21AIE211

INTRODUCTION TO COMPUTER NETWORKS

B.Tech-CSE-AI-Semester 4, Batch (2020-24)

END PROJECT PRESENTATION

DATE: 19 JULY 2022

WEB BASED HOME AUTOMATION USING RASPBERRY PI

Submitted by

TEAM 10

M SAI RISHITH REDDY (CB.EN.U4AIE20036)

GUTTULA PAVAN (CB.EN.U4AIE20020)

ILLA DINESH KUMAR (CB.EN.U4AIE20022)

T SATYA GANESH (CB.EN.U4AIE20073)

Under the supervision of

B. GANGA GOWRI

ACKNOWLEDGMENT

We would like to express our special thanks of gratitude to our teacher (Ganga gowri mam) who gave us the golden opportunity to do this wonderful project on the topic (Web based Home Automation using raspberry pi), which also help helped us in doing a lot of research and we came to know about so many new things. We are thankful for the opportunity given.

CONTENTS

ABSTRACT

CHAPTER 1: INTRODUCTION

1.1 HOME AUTOMATION

1.2 DIFFERENT APPROACHES FOR HOME AUTOMATION

CHAPTER 2: THEORY

2.1 WORKING PRINCIPLE

2.2 BLOCK DIAGRAM

2.3 HARDWARE REQUIREMENTS

2.4 SOFTWARE REQUIREMENTS

CHAPTER 3: PROTOCOLS

3.1 SSH

3.2 HTTP

3.3 TCP

CHAPTER 4: IMPLEMENTATION

CHAPTER 5: OBSERVATION AND EXPERIMENTAL RESULTS

CHAPTER 6: ADVANTAGES & DISADVANTAGES

6.1 ADVANTAGES

6.2 DISADVANTAGES

CHAPTER 7: CONCLUSION

CHAPTER 8: REFERNCES

ABSTRACT

This report discusses about IoT and how it can be used for realizing smart home automation using Raspberry Pi, Our Aim is to operate and regulate the home appliances by using a webpage in any smart device like smartphone and laptop and also, we used Temperature and humidity sensors for displaying details of real time weather conditions: Temperature & Humidity in our web interface provided. We are accessing our home appliances by web interface on smart device is connected to raspberry pi using the IP address of Pi through web.

This wireless application is user friendly which helps in improving the efficiency and lifestyle, it is an application of IOT which is one of the promising technologies which helps us in connecting, controlling and managing the devices connected to raspberry PI

CHAPTER 1

INTRODUCTION

1.1 HOME AUTOMATION

IoT is the internetworking of physical devices like connected and smart devices, vehicles, structures, and other particulars- bedded with electronics, software, detectors, selectors, and network connectivity that enable these objects to collect and change data. In 2013 the Global norms Initiative on Internet of Things IoT- GSI) defined the IoT as “the structure of the information society”. The home automation is defined as connection of physical bias bedded with sensors and software. The network connectivity is used to collect and change the data. Home automation refers to the automatic and electronic control of manage features, execution of home appliances. Modern World Automation generally correspond of switches and detectors & Sensors connected to a central “gateway” from which the system is controlled with a user interface that's interacted through either a wall- mounted terminal, mobile phone software, tablet computer or web interface, frequently via internet.

Nowadays home automation system is being widely used to control devices in our homes. All kinds of home appliances like doors, lights, fan, electric heater, surveillance systems, cameras, smart TVs and consumer electronics belong to the home automation system devices.

This project design presents a prototype of an intelligent home Automation to control the home appliances like fan, bulb, etc. … via a web interface which can be Accessed through our smartphones, computers, tablets etc. having an active internet connection. It'll turn ON or OFF and will regulate automatically as well as manually the home appliances and electrical outfit by using relay circuits with the conception of IoT. It'll automatically regulate the fans according to the temperature sensor conditions by continuously seeing and comparing the live moisture and temperature of the house with the preset values. A software alarm will also be projected if it detects abnormally high temperature inside the house. All of these are enforced by using Raspberry Pi

1.2 DIFFERENT APPROACHES FOR HOME AUTOMATION

1. ***Bluetooth based home automation system using cell phones*:**

In this home automation system, the home appliances are connected to the Arduino BT board at input and output ports using relay. The program of Arduino BT board is developed on high level interactive C language of microcontrollers; which makes a connection The Bluetooth connection is established between Arduino BT board and phone for wireless communication

2. ***Smart home based on Zigbee:***

Constructing the efficient, convenient and cozy home environment has become the current hot spot by using ZIGBEE wireless communication technology. This system uses ZIGBEE Wireless Technology to build home internal Network, and connect a variety of sensors and home appliance controller to ZIGBEE network node.

**** *In this project we implemented a* ***Web based Home Automation System*** ***

3. ***Web based Home Automation system using cell phones:***

Basically, it is one of the most used Automation using now a days, this Web based home automation system mainly consists of three modules, the server, the hardware interface module, and the software package. User will use Web technology and hardware Interface module to communicate with each other. The same Web network uses to login to the server web-based application. The server is connected to the internet, so remote users can access server web-based application through the internet using compatible web browser.

