Industrial Internship Report on

"HOME AUTOMATION SYSTEM"

Prepared by

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Executive Summary

The report is based on the 6 weeks Industrial Internship journey provided by Upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). Upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process. Each and every member was great in dealing with student queries and the replies were very helpful.

This internship was project based and we had to finish the project including the report in 6 weeks time. The first three weeks were little challenging as I dealt with new things. The next three weeks were very effective and I learnt many things throughout my journey.

This internship provided me with necessary exposure regarding various problems based on industrial grade and gave me a very good opportunity to implement solution for that. It was an overall great experience to have this internship.

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1 Preface

In modern day world, everything is being automated from home to colleges and from offices to industries. Devices and machines are being automated to reduce the human efforts and it additionally saves energy and time. With the event of latest technologies, the ability to connect with one another through network is phenomenal. Internet of Things may be a network of interconnected devices, designed to gather and exchange information which may then flip it into data, eventually into knowledge. With internships like the one provided by Upskill Campus, students get more skilled and they get a chance to brainstorm themselves to develop useful devices and objects. For a beginner it is a perfect opportunity to start the development of his or her skill set and in turn develop his or her career.

There were many projects given to us and out of which we had to choose one project. The privilege of choosing more than one project was also given to us. I chose "HOME AUTOMATION SYSTEM" as my internship project as I really wanted to get deep in this IoT field particularly. I personally wanted to learn more out of the automation systems like how they work, what are the innovation opportunity etc. to which USC/UCT has provided the students one of the best platform to learn and explore. Additionally they have given the freedom to each and every student to make and choose topic of their own.

This 6 weeks journey was nicely planned. At the end of each week, reports of weekly work were asked to submit and the queries were attended very nicely.

- Week1: This week was full of exploring more about UCT and choosing the problem statement
- Week2: This week focused on making a plan
- Week3: In this week the design making and implementation was started
- Week4: In this week we extended our project design and made necessary changes
- Week5: This week was to fix errors and test the model developed
- Week6: The final week marked the project completion week

2 ACKNOWLEDGEMNT

I would like to express my heartfelt gratitude to all the individuals who have contributed to the creation of my project on "Home Automation". Without their support, expertise, and encouragement, this project would not have been possible. A special thanks to Respected Sir, **Kaushlendra Sisodia,** Director at **UniConverge Technologies Pvt. Ltd.** for providing necessary guidance. The interactive sessions conducted were very useful to us.

I also extend my deepest appreciation to my family and friends for their unwavering support and understanding throughout this journey. Their encouragement and belief in me provided the motivation to keep going, even during challenging times. I am profoundly thankful to the team at Upskill Campus, The IoT Academy and UniConverge Technologies Pvt Ltd (UCT) who have worked tirelessly during this 6 weeks.

Lastly, my heartfelt gratitude goes to all the individuals who participated in the testing and provided valuable feedback. Their insights and suggestions have immensely improved the quality and effectiveness of this project.

3 Introduction

3.1   About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end etc.
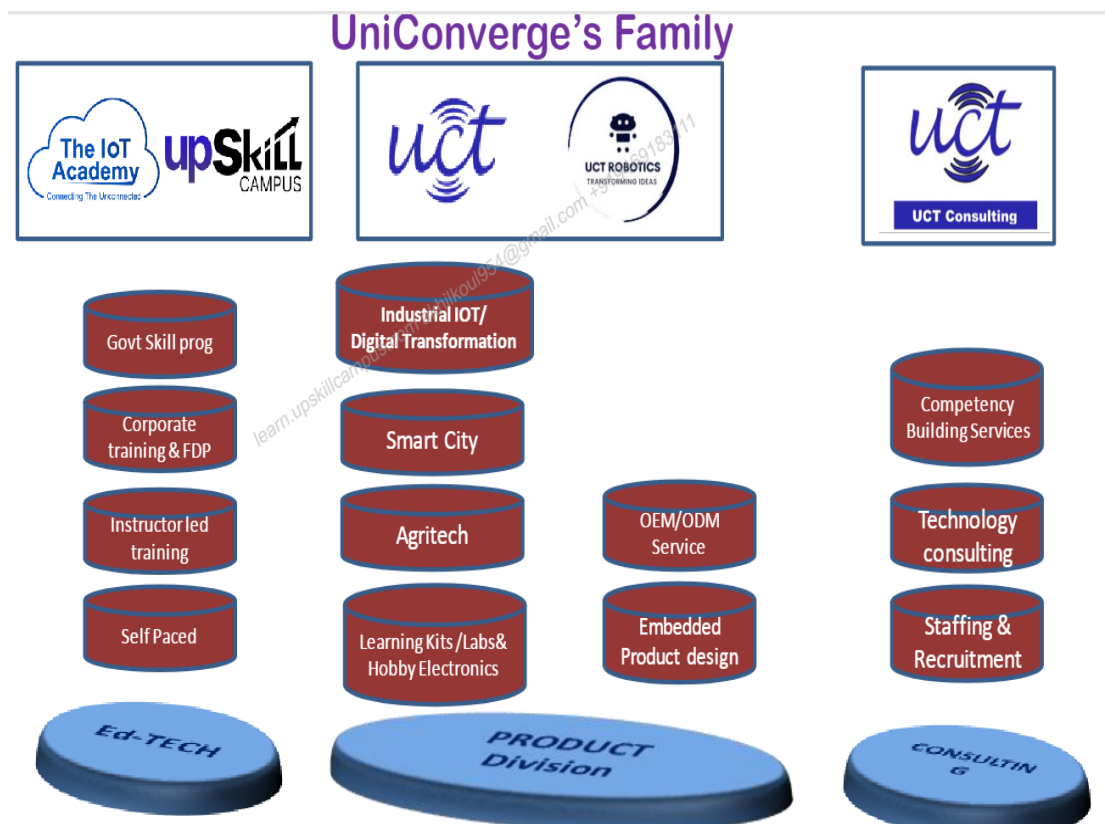

Figure 1

i. UCT IoT Platform

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA

- It supports both cloud and on-premises deployments.

It has features to
- Build Your own dashboard
- Analytics and Reporting
- Alert and Notification
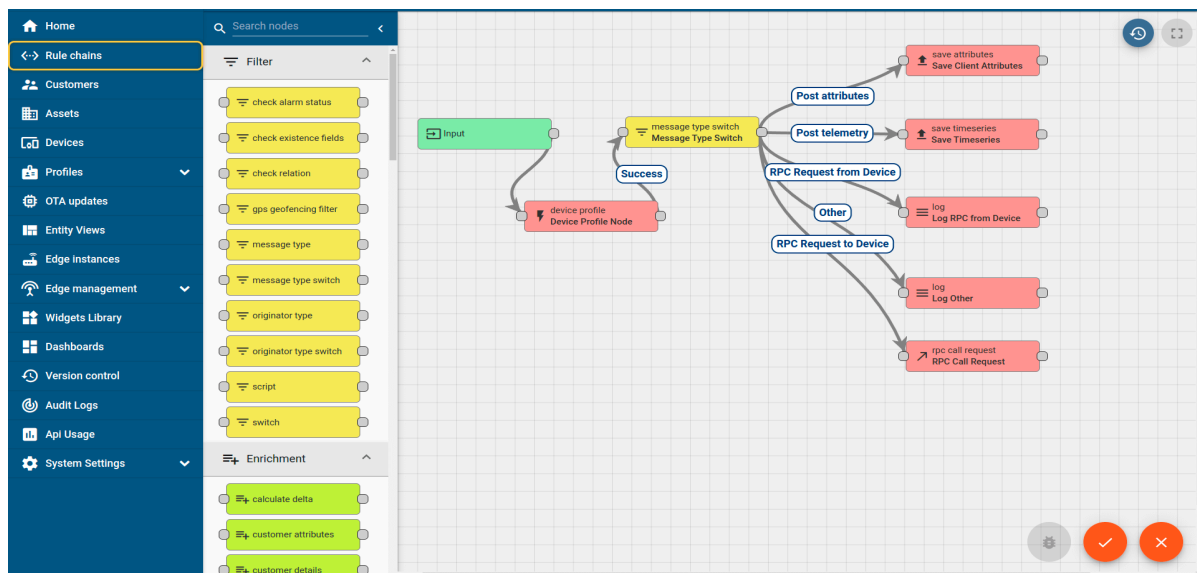- Integration with third party application (Power BI, SAP, ERP)
- Rule Engine

Figure 2

ii. **Smart Factory Platform (** FACTORY WATCH **)**

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring

- OEE and predictive maintenance solution scaling up to digital twin for your assets.

- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.

- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

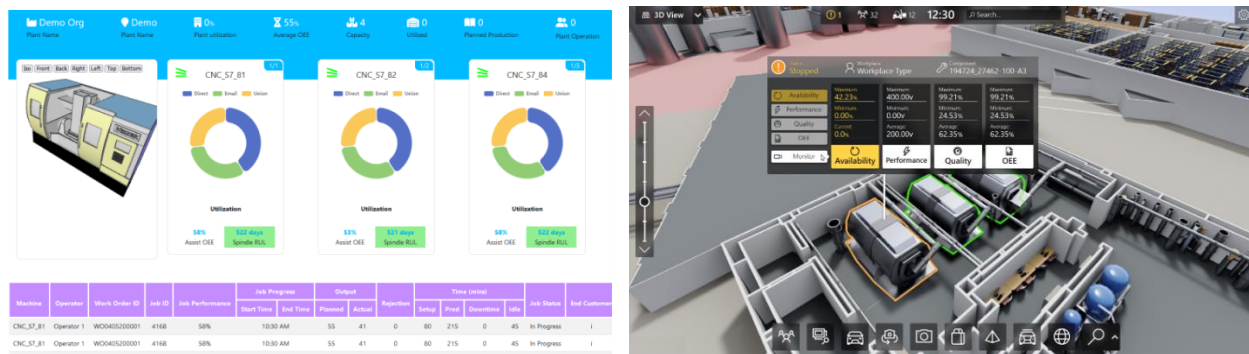Its unique SaaS model helps users to save time, cost and money.

Figure 3

iii. LoRaWAN™ based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

Figure 4

Figure 5

iv.   Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various machines used in production process.
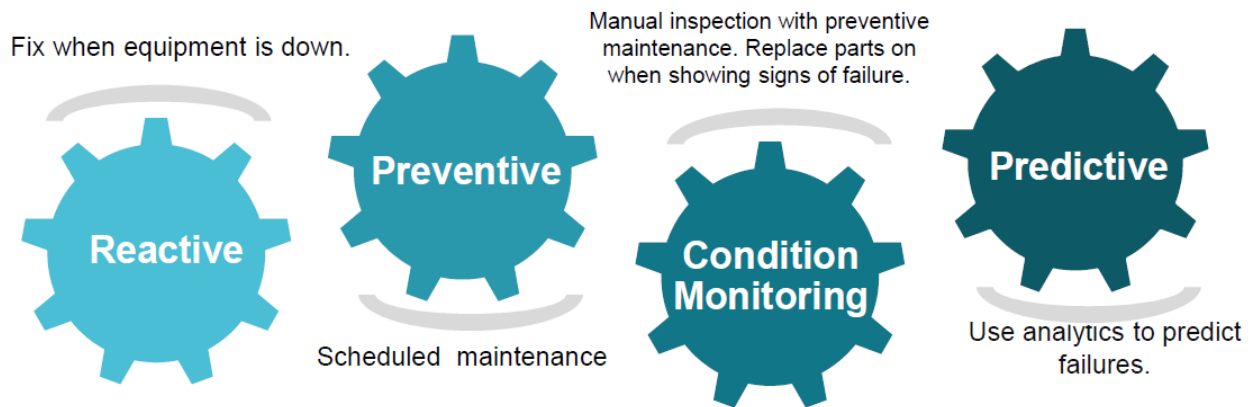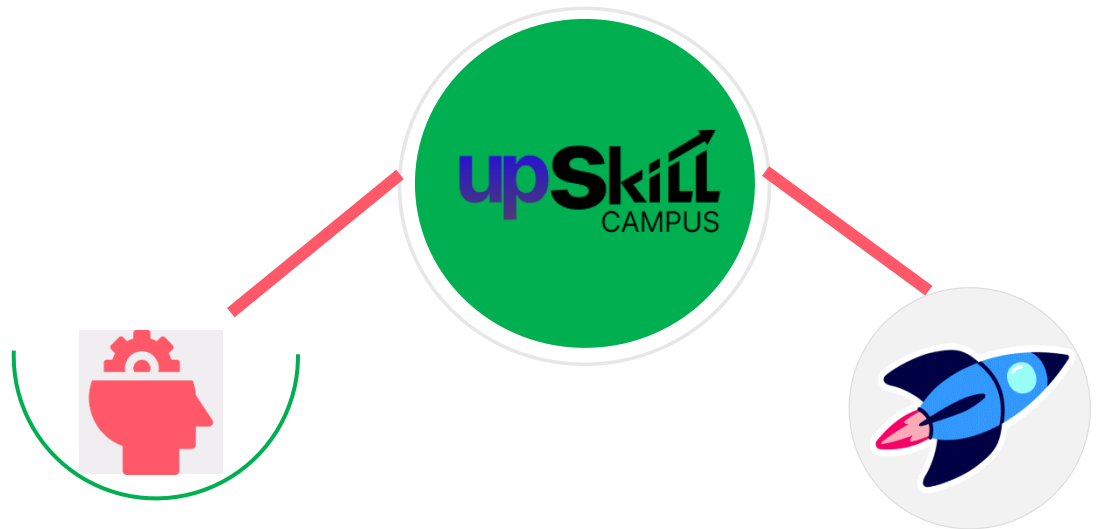
Fix when equipment is down.

Manual inspection with preventive maintenance. Replace parts on when showing signs of failure.

Reactive

Preventive

Condition Monitoring

Predictive

Scheduled maintenance

Use analytics to predict failures.

Figure 6

## 3.2   About upskill Campus (USC)

Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

UpSkill Campus aiming to upskill 1 million learners in next 5 year

Upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.
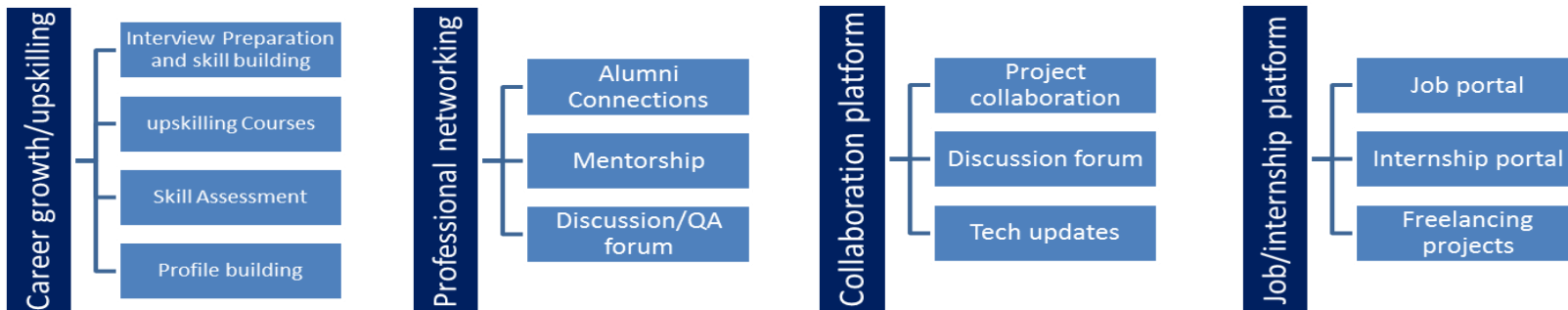
3.3 About The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains. It is an NCR Based Firm founded and guided by a group of IT Professionals having excellent experience in various IT Sectors and who have been working in MNCs for past years. They are specialized in education and skill development programs which help students to brighten their career.

