Department of Information Technology

A.P. Shah Institute of Technology

G.B.Road, Kasarvadavli, Thane (W), Mumbai-400615

UNIVERSITY OF MUMBAI

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A Project Presentation on

IoT Enabled Smart Laboratory

Submitted in partial fulfillment of the degree of
Bachelor of Engineering(Sem-7)
In

INFORMATION TECHNOLOGY

By
Prathmesh Pande (16104020)
Ritesh Shetty (16104048)
Bhavana Kondurkar (16104066)

Under the Guidance of
Prof. Vishal Badgujar

1. Project Conception and Initiation

1.1 Abstract

- Internet of Things is defined as a system wherever appliances are embedded with software system, sensors and actuators.
- In our Lab, there are multiple appliances like Lights, Fans, Air Conditioners, and Projectors.
- The current, usual way to control the appliances in the lab is to manually toggle switches on the switch board of the particular Lab.
- However, that in itself is a time consuming task as a person has to be available to do so.
- Our proposed system is aimed at developing an automated solution where even if the end-user/admin is located remotely, the appliances can be turned on.

1.2 Objectives

- To automatize the appliances present in Labs.
- To reduce the power consumption by economical usage of the appliances.
- To minimize, monetary costs, user discomfort, delays, utilization of resources.
- To provide cloud access so that any device can access remotely regardless of being in same network or not.
- To attempt integration of laboratory time scheduling with the system.

1.3 Literature Review

Author	Title of Paper	Publication	Findings
M. Poongothai, P. M. Subramanian and A. Rajeswari	Design and implementation of IoT based smart laboratory,	2018 5th International Conference on Industrial Engineering and Applications (ICIEA), Singapore, 2018, pp. 169-173.	• Benefits of IoT in general, • How automation can be useful • Use of MQTT and Node-RED for automation.
R. K. Kodali and A. Anjum	IoT Based HOME AUTOMATION Using Node-RED,	2018 Second International Conference on Green Computing and Internet of Things (ICGCIoT), Bangalore, India, 2018, pp. 386-390	Home automation system through Node-RED and MQTT using affordable Wi-Fi Boards.
T. Malche and P. Maheshwary	Internet of Things (IoT) for building smart home system	2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), Palladam, 2017, pp. 65-70.	In-depth discussion about IoT, Smart Home, and Home Automation.

1.3 Literature Review

Author	Title of Paper	Publication	Findings
S. Somani, P. Solunke, S. Oke, P. Medhi and P. P. Laturkar	IoT Based Smart Security and Home Automation	” 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), Pune, India, 2018, pp. 1-4.	Home Automation using IoT via Raspberry-Pi and an Android Application.
H. K. Singh, S. Verma, S. Pal and K. Pandey	A step towards Home Automation using IOT	2019 Twelfth International Confernce on Contemporary Computing (IC3), Noida, India, 2019, pp. 1-5.	Building a home automation system using NodeMCU (ESP8266), NodeJS, and Relays.

1.4 Problem Definition

- Our institute has many laboratories and therefore, more staff.
- If laboratory session ends, sometimes the machines and appliances are left running.
- Physically toggling switches at the start/end of a lab session adds to wastage of time.
- Also, when out of premises and unable to turn off devices, this will lead to huge power wastage.
- To mitigate this issue, we built this system.

1.5 Scope

- Our system can be used in not only college/institute laboratories, but with suitable modifications to cater the needs of the specific domain, it can also be used in places like:
    - Homes.
    - Offices.
    - Industrial locations.
    - Shops.

- With Node-RED, Cross platform compatibility is ensured.

