DAYANANDA SAGAR UNIVERSITY

MINOR PROJECT REPORT

ON

Smart Home Appliance

BACHELOR OF TECHNOLOGY

IN

COMPUTERSCIENCE & ENGINEERING

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CERTIFICATE

*This is to certify that the minor project report entitled "…**Smart Home Appliance**…"being submitted by Mr./**Ms. M.Suma, Neti Sahithi** and **Parth Soni** bearing USN **ENG19CS0190, ENG19CS0205** and **ENG19CS0218** has* satisfactorily completed her Minor Project as prescribed by the University for the 5th semester B.Tech Program in Computer Science & Engineering during the academic year 2021 – 22 at the School of Engineering, Dayananda Sagar University, Bangalore.

Date: Signature of the faculty in-charge

Signature of Chairman
Department of Computer Science & Engineering

DECLARATION

We hereby declare that the work presented in this minor project entitled as "**Smart Home Appliance**", has been carried out by us and it has not been submitted for the award of any degree, diploma or the minor project of any other college or university.

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Abstract

The modern home automation system gives security and blissful life at residence. That is why the popularity of using home automation technology is increasing day by day. Home automation is the control of any or all electrical devices in our home or office. There are many different types of home automation system available. These systems are typically designed and purchased for different purposes. In fact, one of the major problems in the area is that these different systems are neither interoperable nor interconnected. There are number of issues involve when designing a home automation system. It should also provide a user-friendly interface on the host side, so that the devices can be easily setup, monitored and controlled.

Our proposed home automation system provides the user with a web page control of various lights and appliances within their home with the help of raspberry pi. This system is designed to be low cost and expandable allowing a variety of devices to be controlled. Our Smart Home automation will be focused on how this can be achieved through the use of the Internet of things (IoT), raspberry pi and node red.

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1 Introduction

THE modern age is the age of technology and technology is never finishing process. Technology is advancing continuously and making our life easier, safer and comfortable. A home furnished with heating, lighting and electronic devices that can be controlled and monitored remotely by computer or smart-phone is called a smart home. In our busy lives, it is very tough to keep an eye on security but with a smart home system, it becomes very simple.

Internet of Things

IoT means the Internet of Things. The Internet of Things is the most trending technology today, alongside wearables and robotics. The concept is simple: Devices in your home (or wherever they are) have the capability to communicate with each other via the internet. This technology usually uses sensors to pass data to the internet. Imagine home automation systems were one can use to control appliances in their home like lights, fans, Tv, and air conditioning through a web interface or smartphone application. A lot of technologies are being developed around this concept, such as independent lightweight IoT networks and protocols for passing data. Many computing devices are embedded with our necessary appliances to the internet through IoT.

IoT term has two major parts:

- Internet is the backbone of connectivity
- Things meaning objects the term internet of things is a concept but it is not specific

hardware or software or electronics.

With the introduction of IoT, the home automation systems are becoming more famous at present days research. Most of the devices are monitored and controlled for the people. Through the internet of things, it is possible to control and monitor home appliances. With the internet of things, the physical world is becoming one big information systems. To enhance the living value of our life IoT technology is used to get novelty concepts.

Raspberry pi

Similar to a desktop computer, this credit-card-sized computer is capable of performing various functions like- browsing the internet, making spreadsheets and playing games.

raspberry pi is an affordable mini-computer that is perfect for home automation software. Nevertheless, it is a perfect option if you are looking for expanding your home. Similar to other home automation tools it is also a great alternative for managing your smart home. As compared to other commercial offerings, it offers a controllable, open and privacy-minded approach.

Besides peace of mind, its benefits are divided into various categories. For instance – safety, comfort, savings, convenience, control and a lot more. Have a glance at some important benefits of home automation with raspberry.

- **Savings** – In addition to energy, smart light bulbs reduce utility costs.
- **Safety** –This benefit is offered by a majority of home automation technologies. They are perfect to make your home safer and secure.
- Convenience – It provides comfort and convenience.
- **Control** – Besides a busy schedule, automation technologies enable you to keep proper control.
- **Peace of mind**– Imagine you came into your room after parking your car. However, you don't remember whether you have closed the garage door or not. With home automation technology you can check it by an app without leaving your seat.

Node-red

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It can be combined with Home Assistant via an Add-on or with Home Assistant Core by running Node-RED as its own service. After Node-RED is running you can then add the node-red-contrib-home-assistant-WebSocket palette to begin wiring up your automations for Home Assistant.

Home Assistant uses their UI or yaml to define automations. For basic automations this works just fine, however once you add more devices and want to do more automations based on the states of those devices, the yaml format becomes particularly limiting and cumbersome. Using Node-RED you can perform loops, define flow level and global variables, execute arbitrary JavaScript code to process incoming information and much more. This is one area that Node-RED shines. There is a lot that can be done with the default flows and beyond that you can install additional flows through the Manage palate menu.