3.4 Objectives of this Internship program

The objective for this internship program was to

☛ get practical experience of working in the industry.

☛ to solve real world problems.

☛ to have improved job prospects.

☛to have Improved understanding of our field and its applications.

☛to have Personal growth like better communication and problem solving.

3.5   Reference

[1]   https://www.upskillcampus.com/

[2]   https://www.linkedin.com/company/upskillcampus/

[3]   https://www.theiotacademy.co/

[4]   https://www.uniconvergetech.in/

4 Problem Statement

As we know the present day home systems are not automated, that is they have to be controlled manually using physical switches. On individual level it is time consuming and leads to unnecessary power wastage. This makes monitoring of appliances very much important. Other than this there are various challenges like maintenance, security, connectivity, physical presence etc. By overcoming these obstacles, we can create an environment where users can effortlessly control and manage their smart devices, leading to increased adoption and a more satisfying home automation experience.

So the problem proposed was to design and implement a "Home Automation System" using Microcontrollers so that there can be automation in home appliances also. The suggested microcontrollers were Node MCU and arduino and the automation had to be controlled using third party website or app.

The objectives needed to be achieved were as follows:

- Energy Efficient Systems

- Increased Convenience

- Remote Access

- Automated Control

- Better Security

5 Existing and Proposed solution

The existing solutions included simple home systems having one microcontroller and Wi-Fi Module control. So I tried to implement the home automation using occupancy detection of persons in range using PIR Motion Detection.

DISADVANTAGES OF EXISTING SYSTEM:

The existing system was operated manually but not being physically present to operate the home appliances. But the problem still existed when the user itself forgets to turn off the appliances through third party apps also. That is why the automation part was still missing.

PROPOSED SOLUTION:

One solution was to detect the occupancy and then turn off appliances when occupancy was not detected. This solution was implemented by adding PIR Motion Detection Sensor which regulated appliances in use. In addition the user also had the access to control the appliances whenever needed.

This solution can be aided by the use a LDR circuitry. Whenever needed the decision can be made by taking in consideration the outputs of both PIR Motion Sensor and LDR circuit.

5.1 Code submission (Github link):

https://github.com/akhilkoul12/HOME-AUTOMATION-SYSTEM
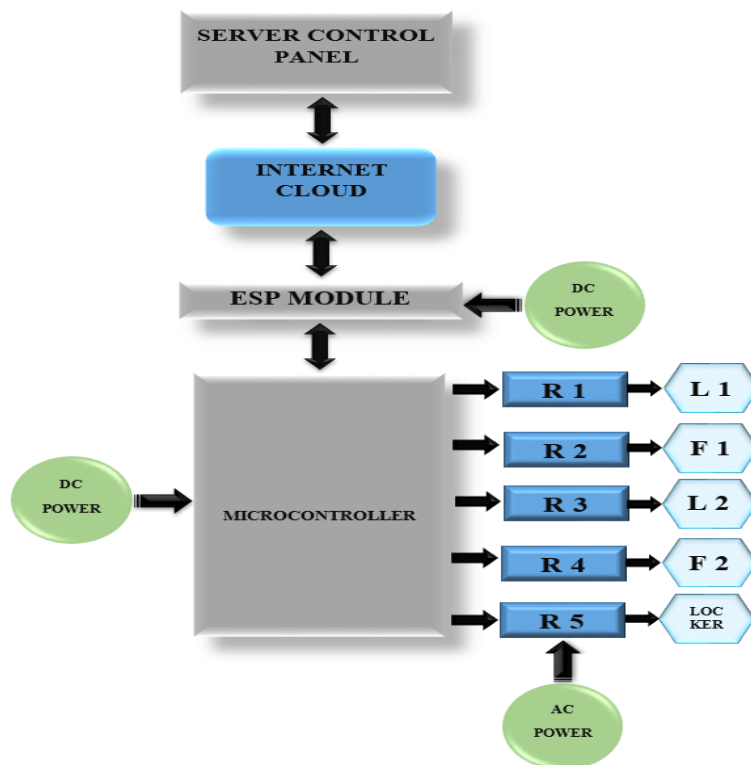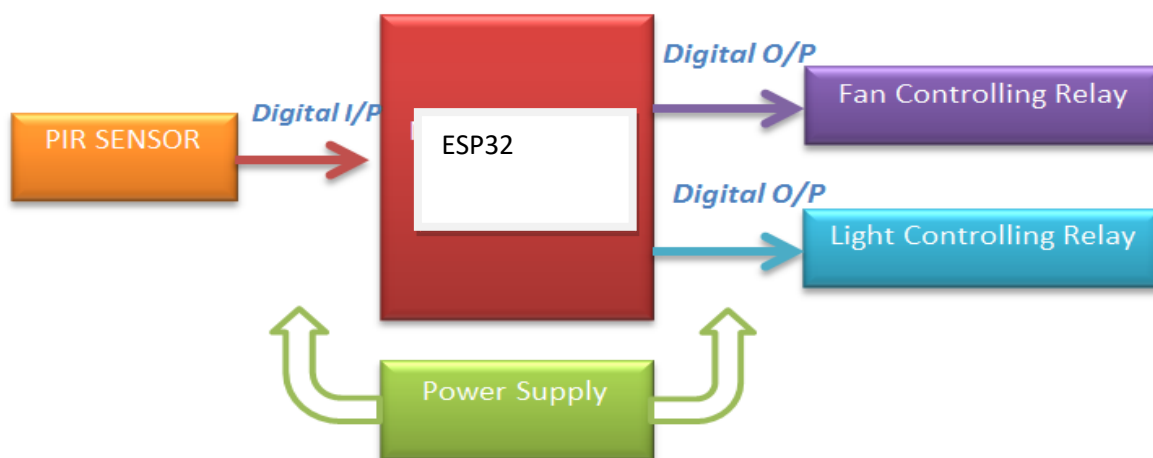
6 Proposed Design/ Model

Figure 7

Figure 8

- Fig.7 explains the flow of signals between the NODE MCU and its WiFi Module with the third party server having automation in control

