# HOME AUTOMATION USING VOCAL COMMANDS

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# Abstract

Home Automation [1] [2] [3] is the present trend in this fast moving world, everyone in this world are trying to reduce their efforts and increase their comforts. Think once, if you enter your home and just say "Light On" then the tube light in your room glow, imagine how exciting it will be. Our present work is related to this topic which controls your home appliances by just your voice commands. Here the voice commands of the user is received by the android mobile phone and they will be transferred to the programmed micro controller through a Bluetooth module and then the micro controller will generates the output voltage required to control the relays to which the 220 volts home appliances were connected.

Keywords: Arduino UNO, Relay Board, HC – 05 Bluetooth Module, and Android etc...

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# **1. INTRODUCTION**

### 1.1 Need for This Type of Home Automation

Home Automation is the term which describes the situation where electrical home appliances in our house works automatically just by our commands rather than the physical actions like turning ON the two way switches etc., There are several companies in the present society which are providing Home automation to the houses. But what to know here is they are costing too much for this, which is hard for a middle class man to bear. According to the some web sources, it was seen that they are costing about some lakhs of rupees for just providing home automation to limited no. of home appliances. This made us to proceed in a way to find the alternate for this high cost home automation system by just using the basic electronic components and for our project the total prototype costs around Rs.5000/- for automating approximately 8 home appliances in the house, hope this figures look just prettier.

# **1.2 Apparatus**

To complete this prototype we have utilized the components which are stated below.

- 1. HC 05 Bluetooth Module<sup>[6]</sup>
- 2. Arduino UNO<sup>[7]</sup>
- 3. 5V, 8 Channel Relay Board
- 4. 9V Batteries
- 5. Android Phone with BT Voice Control for Arduino application<sup>[8]</sup>
- 6. Home Appliances

# 1.2.1 HC - 05 Bluetooth Module

HC - 05 Bluetooth Module is a Bluetooth data transfer chip i.e. it transmits and receives the signals over short distances by using short wave length ultra-high frequency radio waves in ISM band (Industrial, Scientific and Medical Radio Band) from 2.4 to 2.485 GHz. The HC - 05 is used to connect with mobile phones and Personal Area Networks (PANs) in the range of about 10 Mts.

The HC - 05 comes along with a BT Board to connect with devices like Arduino. The main components in this Bluetooth Module are CSR Bluetooth Radio, 8MB Flash Memory, Micro strip Antenna, 26 MHz Crystal Oscillator and RF matching network along with pins like VCC, GND, TXD, RXD, State, Key to connect with Arduino.

In our prototype, this HC - 05 receives signals from the android mobile phone and transfer them to the Arduino UNO for next processing step.

As default the passkey for this HC - 05 is 1234 and the Baud rate is 9600 bps.



Fig -1: A) Front view of HC - 05, B) Back view of HC - 05

#### 1.2.2 Arduino Uno

The Arduino UNO is a micro controller board based on the ATMEGA328P<sup>[5] [10]</sup>. The UNO contains 14 digital Input/ Output pins, 6 Analog Input Pins, 16 MHz Crystal Oscillator, a USB connection, a power jack, an ICSP header and a reset button. It is operated at 5V.

The ATMEGA328P is a microcontroller of totally 28 pins. To make users easy to utilize this ATMEGA328P it has been interfaced with Arduino UNO.

While Coming to our prototype the HC - 05 is connected to Arduino and from the Arduino the connections were given to a 5V, 8 channel Relay board.



Fig -2: Arduino UNO

#### 1.2.3 5V, 8 Channel Relay Board

Relays are the small electro - mechanical switches, these relays has totally 5 pins out of which two pins are for relay's input purpose and three pins are for relay's output purpose i.e. the input two pins are the terminals to receive the input voltage. The input voltage may be 5V or 12V based on the specifications, here in our experiment we use 5V relays. The three output pins are NO (Normally Open), C (Common), NC (Normally Close). If NO and C connections are given to any device as a switch connection then the switch will be in OFF mode generally when input voltage is low and the switch will turn ON if the input voltage changes to high, If NC and C connections are given to any device then the switch will be in ON mode generally when input voltage is low and the switch will turn OFF if the input voltage changes to high.