Software of the latest home automation system is split to server application software, and Raspberry Pi firmware. Raspberry pi is culpable for gathering events from connected sensors, then applies action to the actuators and preprogramed in the server. Another job is to report the and record the history in the server. The server application software package for the proposed home automation system, is a web-based application. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator. Server application software is capable of, maintain the whole home automation system, setup, configuration.

CHAPTER 2

THEORY

2.1 WORKING PRINCIPLE

Our project will fall under the concept of IOT

- ✓ All the appliances & devices are centrally connected to the raspberry pi
- ✓ Web interface is designed to access the dedicated IP address of Raspberry pi to gain remote access over the devices which are connected to raspberry pi

There are 3 components of home automation:

1. **SENSORS**

   A device which can detects and responds to input from the physical environment and it can monitor the changes in Humidity, temperature, or motion detection. Home automation systems can then adjust those settings to our preferences.

   These are calibrated with pi to obtain data then fed to the interface as well as used for automatic regulation of the connected devices

2. **CONTROLLERS**

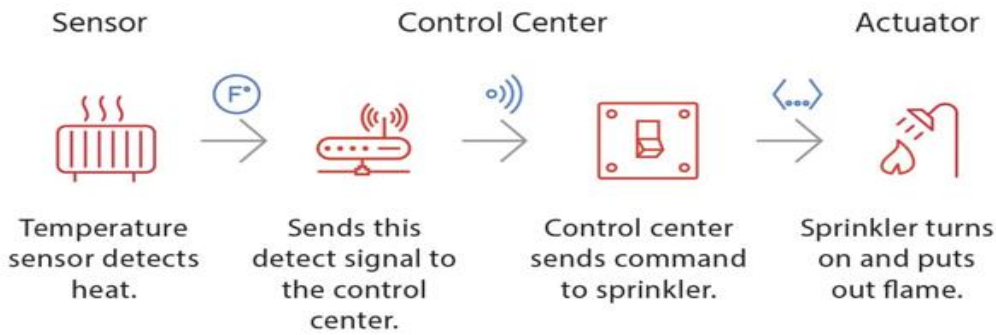
   Refers to our smart devices like personal computers, tablets, smart phones

   Which are used for sending and receiving messages and commands about the status of automated features in smart home

3. **ACTUATORS**

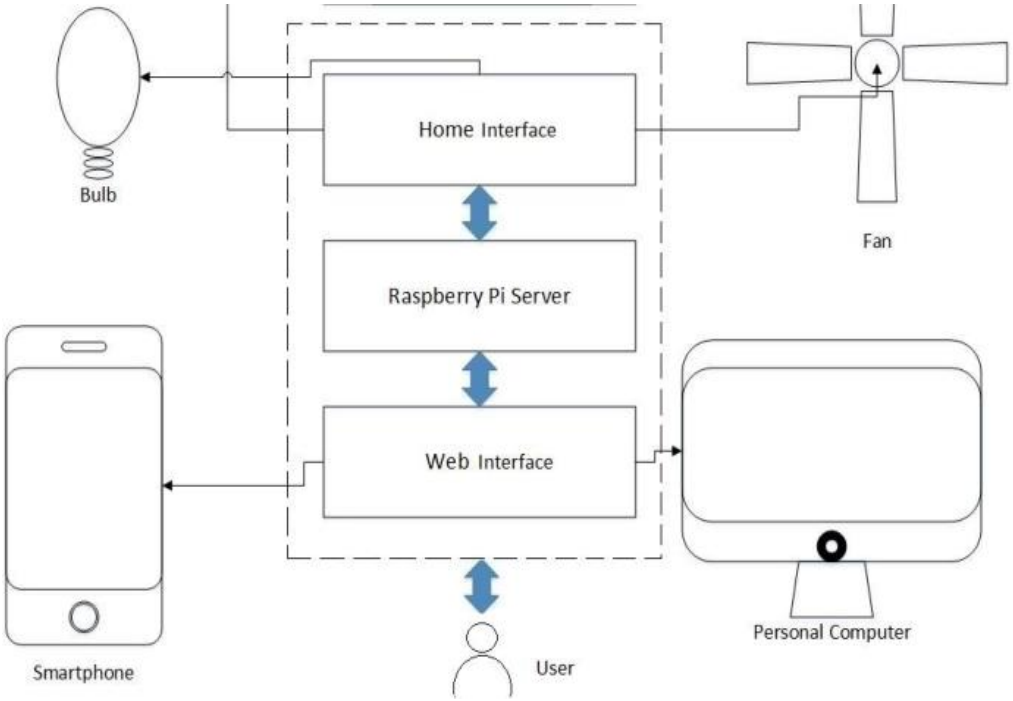
   Actuators may be light switches, motors, or motorized valves that control the actual mechanism, or function, of a home automation system. They are programmed to be activated by a remote command from a controller.

