

AUTOMATED WAREHOUSE SHELF SPACE MONITORING AND WARNING SYSTEM

Theme: Warehouse Management System

Group 3 Members:

Edwin Ooi Yong Qing
Fang Wei Qiang
Yee Hon Cheung, Gary
Tan Yong King



INTRODUCTION



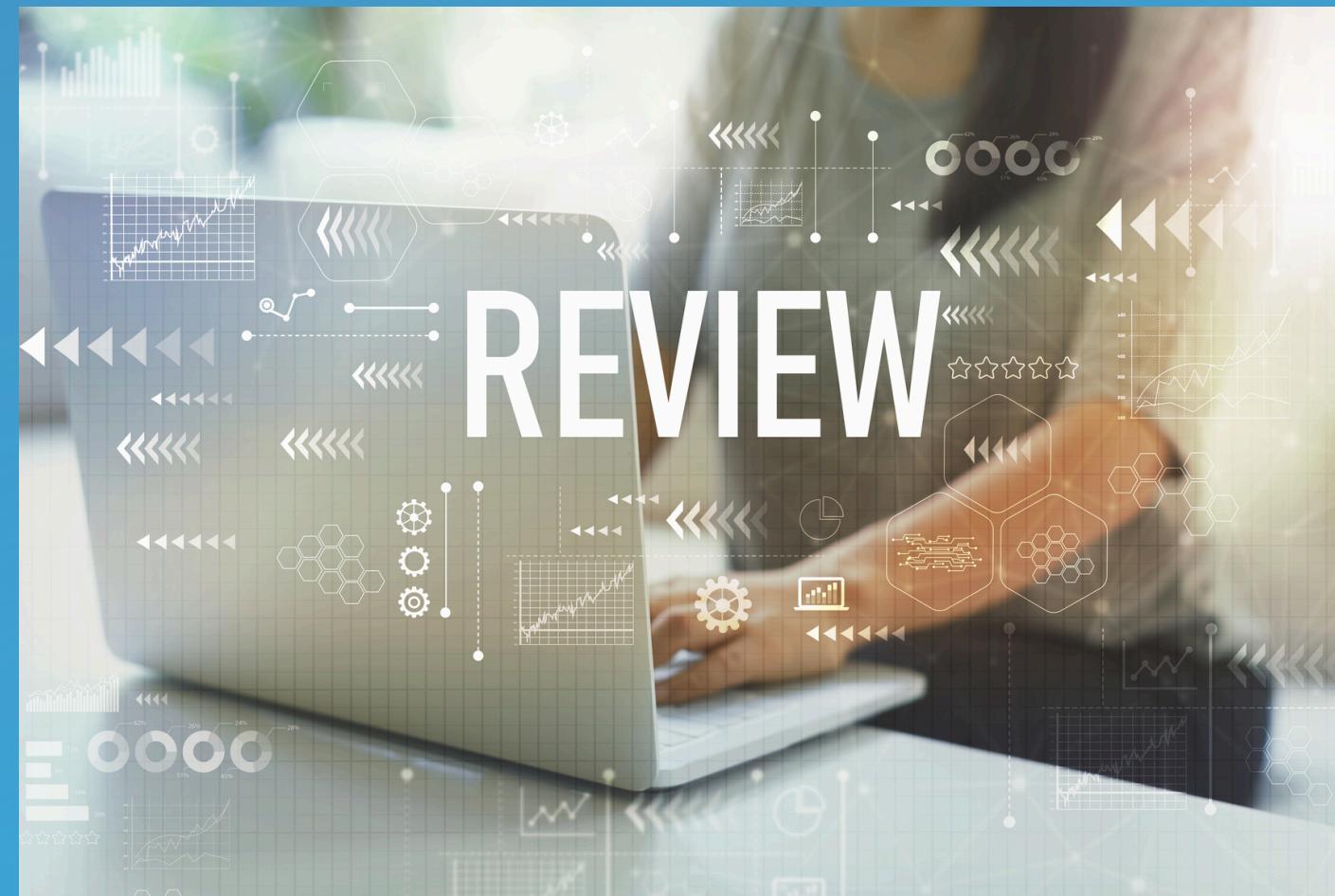
In this new era of modern warehousing, it is essential to manage factory inventory efficiently. One important aspect is the optimization of shelf space utilization. To address this need, we are proposing an automated warehouse shelf space monitoring and warning system. These system utilizes advanced technologies for continuous monitoring of shelf space availability and temperature and issue warnings when temperature readings are outside the accepted range.



