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Developing Energy Efficient and Smart Lighting

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Open-Source Platforms Enhance Learning Activities in Smart Lighting

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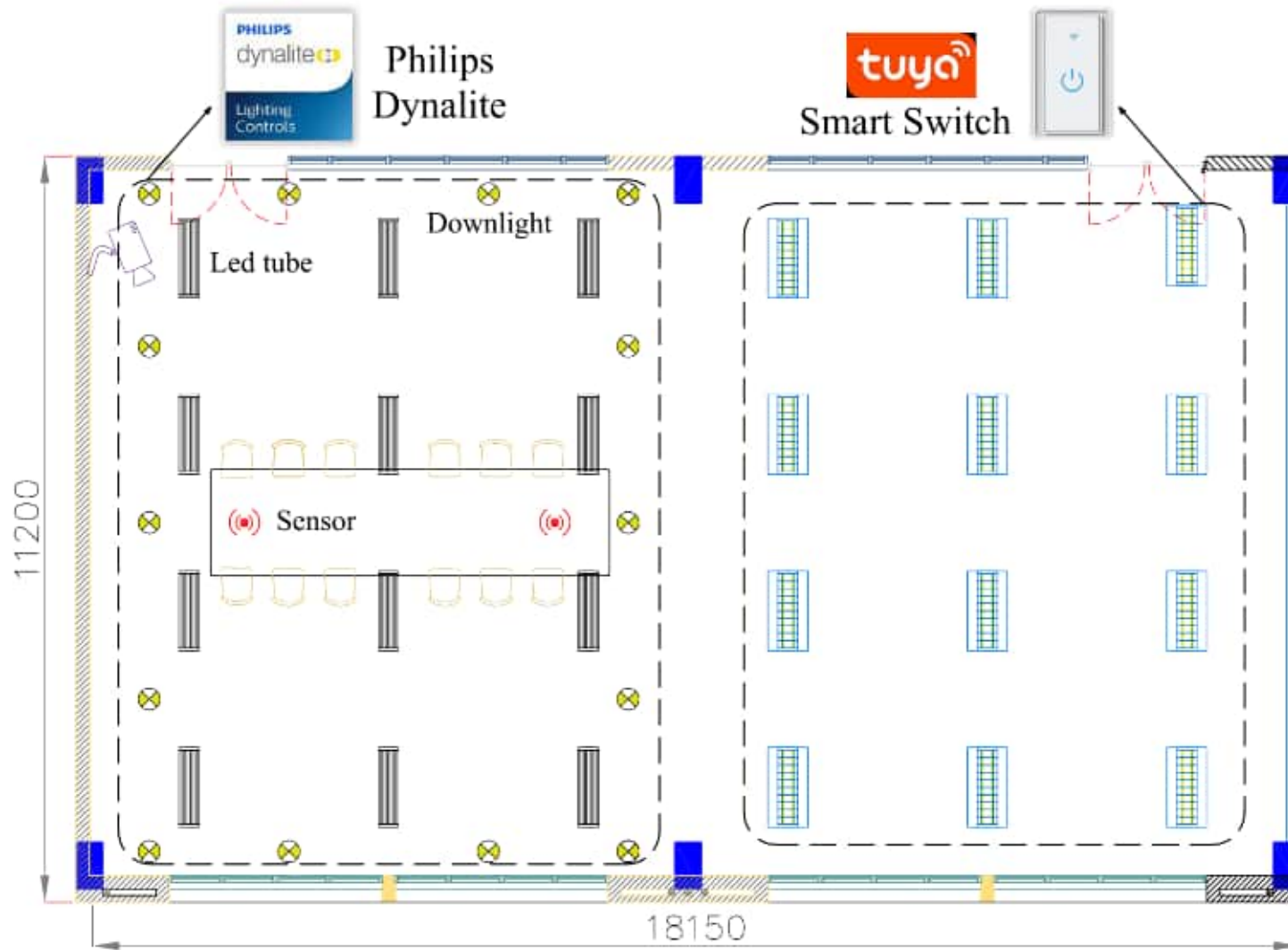
Content