1.1 Problem Statement

Today we are living in 21st century. It is necessary to control the home from desire location. Home automation is the control of any electrically and electronics device in our home and office, whether we are there or away. There are hundreds of products available that allow us to control over the devices using remote control, DTMF, free hand gesture, internet and resource connection and so on.

In this project we would like to share the procedure on how to build a home automation system with Raspberry Pi and Node Red, that will allow you to control any appliance at home from anywhere in the world using a web browser.

2. Literature Survey

Hand Gesture based Automation

Author Name	Year of Publication	Description	Limitations
Manoj Harsule 2. Prashant Ingole	2013	This is a type of home appliance control system where the person must be present in sight to the appliance that is needed to be controlled and a predefined gesture must be used to turn on the device and another gesture must be used by us to turn off the device. The performance of the proposed system is done with a hardware embedded in that particular device.	• This process is only suitable in light places and cannot be used in dark places or in the noisy background. • It's expensive.

DTMF based Automation

Author Name	Year of Publication	Description	Limitations
Md. Mamunoor Islam Mehdi Hasan Chowdhury	2014	In this method, the control of home appliances can be done even though when we are elsewhere just by using the DTMF tone generated when the user pushes mobile phone keypad buttons or when connected to a remote mobile.	• There is no security. Anyone can control their appliance by calling the mobile connected to the module. • There is a limitation for connecting the appliances we want to connect as a mobile can generate only 16 tones.

Remote Control based Automation

Author Name	Year of Publication	Description	Limitations
Chintha Rajendra Benny pears O. Vijayalaxmi Varsha Devi B. Sanjai Prasad.	2017	The lights, fans can be automatically turned on/off with the help of a remote where there will be a sensor instead of going near to a switch board and putting on/off the switch. Companies like Legrand and Gold Medal already started these kinds of control system and they are at present available in the market	• While controlling the appliance, each time we have to point out the remote towards the appliance to control them. • The appliances cannot be controlled from any other room as the IR wave cannot travel through the door or wall.

Internet and Radio based Automation

Author Name	Year of publication	Description	Limitations
Ravi Kishore Kodali Sreeramya Soratkal Lakshmi Boppana.	2016	In this system, the control of home appliances can be done from a remote are with an option from a local server, using the Internet and radio connection. This system is accomplished by personal computers, interface cards, radio transmitters and receivers, microprocessors, ac phase control circuits, along with window-type software and microprocessor control software.	• It is limited to a specific distance. It can be used only to that specific area or part to cover. • The number of devices that need to be connected is also limited.

3. Requirement Analysis

HARDWARE REQUIREMENTS

- Raspberry PI 3
- LEDs
- 5V, 4 channel relay board
- PIR motion sensor
- Resistor 330 ohm
- Jumper cables

SOFTWARE REQUIREMENTS

- SD card formatter
- Raspbian OS
- Buster OS
- VNC Viewer
- Advance IP scanner
- Node Red

4.1 Architecture Diagram

The raspberry pi connects the led, the motion sensor and the relay board through jumper cable wires. The relay board is used as a switch and also as a regulator to control the intensity of the LED's which represent bulbs. The motion sensor is used to detect any movement, if any movement is detected, it would display a predefined message on the webpage.