If some number of relays are connected together and made as a circuit board for easy functioning then it will be called as a Relay board and according to the number of relays connected the board name will be differed if 4 relays are connected then it will be called as 4 channel relay board, if 8 relays are connected then it will be called as 8 channel relay board and so on. The boards are also differed according to their input voltage readings, they may be available as 5V Relay boards or 12V Relay boards. Here in our model we use 8 channel relay board with 5V as input voltage because the output voltage for the Arduino will be 5V and the relay's output connections will be connected from NO and C terminals to home appliances.



Fig -3: 5V, 8 Channel Relay Board

#### 1.2.4 9v Batteries

Here in our model we use two 9V Zinc Carbon batteries, the selection of batteries is not restricted, any type of batteries can be selected but the voltage range should be 9V. The batteries are used to give the supply to Arduino UNO and the 5V, 8 channel Relay board. The Relay Board can also be worked with the voltage coming from Arduino, but an additional battery will be safe to use.



**Fig -4**: 9V Zn – C Battery

# **1.2.5** Android Phone with BT Voice Control For Arduino Application

BT Voice Control for Android is a voice recognition application (.apk) available in the open source market of Google Play. This application collects your voice signals through your mobile phone's internal mic and pass these commands to Bluetooth module connected to it. It pairs with the Bluetooth module and send the recognized voice commands in the form of strings. For example if you say "Home Automation", then it will send a string to the Bluetooth module as "\*Home Automation#". Here \* and # symbols represent the start and stop bits. This application is designed in a way that it can be used with any micro controller that can handle strings like Arduino, ARM, 8051 etc.



Fig -5: Screen Shots of BT Voice Control for Android application at different timings

#### **1.2.6 Home Appliances**

Different types of home appliances can be used in this model as per our convenience, for example Fans, Lights, Television, and Refrigerator etc.

In between these home appliances and mains voltage supply of 220 volts AC the relay acts as a switch.

# 2. PROTOTYPE

#### 2.1 Hardware Interfacing

First the HC - 05 Bluetooth module should be connected with the Arduino UNO, to do that the TXD pin of HC - 05 is given to RX pin i.e. Digital pin 0 of Arduino and the RXD pin of HC - 05 is given to TX pin i.e. Digital pin 1 of Arduino, then the GND pin of HC - 05 is connected with the GND pin of Arduino and the VCC pin of HC - 05 is connected with the +5V or +3.3v pins of Arduino.

Now the relay board is also needed to be connected with the Arduino, for that from the 11 Digital pins (Actually 13 but two are already assigned for TX and Rx), 8 digital pins are selected and they are connected to the relays one of input pins the other pins of all 8 relays are shorted and given to GND pin of Arduino.

Now the relay board should be interfaced with the home appliances, to proceed with that one of the 220 volts phase line is connected to the relay 1's NO pin and from the C pin

the wire should be connected with the home appliance's phase terminal then the neutral terminal is connected with the neutral point of the mains voltage supply. Similarly the remaining 7 relays are also connected with the home appliances.

The 9V batteries supply was given to the Arduino and relay board separately. Finally the Bluetooth module, HC - 05 is paired with the android mobile phone by selecting an option "CONNECT ROBOT" present in the application. As already mentioned the passkey for HC - 05 is 1234 by default.

Caution: Safety should be maintained while giving connections to 220 volt phase and neutral. Try to give connections by turning off the supply and after connections were given in proper manner turn on the supply.



Fig -6: Circuit diagram of the Prototype



Fig -7: Prototype of Home Automation using Vocal Commands

#### **2.2 Software Interfacing**

The Micro controller is an integrated circuit which is used to work as a mini computer. The Micro controller is also called as a computer on single chip. But to utilize its functionality it should be programmed first. According to the commands we had given in the program the micro controller start working. Here also for our micro controller ATMEGA328P, we need to program as per our need for executing this project. For programming <sup>[4]</sup> a micro controller there will be different types of micro controller kits and programmers available in the market but here as we are using Arduino UNO as micro controller kit we have to use Arduino software (IDE)<sup>[9]</sup> (IDE Development Environment) to Integrated program ATMEGA328P.

This Arduino Software (IDE) uses only simple Embedded C commands to program the micro controller.

Now the program for our project should be written in such a way that first we have to initialize the inputs and outputs for the project, the inputs to the micro controller in our project are voice string commands which are coming the Bluetooth module and the outputs will be the connections given to the relays.