- Fig.8 explains the circuit flow of PIR Sensor with NODE MCU
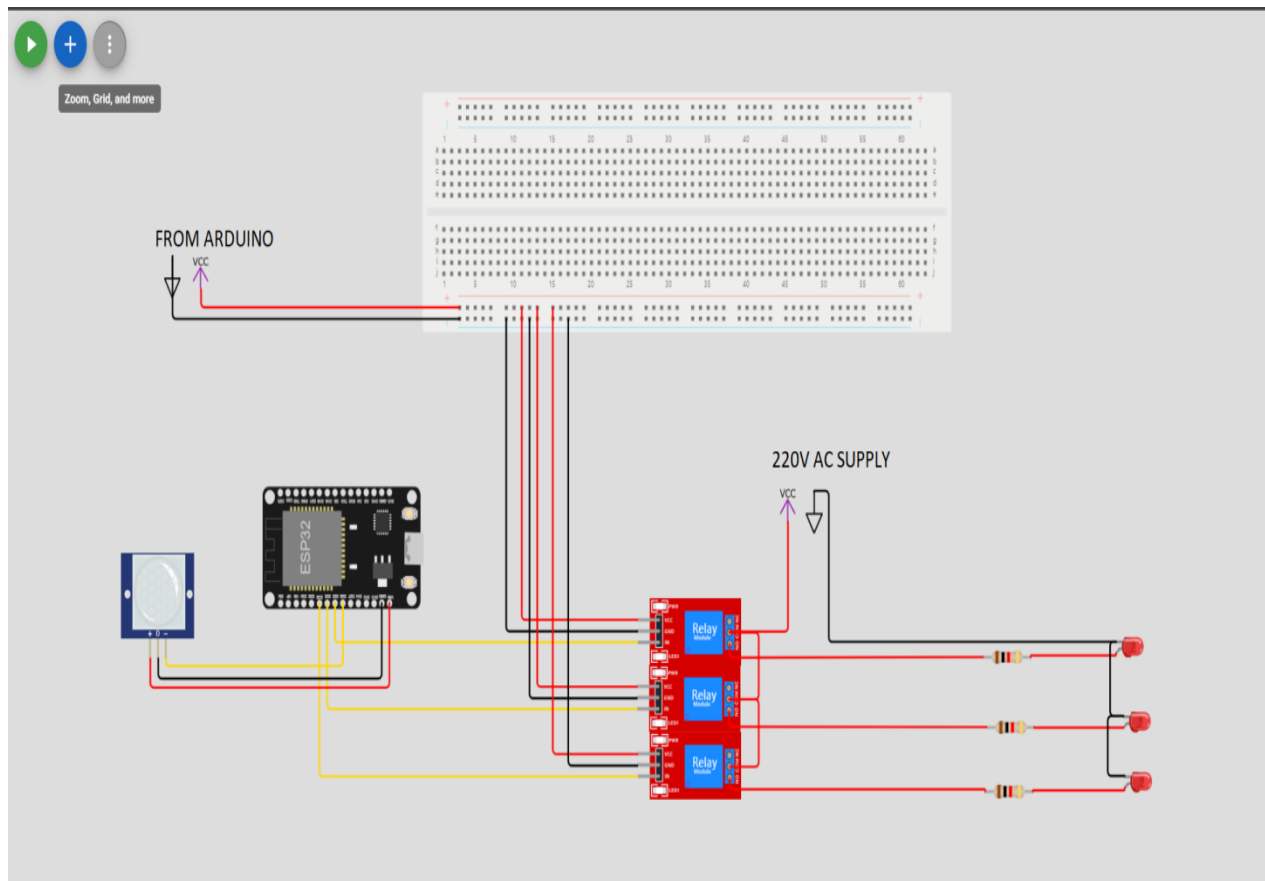
6.1 Low Level Diagrams

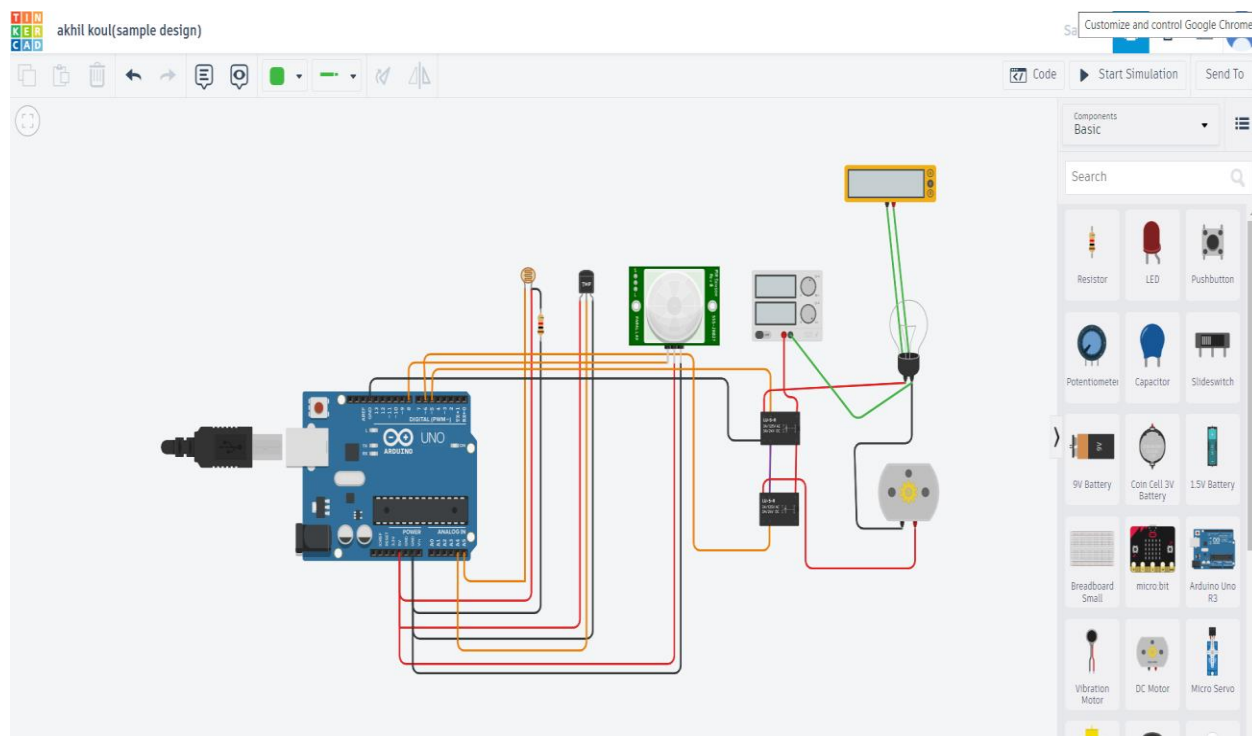- Fig.9 explains circuit flow using ESP32 Microcontroller
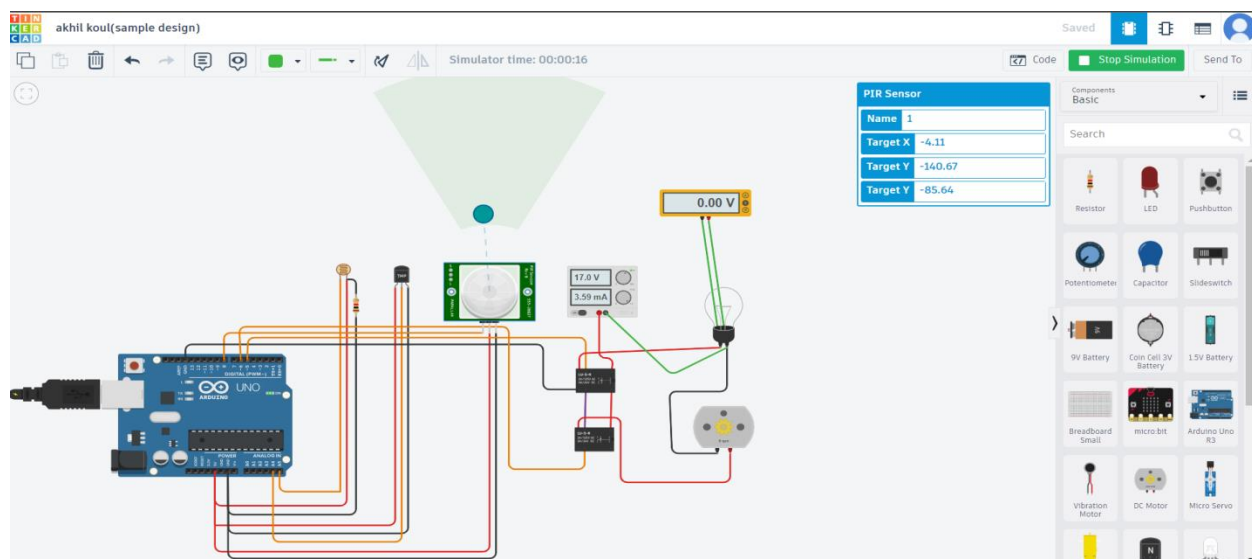
Figure 10

