

# Teaching Experiences and Improvements for the Courses and Implementation of Undergraduate-Level Lighting Projects

**Vietnamese-German University**

Tran Quang Nhu  
And students

# Teaching Experiences and Improvements for the Courses

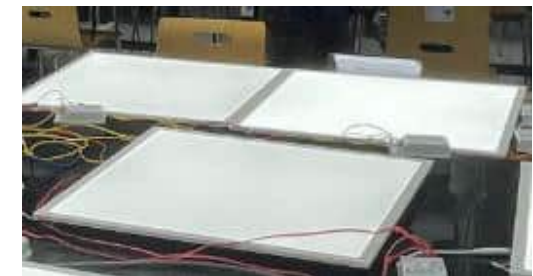
1. Course development
2. Equipment
3. Students background
4. Suggestion for improvement

# Course Development

No.	Course	Round 1		Round 2	
		Students	Ending	Students	Ending
1	Illumination Engineering	16	6/2022	15	8/2023
2	Lighting Design and Application	20	9/2022	30	On-going
3	Energy Efficient Smart Lighting	12	3/2023		

# Equipment

- Illuminance meter (Lux meter)
- Luminance meter
- Integrating sphere system
  - Integrating sphere
  - DC power supply
  - AC power supply
  - Power meter
  - Spectroradiometer
- Dimmable LED panel with controller:
  - DALI controller
  - LED panel



# Student Background

- Bachelor programs:
  - ECE/Electrical Eng.
  - Computer science
  - Mechanical Eng.
  - Architecture
  - Civil Eng.
- Master programs
  - MST/Mechatronics and Sensor Systems Technology.
  - GPE/Global Production Engineering and Management

# Suggestion

- Project-based learning
- Workshops related to lighting
- Lab/company tours for students
- Further course development for Master level and practitioners



# Student project

# DALI-BASED SMART LIGHTING SYSTEM

Presenting by Nguyen Hai Ha (Project leader)

Duong Trong Anh

Nguyen Cong Minh



# THE DALI-BASED SMART LIGHTING SYSTEM PROJECT TEAM

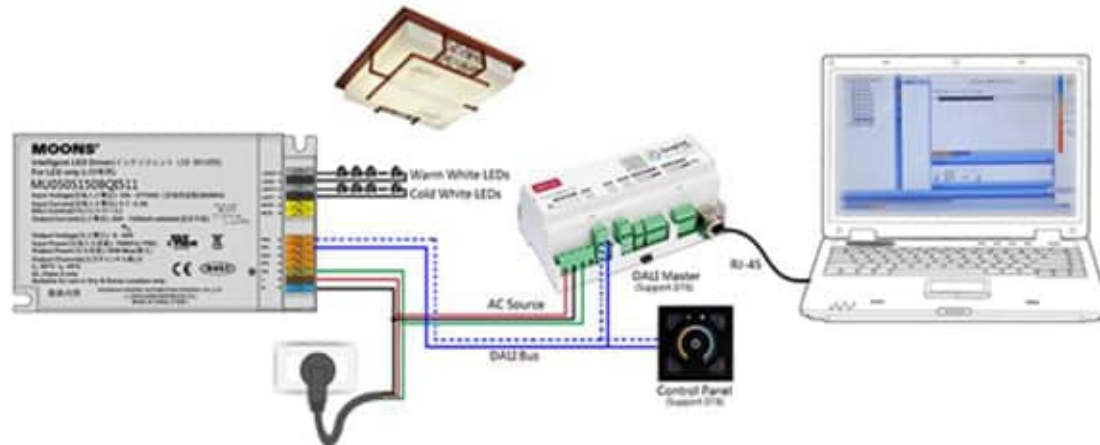
- Project supervisor:
  - Mr. Tran Quang Nhu
- Project team:
  - Nguyen Hai Ha (group leader)
  - Lai Quoc Khanh
  - Nguyen Hai Son
  - Duong Trong Anh
  - Nguyen Cong Minh