- 1) Project's objectives
- 2) Introduction to the lighting system of EIU Lighting Lab and Smart lighting solution using **Philips Dynalite**
- 3) **Home Assistant** and smart lighting solutions using Home Assistant
- 4) Demonstration of lighting control in EIU Lighting Lab

Objectives

- Introducing “Home Assistant”, a free software for Smart lighting teaching and learning.
- Sharing open-source platform with the community to enhance learning activities in lighting control systems.

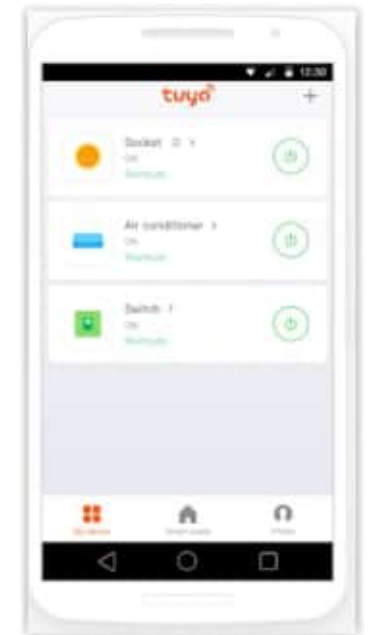
Layout of Lighting Lab



Energy Saving, Comfort, Flexibility



Philips App



Tuya App

Smart lighting with Philips Dynalite

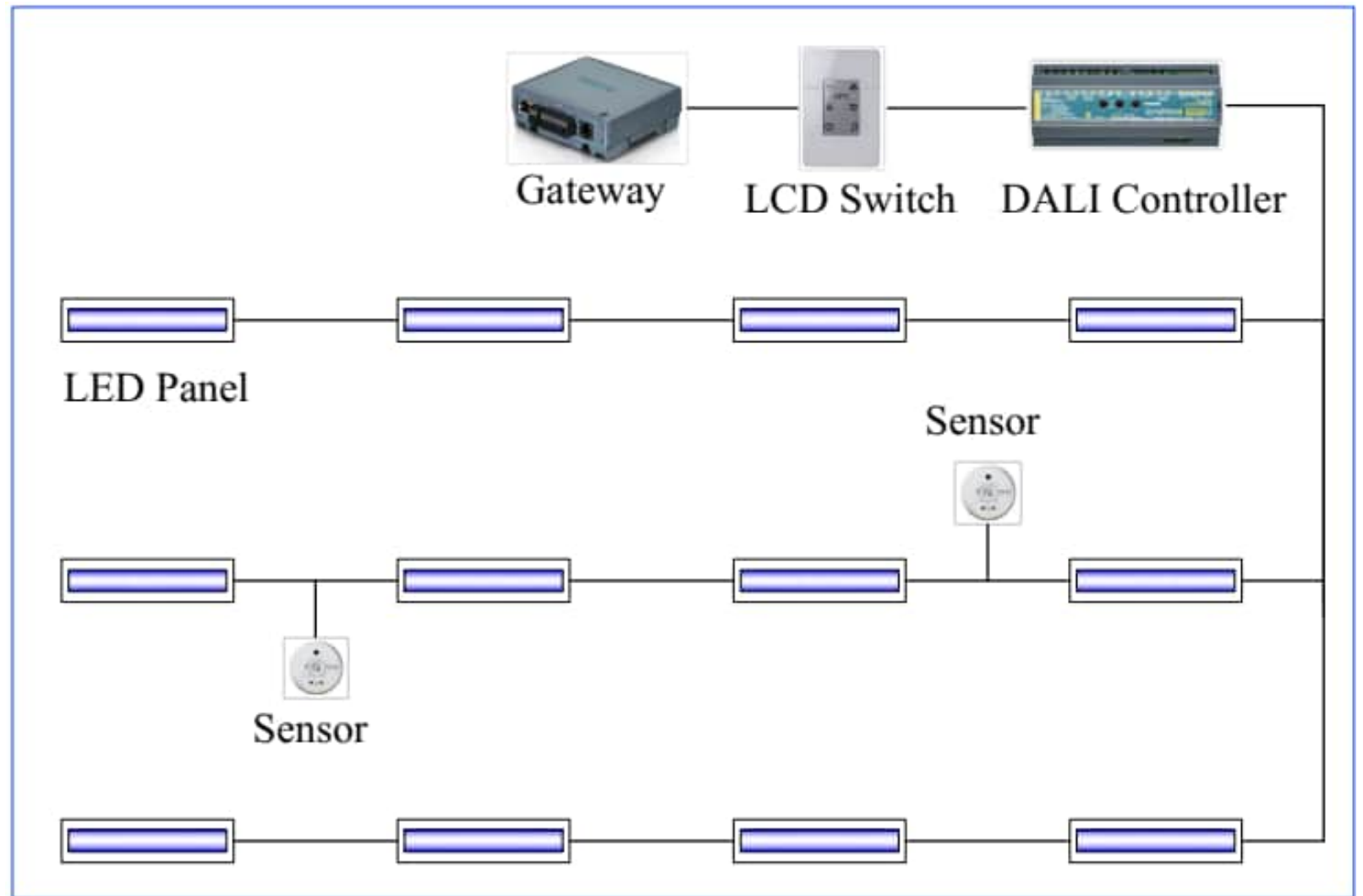
- **Smart lighting** is a lighting system that utilizes technology, typically through wired or wireless connectivity protocols. These systems often incorporate features such as automation, energy savings, remote control, and customization.
- **Philips Dynalite** is part of the Philips lighting (Signify) systems group. It is a lighting control system that offers energy savings, flexibility, and the ability to create smart lighting environments.