Figure 11

- Fig.10 and Fig.11 shows circuit flow using arduino microcontroller. Also I have demonstrated the use of PIR and LDR sensor
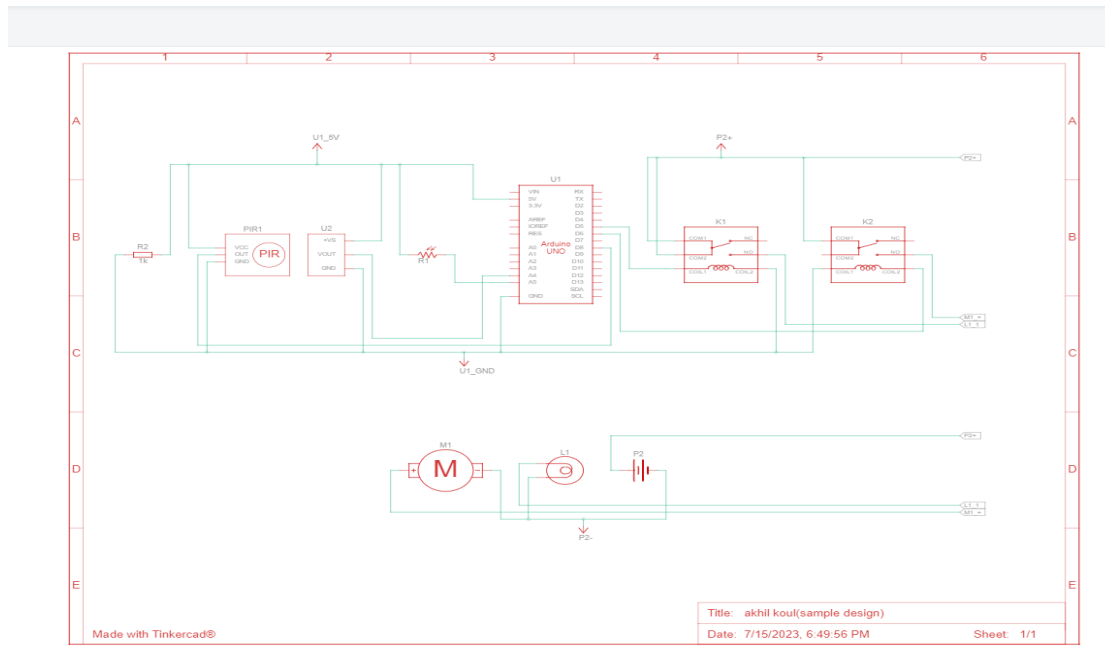
6.2 High Level Diagrams

Title: akhil koul(sample design)
Date: 7/15/2023, 6:49:56 PM   Sheet: 1/1
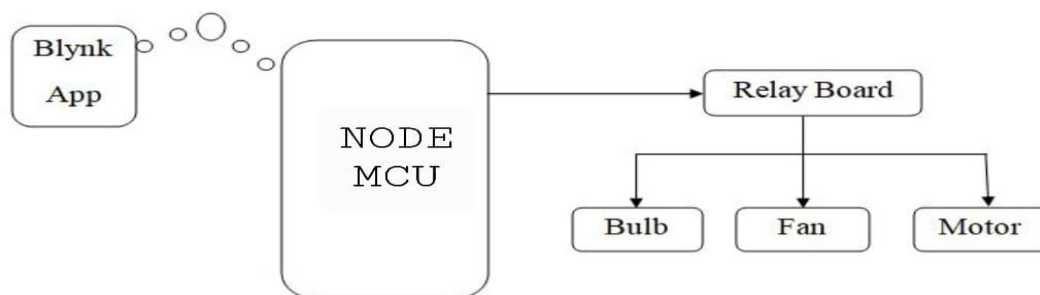
Figure 12
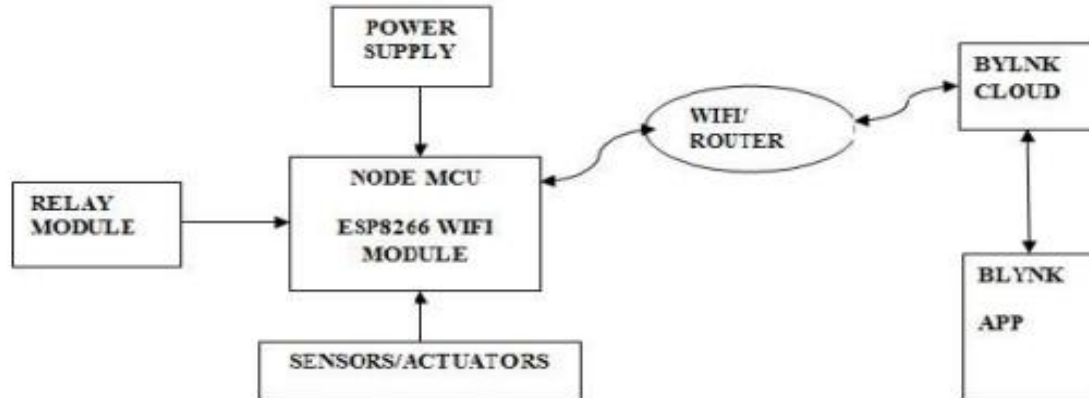
6.3 BLYNK Interfaces

Figure 13

Figure 14

- In the following block diagrams NODE MCU is connected with relay, sensors and with power supply. The 5V power supply is provided to NODE MCU with the help of laptop or any adapter.

- Block diagram above also shows the electrical systems that are controlled with IOT system by using wireless network. The devices are connected to the router in the house.

- Human will send information to switch ON the appliances in their home or building or industry through router and router will send the information to the controller.

- After that, controller will analyze the data with the help of WiFi Serial Transceiver module to communicate with the relay circuits.