So, we can manage all home appliances from our smartphone or tablet whether you're at home, or miles away. This allows us to turn on the lights, lock the front door, or even turn down the heat, no matter where we are.

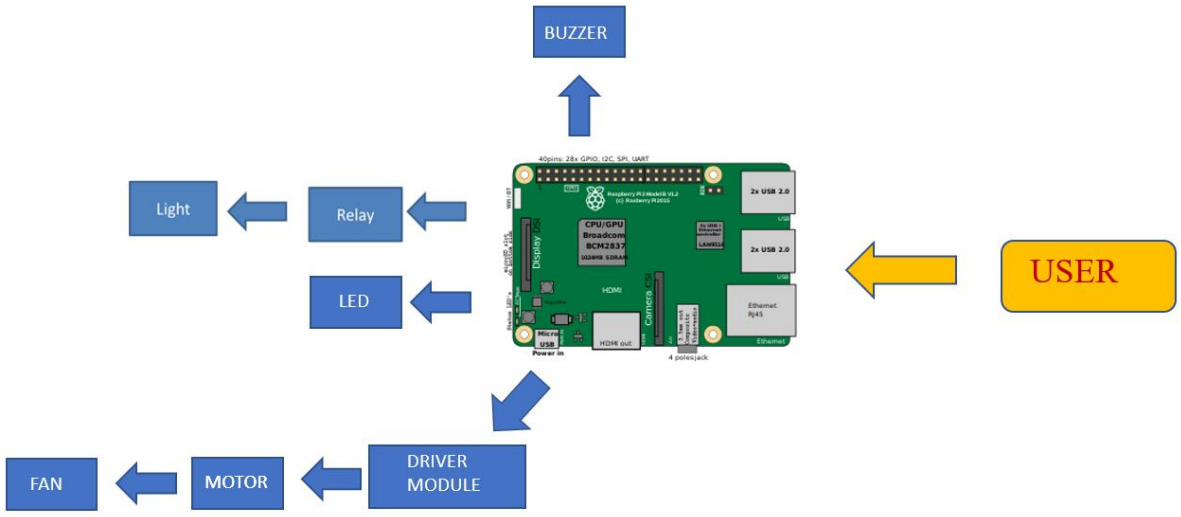


2.2

BLOCK DIAGRAM



DEVICES

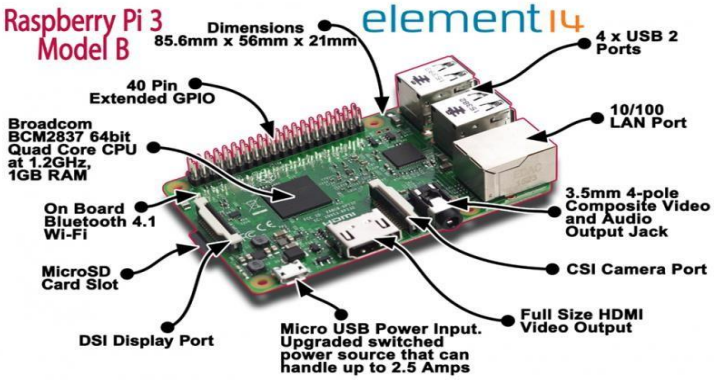


2.3 HARDWARE REQUIREMENTS

1. RASPBERRY PI
2. RELAY CIRCUIT
3. DC MOTOR
4. LED
5. LED BULB
6. BREADBOARD
7. BUZZER
8. DRIVER MODULE

RASPBERRY PI 3B+

- SoC: Broadcom BCM2837B0 quad-core A53 (ARMv8) 64-bit @ 1.4GHz
- GPU: Broadcom Video core-IV
- RAM: 1GB LPDDR2 SDRAM
- Networking: Gigabit Ethernet (via USB channel), 2.4GHz and 5GHz 802.11b/g/n/ac Wi-Fi
- Bluetooth: Bluetooth 4.2, Bluetooth Low Energy (BLE)



- Storage: Micro-SD
- GPIO: 40-pin GPIO header, populated
- Ports: HDMI, 3.5mm analogue audio-video jack, 4x USB 2.0, Ethernet, CameraSerial Interface (CSI), Display Serial Interface (DSI)
- Dimensions: 82mm x 56mm x 19.5mm, 50***g***

Raspberry Pi is a low-cost credit card size computer that plugs into a computer monitor or TV and uses a standard keyboard and mouse. Most importantly it's open-source hardware. Computing Programmable Language like python and scratch under Linux platform. Raspberry Pi 2 model B has CPU 900MHZ quad-core ARM cortx-A7 processor. The Ethernet adaptor is connected to an additional USB port. In model A and A+ the USB port is connected directly to the Silicon on Chip (SoC).