Lighting diagram with Philips Dynalite

Components:

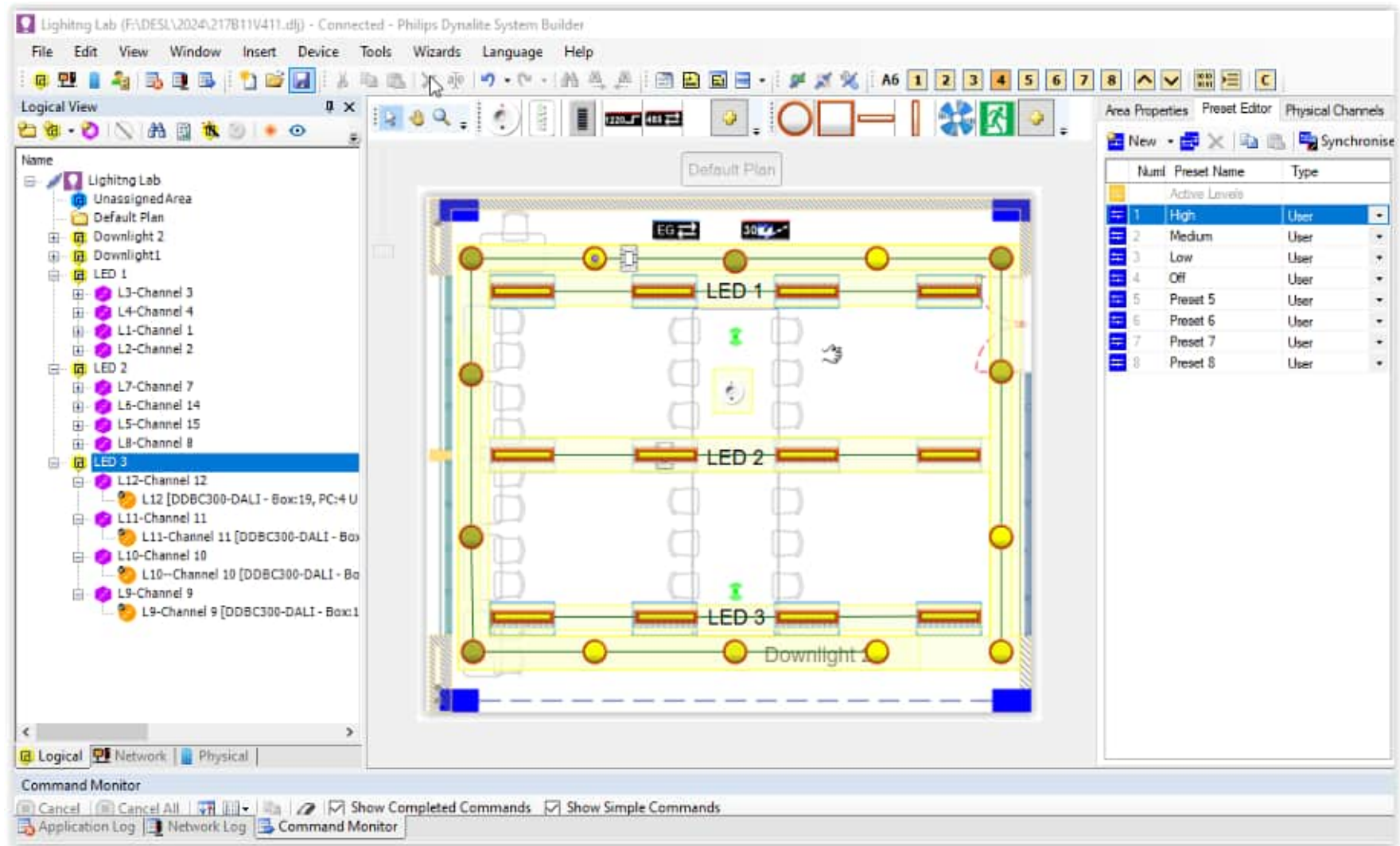
1. DALI Controller
(Digital Addressable Lighting Interface)

1. LED Panels
2. Gateway
3. Sensors
4. LCD Switch



Main application windows of System Builder software

System Builder is a comprehensive platform from Philips Dynalite



Network view windows of System Builder software

The screenshot shows the System Builder software interface. The main window is titled "Network View" and displays a tree view of components on the left and a table of device properties on the right.

Tree View Components:

- Lighting Lab
 - Gateways
 - PDEG (Ethernet Gateway) #1
 - Load Controllers
 - DDBC300-DALI #19
 - User Interfaces
 - PADPA #18 (LED 2)
 - Sensors
 - DUS360CR-DA #9 (LED 2)
 - DUS360CR-DA #27 (LED 1)

Table of Device Properties:

Number	Channel Name	Logical Area	Logical Channel	DALI Address	Ballast Type
4	L12--Channel 12	6	1	Known	Normal
11	L11--Channel 11	6	2	Known	Normal
12	L10--Channel 10	6	3	Known	Normal
16	L9--Channel 9	6	5	Known	Normal
25	L8--Channel 8	5	12	Known	Normal
8	L7--Channel 7	5	6	Known	Normal
14	L6--Channel 14	5	7	Known	Normal
24	L5--Channel 15	5	11	Known	Normal
9	L4--Channel 4	4	2	Known	Normal
5	L3--Channel 3	4	1	Known	Normal
26	L2--Channel 12	4	4	Known	Normal
10	L1--Channel 11	4	3	Known	Normal
23	Downlight 2 - D14-2-2	2	16	Known	Normal
1	Downlight 2 - D12-2-2	2	18	Known	Normal
30	Downlight 2 - D11-2-2	2	6	Known	Normal
27	Downlight 2 - D10-2-2	2	1	Known	Normal
28	Downlight 2 - D9-2-2	2	3	Known	Normal
6	Downlight1-Downlight 1	3	13	Known	Normal
18	Downlight1-Downlight 1	3	5	Known	Normal