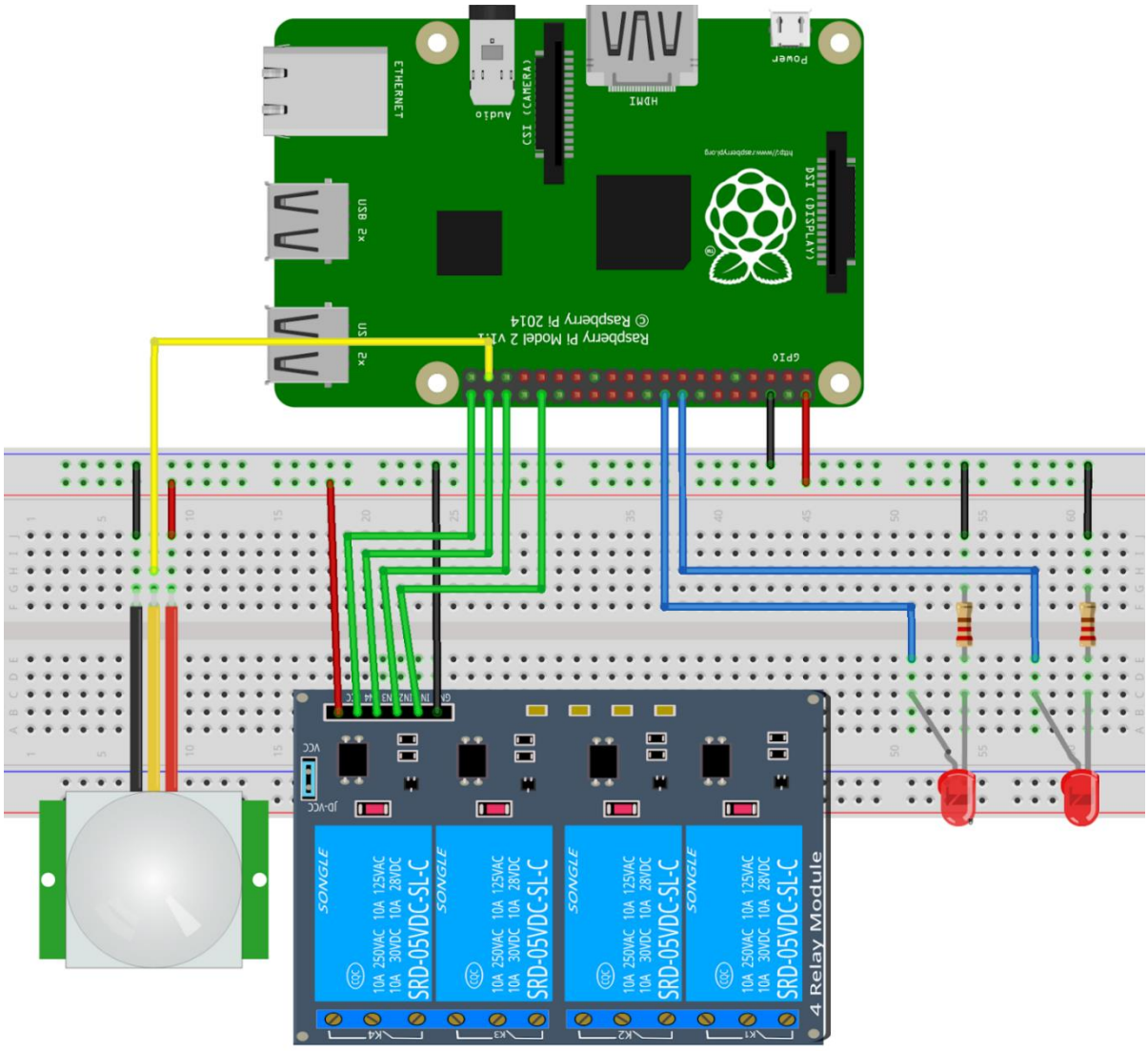

Figure 1

4.2 Flow chart/ DFD/ UML Diagrams

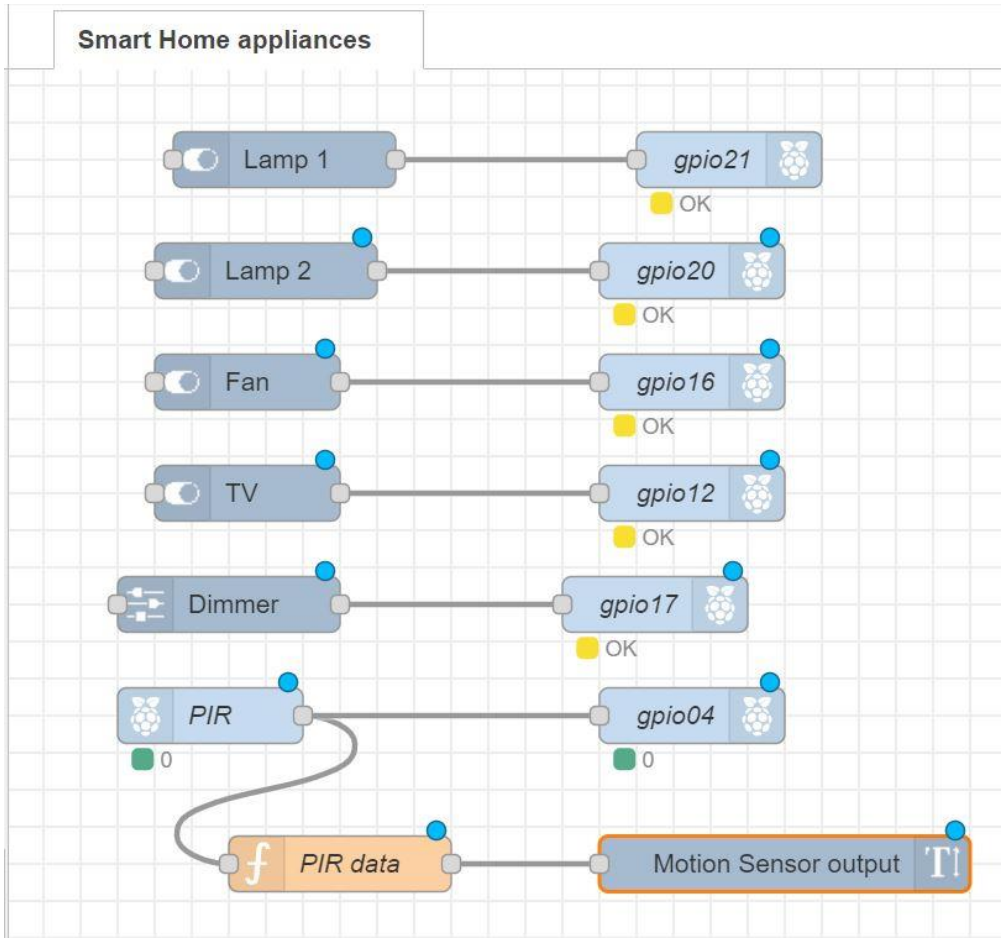

Figure 2

As shown in the above figure, the lamp is connected to gpio21(which is basically a physical pin on the PI which is mapped to this particular connection). Similarly, the other lamp, fan, tv, dimmer is connected to pins 20, 16, 12, 17. The PIR motion sensor is connected to pin 4, and it is also attached with an if-else condition. If the sensor detects any motion, the value/state of the sensor would change to one, which would trigger the condition, hence it should display a message/output saying output detected. Else it should not display anything.