Next in the statements we use "if" conditions to specify the commands like if voice string 1 appears then make home appliance 1 ON. Similarly we write these type of statements for all 8 relays for both ON and OFF conditions.

After compiling the program without any errors, it should be dumped into the micro controller for processing.

The screen shots of the program utilized for this project is provided below in Fig: 8 and Fig: 9.

🥺 Home_Automation_using_Vocal_Commands   Arduino 1.6.5 — 🛛 🗌	×
File Edit Sketch Tools Help	
	5
Home_Automation_using_Vocal_Commands	•
String voice;	^
int	
Relay1 = 6,	
Relay2 = 7,	
Relay3 = 8,	
Relay4 = 9,	
Relays = 10, $P_{1}$	
Relayo = 11, Bolay7 = 12	
Relav8 = 13:	
void setup()	
<pre>Serial.begin(9600);</pre>	
<pre>pinMode(Relay1, OUTPUT);</pre>	
<pre>pinMode(Relay2, OUTPUT);</pre>	
<pre>pinMode(Relay3, OUTPUT);</pre>	
<pre>pinMode(Relay4, OUTPUT);</pre>	
<pre>pinMode(Relay5, OUTPUT);</pre>	
<pre>pinMode(Relay6, OUTPUT);</pre>	
<pre>pinMode(Relay7, OUTPUT);</pre>	
pinMode (Relay8, OUTPUT);	
}	
Void loop()	
while (Serial available())	
delay(10);	
Done Saving.	
Build options changed, rebuilding all	^
Sketch uses 4,788 bytes (14%) of program storage space. Maximum is 32,256 bytes.	~
28 Arduino Uno on COM	13
Fig8: Screen shot of the Program used for Home	
A transformation Visual Chamman In Et al. 16	
Automaton using Vocal Commands – First half	



Automaton using Vocal Commands - Second half

#### **3. WORKING**

After the interfacing Hardware and Software is done then we proceed with the final stage that is working of the prototype to get our desired output.

First the power supply should be given to the Arduino and the relay board. From the supply of Arduino the HC - 05Bluetooth module also gets the supply and turns on. Now connect the Bluetooth module with the android mobile phone for that first open the BT Voice Control for Arduino application and go the options, there you will find the option as "Connect Robot", click that option. Then it will ask the pass key (only for first time), enter the passkey. Now the HC - 05 was connected with the android mobile phone. Now press the option called "speak now" on the application, then a pop up comes there displaying "speak now". Now you can say your command like "light on" then this command will be converted into a voice string and will be sent to the HC -05. The HC - 05 transmits the voice string to the Arduino i.e. to ATMEGA328P micro controller. As we have programmed like if the voice string matches with any voice string that we listed, then that particular command gets activated. At that situation the digital pin linked with that command produces +5V supply and it will be given to the relay attached to it. Now the relay gets its input +5V, as the relay is connected in NO condition actually, now it will be closed so the 220V phase supply will be shorted and the supply starts moving, then the home appliance connected to it will start working.

If the command which is written to stop the above command is said, then the micro controller will stop the +5V supply to the digital pin and the input to the relay will be made low. So the switch comes to the normally open condition so the 220V phase supply will break and the supply to particular home appliance will stop.

#### 4. FURTHER DEVELOPMENT

Here we are using a single Arduino and an 8 channel relay board to give connections to 8 home appliances. If we want to increase the number of home appliances to be automated then we can utilize a Decoder i.e. for example if we use a  $4\times16$  Decoder then four digital pins of Arduino will be connected to the four inputs of  $4\times16$  Decoder and its sixteen outputs will be given to sixteen relays, so totally sixteen home appliances can be controlled.

Note: Here usage of decoder is not mandatory for everyone. In electronics there are several ways to proceed for a single situation. But to our convenience we had used a decoder here.

#### 5. CONCLUSION

By this we conclude that, by having a little grip on the electronics, we can create our own home automated house with low cost and less strain. This is the one of the cheapest methods to provide home automation. Though it doesn't uses advanced sensors but by just utilizing your voice commands you can control your home.

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In this paper some of the products like Arduino UNO, ATMEGA328P, BT Voice Control for Android application etc., are not our own products, they had been utilized by us as they were available in the open market. The total credits about these products goes to their respective owners.

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