RELAY CIRCUIT

- 5V, 10A 2-Channel Relay

Relays are like switches that open and close circuits

electromechanically or electronically. Relays control one electrical circuit by opening and closing contact in another circuit. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized. It is an electromagnetic switch operated by relatively small electric current that can turn on or off much larger electric current the heart of a relay is an electromagnet. 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. Two channel relay diagram is shown in the figure. This is a 5V, 10A 2-Channel Relay interface board. It can be controlled various appliances, and other equipment with large current. It can be controlled directly with 3.3V or 5V logic signals from a microcontroller (ARM, 8051, PIC).

DC MOTOR

- Motor Type : DC with Gear Box, Metal Gears
- Base Motor : DC 300 RPM
- Shaft Type : Center , Circular 6mm Dia with Internal Hole for coupling, 23mm shaft Length
- Maximum Torque: ~2.5 Kg-cm at 12V
- RPM : 300 RPM at 12V
- Weight : 145 Gms
- Max Load Current: ~250mA at 12V-30RPM

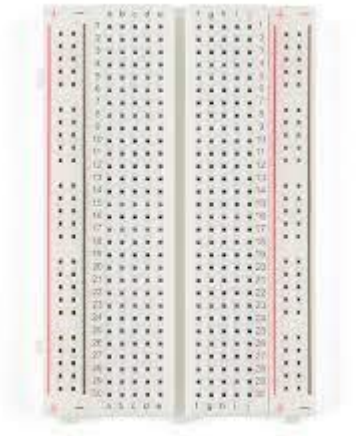
A DC motor is any class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in the part of DC motor. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances

LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. Here the light emitting diode is used just post face recognition where it will indicate whether the face is recognized. If the face is recognized the LED (Light Emitting Diode) will glow otherwise it will not glow which will in turn unlock the door.

LED BULB

An LED light bulb is a solid-state lighting (SSL) device that fits in standard screw-in connections but uses LEDs (light-emitting diodes) to produce light.



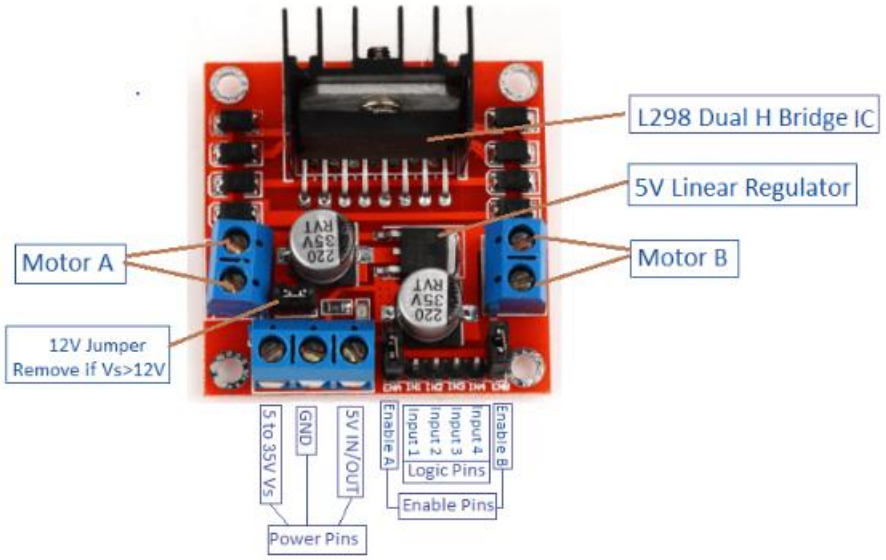
BREAD BOARD

A construction base used to build semi-permanent prototypes of electronic circuits and have high parasitic capacitance, relatively high resistance, and less reliable connections, signaling is limited to about 10 MHz

BUZZER

an audio signaling device, which may be mechanical, electromechanical, or piezoelectric