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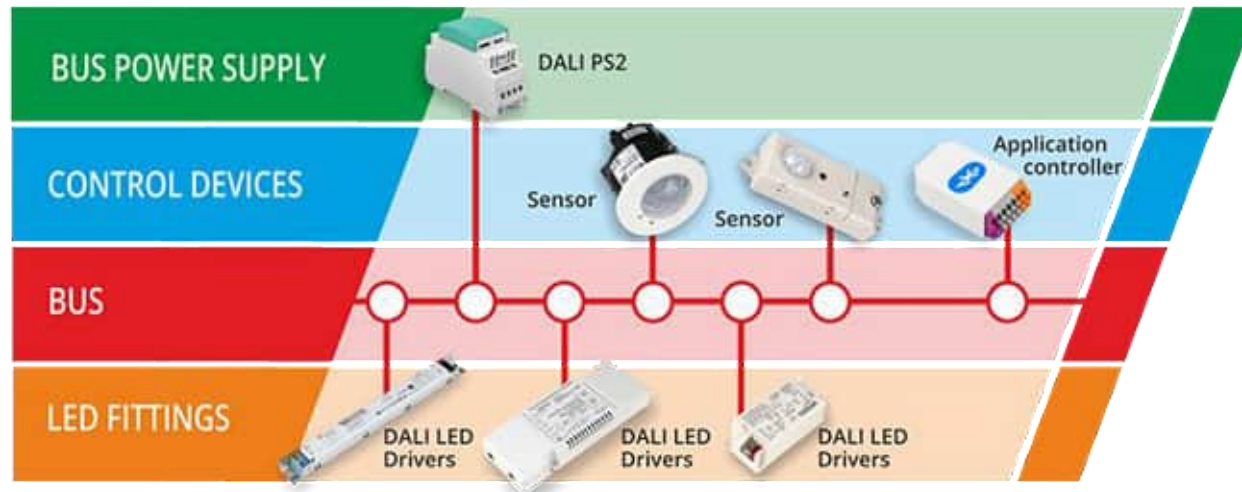
1. Introduction of the project
2. Equipment: Hardware and Software
3. Plan and procedure of the lighting frame
4. Operation of the lighting system
5. Conclusion and future plan

# 1. INTRODUCTION OF THE PROJECT

- Smart lighting system has been a hot topic in these years:
  - FPT Vietnam, Philips, DALI
- Many modern lighting products have been developed:
  - Dimmable LEDs with different color
  - Lighting sensor/ Daylight sensor
- Modern smart lighting system
  - Smart home system



DALI DT 8



Beutelsch  
Struman  
Pvt. Ltd.