- Then, after the relay circuit has received the data on which switch is going to be ON, the data will be send to the appliances
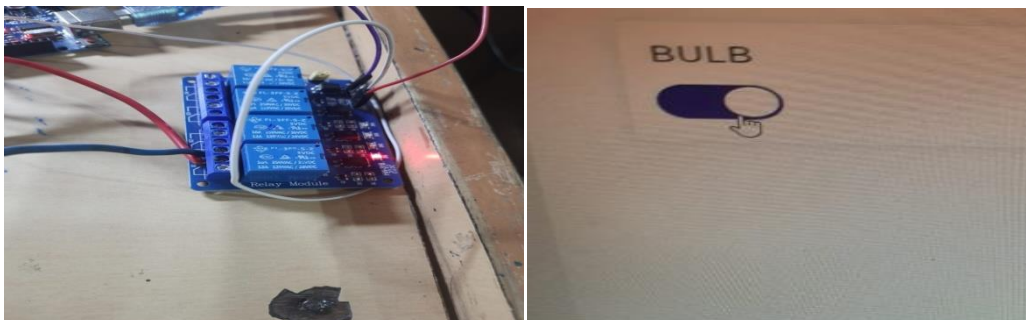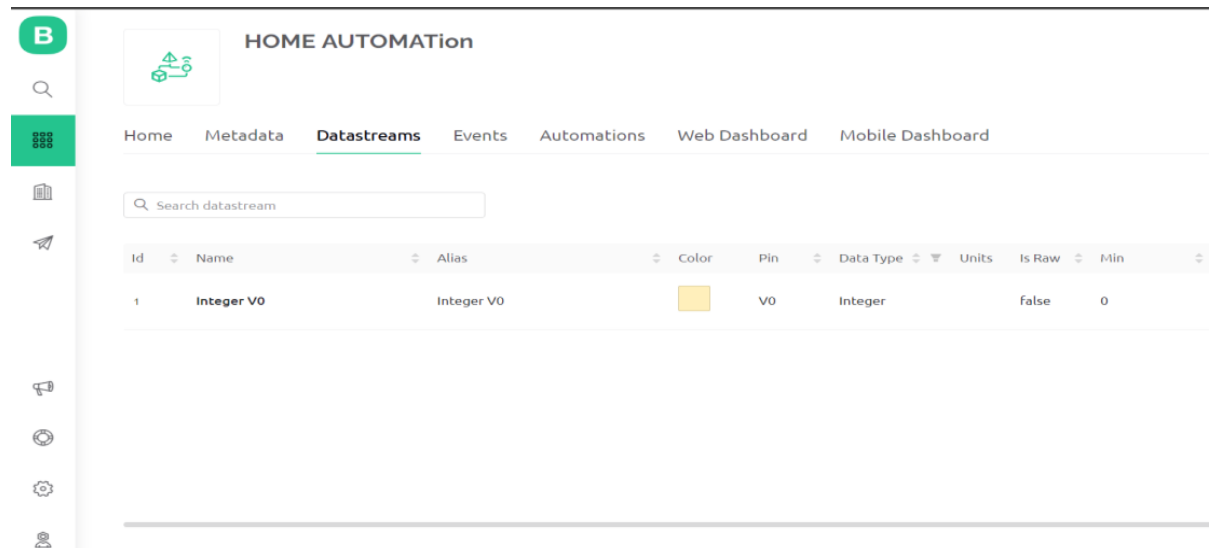

Figure 15

Figure 16

7 Performance Test

HOME AUTOMATION has evolved a lot and it is a growing industry as everybody wants to make life easier and effective with the controls of everything within the reach of their pockets. Including numerous applications and widespread usage, several factors have led to its transformation into a significant market. Some of the factors are as follows:

- **ENERGY CONSUMPTION:**
  The energy-saving potential of home automation systems, which efficiently control lighting, heating, and cooling based on occupancy, weather conditions, and user preferences, has captured the interest of individuals, businesses, and governments. This attraction stems from their desire to minimize their carbon footprint and decrease energy costs.

- **BETTER INTEGRATION:**
  The increased prevalence of high-speed internet and the introduction of wireless communication standards such as Wi-Fi and Bluetooth have greatly enhanced device connectivity within households. This has facilitated the seamless integration and communication between diverse home automation systems, leading to a more holistic and streamlined user experience. Consequently, individuals can enjoy a unified and cohesive interaction with their interconnected smart devices and automation systems.

- **INDUSTRIAL PRESPECTIVE:**
  The promising prospects of home automation have drawn the attention of numerous companies and startups, prompting them to make substantial investments in research, development, and marketing. This heightened competition has sparked innovation, leading to the introduction of novel products, enhanced features, and competitive pricing.

7.1 Test Plan

- **Setup:**

  1. Gathering necessary components
  2. Downloading necessary software
  3. Registrations in Third Party Cloud to be used
  4. Establishing connectivity like WiFi and Bluetoot

- **Components Required:**

1. Node MCU
2. Arduino
3. Relay Module
4. Breadboard
5. PIR Motion Detection Sensor'
6. LDR Sensor
7. Resistors
8. Jumper Wires
9. AC Supply
10. Load
11. Electrical Wires

7.2   Test Cases

o   Confirm the successful installation of the Arduino IDE.
o   Validate the connection between the hardware components.
o   Ensure accurate identification and registration of all devices within the system.
o   Verify the initial configuration and settings of the home automation system.
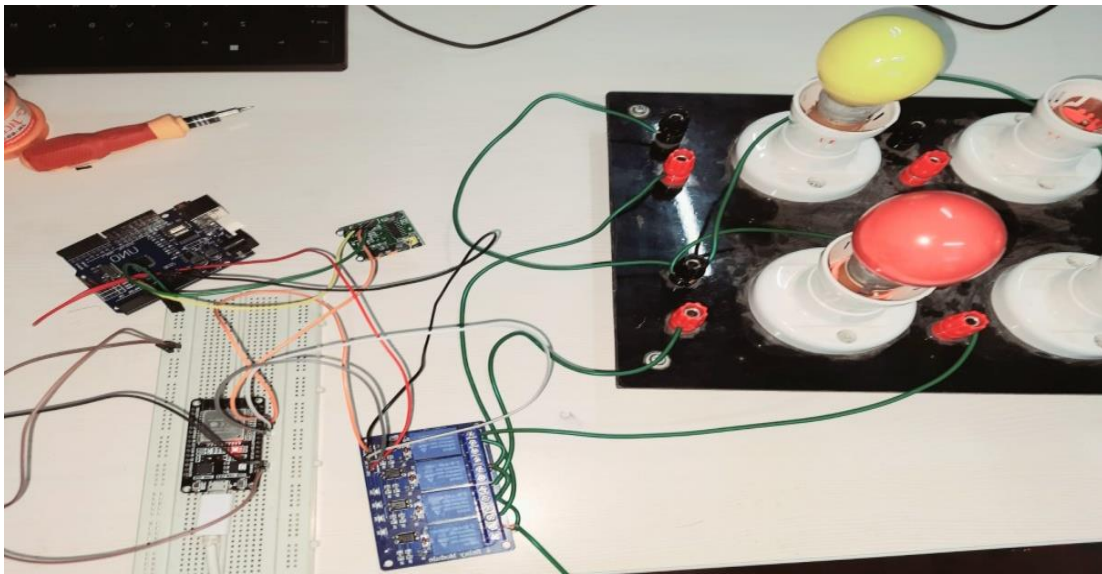o   Test basic functionalities, such as controlling lights or running an AC

Figure 17

7.3   Test Procedure

STEP 1: Decide what parts of the system to test and how to test them.

STEP 2: Connect all the devices and install the required software.

STEP 3: Test if the devices can be controlled properly, like turning them on or off.

STEP 4: Try out the automatic routines and rules you set up to see if they work correctly.

STEP 5: See how fast the system responds to commands and how well it handles many devices at once.

STEP 6: Make sure the system is secure and protects against unauthorized access.

STEP 7: Check if the system works well with different devices and platforms.