5. Project Breakdown

1) Setting up Raspberry Pi
2) Installing and running Node-Red
3) Making Node-flows
4) Assembling Components

6. Implementation

1. Setting up Raspberry Pi:

The version of Pi which we have used in our project is 3B+. We have also combined the Pi with a micro-SD card, which we had to format earlier to prevent any complications. Firstly, we install the Raspberry Pi imager, we open advanced settings and enable SSH and provide username password of the local Wi-Fi network which we want to use. The target location for the installation should be SD card, so we insert the SD card into the PI and boot it.

Figure 3

2. Installing and Running Node-Red:

We install the “buster” package from the PI’s desktop webpage. We open PI terminal and run the bash command. We install some extra nodes which can come handy in the later part of the project. Once everything is installed, we start the node red, the terminal would display an IP address, we copy the given address and run the same in a browser which would give us the control page for node red.

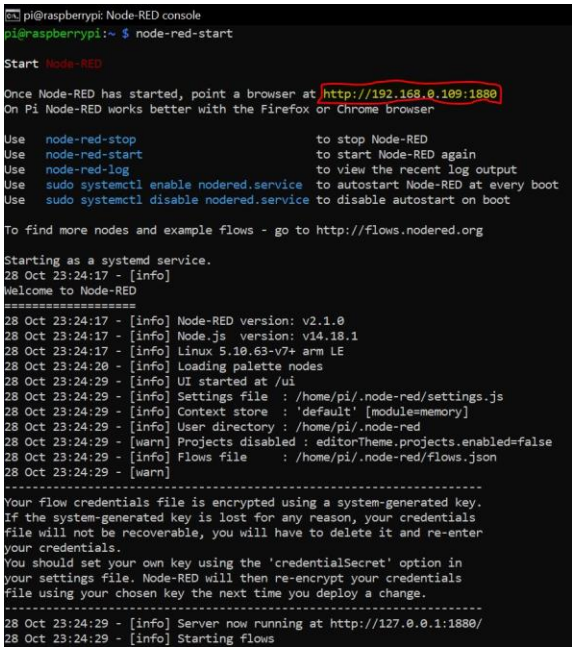

Figure 4

3. Creating node flows:

We run the node red interface in the browser. After running, we can select the necessary nodes from the available nodes which the interface or the node is offering. After selecting, we configure each node according to our needs and requirements, we also provide the connections and linking to the nodes. After we are satisfied with the above, we can deploy the node model, and it will be applied/implemented onto the PI.

