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## Department Of Electronics and Computer Engineering

SE Electronics and Computer Engineering 2022-23

### Project Base Learning Report

On

**“HOME AUTOMATION SYSTEM USING ARDUNIO”**

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Home automation has recently come into the limelight and thus has undergone large scale development. Everything from lights and gas stoves to a garage door can be controlled using a central panel in the house or through wireless devices using an application or even voice commands. Vacher Michel et al [1]. It has been a huge advancement in technology, where it proves very useful in big houses or for the differently abled such as for the blind etc. It goes from basic switch controls that turn the lights on/off to creating different environments in the house based on requirements or mood, calling an Uber cab for you, controlling the HVAC systems of the house, Audio Visual entertainment systems etc. and many other advanced functions in the technological aspect. Home automation is not only a luxury, but for certain demographics like the quadriplegic, the elderly and the differently abled, it can be of great assistance. A home automation system makes them independent and self-reliant to a certain extent.



**Figure 1: Voice controlled home automation using arduino and HC-05 Bluetooth.**

Home automation is relatively new technology and they quite expensive making people to think twice before having it in their house alternatively, those system could be developing a using open-source software and multipurpose Single Board Computer (SBC) like Raspberry Pi. Open-source software allows people to participate in the development of those devices. It will also encourage people to share any resource they got which in turn rapidly increased adoption and development of the system.

It also relatively has a lower cost compared to built-in commercial products on the 2 | P a g e market such as home automation. Having a remote will make the system more user-friendly and portable. Smart homes systems are somewhat different from ordinary homes, where the different smart devices in the presence of communications network being installed that allows the devices to communicate with each other. Y. Usha et al.[5].Integrated communication systems provide the facility for monitoring and managing the performance of the home, and offer the choice support to the occupants for available facilities. The varieties of systems are installed in today's modern home such as central air conditioned and heating, fire and security alarms, and different other devices, such as home theater, televisions, lights etc. These systems and devices usually exist in total isolation from each other. Faisal et al [3]. Smart home provides the facility of passing information and commands among different installed devices and systems. Such facility and control not only provide better control locally and remotely but also supports special needs, particularly services that support the elderly. Anamul Haque et al [6]. Smart home technology also greatly improves the usability and functionality of any home. It also allows to potentially reducing power consumption by preventing occurrences such as lighting and air conditioning being left on longer than necessary. A smart Home Automation system allows saving money and the environment. Yash Mittal et.al [9].

## **1.2 Problem Statement**

The goal of this project is to create a model that will be able to recognize and determine the human voice and operate devices according to the instructions given by the person. Though the goal is to create a model which can act with a Bluetooth module, it can be extended by using module too. The major goal of the proposed system is understanding human language and making the device act according to the instructions given by the person.

## **1.3 Aims and Objectives**

The main aim of this project is to design and implement a voice-based home automation system. The main objectives of this project are:

1. Design an interface for a Bluetooth medium and a microcontroller board (Arduino board).
2. Activate communication between an android device and the Bluetooth enabled microcontroller board wirelessly via Bluetooth communication.
3. Detect and transfer speech data via Bluetooth to the microcontroller board. 3 | P a g e
4. Prepare a software to run on the microcontroller that will perform the necessary control.

5. Prepare the software to run on the android device in other to get speech data and transferring over Bluetooth.

#### **1.4 Report Organization**

The project report consists of four chapters organized as follows:

- Chapter 1 Includes Introduction, Problem Statement, Aim and Objectives, of the Project.
- Chapter 2 Is Related to Literature Review of Relevant Topic.
- Chapter 3 Describes “Voiced Recognition Based Home Automation System”. □ Chapter 4 Is Related to The Conclusion of the Project. 4 |

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Background**

A There are some projects that have been completed which regard to the application of the voice in the controlling method. In an intelligent home navigation system (IHNS) is proposed to facilitate the elderly and the physically challenged persons. It proposes an idea of an automated voice-based home navigation system. Arthi et al. [2].The system comprises over a wheelchair, navigation module and voice module. It uses a speech recognition module SR-07 and a line follower module for navigation. The system has predefined voice commands relating to different rooms, and predefined routes relating to those rooms for the navigation. There is also a collision avoidance system installed in the project.