# 1. INTRODUCTION OF THE PROJECT

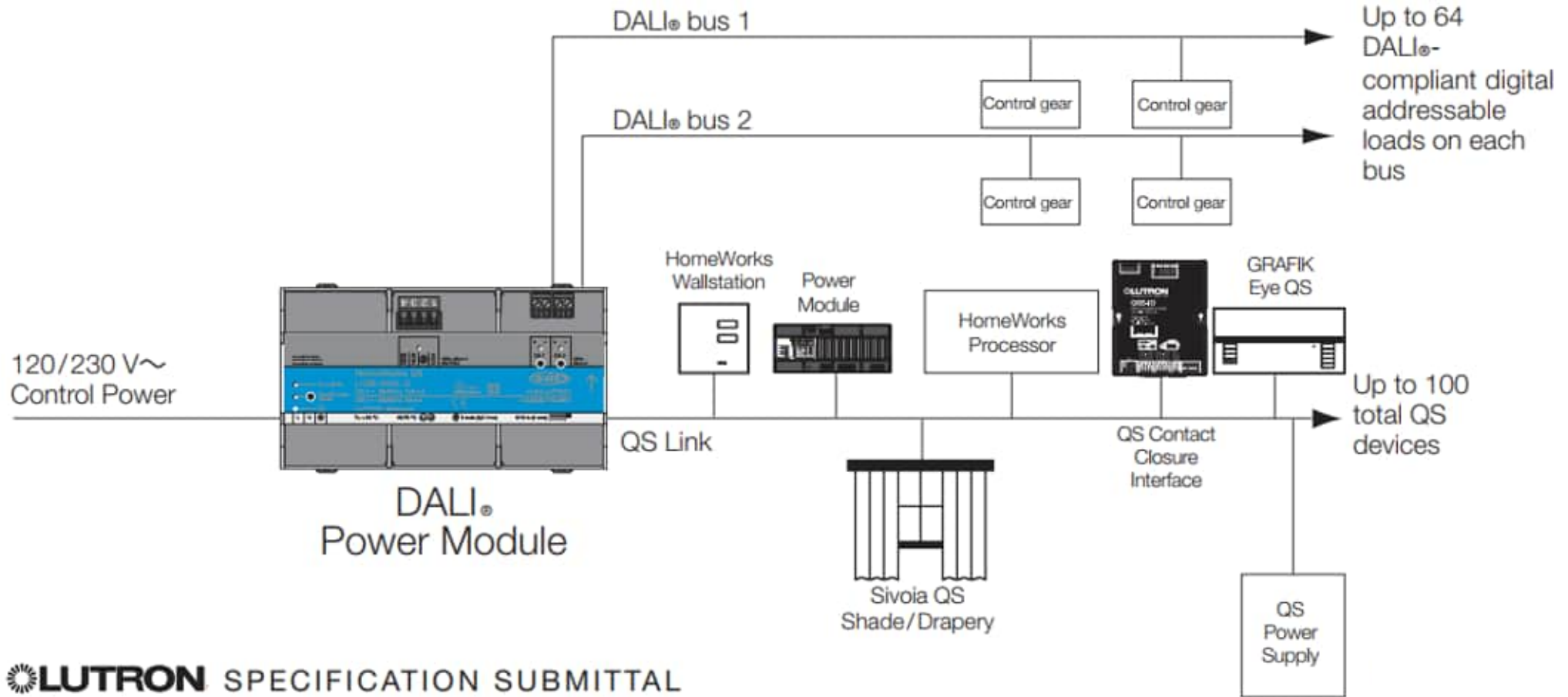


These products and system are all important inspiration for our student project

## 2. EQUIPMENT: HARDWARE AND SOFTWARE

- The hardware:
  - 8 Philips DALI LED panels and drivers
  - Lutron HomeWorks QS Processor & Power Module
  - Lutron wired & wireless controller
  - 1 DALI Occupancy/ Vacancy sensor
  - 1 DALI Daylight sensor
  - 1 DALI LED strip
- The software:
  - Homework QS software



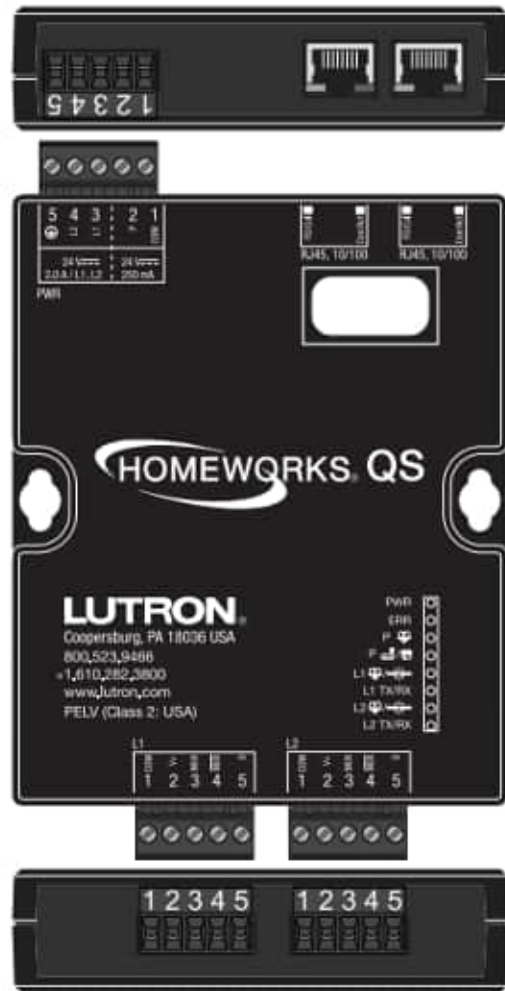




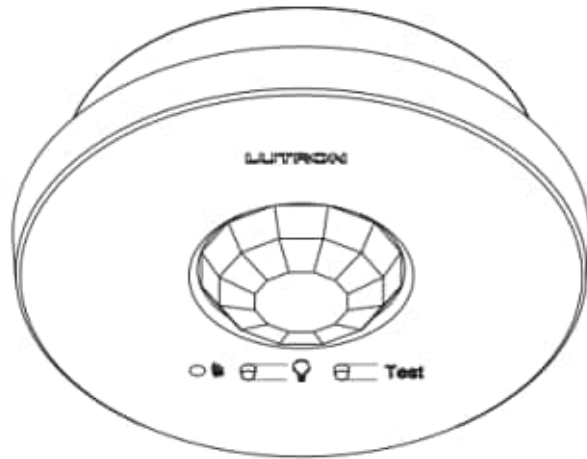
## Specification: HomeWorks QS Processor

- Power Processor (P): 24–36 V- 250 mA Links (L1 / L2): 24–36 V- 2 A per link
- Typical Power Consumption: 5 W; 8 Power Draw Units (PDUs) Test conditions: Two Ethernet links connected, both device links in use
- Communications: Ethernet, RS485 (QS, RF, Power Panel)
- Link Capacities:
  - HomeWorks Power Panels 16 interfaces/256 zones,
  - HomeWorks QS Wired Device Link 99 devices/512 zones,
  - HomeWorks RF Link 99 devices/100 zones HomeWorks
  - Wired Dimmers 4 interfaces/192 zones





- The QS processor provides control and communication to HomeWorks system components.
- The Ethernet links allow communication to the HomeWorks QS software.
- HomeWorks QS processors may be connected using either standard networking or using ad-hoc networking.
- The HomeWorks QS software and all integration equipment must be connected to the same network as the processors.