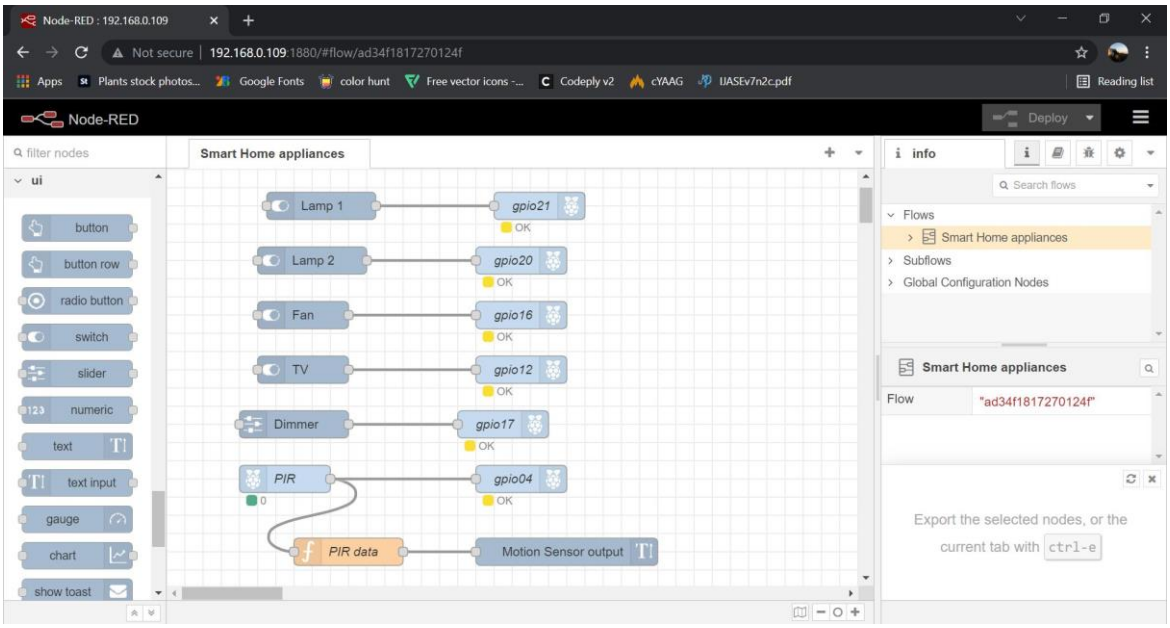

Figure 5

4. Assembling components:

Once the node flow is set, we make a note of the configurations/node flows, because we need to assemble the components according to the linking. We connect the hardware components to the PI and we provide a power source to test it. If the PI is activated, we can run the UI and check the functionality of the PI.