The intelligent access control system is developed that is based on SPCE061A voice recognition chip. The supporting software comprises of the voice training module, the voice recognition module, the voice data processing module and the voice-playing module. Anamul Haque et al.[6].The system completes the functions of collecting the voice data, distilling character, special voice recognition and voice playing in terms of initializing the system and the identification training. The central processor of this system is the SPCE061A single chip. The talker confirmation that is relevant to text is realized on the chip, and then homologous order and operation are carried out. Olatunji et al.[7]

#### **2.2 Literature Review**

Home automation system, presented an audio processing module called PATCH. The proposed approach allows real-time reorganization of voice instructions to control what they called it SWEETHOME. They evaluated their approach in a realistic Smart Home with three user groups: seniors, visually impaired people, and people with no special needs. Results showed how PATCH approach worked properly for people with special needs. Michel Vacher et al.[1].utilized LabVIEW software in speech recognition for home automation to switch lights ON/OFF. Their simulation experiments measured the speed of any appliances respond. The result demonstrated how their system recognizes the input commands and responses achieved with a voice recognition accuracy of 95%.

Based on this result, they inferred that their system can be employed in electrical appliances like fan, fridge, air conditioner, television, etc.

Developed mobile application that allows controlling home appliances through voice instructions. The application tries to transform the user voice orders into SMS and send them via GSM network which increases the software complexity. Faisal et al.[3].illustrated a home automation system for elderly and disabled people. To recognizing the voice command Lab View software is utilized and in order to develop the wireless system ZigBee wireless modules is utilized. The proposed system has been tested with three home appliances. Thoraya et al. [4].developed Wireless Home Automation System to control all electrical appliances at home. After recognizing the human voice instructions, they utilized low-power Zigbee wireless communication modules to control the home appliances. Y. Usha et al. [5]. Employed microcomputer PC to control home appliances. They articulate two approaches to control the home appliances i.e., timer option and voice command. Moreover, many researches that addressed developing smart systems utilize Arduino, Zigbee, and raspberry pi devices to read inputs - light on a sensor, a finger on a button, or a Twitter message or in building facial and voice recognition model. Anamul Haque et al.[6][8].

Talks about developing a home automation system using a dedicated hardware module for the voice recognition module and an Arduino Uno microcontroller to send respective commands to devices. The voice commands are divided into five groups with up to seven commands in each group. The command groups are Access, Safety, Fan, Light and Utility. Anamul Haque et al.[8] the user has to state the group name followed by the command for it to register successfully. The voice recognition module is trained using the voices of five male and five female users. This ensures that the system can recognize voice commands irrespective of user age, gender, accent and distance from microphone. A bar graph of the average number of attempts it takes to successfully recognize a command at different distances from the microphone is generated to determine the best position for placing the central microphone. Yash Mittal et.al [9].

Arthi.J. E and M. Jagadeeswari [2].presented a low-cost Bluetooth based home automation system using an Android phone was presented by. An Arduino Mega 2560-R3 board and relays were used to connect the home appliances as input/output ports of the board, a Bluetooth were used to establish wireless communication between them. R. K. Kodaly et al.[11].designed and implemented an Android application with a Bluetooth module and Arduino UNO board for home-based automation. Users can interact with the android phone and send a control signal to the Arduino UNO that will control other embedded devices/sensors. Similarly, Diyala. [10].controlled home appliances through voice

commands with Arduino and 6 | P a g e Android OS. In the same Khalid Jamal Jadaa.et.al [8]. Networked all home appliances and controlled them through Bluetooth. The network contained a remote, mobile host controller and home appliances. The home appliance communicated with the host controller through the Bluetooth devices, which operated the home appliances through a RS232 network using Bluetooth module. Faisal Baig et al. [3]. Developed a GSM, Internet, and speech recognition-based home appliances automation. The Signals from the Radio Frequency (RF) antenna were processed by the microprocessor, which in turn was used to control the appliances. Also, Olatunji K. A et al.[7].also presented a Bluetooth-based home automation, but the only difference is that it had an authentication mechanism that made it secure and accessible to authorized users. Mukesh Kumar and Shimi S.L.[9].designed and implemented a smart home automation system based on a mobile phone and GSM modem. In this design, an incoming message was sent from the user phone to the GSM modem as a text message via the cellular network. It then decodes the SMS to activate the connected appliances; this is not a cost effective method of automation, as there is no means of getting feedback from the system. Elsevier B.V.[12].proposed how to use a Television (TV) remote control to control room lighting and other appliances in their work entitled “Programmable Infrared Accessory Light Switch”. An Infrared (IR) remote and one IR receiver was programmed to store the frequency of the existing remote and use them directly to control appliances. Mukesh Kumar and Shimi S.L.[10].