DRIVER MODULE

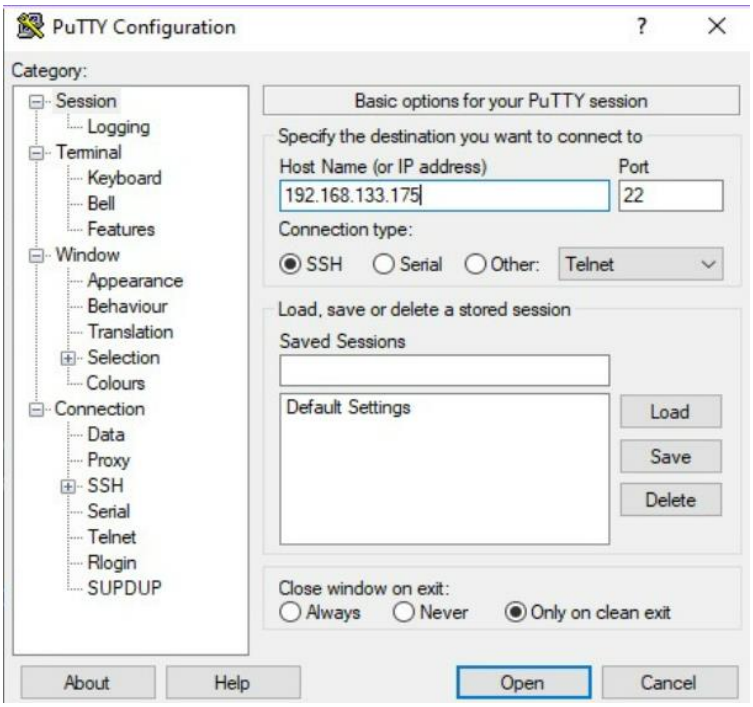


This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC

2.4 SOFTWARE REQUIREMENTS

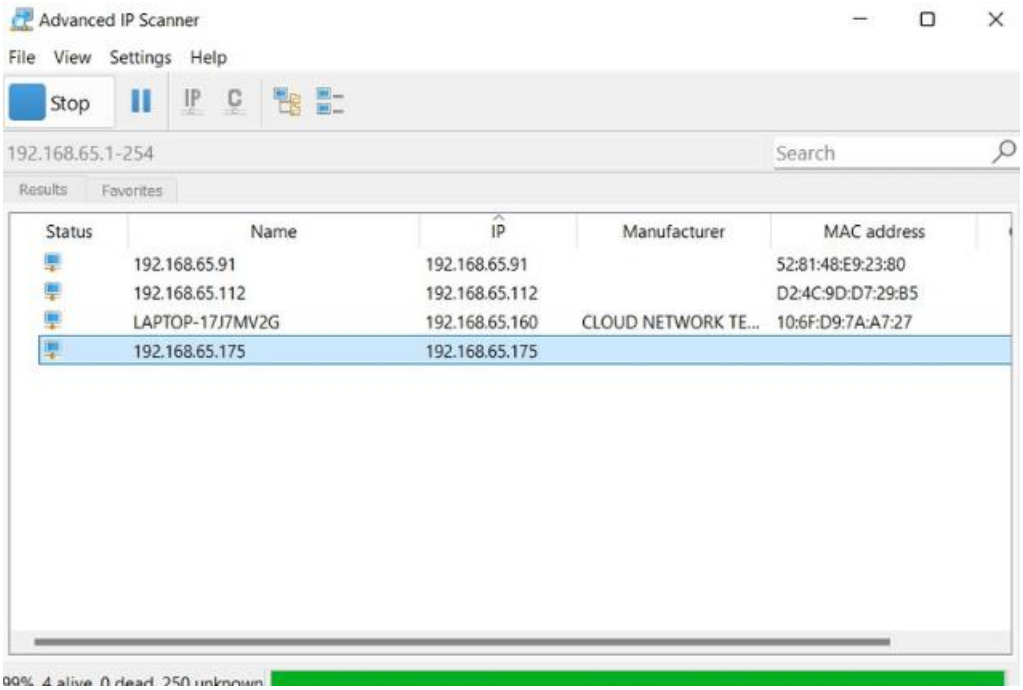
1. PUTTY

Used to connect devices over ip address



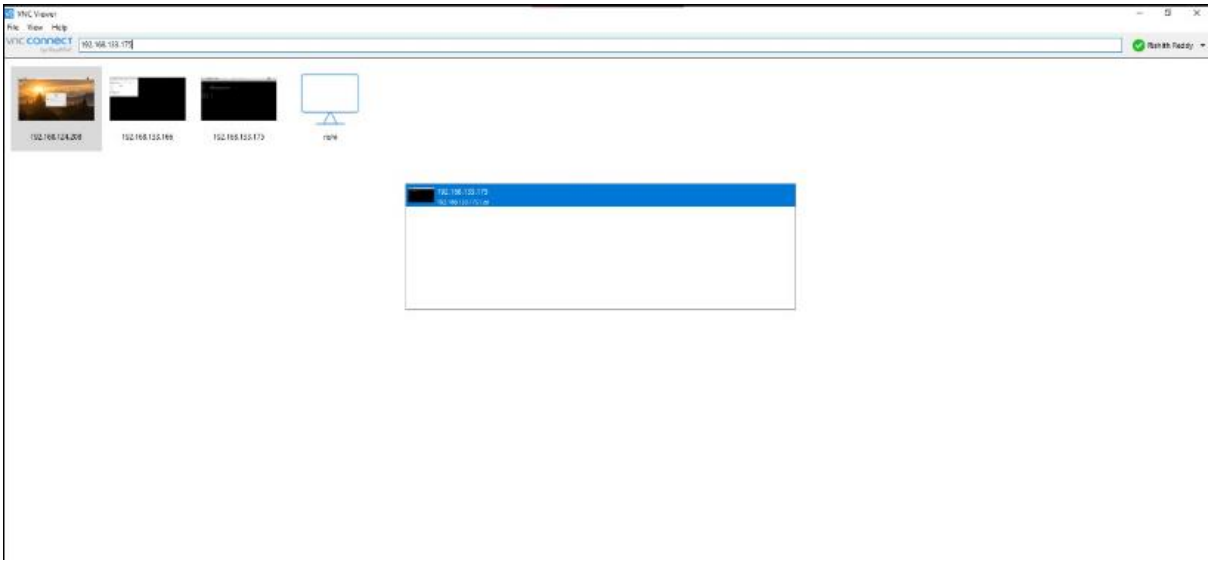
2. ADVANCE IP SCANNER

Used to scan the ip address of the devices.