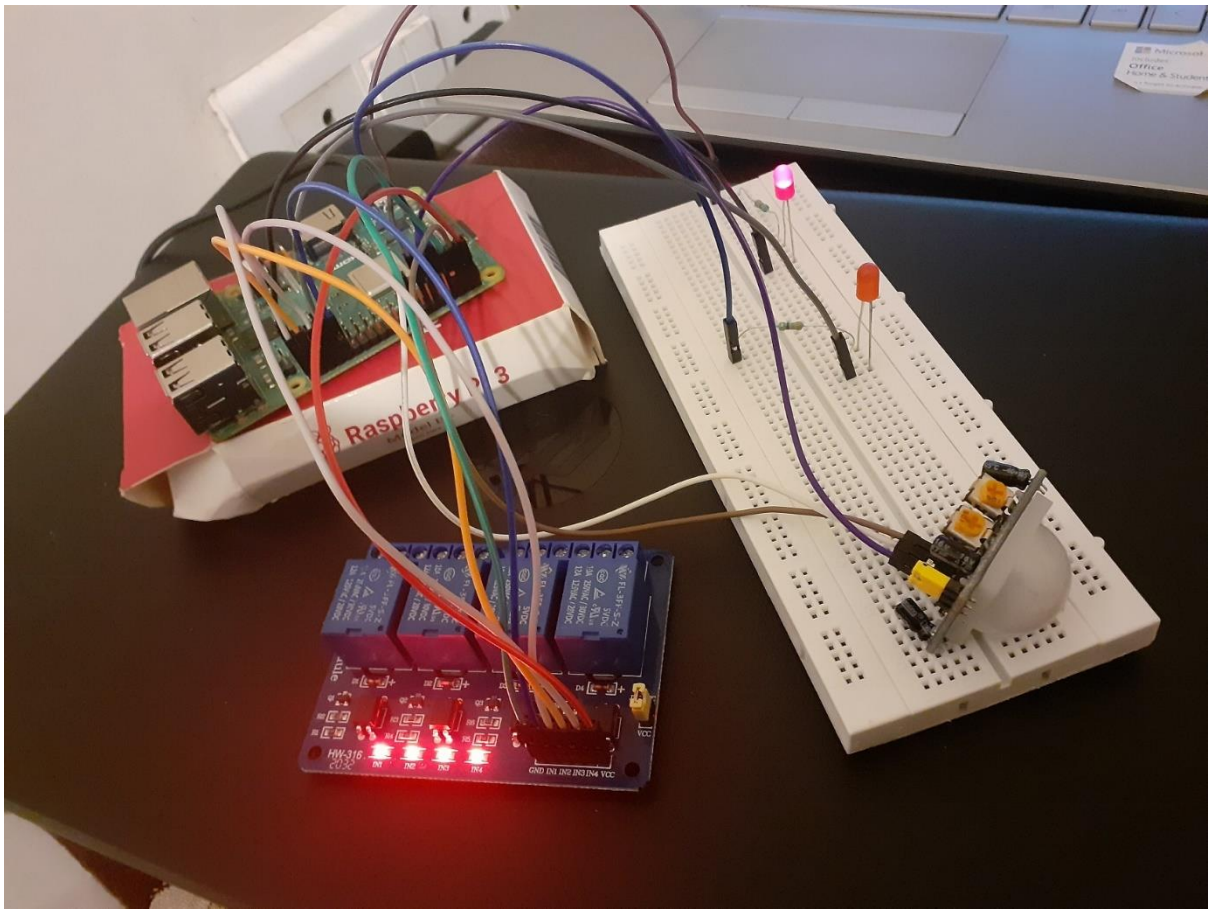

Figure 6

7. Testing

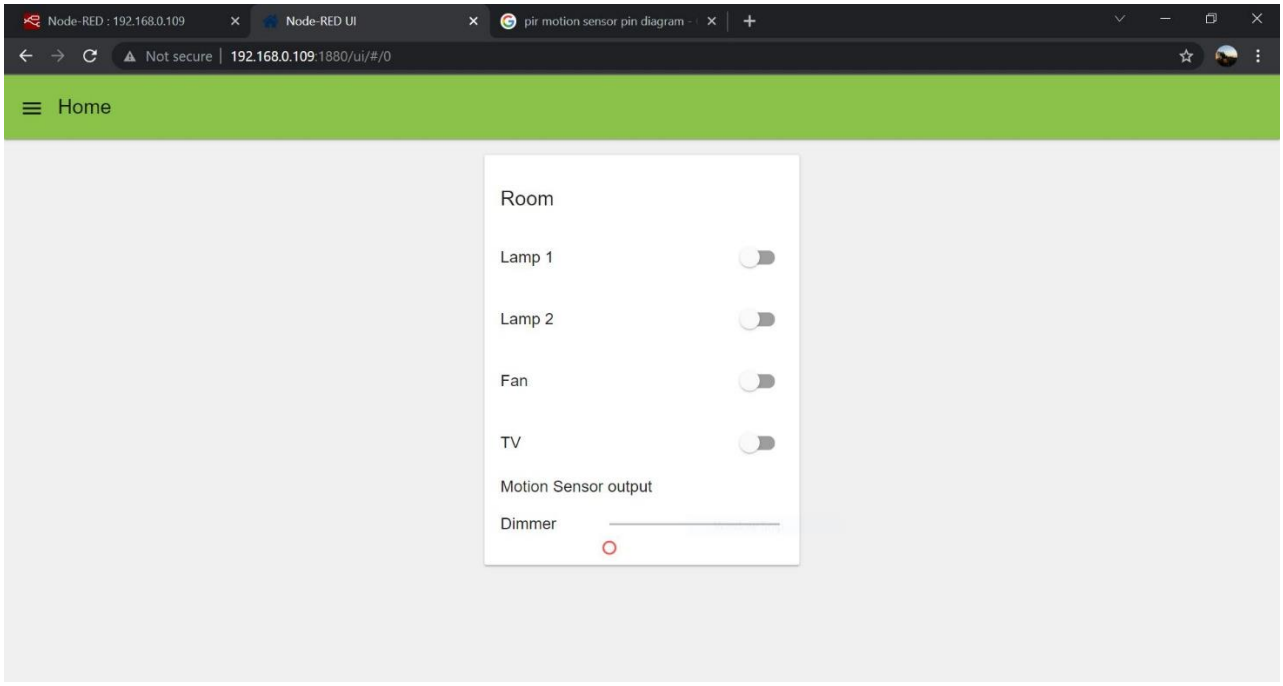

Figure 7

Once the hardware components are assembled, we then run the node-red. After running the node-red, we can view the UI of our Smart Home Appliance, using which we can control all the devices listed.

8. Results/Output Screenshots

Testing Relay Board

Analysis**:**

Relay board acts an indicator, where each device that will be in automation system represents one indicator on relay board.

When we on a device from UI, the associated indicator on relay board will be off.