## **CHAPTER 3**

### **VOICE BASED HOME AUTOMATION SYSTEM**

#### **3.1 Introduction**

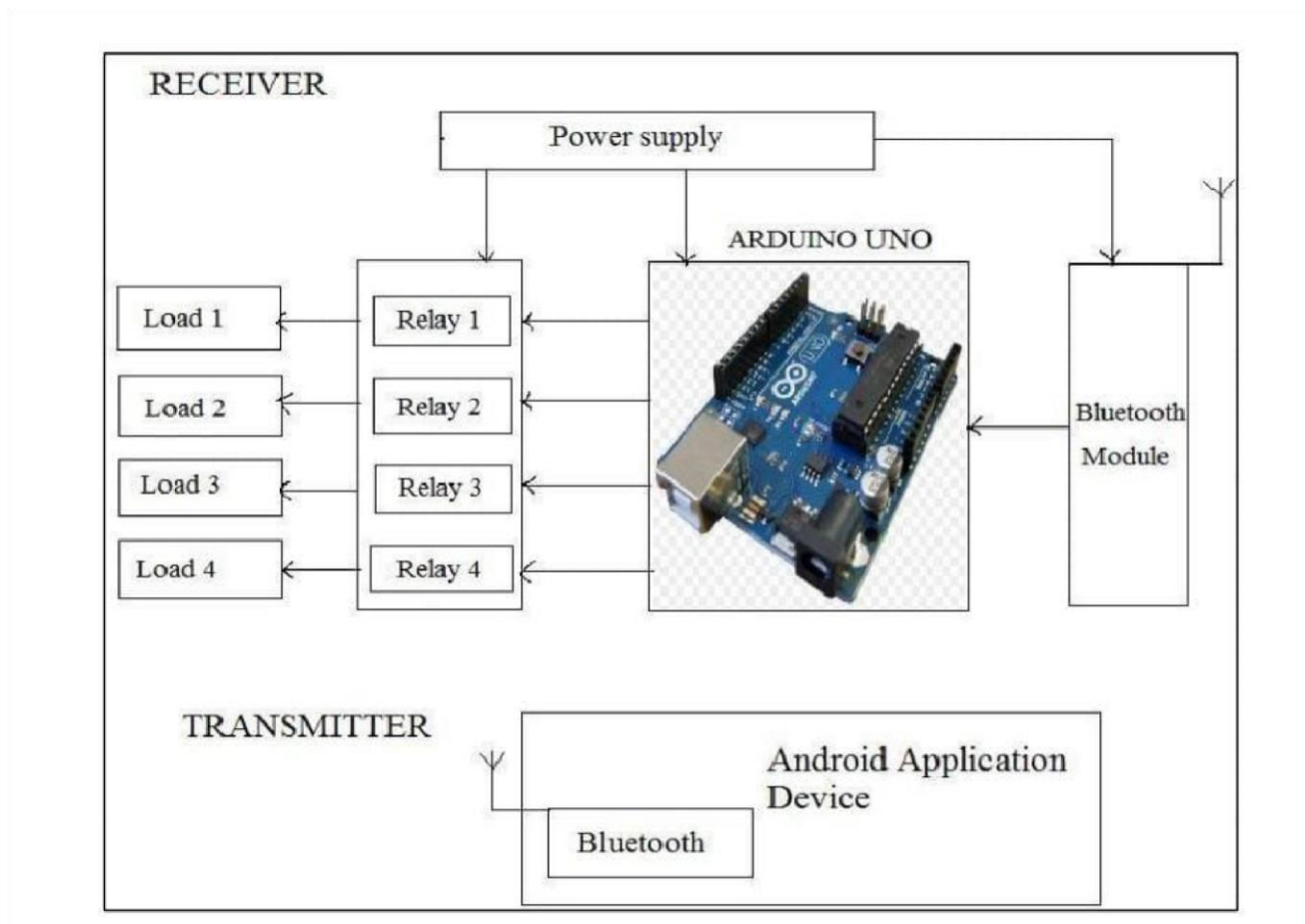
Home automation is a technology that can help normal, elderly, or even disabled users in controlling electrical appliances in a house by utilizing his/her voice. Home automation could facilitate their life especially if they need caregivers and continuous attention. This research designs an entirely useful system that has the ability to recognize the human voice and differentiate between his/her commands. Vacher Michel et al [1]. This research also seeks to design and implement a voice-based system that helps users to operate the electrical appliances at home via utilizing android mobile phones. Using android mobile phone in controlling the electrical appliances could provide several benefits to divers' users such as system security where the system can validate specific voice that belongs to the system owner, accessibility where the system can be used by people that have disabilities as (blinded, deaf, dumb). To demonstrate our approach, we have developed a prototype where an Android smart phone is used as speech based remote control that allow customers to control doors, light, and subwoofer remotely. Faisal et al [3].