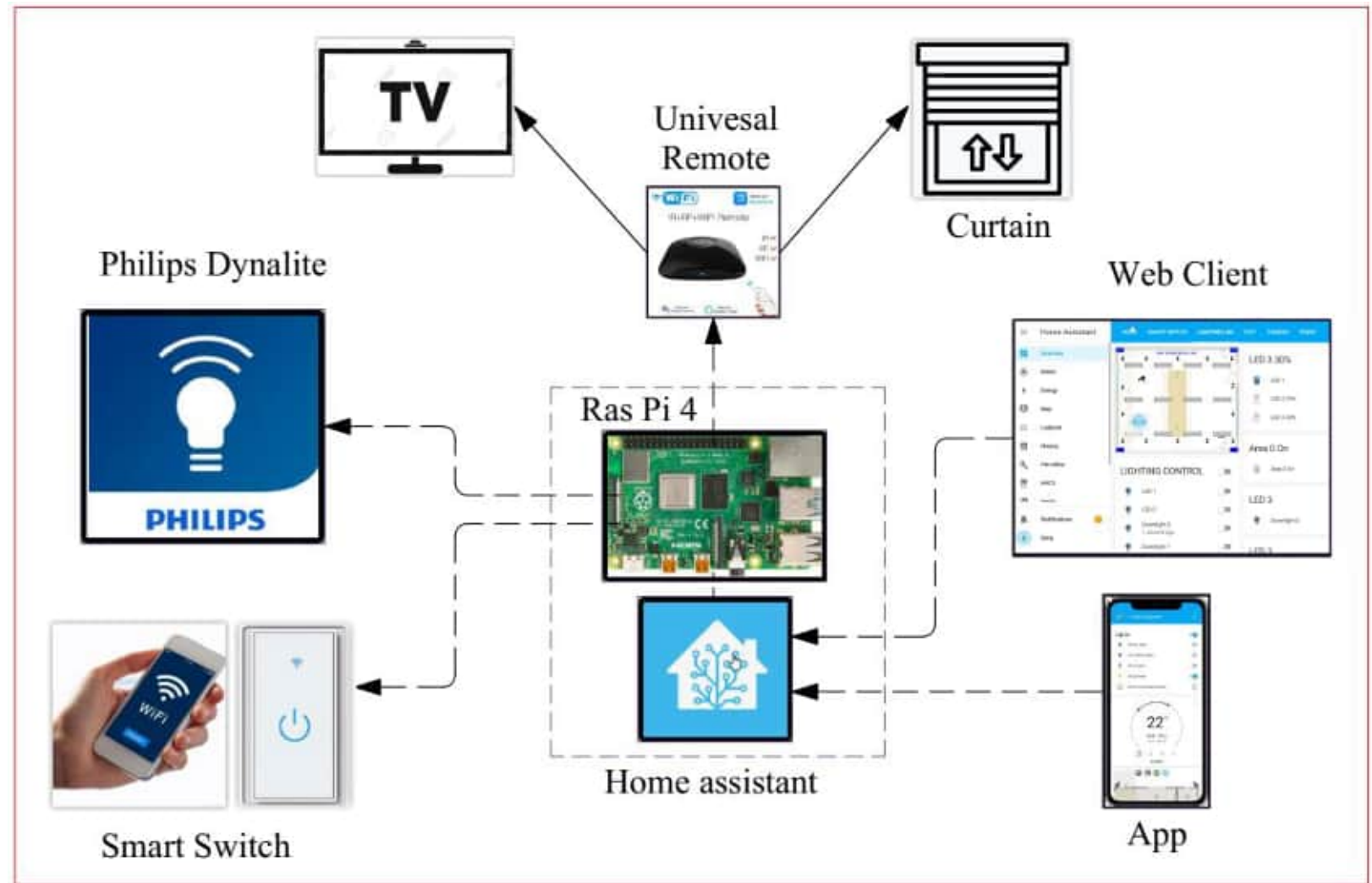
The interface also includes a menu bar (File, Edit, View, Window, Insert, Device, Tools, Wizards, Language, Help), a toolbar, and a Command Monitor at the bottom with options like "Cancel", "Cancel All", "Show Completed Commands", and "Show Simple Commands".