PROBLEM STATEMENT

These days, warehouses play an important role in modern logistics. However, it is still hugely reliant on human labour and this causes inefficiency in shelf space monitoring and temperature monitoring especially when dealing with large amounts of data. The current reliance on human error often results in space optimization challenges and risk of stockouts and overstock, which may result in lost sales and high operation costs.





LITERATURE REVIEW

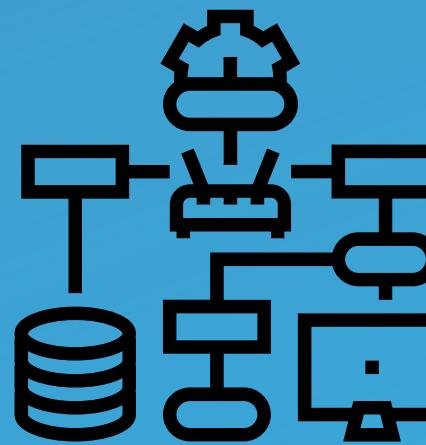
In the realm of warehousing, automation and robotics have set a new standard for efficiency and productivity. With the meteoric rise in e-commerce, it has become essential for warehouses to cope with the volume and speed needed.

In 2024, CelcomDigi and ZTE Malaysia announced a strategic partnership to apply smart technology and 5G powered innovative solutions to transform Malaysia's manufacturing and warehousing landscape.

OBJECTIVE :

1. To increase the efficiency of warehouse shelf space and temperature monitoring.
2. To reduce reliance on humans to perform generic monitoring tasks.
3. To allow real time visualization of shelf space utilization and warehouse conditions.

SCOPE



SYSTEM ARCHITECTURE DESIGN

Design system architecture to show a clear connection among sensors, PLC and SCADA.



SENSORS CIRCUIT

Decide required sensors to implement shelf status monitoring and design sensors circuit.



HARDWIRED LADDER / PLCs

Design control circuits using hardwired ladder or PLCs integrating with sensors circuit in CODESYS.



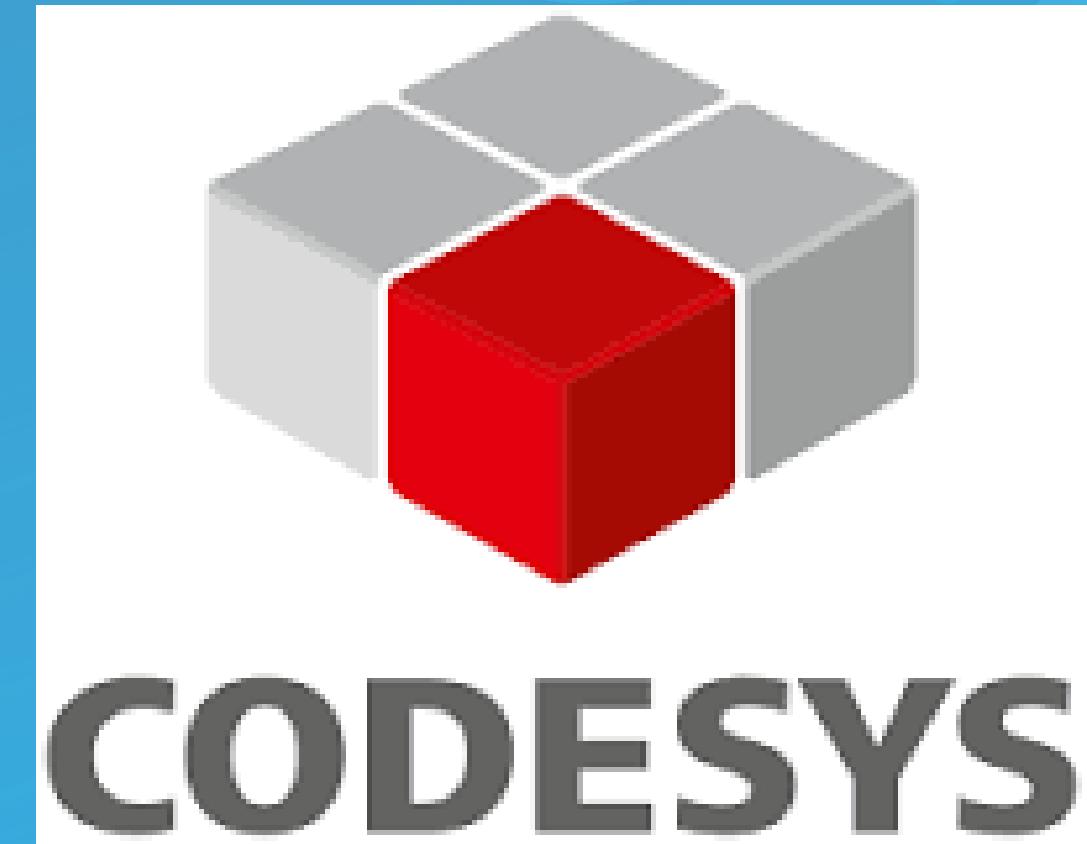
SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Develop custom dashboards for real-time monitoring and data visualization of shelf status and warehouse operations .