Smart home automation is getting pervasive gratitude due to the expediency it provides to the community. Smart home automation allows centralizing the process of managing and controlling several home parts such as lighting, heating, ventilation and air conditioning, appliances, etc. Arthi.J. E and M. Jagadeeswari [2]. Smart home voice-based control systems allow home residents to wirelessly control any electrical appliances that can be configured to operate virtually. As real example, the home light system can be controlled by using voice command recognition where then can be translated to turn on, turn off, or set the levels of different rooms lights'. Usha et al [5]. Moreover, the smart home security system can configure to be controlled based on voice recognition system to activate and deactivate the alarm system. Even the TV channel can be changed using the voice-based system in the smart home. Thoraya et al. [4]. The proposed project attempt to implement a system that will overcome the disadvantages of traditional system in speech recognition based in controlling houses. In our project, it will be possible to run any system from any place using a single voice command. The use of voice recognition provides a significant increase in security, emulating an individual's voice is much more challenging, and need the use of modern communication technology.

Anamul Haque et al [6].



### 3.2 Block Diagram



**Figure: 3.1 Block diagram of Voice Based Home Automation System Using Arduino.**

### 3.3 Working

In Bluetooth based home automation systems the home appliances are connected to the Arduino BT board at input output ports using relay. The program of the Arduino BT board is based on the highlevel interactive C language of microcontrollers. The connection is made via Bluetooth. The password protection is provided so only authorized users are allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environments, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicates the status of the device R. Badlishah Ahmad [8].

The main aim of our system is to build a perfect companion for someone to be at home. Generally, home automation research targeted many needs like applications that provide the luxury smart

requirements while some threw light on the special needs for elderly and disabled etc. our system is a computer-based system that can accept voice to direct commands and process them. The system provides us switching any device ON/OFF. The HC-05 has two operating modes, one is the Data mode in which it can send and receive data from other Bluetooth devices and the other is the AT Command mode where the default device settings can be changed [9]. We can operate the device in either of these two modes by using the key pin as explained in the pin description. It is very easy to pair the HC-05 module with microcontrollers because it operates using the Serial Port Protocol (SPP). Simply power the module with +5V and connect the Rx pin of the module to the Tx of MCU and Tx pin of module to Rx of MCU. Mukesh Kumar and Shimi S.L [10]. During power up the key pin can be grounded to enter into Command mode, if left free it will by default enter into the data mode. As soon as the module is powered you should be able to discover the Bluetooth device as “HC-05” then connect with it using the default password 1234 and start communicating with it. The name password and other default parameters can be changed. Olatunji K. A. et al [7].

### 3.4 List of Components

Sr. No	Name of the Components
1	Arduino UNO -1
2	HC – 05 Bluetooth Module -1
3	4-Channel Relay Module -1
4	Smart Phone or Tablet -1
5	Zero Bulb – 4
6	Bulb Holder – 4
7	Power Supply - 5V
8	Connecting Wires
9	Breadboard -1
10	Arduino Bluetooth control (App for transmitting voice to Bluetooth)

**Table: 3.1 List of components**

### 3.5 Component Specification

#### 3.5.1. Arduino UNO:

Arduino is an open-source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits. Arduino board designs use a variety of microprocessors and controllers. Subhajit Dey [13]. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) 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 are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. Mok Vee Hoong [14].



**Figure 3.2: Arduino uno.[14]**

## **Features of the Arduino**

UNO 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

A 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

## **Arduino Hardware Part:**

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copy left licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. Mok Vee Hoong [14].

