop, and the range of it is approximately 10 m.

**Specifications**

- Bluetooth protocol: Bluetooth Specification v2.0+EDR

- Frequency: 2.4GHz ISM band

- Modulation: GFSK(Gaussian Frequency Shift Keying)

- Emission power: ≤4dBm, Class 2

- Sensitivity: ≤-84dBm at 0.1% BER

- Speed: i) Asynchronous: 2.1Mbps(Max) / 160 kbps ii) Synchronous: 1Mbps/1Mbps

- Security: Authentication and encryption

- Profiles: Bluetooth serial port

- Power supply: +3.3VDC 50mA

- Working temperature: -20°C ~ 75°C

- Dimension: 26.9mm x 13mm x 2.2 mm

## 5V FOUR CHANNEL RELAY

4 – Channel relay board can be used to control four different types of loads at the same time without interfering with each other. It has all the necessary components and connections to make it happen, like flyback diode, base current limiting resistor, and header and LED indicators for connecting it to other devices.

**Specifications**

- Supply voltage: 3.75V to 6V

- Trigger current: 5mA

- Current when the relay is active: ~70mA (single), ~300mA (all four)

- Relay maximum contact voltage: 250VAC, 30VDC

- Relay maximum current: 10A

The software part has a ready-made android application like Bluetooth terminal (can be easily accessed from playstore) and Arduino IDE. Arduino IDE (Integrated Development Environment) is open-source software and that enables better and assisted code editing, compiling and debugging. Arduino IDE (Integrated Development Environment) is open-source software that enables better and assisted code editing, compiling and debugging.

## WORKING

Arduino based home automation systems using Bluetooth helps the user control any appliance with the help of a smartphone using an application.

**The Working of the Whole System Has Been Described Below**

- The android application is used to transmit the instruction, which carries the information about the operation to be performed. The transmitted instruction is received by the Bluetooth module which has been paired with the android smartphone beforehand.

- The data received is then transferred to the Arduino UNO which then processes the data and switches on the desired relay as instructed by the data. When the same data set is received again the corresponding relay is then switched off.

For example: Let us assume 4 relays are present (namely 1, 2, 3 & 4). When the switch for load/device 1 is pressed, the device is supposed to switch on, so the android smartphone transmits the data to the HC – 05 module using the inbuilt Bluetooth in the smartphone which had been paired. The transmitted data is received by the module and sent to the Arduino UNO which processes the data and realizes that it is supposed to switch on the relay for device named '1'.The relay is the switched on which results in the device turning on. When the device switched on is turned off the data is transmitted again which is then received and processed. This further results in switching off of the relay 1. And similarly for the other devices connected to their respective relays.

The connections required for the project to be implemented have been shown below in the form of circuit diagram.

## CIRCUIT DIAGRAM

Figure 3 shows is the output obtained by simulating our project. We have switched on all the appliances by using the "All ON" command, as we can observe from the above image.

As soon as the Bluetooth module receives the command it transmits it over to the UNO. Which processes the command and executes accordingly, in our case it switches on all the relays which in turn results in the switching on of the appliances connected to it.
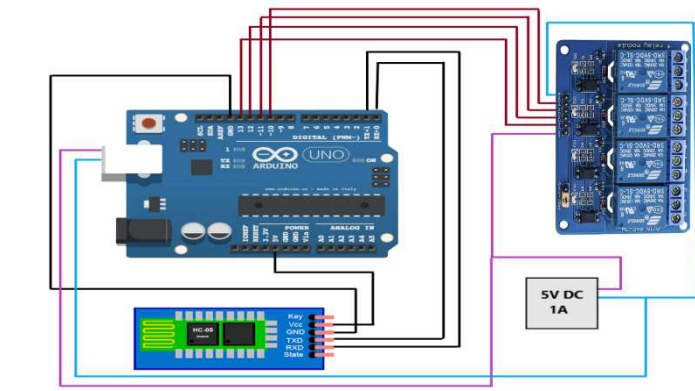


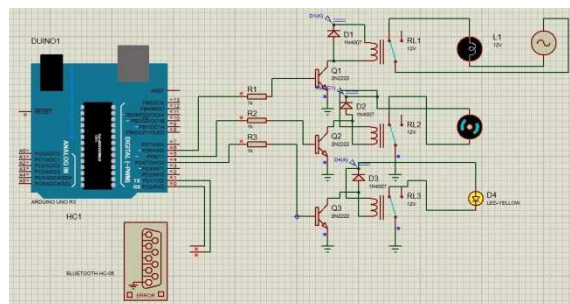**Figure 2: Basic Circuit Diagram of Proposed System.**



**Figure 3: Simulation of Proposed System in Proteus.**

## RESULTS

From the above experiment we obtained a voice controlled as well as a touch screen interface home automation system which is used to control our appliances. We also observed that the time consumed in executing a command is very small which shows that this system is very fast and precise. While some drawbacks were also observed, such as - it can only support one device at a time for the control of the system, if a new device needs to be added it needs to be configured and paired for it to be operational and if the controller is out of Bluetooth range the automation control cannot be performed.

## APPLICATIONS

- Lighting control

- Heating, Ventilation, and Air Conditioning

- Smart Home Appliances

- Improved Home Safety and Security

- Home Air Quality and Water Quality Monitoring

- Native language-based voice assistants

- Smart Energy Meters

## FUTURE SCOPE

In the last few decades, the need for automation has been increasing a lot and automation holds more potential than it is currently being used for. As technology advances, new ways to use automation and its applications will also vastly increase. Automation can be used for making homes friendlier for the elderly and children. In the near future automation can further be applied for centralized metering systems, security, surveillance, indoor climate control and a lot more that we can imagine.

## CONCLUSIONS

From the above discussion it can be concluded that Home Automation is a special device used for controlling and monitoring devices in our home in a centralized place and easily accessible with minimum effort. And in this paper, we discussed the components, working, application and future scope of home automation. We have created a device which is compact, easy to use, long life and low cost. The need of this paper is to create a device which is energy efficient and makes human life easier.

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**APPENDICES**

```
String voice;

void setup() {

Serial.begin(9600);

pinMode(6, OUTPUT);

pinMode(5, OUTPUT);

pinMode(4, OUTPUT);

}

void loop() {

while(Serial.available()){

delay(3);

char c = Serial.read();

voice+=c;}

if(voice.length() >0){

Serial.println(voice);

if(voice == "light on")

 {digitalWrite(6, HIGH);}

else if(voice == "light off")

 {digitalWrite(6, LOW);}

else if(voice == "fan on")

 {digitalWrite(5, HIGH);}

else if(voice == "fan off")

 {digitalWrite(5, LOW);}

else if(voice == "night lamp on")

 {digitalWrite(4, HIGH);}

else if(voice == "night lamp off")
```

```
 {digitalWrite(4, LOW);}

else if(voice == "all on")

 {digitalWrite(4, HIGH);

digitalWrite(5, HIGH);

digitalWrite(6, HIGH);}

else if(voice == "all off")

 {digitalWrite(4, LOW);

digitalWrite(5, LOW);

digitalWrite(6, LOW);}

voice = "";}

}
```

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