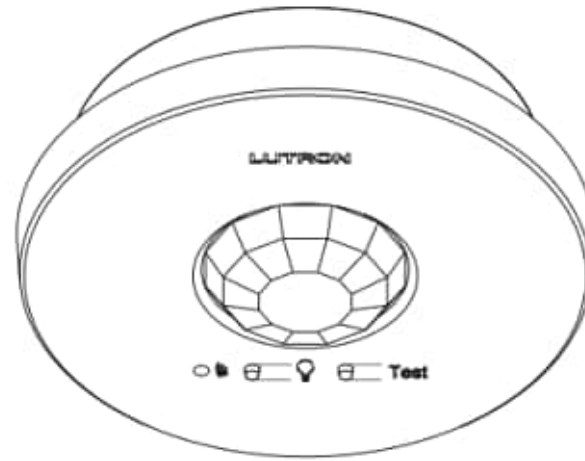


### Occupancy/ Vacancy sensor

- Lutron Radio Powr Savr occupancy/vacancy sensors are wireless, battery-powered, passive infrared (PIR) sensors
- These sensors detect the heat (IR radiation of  $9.5 \mu\text{m}$ ) from people moving within an area
- The sensor is in wireless connection.

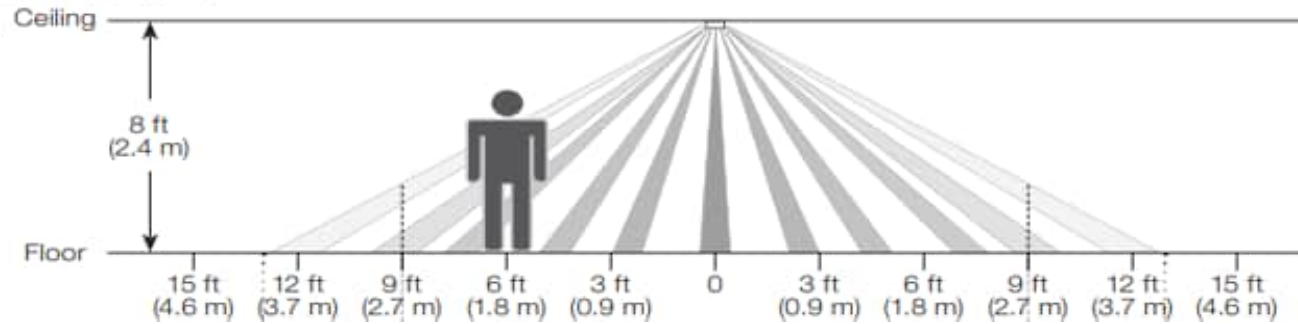
### Features

- Wireless occupancy sensor has 3 settings available: Auto-On/Auto-Off, Auto-On Low-Light/Auto-Off, and Manual-On/Auto-Off
- Simple and intuitive adjustments available for Timeout, Auto-On, and Activity settings
- Supports advanced occupancy features
- Multiple sensors can be added for extended coverage.



## Coverage Diagrams

Per NEMA WD7 test method



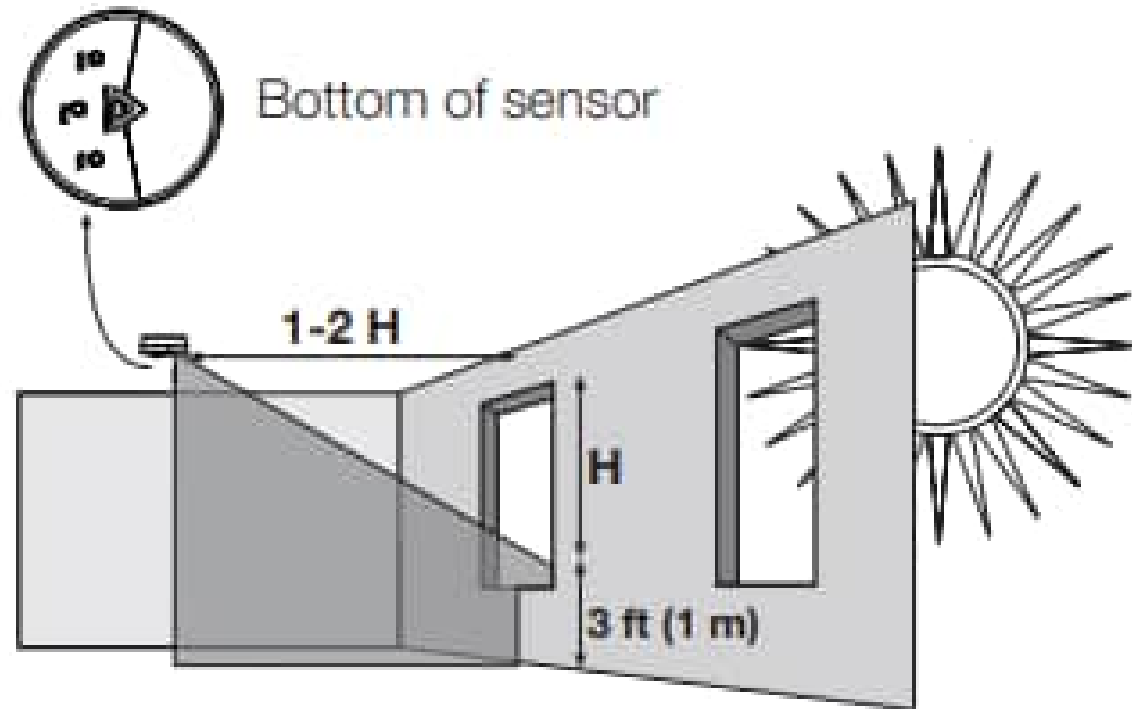


### Wireless Daylight Sensor

- Lutron's wireless daylight sensor is a battery powered sensor that automatically controls lights
- This sensor mounts to the ceiling and measures light in the space.
- The sensor is in wireless connection.