The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in -duino. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. Avadhoot R. et al [15]. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I<sup>2</sup>C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the Lilypad, run at 8 MHz and dispense with the onboard voltage

regulator due to specific form-factor restrictions. Arduino microcontrollers are preprogrammed with a boot loader that simplifies uploading of programs to the on-chip flash memory. Mok Vee Hoong [14].

### **Arduino Software Part**

IDE The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. Avadhoot R. et al [15]. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. Jinan N. Shehab et al [16]. The source code for the IDE is released under the GNU General Public License, version 3. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. R. K. Kodaly et al [12]. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub `main()` into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program `avrdude` to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. Subhajit Dey [13].

### **3.5.2. 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 separate low-power signal, or where several circuits must be controlled by one signal. R. K. Kodaly et al [17]. 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. Sushant Kumar and S.S. Solanki [19]. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a

semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. B. Ghazal and K. AIKhatib [18]. Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands. Avadhoot R. et al [15].



## 2 RELAY MODULE S

### Applications of Relay

Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable. The first application of relays was in long telegraph lines, where the weak signal received at an intermediate station could control a contact, regenerating the signal for further transmission. R. K. Kodaly et al [17]. High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots' switches. Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a



starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key. Sushant Kumar and S.S. Solanki [19].

### 3.5.3bluetooth Module (HC-05 Bluetooth Module) HC-05 Specification:

Bluetooth protocol: Bluetooth Specification v2.0+EDR

Frequency: 2.4GHz ISM band

Modulation: GFSK (Gaussian Frequency Shift Keying)