STEP 8: Test if the system is easy to use and understand for regular users.
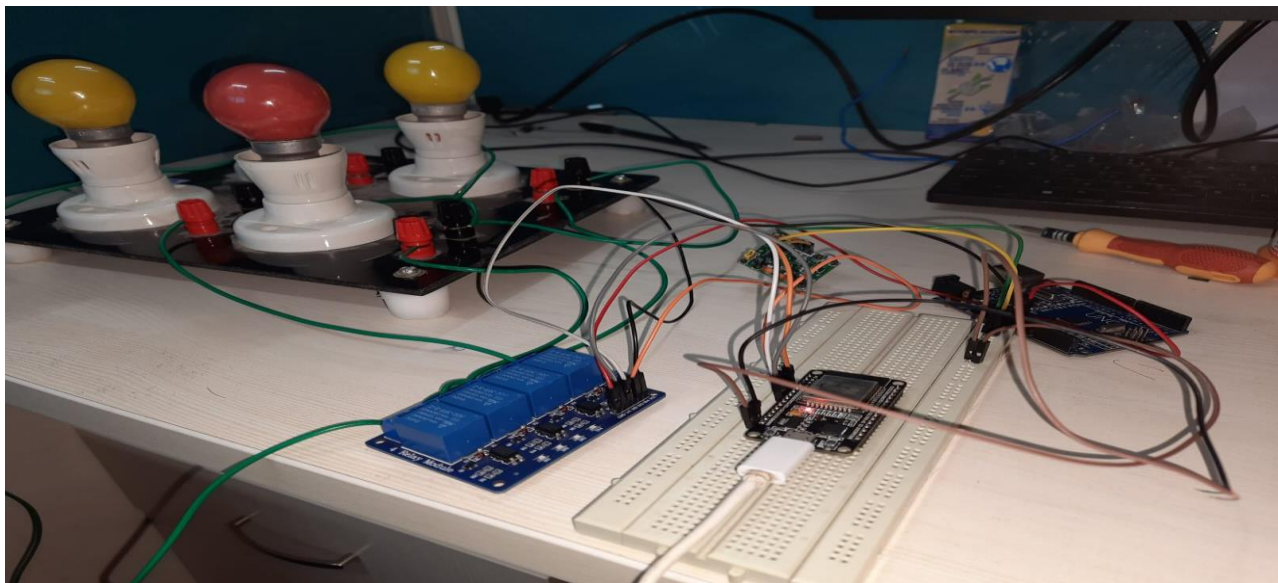
STEP 9: After any changes, test to ensure nothing else got affected.
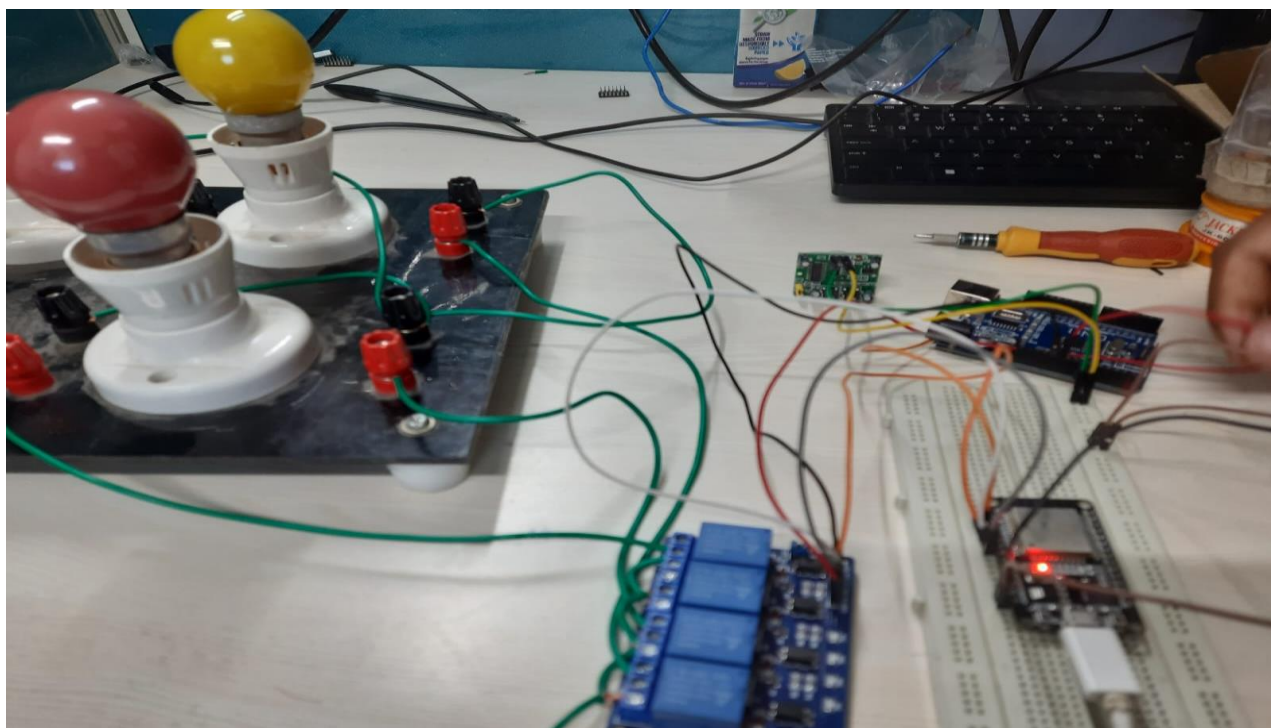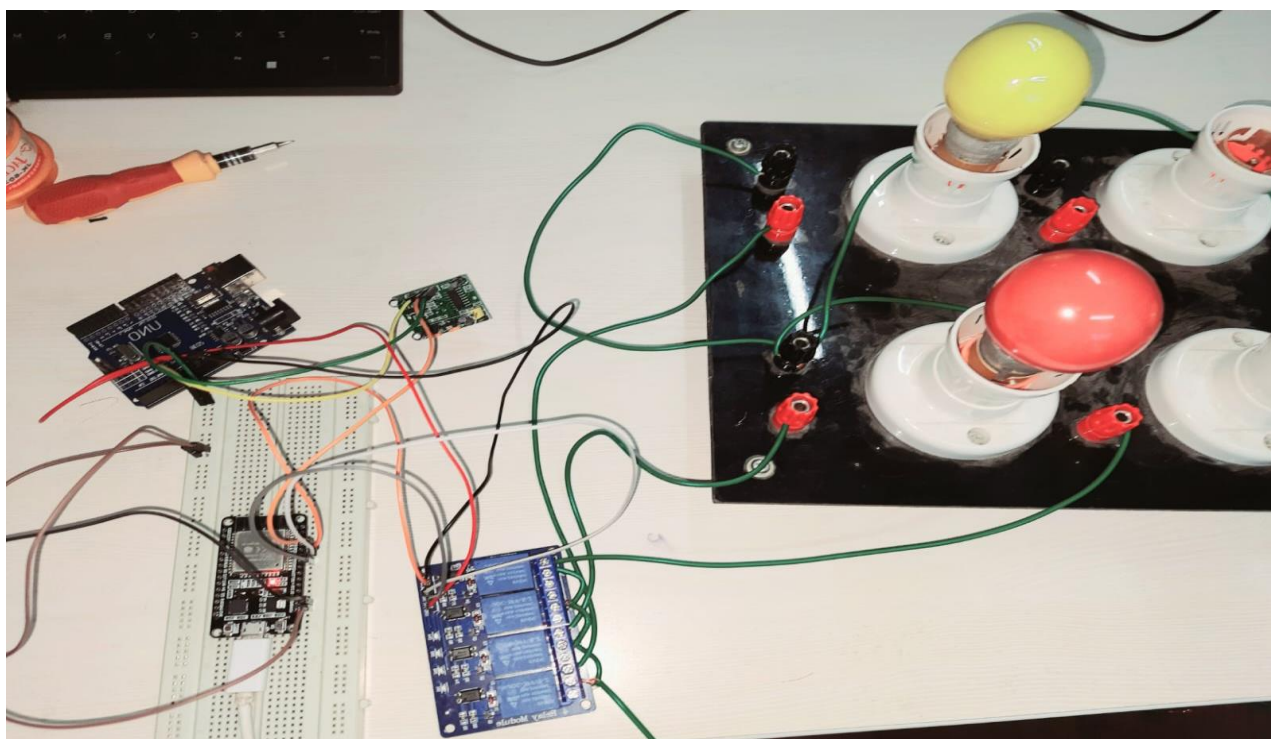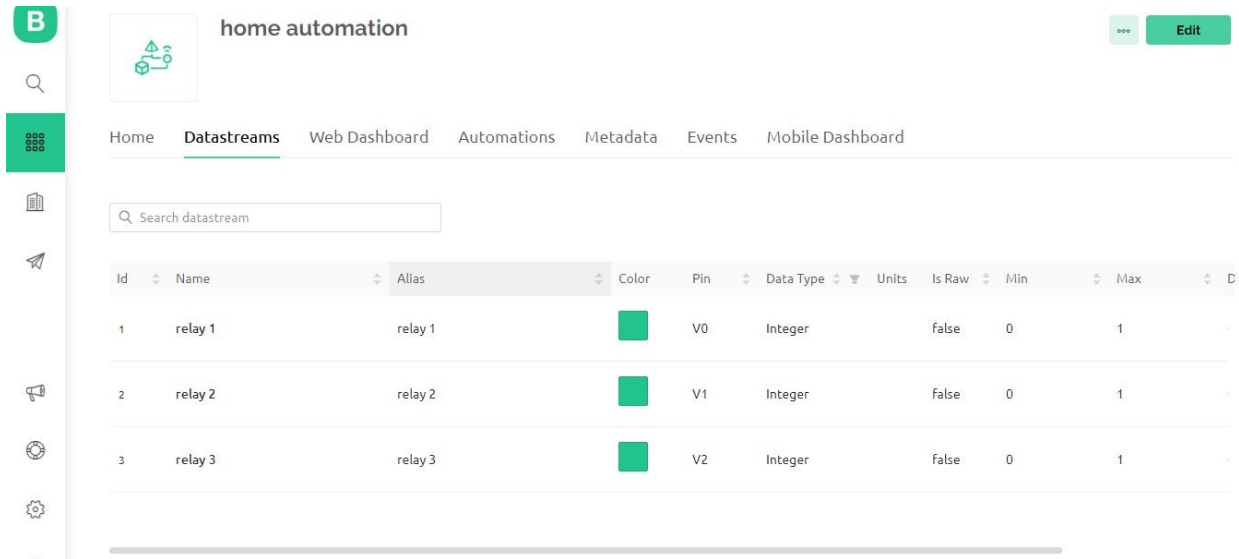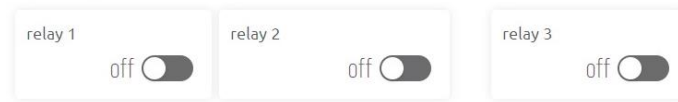