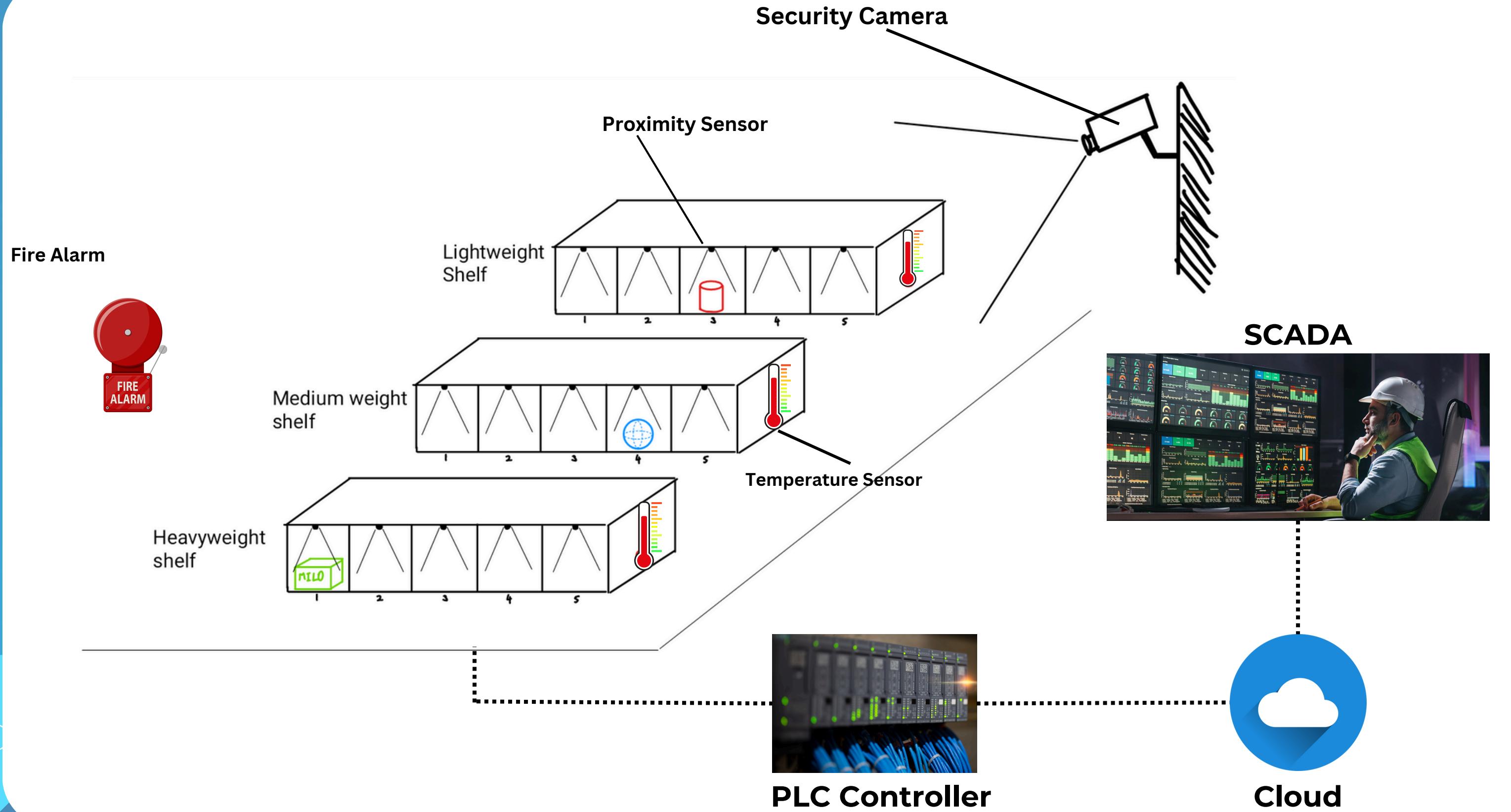
METHODOLOGY

CODESYS is used to program, develop and manage control applications for programmable logic controllers (PLCs) as it is powerful and supports ladder logic and other programming languages.

A dashboard is built to visualize the status of every shelf and other support functions. MySQL Database, Node.js, Express.js and other programming languages will be used to build the dashboard.