3. VNC VIEWER

Used to remotely control the pi over a GUI.



4. WebIOpi

A tool used to Control, debug, and use your Pi's GPIO, sensors and converters from a web browser or any app

5. ngrok

ngrok is a cross-platform application that enables developers to expose a local development server to the Internet

CHAPTER 3

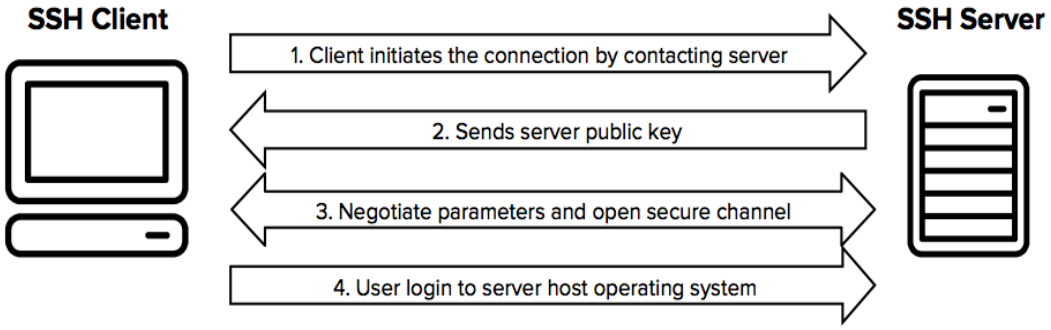
PROTOCOLS

3.1 SSH PROTOCOL

SSH (Secure Shell) is a protocol for running secure network services over an insecure network. This protocol runs as an application on top of the TCP/IP layer. The SSH protocol is implemented through separate client and server application which negotiate protocols before deciding whether to establish a secure connection. The protocol provides some secure functionalities like user authentication, strong encryption, integrity protection, and the simultaneous tunneling of multiple data channels. These features lend themselves to more than just secure remote logins.
These are some features of SSH includes:

- Secure remote login
- Secure remote command execution
- Secure remote file transfer
- TCP port forwarding
- Cryptographic key control
- Authentication agents (including single sign-on)
- Configurable access control
- Data compression
-

In Our project this protocol used to connect raspberry pi and our laptop remotely



3.2 HTTP PROTOCOL

- HTTP (HyperText Transport Protocol)
- HTTP - Simple request-response protocol layered on TCP/IP

1. Establish a TCP/IP connection to www.example.com:80
2. Send a http GET request along connection
3. Read from the connection the response from the web server

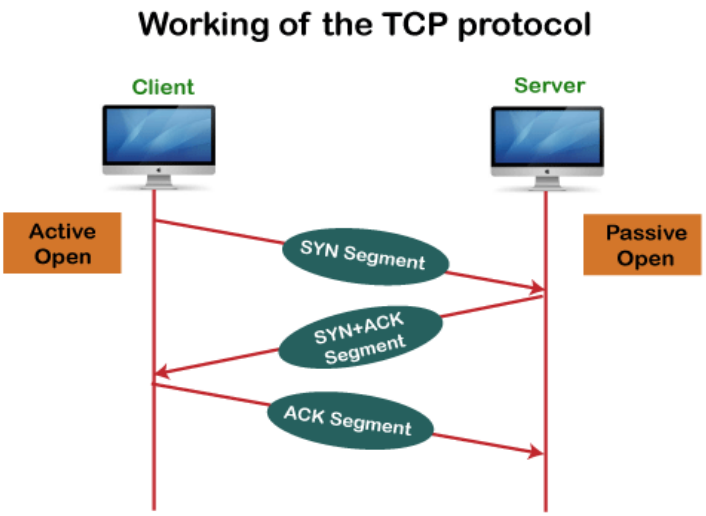
HTTP functions as a request–response protocol in the client–server model. A web browser, for example, may be the client whereas a process, named web server, running on a computer hosting one or more websites may be the server. The client submits an HTTP request message to the server. The server, which provides resources such as HTML files and other content or performs other functions on behalf of the client, returns a response message to the client. The response contains completion status information about the request and may also contain requested content in its message body.

In this project We are operating through web page where we are using http1.1 and from here we are requesting a raspberry pi to control the appliances so it sends a request message to raspberry (Server) and raspberry will configure our commands.