Figure 18

Figure 19

Figure 20

Figure 21

7.4 Performance Outcome

o **Energy Efficiency:** Since we have automated the home appliances there was minimum 40% reduction in unnecessary usage of electricity

o **Load Handling**: The system was kept running for half an hour and the load applied were three small bulbs with low power consumption. After that three highly rated bulbs in power consumption were tested. In both cases the system responded well and the heat emitted was minimal.

o **Latency:** The delay between turning switches ON and OFF was barely any. The devices responded immediately to each command given

.

- o **Reliability:** In terms of reliability, it lags this function as sometimes it produces unnecessary errors in functionality. This can be solved by properly ensuring system connections and connectivity.

- o **Scalability:** In terms of scalability, it can handle number of devices at the same time, thus making it very much scalable for future use.

- o **Network Performance:** The network connectivity between devices is very much compatible and with each devices responding quickly to the commands given.

- o **User Interface:** Since we have used BLYNK interface as a third party service, we cannot control or edit the user interface experience. The default interface provided by BLYNK is also very easy and appealing.

- **ERROS ENCOUNTERED:**

    1. Sensor Malfunction
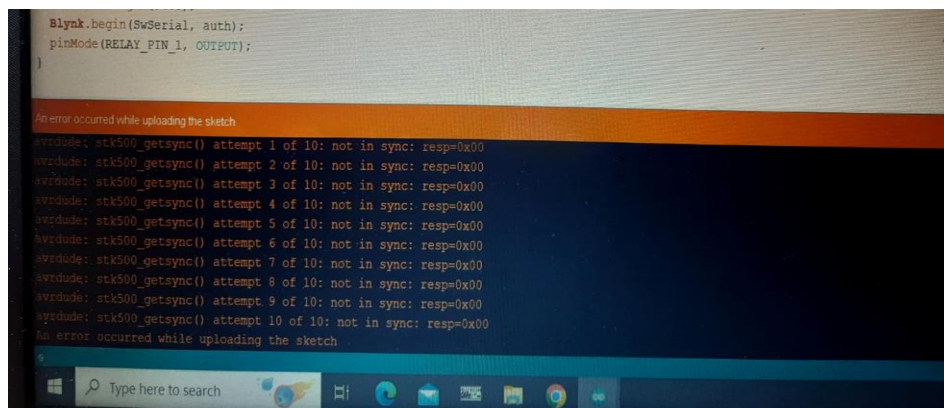   2. Firmware errors
    3. Device Connection Failures

Figure 22

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8 MY LEARNINGS

In my complete journey of designing and implementing Home Automation as my internship project I have learnt some of the important fundamental principles of automation. I have learned how it works and how to set up the complete procedure of Home Automation. I now understand how different devices can work together, like lights, AC, and fans. I've also figured out how to make things happen automatically, like turning on the lights when I enter a room. Along the way, I've encountered and resolved common issues, which has helped me become better at solving problems. Overall, I've gained valuable knowledge and skills that allow me to make my home smarter, more efficient, and more convenient to live in. I'm excited to keep exploring the home automation technology. By gaining insights into these essential elements, I now grasp how this advanced technology operates and enhances the functionality of everyday devices in our homes.

Practical experience has been a vital aspect of my learning process. I have actively engaged in the installation and setup of various home automation systems. From connecting hardware components like smart devices, sensors, and controllers to configuring these devices and installing the required software or applications, I have gained hands-on knowledge of the entire setup process. This hands-on experience has provided me with a deeper understanding of the system's physical components and how they interact with each other to form a cohesive network.

One of the most fascinating aspects of my learning journey has been discovering the potential of device compatibility and integration. I have explored how different smart devices can seamlessly work together within the home automation ecosystem, creating a unified and interconnected environment. Understanding the challenges and solutions of integrating devices from various manufacturers has been a valuable lesson in ensuring smooth and efficient communication between them.

Overall, my journey into the world of home automation has enriched me with comprehensive knowledge and skills. It has allowed me to leverage the power of technology to create a smarter, more efficient, and convenient living space. My learning experiences have opened up a world of possibilities in making my home safer, more energy-efficient, and tailored to my preferences and needs. As I continue to explore and innovate within the realm of home automation, I look forward to unlocking even more exciting advancements and applications in this transformative technology.

9 Future Scope

The project currently designed takes decisions based on one PIR Motion Sensor. So the project is restricted to one sensor only making it vulnerable for errors. The decision of turning ON/OFF appliances should be taken based upon values given by two or more sensors. For this one solution was to make use of LDR sensor. In future we can use temperature sensors so to make decisions based on temperature of the surroundings. For example, an Air Conditioner or a fan can be turned ON or OFF based on the temperature conditions around.

Also we can use voice recognition features which can help in managing the appliances usage based upon the user voice commands. This will also allow the user to integrate security features with the components.

In addition we can save data on some cloud and then train a model based on Machine Learning Algorithms and then take better decisions based on some pattern developed over time.

The future scope of Home Automation is very broad and increasing features

develops better user experience and provides best results out of the system.