1.6 Technology stack

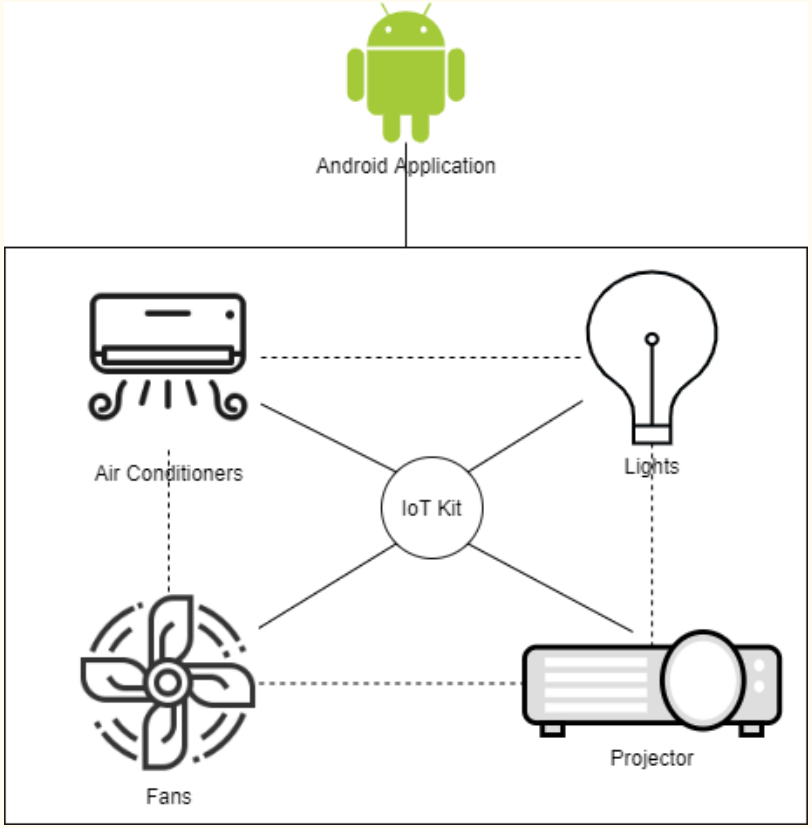
- **Node-RED:** For wiring along all hardware for automation and remote control
- **MQTT:** Standard messaging protocol for the Internet of Things (IoT).
- **MQTT Broker:** A server which implements MQTT Protocol.
- **Raspberry-Pi 3B:** Embedded Board for IoT Projects.
- **NGROK (For Cloud Access):** Program to expose localhost to public internet.
- **Smart NORA:** Node-RED Module for Google Home Integration.
- **Time Scheduler Node:** Node-RED Module for Time/Event Scheduling.
- **Relay Module:** An electrically operated switch, which can be controlled using Raspberry Pi, requires low voltages.

1.7 Benefits for environment & Society

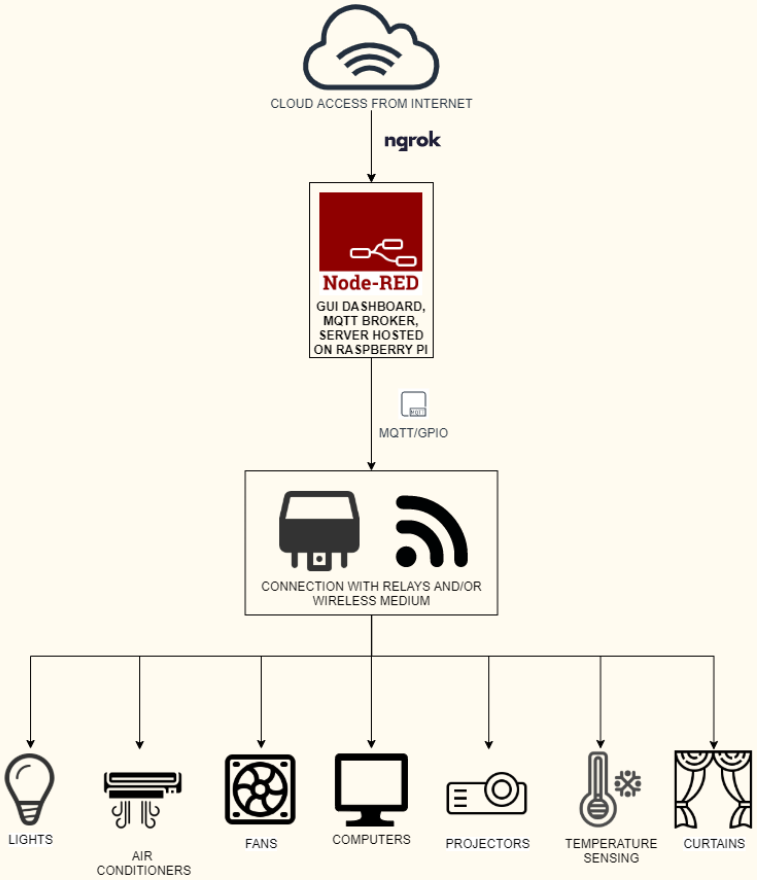
- Fewer additional resources required for implementation.
- Efficient utilization of the energy consumption will help saving electricity, helping the environment, as well as lower the electricity bill.
- Less manpower required for management.
- Easy access to all the devices from anywhere in the world.
- Open-source project, meaning the software code is freely available for everyone, saving costs.