3.3 TCP PROTOCOL

TCP (Transmission Control Protocol) is one of the main protocols of the Internet protocol suite which falls between the Application and Network Layers used to provide reliable delivery services. It is a connection-oriented protocol for communications that helps in the exchange of messages between the different devices over a network

In this project TCP protocol used for exchanging the commands between web page and Raspberry pi



CHAPTER 4

IMPLEMENTATION

JAVA SCRIPT

For configuration of GPIO pins

```
webiopi().ready(function() {
                webiopi().setFunction(17,"out");
                webiopi().setFunction(18,"out");
                webiopi().setFunction(27,"out");
                webiopi().setFunction(22,"out");
                      webiopi().setFunction(23,"out");
                webiopi().setFunction(24,"out");
                var content, button;
                content = $("#content");

                button = webiopi().createGPIOButton(17,"LED");
                content.append(button);

                button = webiopi().createGPIOButton(18,"BUZZER");
                content.append(button);

                button = webiopi().createGPIOButton(27,"BULB");
                content.append(button);

                button = webiopi().createGPIOButton(24,"FAN-ENABLE");
                content.append(button);


                button = webiopi().createGPIOButton(22,"FAN");
                content.append(button);

       });
```

CSS

DESIGN OF WEBSITE

```
body {
                                background-color:#ffffff;
                                          width: 1920px;
                                          height: 1080px;
                                background-image:url('/img/smart.png');
                                background-repeat:no-repeat;
                                background-position:center;
                                background-size:cover;
                                font: bold 18px/25px Arial, sans-serif;
                                color:LightGray;
                     }

               button {
                           display: block;
                           position: relative;
                           margin: 10px;
                           padding: 0 10px;
                           text-align: center;
                           text-decoration: none;
                           width: 170px;
                           height:40px;
                           font: bold 18px/25px Arial, sans-serif;
                           color: black;

                           text-shadow: 1px 1px 1px rgba(255,255,255, .22);
                           -webkit-border-radius: 30px;
                                -moz-border-radius: 30px;
                           border-radius: 30px;

                           -webkit-box-shadow: 1px 1px 1px rgba(0,0,0, .29), inset 1px 1px 1px rgba(255,255,255, .44);
                           -moz-box-shadow: 1px 1px 1px rgba(0,0,0, .29), inset 1px 1px 1px rgba(255,255,255, .44);
                           box-shadow: 1px 1px 1px rgba(0,0,0, .29), inset 1px 1px 1px rgba(255,255,255, .44);

                           -webkit-transition: all 0.15s ease;
                           -moz-transition: all 0.15s ease;
                           -o-transition: all 0.15s ease;
                           -ms-transition: all 0.15s ease;
                           transition: all 0.15s ease;
               }

               input[type="range"] {
                           display: block;
```

```
                width: 160px;
                height: 45px;
    }

    #gpio17.LOW {
                background-color: Gray;
                color: Black;
    }

    #gpio17.HIGH {
                background-color: Red;
                color: LightGray;
    }

    #gpio18.LOW {
                background-color: Gray;
                color: Black;
    }

    #gpio18.HIGH {
                background-color: Red;
                color: LightGray;
    }

    #gpio27.LOW {
                background-color: Gray;
                color: Black;
    }

    #gpio27.HIGH {
                background-color: Red;
                color: LightGray;
    }

    #gpio22.LOW {
                background-color: Gray;
                color: Black;
    }

    #gpio22.HIGH {
                background-color: Red;
                color: LightGray;
```

```
}
#gpio23.LOW {
            background-color: Gray;
            color: Black;
}

#gpio23.HIGH {
            background-color: Red;
            color: LightGray;
}
#gpio24.LOW {
            background-color: Gray;
            color: Black;
}

#gpio24.HIGH {
            background-color: Red;
            color: LightGray;
}
```