SYSTEM DESIGN



SYSTEM ARCHITECTURE: PLC

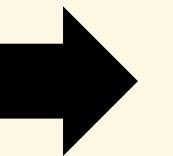
INPUTS

Proximity Sensor

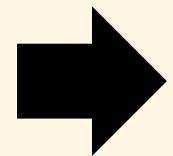
Temperature Sensor

Start Button

Stop Button



PLC



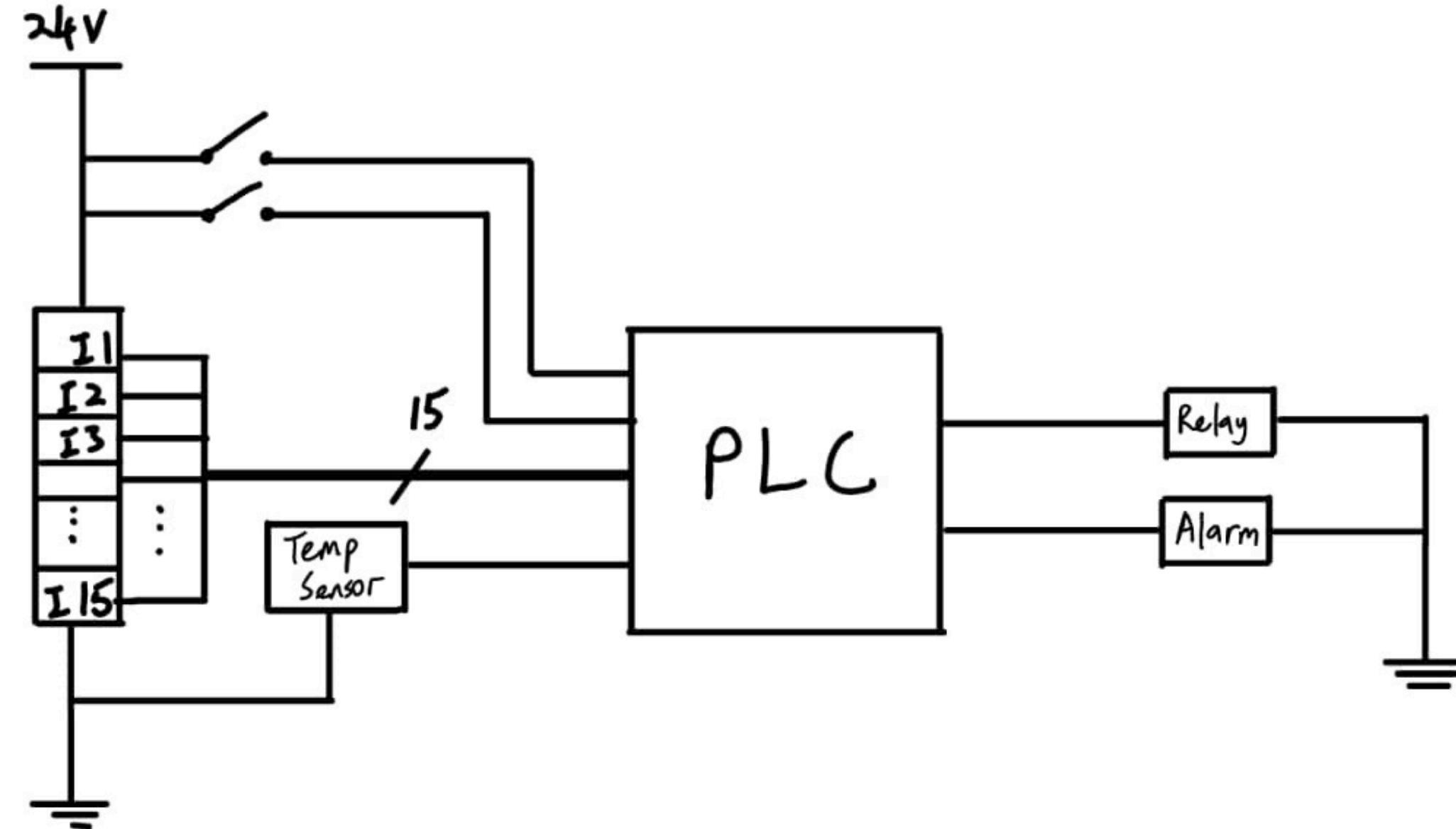
OUTPUTS

Shelf Status

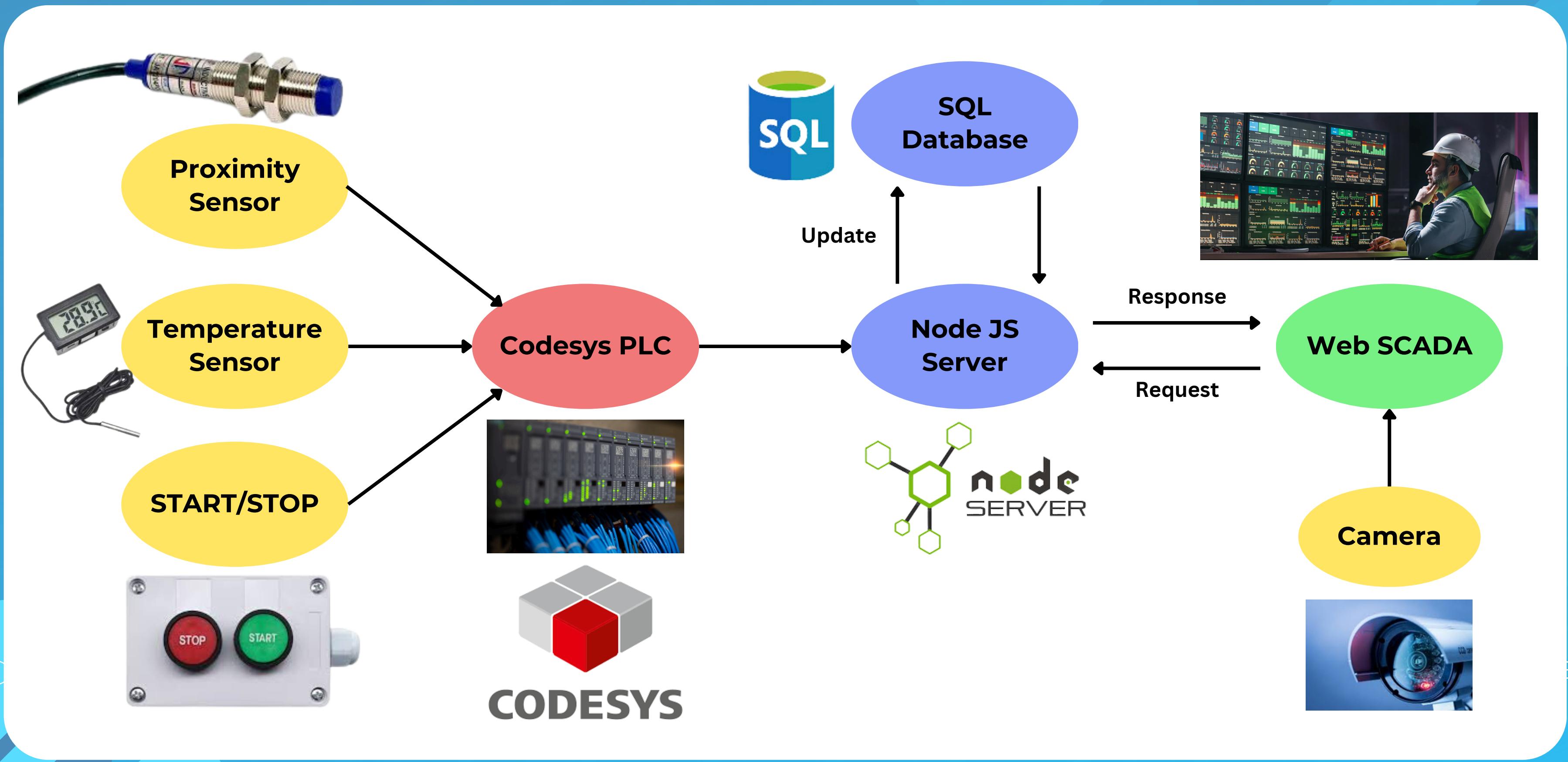
Relay

Fire Alarm

WIRING DIAGRAM



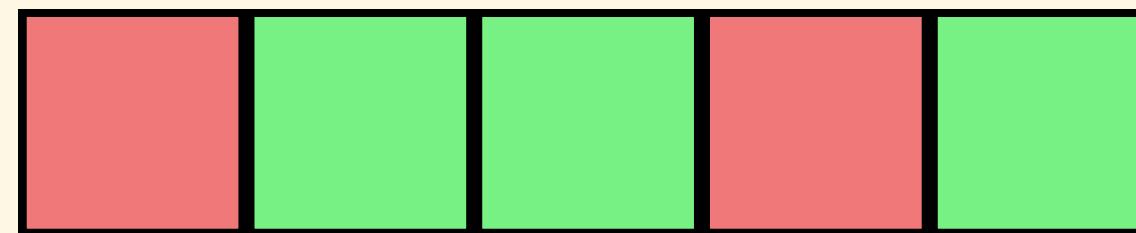