Introduction to Home Assistant

- Home Assistant (HA) is *free* and *open-source* software for home automation that supports a wide range of smart devices and platforms.
- **Community support:** A large community can provide opportunities for learning from others, receiving assistance with problems, and contributing to open-source projects.
- **Integration:** Many smart devices, such as smart switches, lights, and sensors, can be integrated with Home Assistant, and they can be controlled individually or in a group.
- **Web-based user interface** (UI) allows users to interact with their home automation system.

Smart lighting solution using Home Assistant

1. Home Assistant
2. Web client
3. Mobile app
4. Universal Remote
5. Philips Dynalite
6. Tuya smart switch



Smart lighting solution using Home Assistant

Central hub: Raspberry Pi 4 acts as the central hub for home automation, allowing users to connect and control a wide range of smart devices in smart home.

Web-based user interface offers a interface for device control, customization, and automation, including user management and integrations with other smart home platforms.

The mobile app provides users to remotely control and manage the lighting systems and devices through an UI.

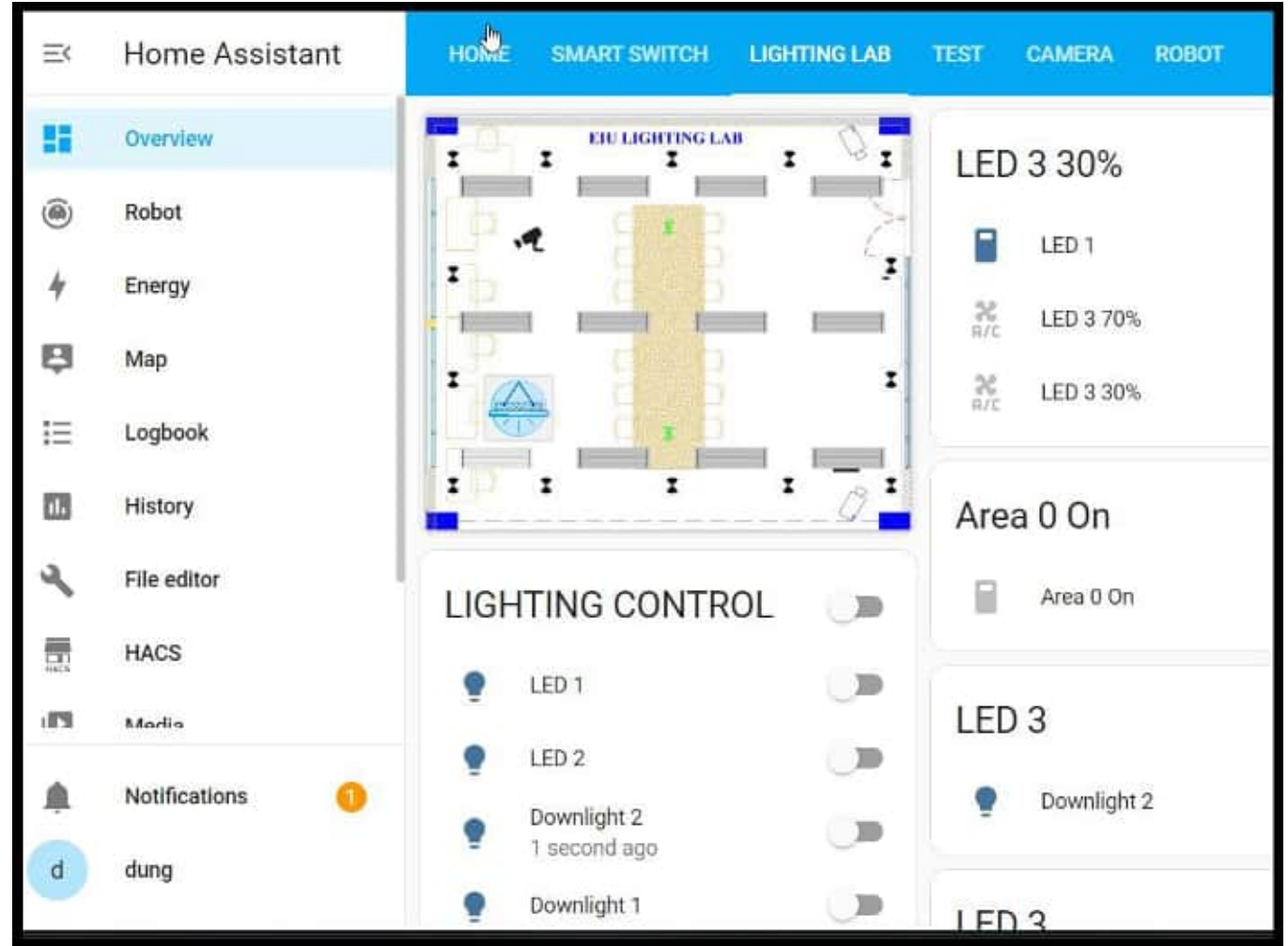
Universal Remote: Broadlink Rm4 is a universal remote. It serves as a single replacement for multiple individual remote controls within a home assistant.