### Features:

- Daylight compensation through Lutron's reliable open loop control.
- Light range 0–107,000 Lux(0-10,000fc)
- Designed to give a linear response to changes in viewed light level
- One sensor can be associated to up to 10 compatible RF dimming and switching devices



## 3. PROCEDURE OF BUILDING THE FRAME

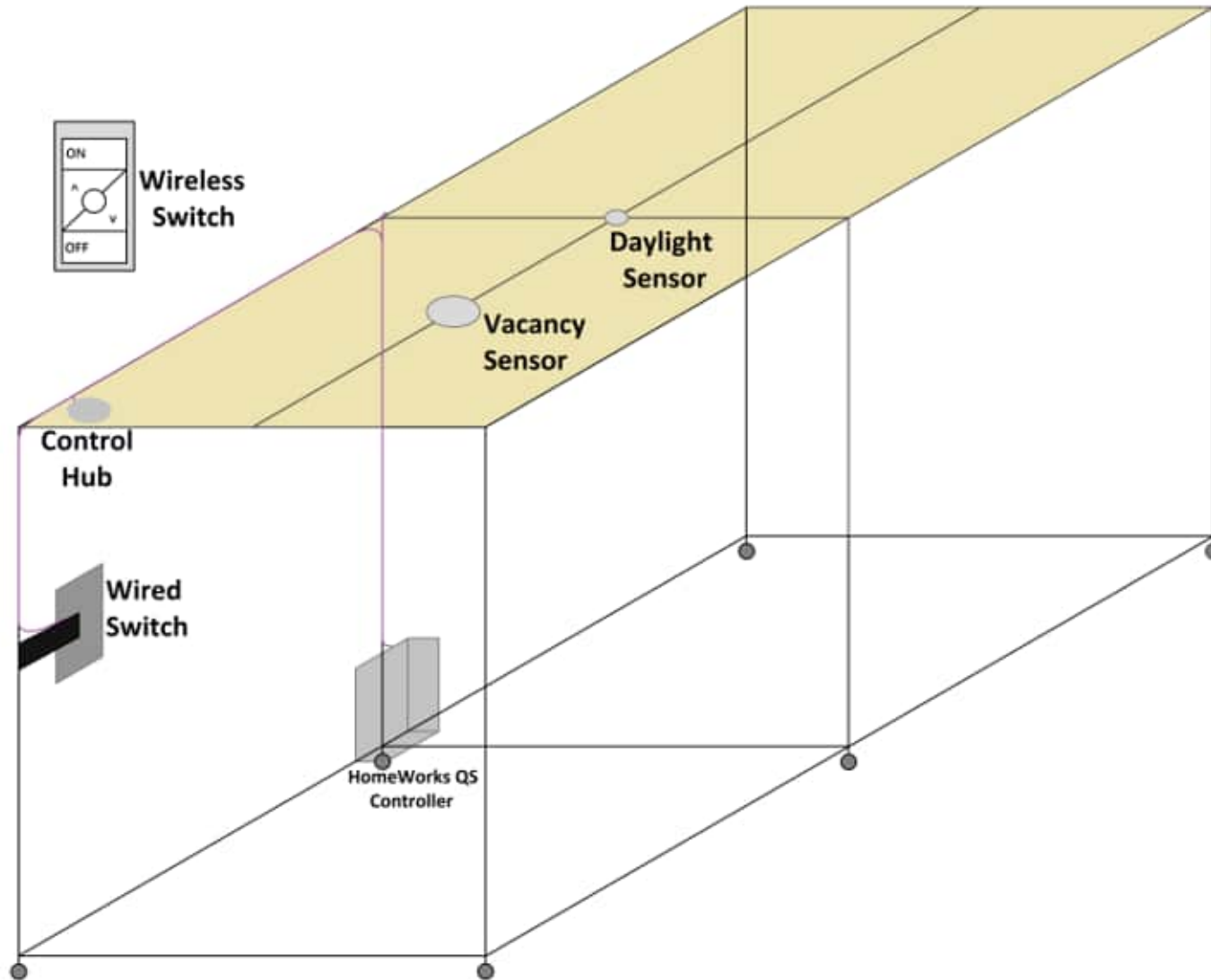
### I. Aluminum Frame

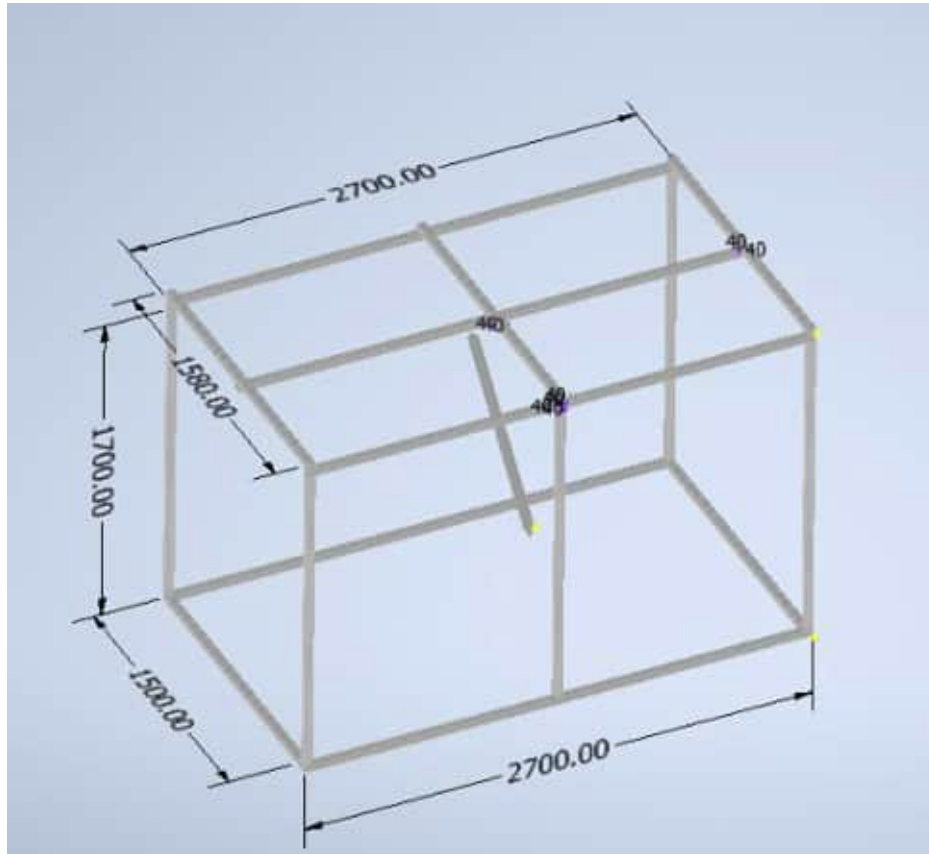
#### a. Design

- Material
- Dimension
- Shape

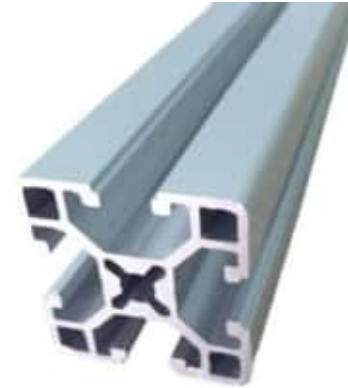
#### b. Qualification

- Steadiness
- Mobility
- High developability and improvability for future development