Emission power:  $\leq 4\text{dBm}$ , Class 2

Sensitivity:  $\leq -84\text{dBm}$  at 0.1% BER

Speed: Asynchronous: 2.1Mbps (Max) / 160 kbps,

Synchronous: 1Mbps/1Mbps

Security: Authentication and encryption

Profiles: Bluetooth serial port

Power supply: +3.3VDC 50mA

Working temperature:  $-20 \sim +75\text{Centigrade}$

Dimension: 26.9mm x 13mm x 2.2 mm

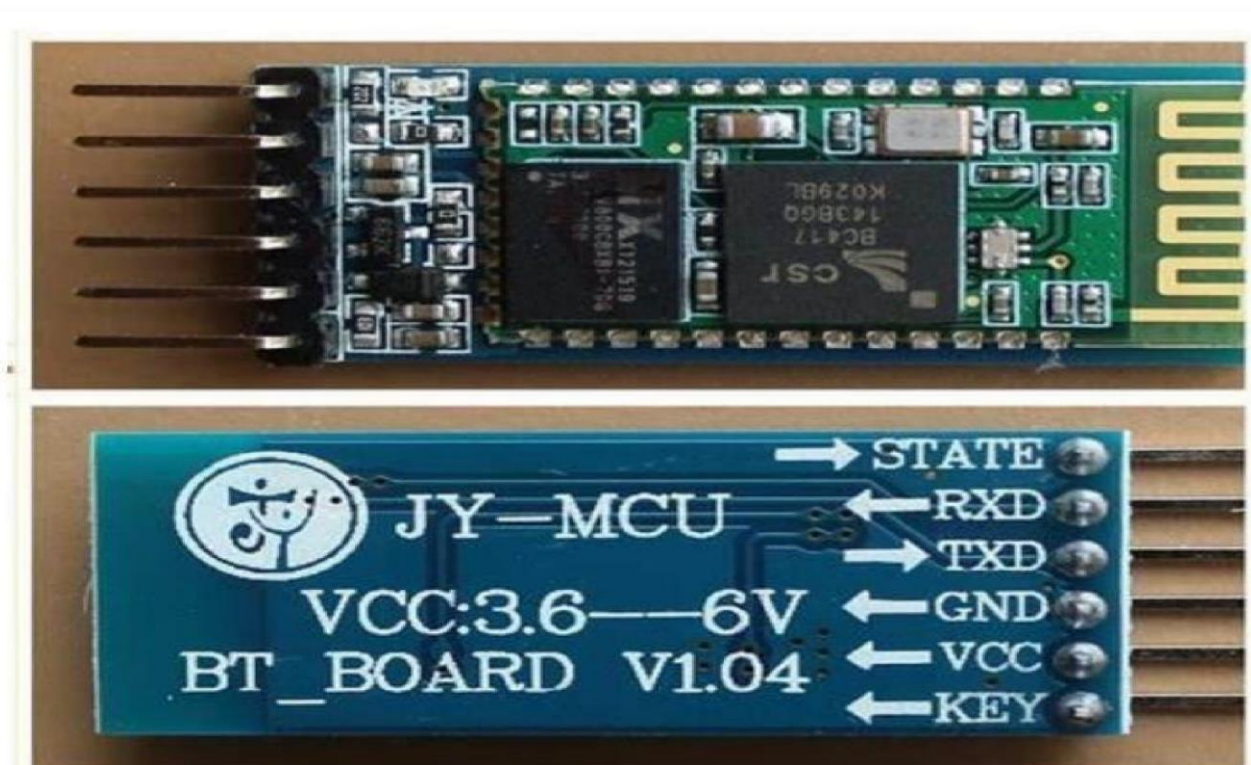


Figure 3.4: HC-05 Bluetooth module [18]

## Overview

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. Sushant Kumar and S.S.

Solanki [19]. It uses CSR Blue core 04- External single chip Bluetooth system with CMOS Technology and with AFH (Adaptive Frequency Hopping Feature). Bluetooth Module HC-05 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 to other 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. Subhajit Dey [13].

## 3.6 Connecting the Required Connections

I. **Arduino:** The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. Simply connect it to a computer with a USB cable or power it with a AC to-DC adapter or battery to get started. R. K. Kodaly et al [17] .

II. **Bluetooth:** For the communication between mobile phone and microcontroller Bluetooth module (HC-05) is used. HC-05 is low power 1.8V operation and is easy to use with Bluetooth SPP (serial port protocol). Serial port Bluetooth module have a Bluetooth 2.0+EDR (enhanced data rate), 3Mbps modulation with complete 2.4GHZ radio transceiver and baseband. Using Bluetooth profile and android platform architecture different type of Bluetooth applications can be developed. Jinan N. Shehab et al [16].

III. **Relay:** Relay is basically an electromagnetic switch which can be turn on and off by an applying the voltage across its contacts. • In this project used a 5V 4-channel relay. Avadhoot R. et al [15].

IV. **Android:** Android is an open-source operating system which means that any manufacturer can use it in their phones free of charge. • It was built to be truly open. Android is built on the open



Linux Kernel. Furthermore, it utilizes a custom JAVA virtual machine that was designed to optimize memory and hardware resources in a mobile environment. B. Ghazal and K. Al-Khatib [18].

**V. Android Application Operated Bluetooth:** The Android platform includes support for the Bluetooth network stack, which allows a device to wirelessly exchange data with other Bluetooth devices. • The application framework provides access to the Bluetooth functionality through the Android Bluetooth APIs. Avadhoot R. et al [15].