2. Project Design

2.1 Existing System.

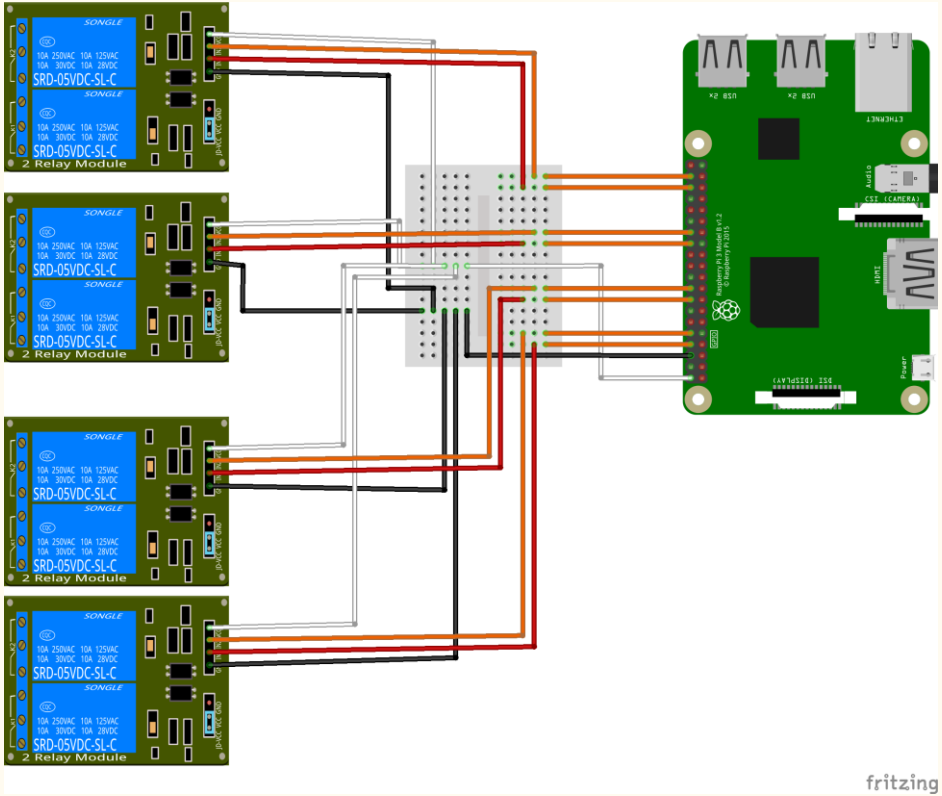


2.2 Proposed System

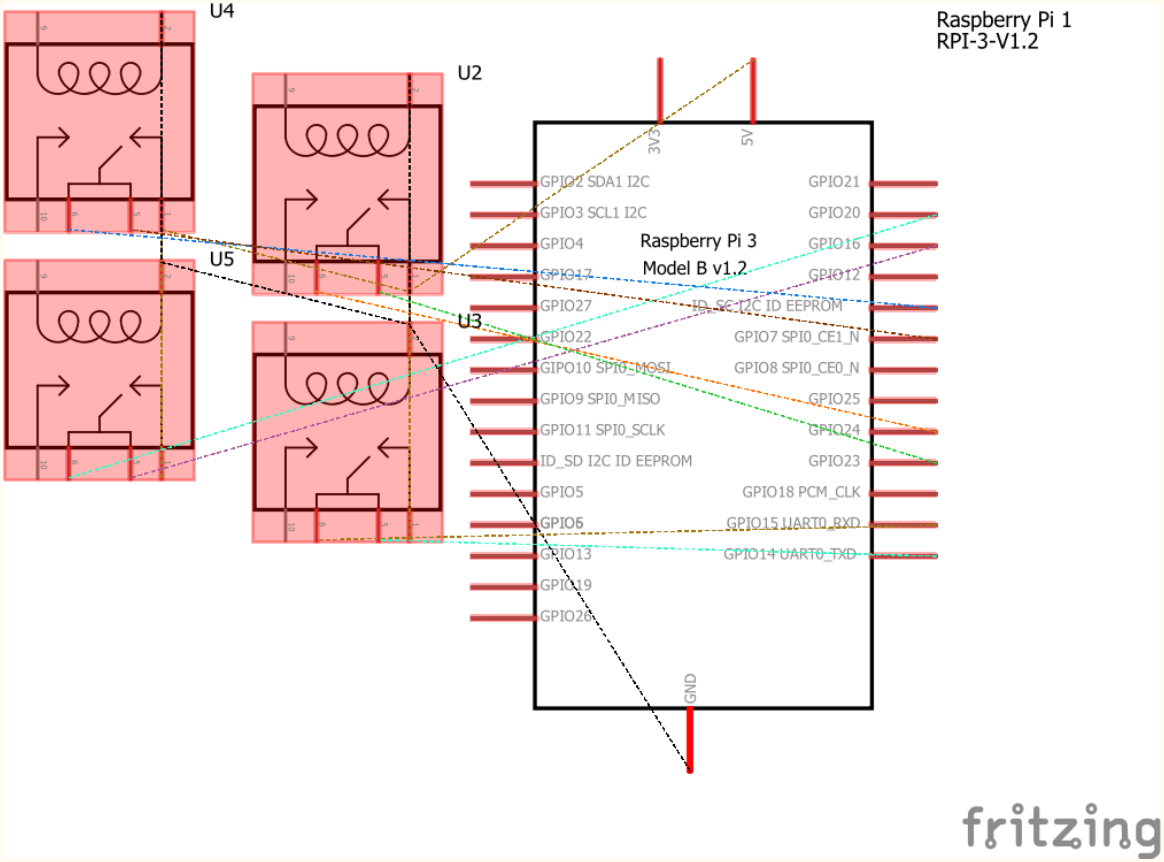


3. Implementation

Breadboard Circuit Design:

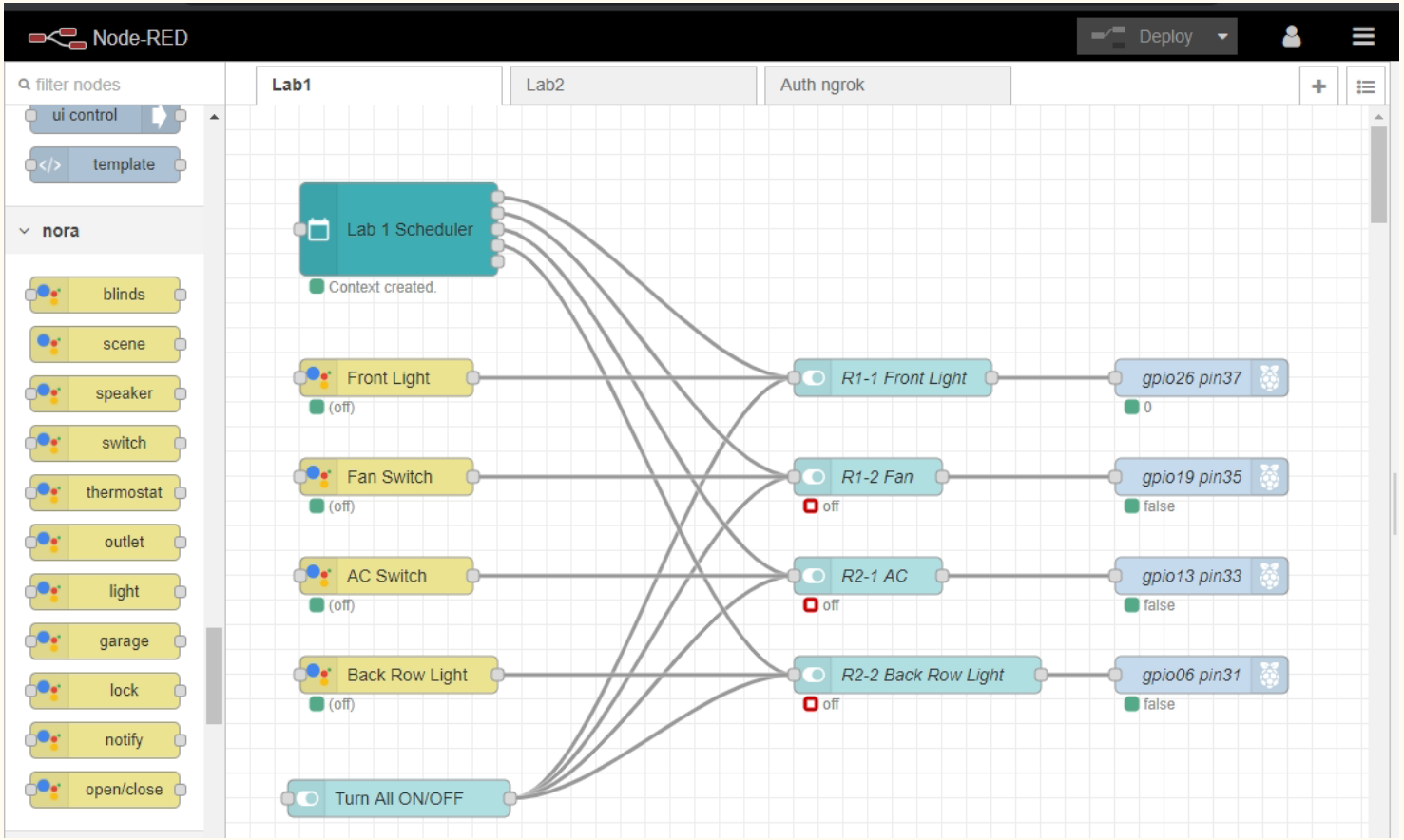


Schematic of the Circuit:

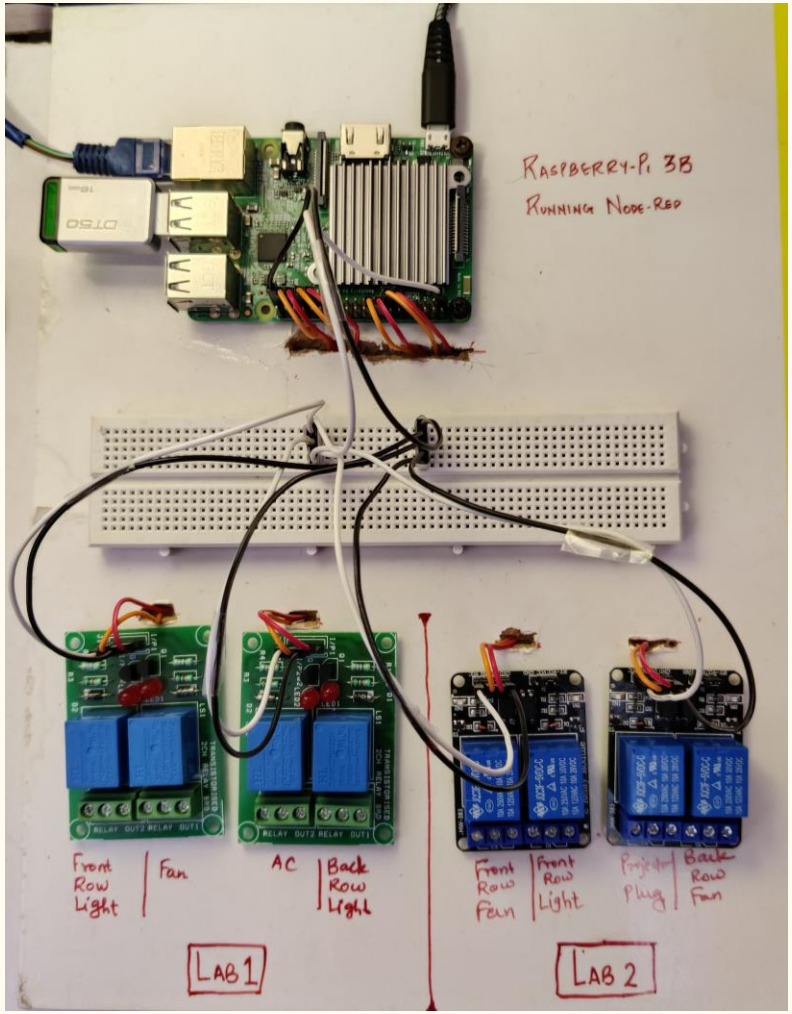


4. Testing

Node-RED Editor:

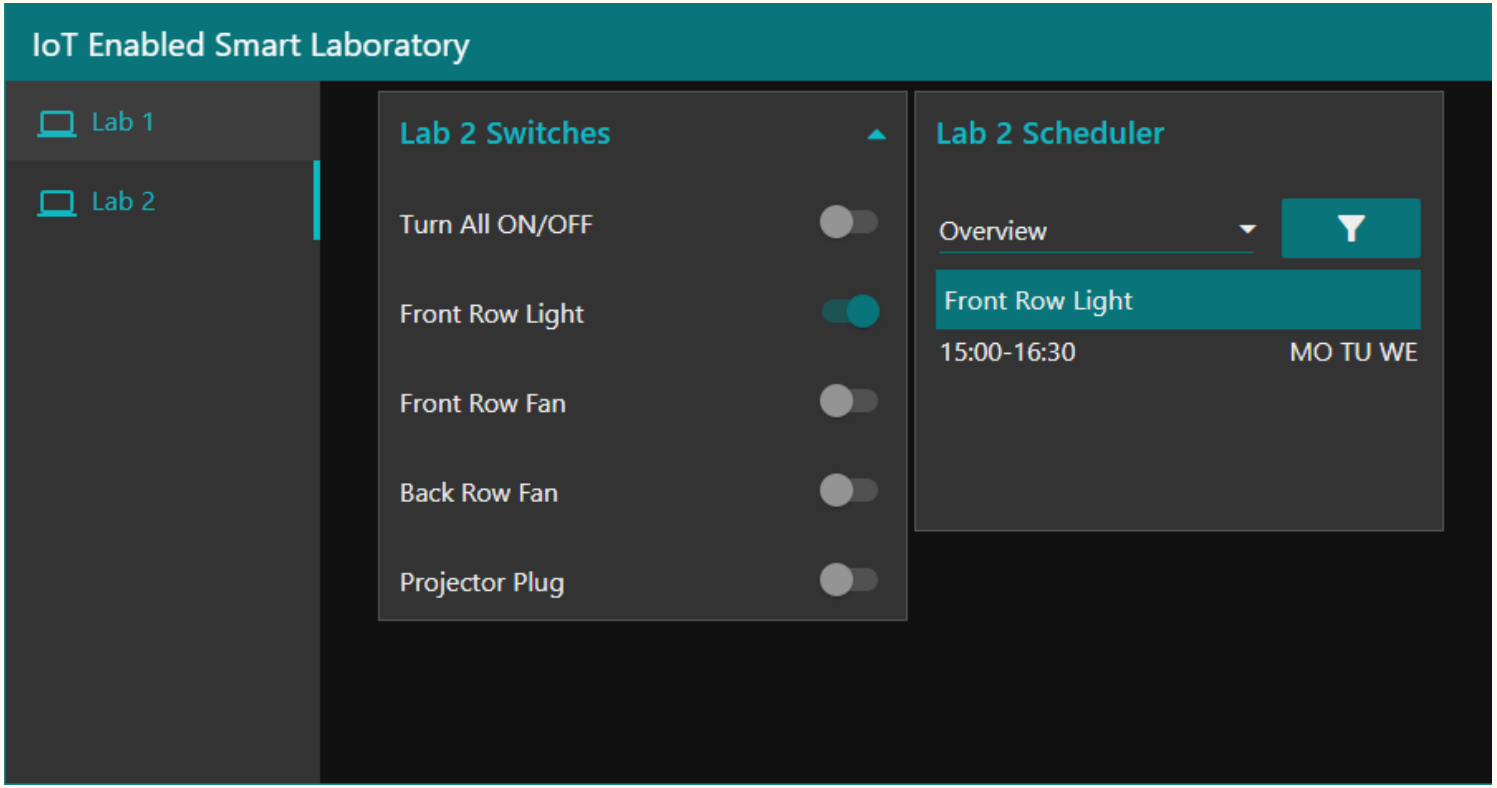


Final Circuit:

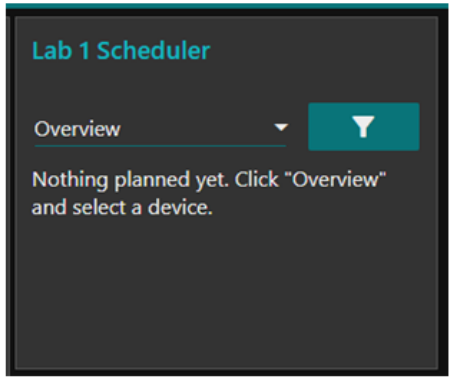


5. Result

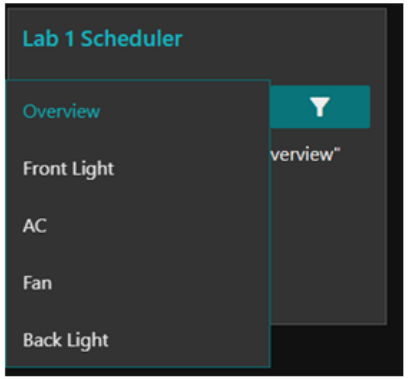
Node-RED GUI Dashboard:



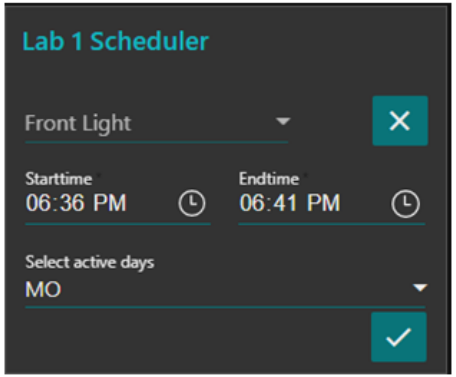
Time Scheduling:



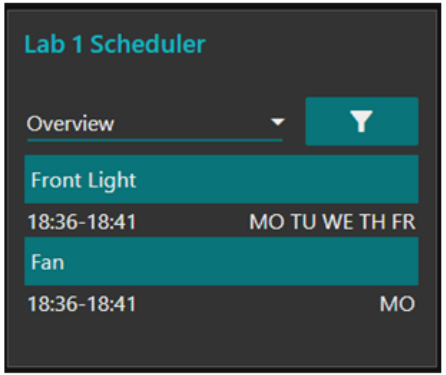
Overview Pane



Drop Down Menu

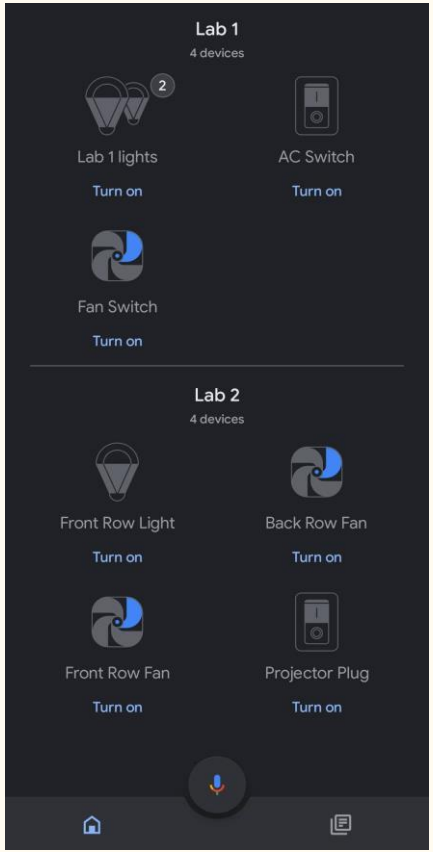


Scheduling Pane



Active Schedules in Overview

Google Home Integration:



6. Conclusion and Future Scope

Conclusion and Future Scope:

- We have listed the problems and proposed a solution to reduce the inconvenience for the research lab assistants and college members to the utmost.
- The Node-RED GUI Dashboard is accessible via browser, it ensures cross-platform compatibility.
- The Expected system can ease the complete automation method in labs and create the lab management easily.
- In Future, we can have a more-refined overall hardware solution, and extend this system for usage in other areas such as homes, studios, industries, shops, offices, etc.

Limitations of this system:

- Constant internet connection required for remote access.
- The system requires continuous power to be supplied in order to function.
- Node-RED only supports BASIC and OAuth Authentication Standards.
- Multi-user support is limited to some extent due to Node-RED's Nature.

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8. Sfikas, Giorgos and Akasiadis, Charilaos and Spyrou, Evaggelos. (2016). Creating a Smart Room using an IoT approach.

Publication:

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Thank You