SYSTEM ARCHITECTURE



SYSTEM ARCHITECTURE: SCADA

Shelf Status & Temperature Monitoring

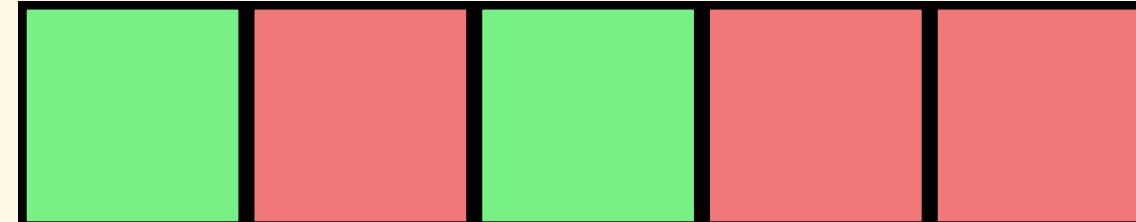
Lightweight



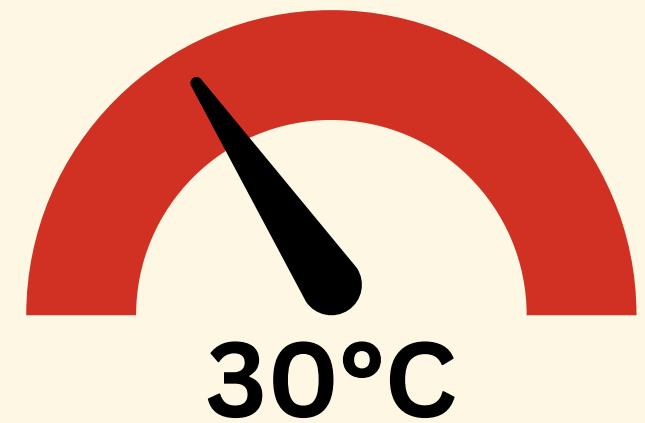