HTML

WEB PAGE

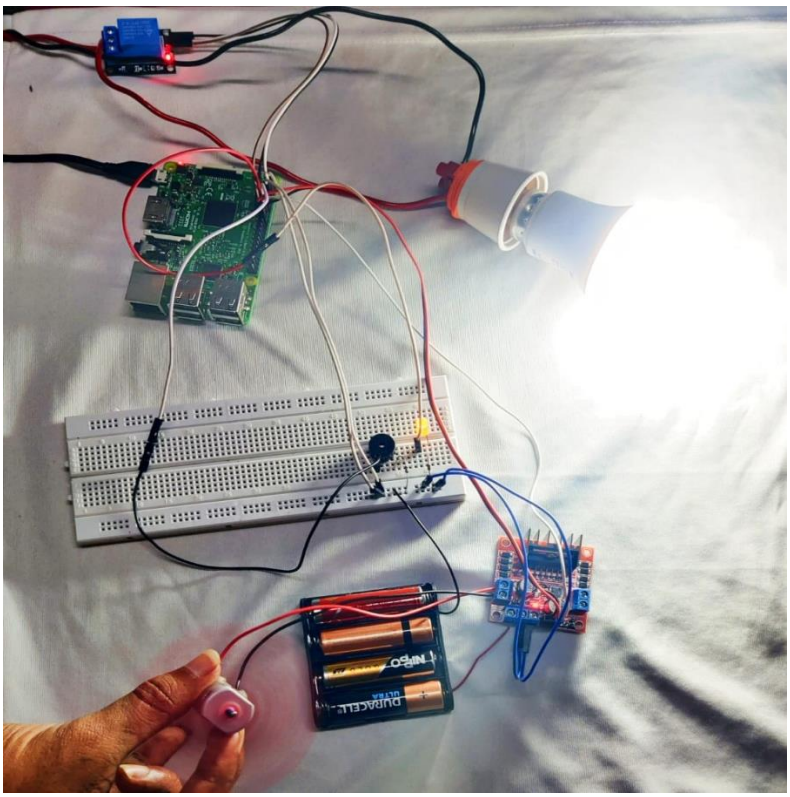
```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" "http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <meta name="mobile-web-app-capable" content="yes">
        <meta name="viewport" content = "height = device-height, width = device-width, user-scalable = no" />
        <title>Smart Home</title>
        <script type="text/javascript" src="/webiopi.js"></script>
        <script type="text/javascript" src="/scripts/smarthome.js"></script>
        <link rel="stylesheet" type="text/css" href="/styles/smarthome.css">
        <link rel="shortcut icon" sizes="196x196" href="/img/smart.png" />
</head>
<body>
            </br>
            </br>
            <div id="content" align="center"></div>
            </br>
            </br>
            </br>
            </br>
            </br>
</body>
</html>
```

CHAPTER 5

OBSERVATION & RESULTS

9W Bulb, LED, Fan1&motor and buzzer are among the appliances that can be used in this system. Home automation system is used for controlling and monitoring the home appliances. It can be performed in several ways. In this system, concept of IoT is used in order to control the devices remotely from anywhere. Raspberry Pi is used as the board controller to connect the appliances via input and output port. Web interface (on Mobile phones, laptop, etc.) and Raspberry Pi are connected through internet. All the devices are connected with Raspberry Pi. The voltage of home appliances is 230V but the Raspberry Pi voltage is 5V. So, in this system, relay circuit is used to cover the high voltage to low voltage, low voltage to high voltage which is also act as a switch. In this system, we are using two bulbs, few dc motors as home appliances. Here two-way relay is used in order to connect bulbs.

For the project to execute and work perfectly according to the embedded program, initially we should keep the Rpi online i.e it should be connected to the WIFI and to access the web interface from anywhere we need to provide IP address in the URL to open the webpage which establishes the connection between the remote like any smart devices (smart phone, laptop) and the Raspberry Pi board thus to the devices connected to the RPi. On the webpage, we are having ON, OFF and regulation buttons for bulb, LED, Fan, Buzzer. By using these
buttons, we can able to control the home appliances which we connected with Raspberry Pi.



CHAPTER 6

ADVANTAGE & DISADVANTAGES

6.1 ADVANTAGES

- **ACCESS FROM ANYWHERE**
  We are extended our project from WIFI based to web based so a user can configure or control his home appliances from anywhere and anytime with connecting to any network

- **EASY TO CONTROL**
  We can easily control our appliances just through web page

- **FAST AND EFFECTIVE**

6.2 DISADVANTAGES

- **LESS SECURE**

Our home appliances configuration is exposing to the global page, Smart home devices are usually linked to companion apps that can be used to control the devices. However, to do this they are granted a range of permissions that influence the functionality of the device, such as being able to open and close a smart lock that is securing your home.
If hackers gain access to these apps, then it could have considerable security implications, as they will be able to control access to your home.

- **COST EFFECTIVE**

Although a lot of smart home devices are now affordable for many, but still, it is extremely expensive to fully equip a home with smart devices.

- **ALL APPLIANCES SHOULD BE CONNECTED TO INTERNET**

CHAPTER 7

CONCLUSION

- In this project, a prototype smart home automation using IoT is presented by integrating relays and devices to Raspberry pi board for controlling the devices from aremote location in a real scenario.
- The proposed home automation system includes control and regulation of lights, model fans, buzzer
- Raspberry Pi proves to be a smart, economic and efficient platform for implementing the home automation.
- The system is Flexible and programmable and has wide range applications and supports wide Varity of appliances and also many sensors
- We extended this project from local web page to global web page development
- So, any device which has been connected to any network can operate our home appliances with our username and password

CHAPTER 8

REFERENCES

- https://webiopi.trouch.com/INSTALL.html
- https://nevonprojects.com/iot-home-automation-using-raspberry-pi/#:~:text=Internet%20of%20things%20is%20a,from%20anywhere%20over%20the%20world
- https://jfrog.com/connect/post/how-to-access-raspberry-pi-by-port-forwarding-with-ngrok/#:~:text=Setting%20up%20Ngrok%20on%20your%20Raspberry%20Pi%2FLinux%20Device&text=Then%20go%20to%20the%20ngrok,the%20link%20for%20Linux%20ARM.&text=After%20copying%20the%20link%2C%20navigate,you%20have%20write%20access%20to