Philips Dynalite is a lighting control system.

Tuya smart switches are used to remotely control the lights.

Home assistant Dashboard

- Home Assistant's architecture promotes flexibility and customization. Users can create custom integrations and components.



Applying Philips Dynalite and HA in the smart lighting experiment

- **Hands-On Learning:** Students gain practical experience with real-world smart lighting systems, enhancing their understanding of how such systems work.
- **Problem-Solving Skills:** Students develop problem-solving skills by configuring and troubleshooting the smart lighting setup.
- **Technical Competence:** Students become proficient in using industry-standard tools and technologies, preparing them for future careers
- **Programming Skills:** With open-source HA platforms provides an opportunity to develop programming skills.

Examples of programming in Home Assistant

Code for Curtain control

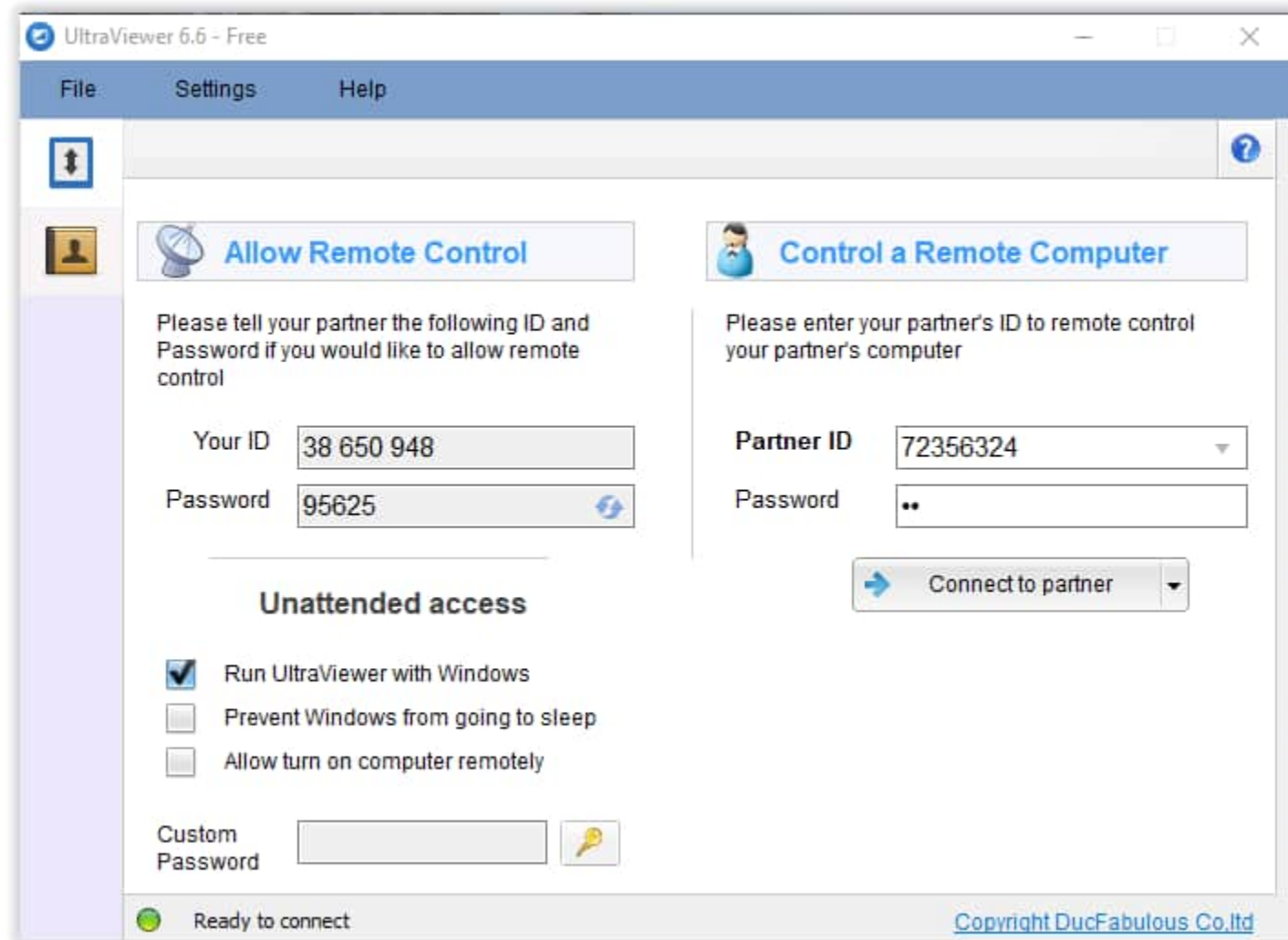
```
1 curtain:
2   alias: CURTAIN
3   sequence:
4     - service: remote.send_command
5       data:
6         device: CURTAIN
7         command: OPEN_CURTAIN
8       target:
9         area_id: living_room
10        device_id: 09ec248d3246d91556c407c06469be72
11        entity_id: remote.curtain_remote
12  mode: single
13  icon: mdi:curtains
14
15  curtain_close:
16  alias: CURTAIN_CLOSE
17  sequence:
18    - service: remote.send_command
19      data:
20        delay_secs: 8.9
21        device: CURTAIN
22        command: CLOSE_CURTAIN
23        hold_secs: 2.4
24      target:
25        area_id: living_room
26        device_id: 09ec248d3246d91556c407c06469be72
27        entity_id: remote.curtain_remote
28  mode: single
29  icon: mdi:curtains-closed
```

Code for Philips LED control

```
1 dynalite:
2   bridges:
3     - host: 192.168.1.89
4       port: 50000
5       autodiscover: true
6       polltimer: 1
7       area:
8         "4":
9           name: LED 1
10          template: room
11          room_on: 1
12          room_off: 4
13         "5":
14          name: LED 2
15          template: room
16          room_on: 1
17          room_off: 4
18         "6":
19          name: LED 3
20          template: room
21          nodefault: true
22          room_on: 1
23          room_off: 4
```

Video Demonstration/ Remotely control lighting system

Link



Thank you!