START

STOP

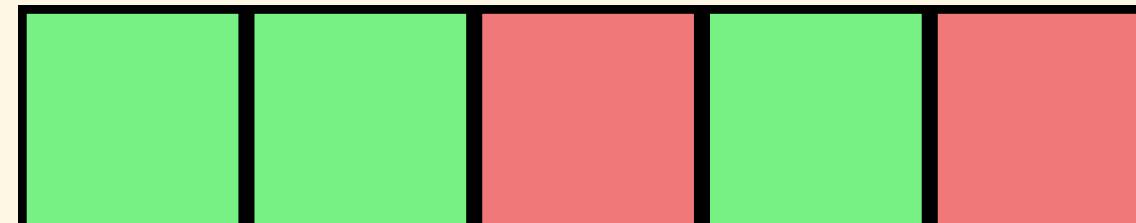
Medium Weight



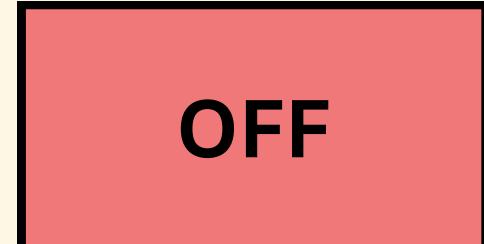
Temperature



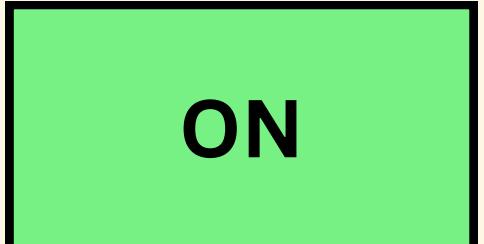
Heavyweight