Shape and dimension



Main material: Aluminum bar



360-degree wheels



Wood pallet for roof of system



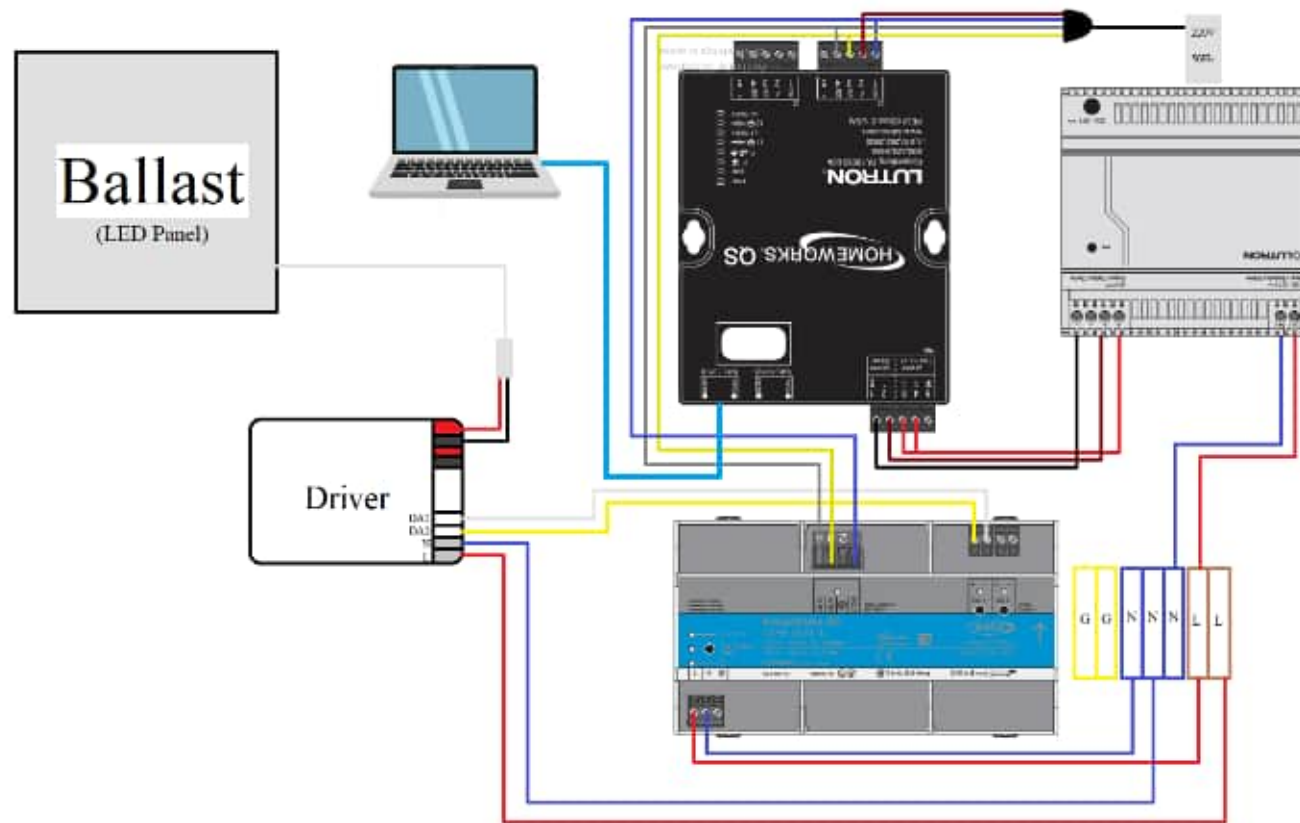


Inserting LEDs panel



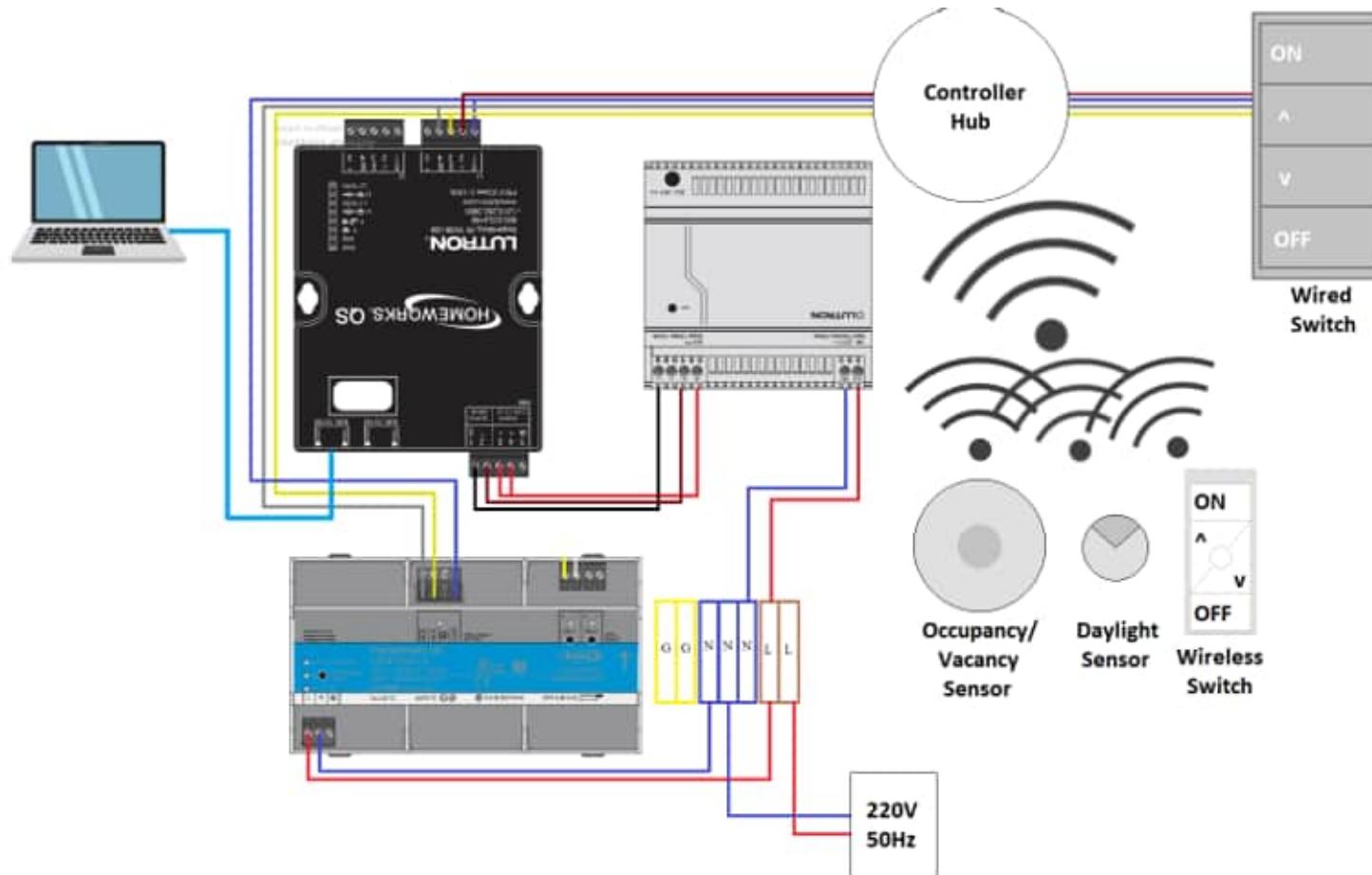
The complete frame

# 4. OPERATING OF LIGHTING SYSTEM



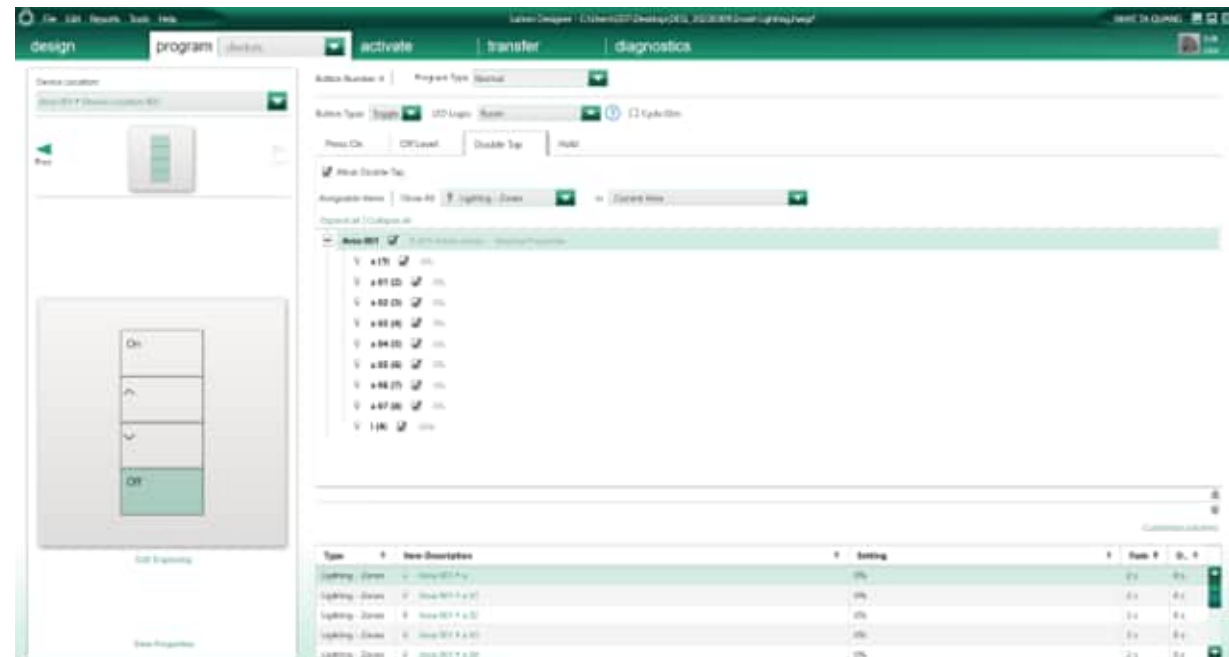
The hardware system and  
wiring plan

# 4. OPERATING OF LIGHTING SYSTEM



The detail control system

# 4. OPERATING OF LIGHTING SYSTEM



Homework QS software

# SCENARIO: Ordinary residency purpose

- The LED strip is used for corridor lighting, while the LED panels are used for room lighting.
- There will be an option to turn all the lights off (and one to turn all the lights on for the wired switch).



# SCENARIO: Ordinary residency purpose

- The vacancy sensor will gradually turn on all LED panels once it detects motion when the panels are off.
- When no motions are detected, it has a 3-minute timeout before gradually turning off all LED panels.



# SCENARIO: Ordinary residency purpose



# SCENARIO: Ordinary residency purpose

- The daylight sensor depends on the illuminance of the room from the outside to adjust the brightness of the LED panels.
- Because of indoor usage, the daylight sensor should only work if the panels are on.





## 5. CONCLUSION AND FUTURE PLAN

### A. Conclusion

- The frame is in totally good condition.
- The scenario works out almost fine, but certain adjustments need to be made to refine the procedure.

### B. Future plan

- Light scene adjustments for more automatic and sufficient operation.
- More DALI-based equipment to advance the system
- New student lighting lab experiment, a model for new lighting projects

# Thank you for your attention