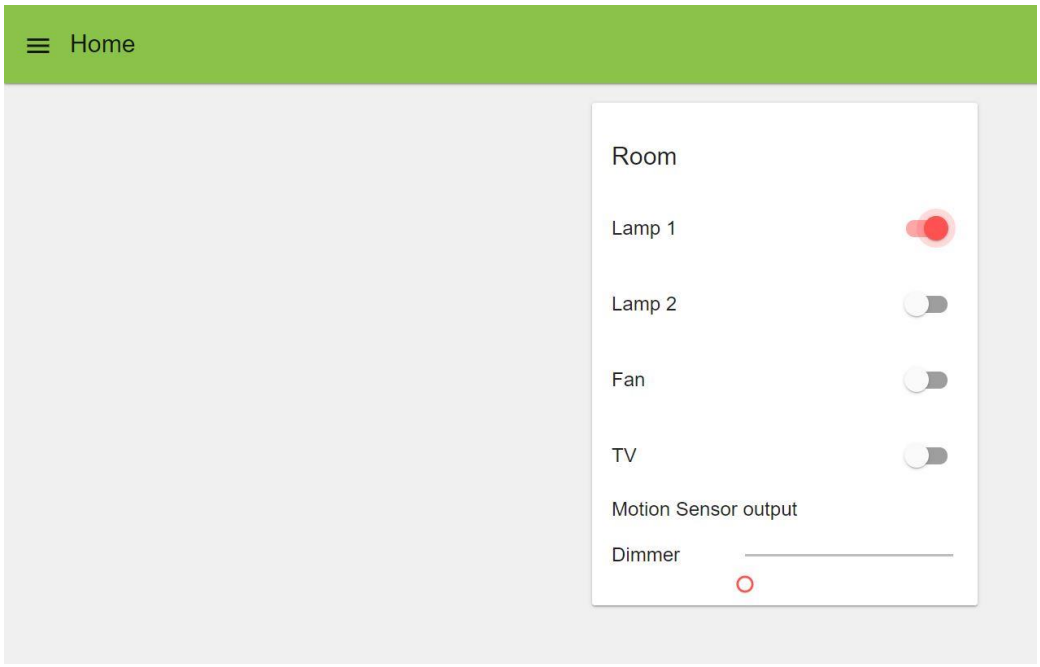

Figure 8

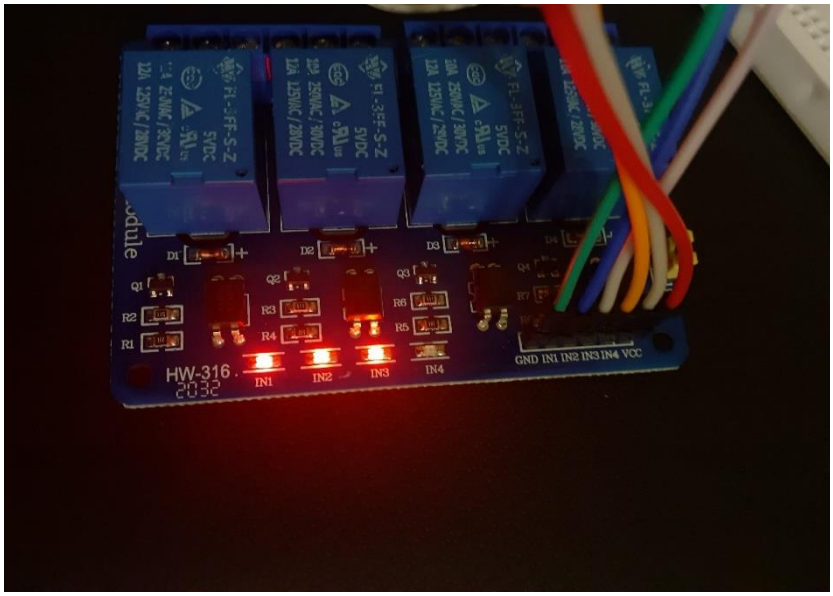

Figure 9

Testing Dimmer

Analysis**:**

Works perfectly, as designed.

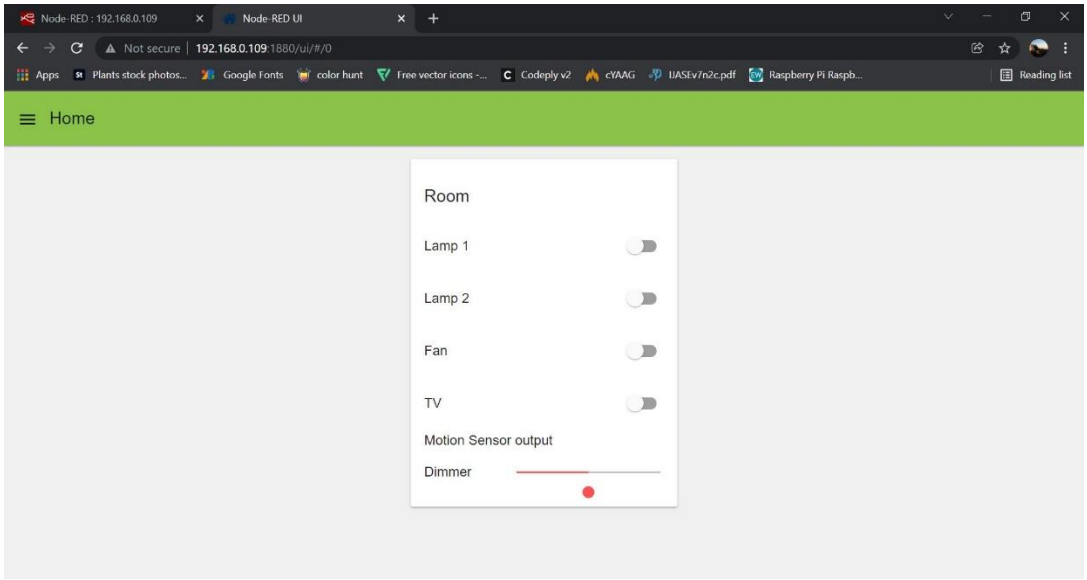

Figure 10

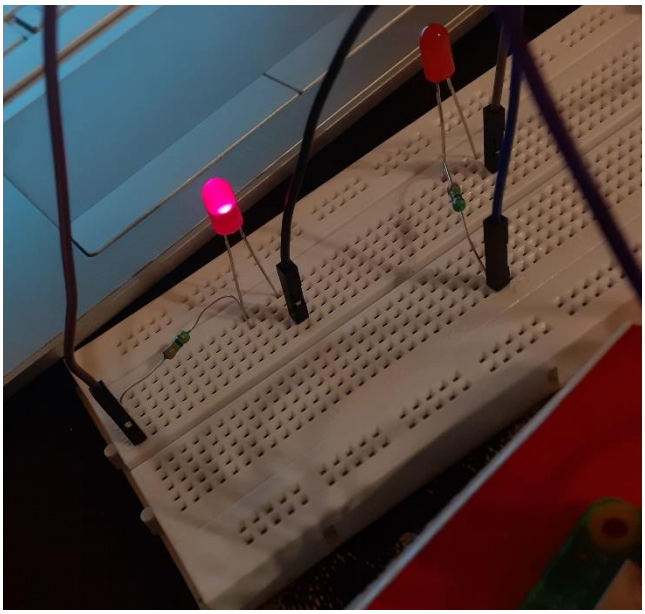

Figure 11

Testing PIR motion sensor

Analysis:

- When there is a movement, it displays “Motion Detected” and the associated LED blinks.
- When there is no motion, it doesn’t display anything.