### 3.7 Programming:

```
#include<softwareserial.h>
String value; int TXD=11;
int RXD=10;

int servoposition;  Softwareserial
Bluetooth(TxD,RxD);

Void setup() {
  PinMode(2,output);
  Pin (mode3,output);
  Serial.Begin(9600);
}

Void loop () {
  Serial.println(value);
  If (Bluetooth. Available ())
  {
    Value=Bluetooth.readString();
    If (value=="all LED turn on")
    {
      Digital write(2,HIGH);
      Digitalwrite (3, HIGH);
```

```

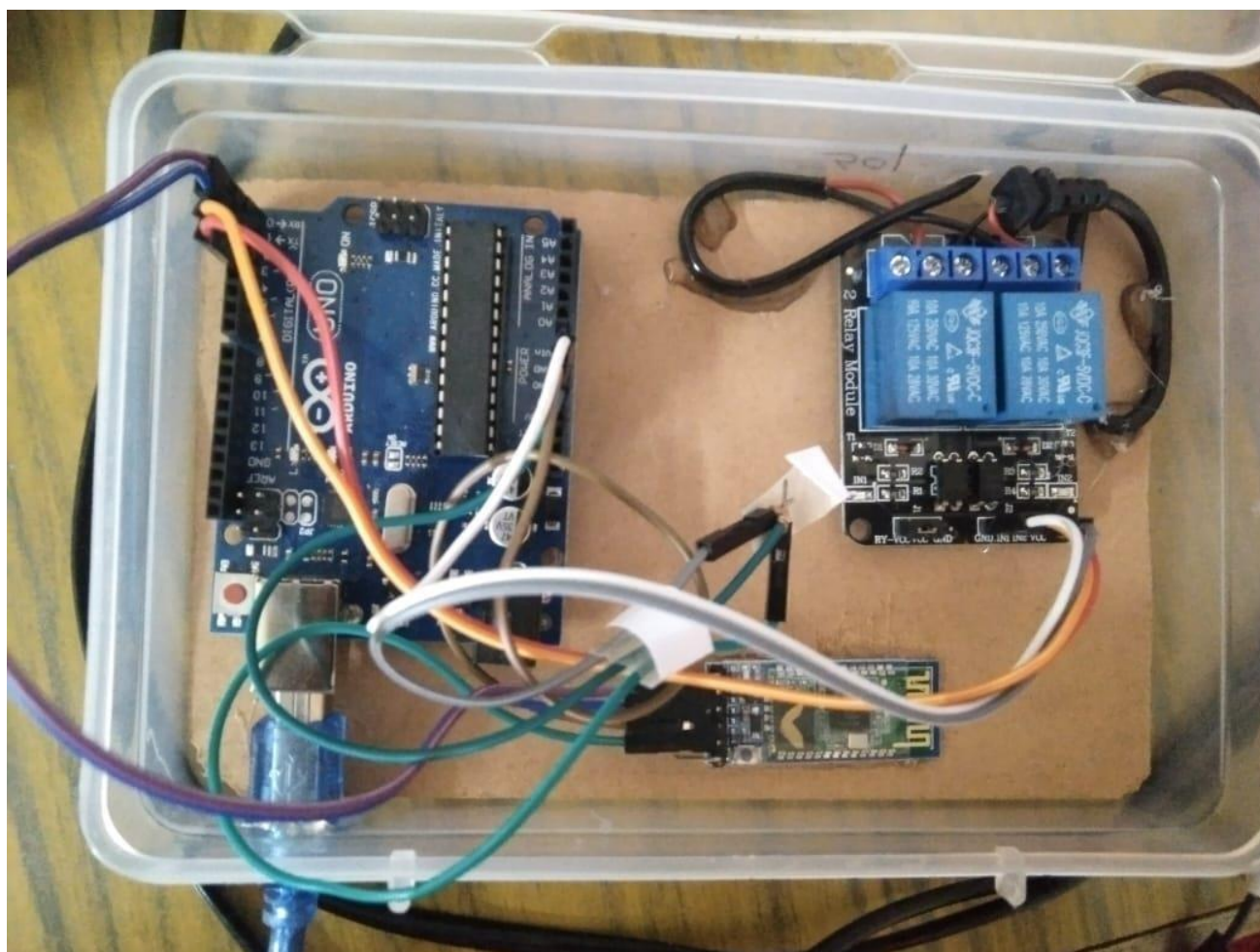
}
If (value=="all LED turn off")
{
Digitalwrite (2, LOW);
Digitalwrite (2, LOW);
}
If (value=="turn on Red LED")
{
Digitalwrite (2, HIGH);
}
If (value=="turn on green LED");
{
Digital write (3, HIGH);
}
If (VALUE=="turn on red LED)
{
Digital write (2,LOW);
}
If (value=="tune on green LED");
Digitalwrite (3, LOW);
}
}
}

```

### 3.8 Activity chart

Sr. No	Activity Planned	march	April	April	May
1	Group Selection	14 march			
2	Project Topic Registration		2 April		
3	3 Project Documentation			17 April	
	Project Review				20 May

### RESULT



## CHAPTER 4

### **Advantages:**

- Ease of access
- Energy savings are the advantage of home automation worth mentioning.
- Home automation is necessary for patient
- Better home security
- Instant notification

### **Disadvantages:**

- Up front costs
- Security concerns
- Maintains cost and more
- Power supply must be constant

### **Applications:**

- Garage lights
- Bathroom lights
- Hand dryers
- Security lights
- Room lights

## **CONCLUSION:**

In this project we have successfully implemented voice-controlled home automation system controlling relays using Arduino with Bluetooth module HC-05. This project can be used for controlling '4' number of input controls by extending number of relays. Our implemented module is more reliable and flexible in order to control any loads and the coverage area for wireless control is 10 meters. Hence this project can be useful for a real time voice- 20 | Page controlled home automation. Thus, Arduino based voice-controlled home appliances proves to be a better remotecontrolled operation on home appliances using Bluetooth module HC-05. This project can be extended for many automation applications such as industrial automation, automotive, military, healthcare, transportation and so on. Further the coverage area can also be increased by the use of GSM modules.

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