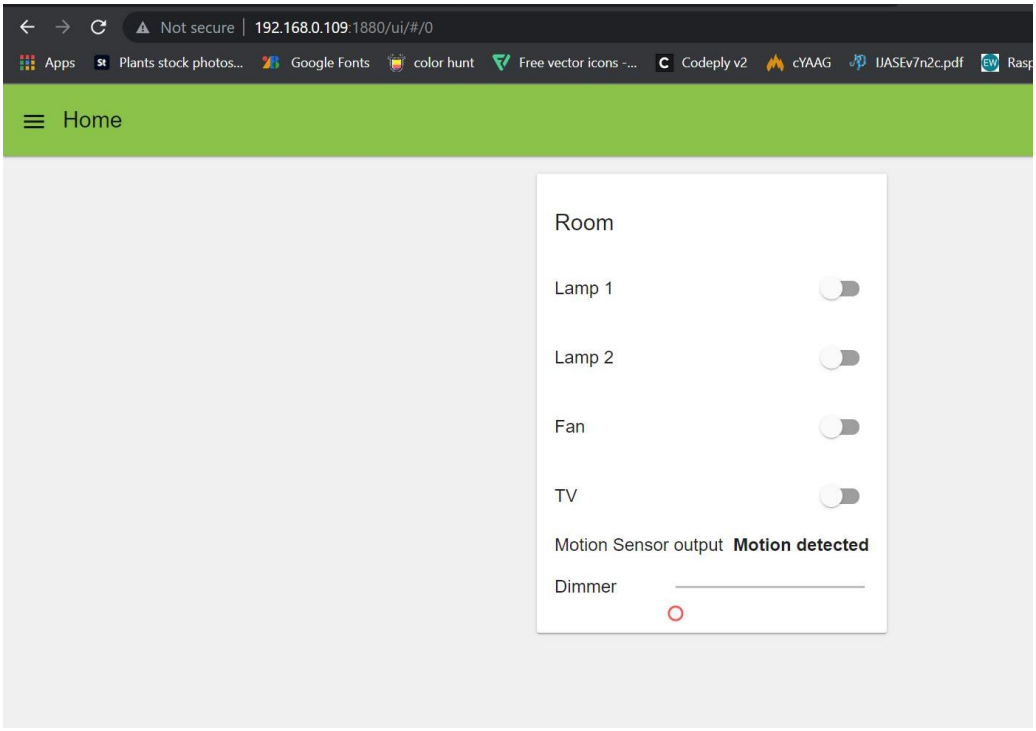

Figure 12

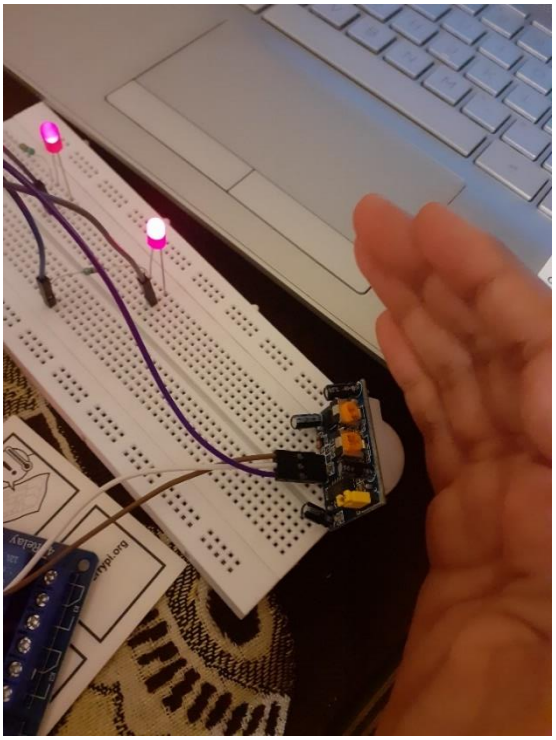

Figure 13

10. Conclusion and Future work

There have been many works done by the existing method on home automation and security purposes. But our method is unique when you compare with existing method cost, and sustainability. We have obtained the prototype for smart home automation. Now one can control their home devices by web browser in smart phone, tablet or computer.

Finally, this project provides a flexible and customizable design and implementation for many applications with low cost thus, not limited to home automation only. In the future, we can work on integrating a voice assistant like Alexa, google etc., Sensor cameras for live video streaming and picture capture. Also, mention/give some methods/options in case of emergency situations.

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