Alarm Status

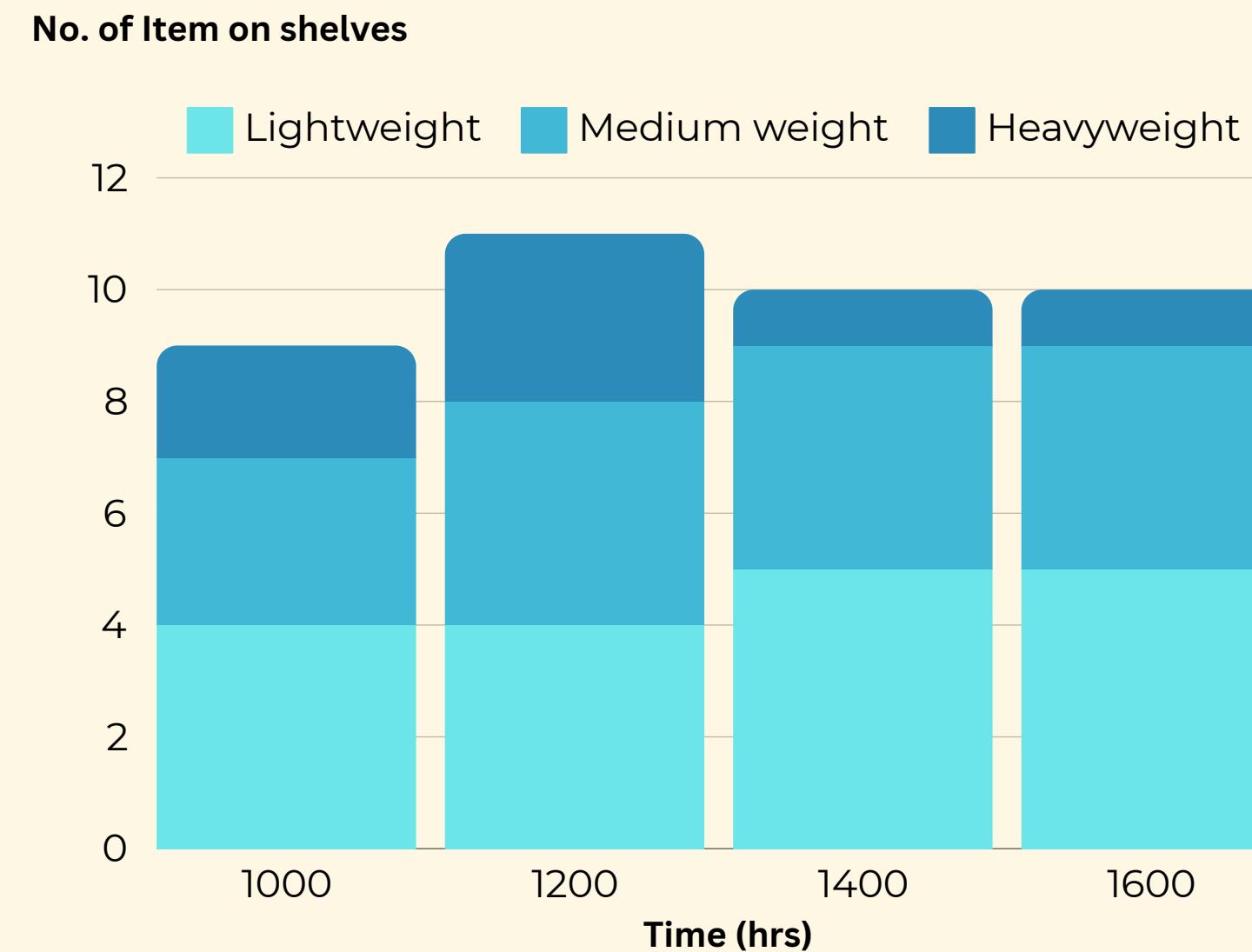
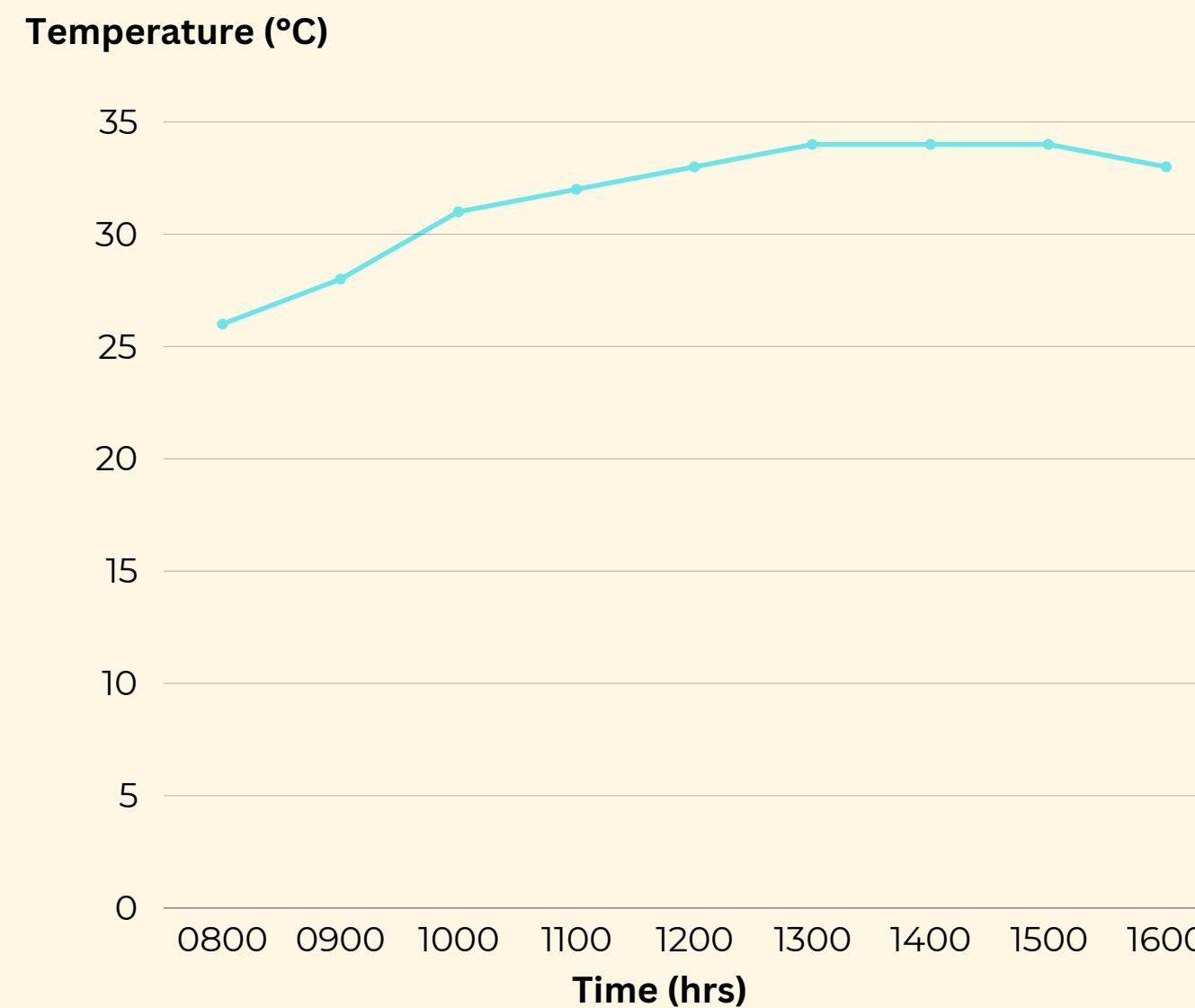


Power Status



SYSTEM ARCHITECTURE: SCADA

Data Visualization



SYSTEM ARCHITECTURE: SCADA

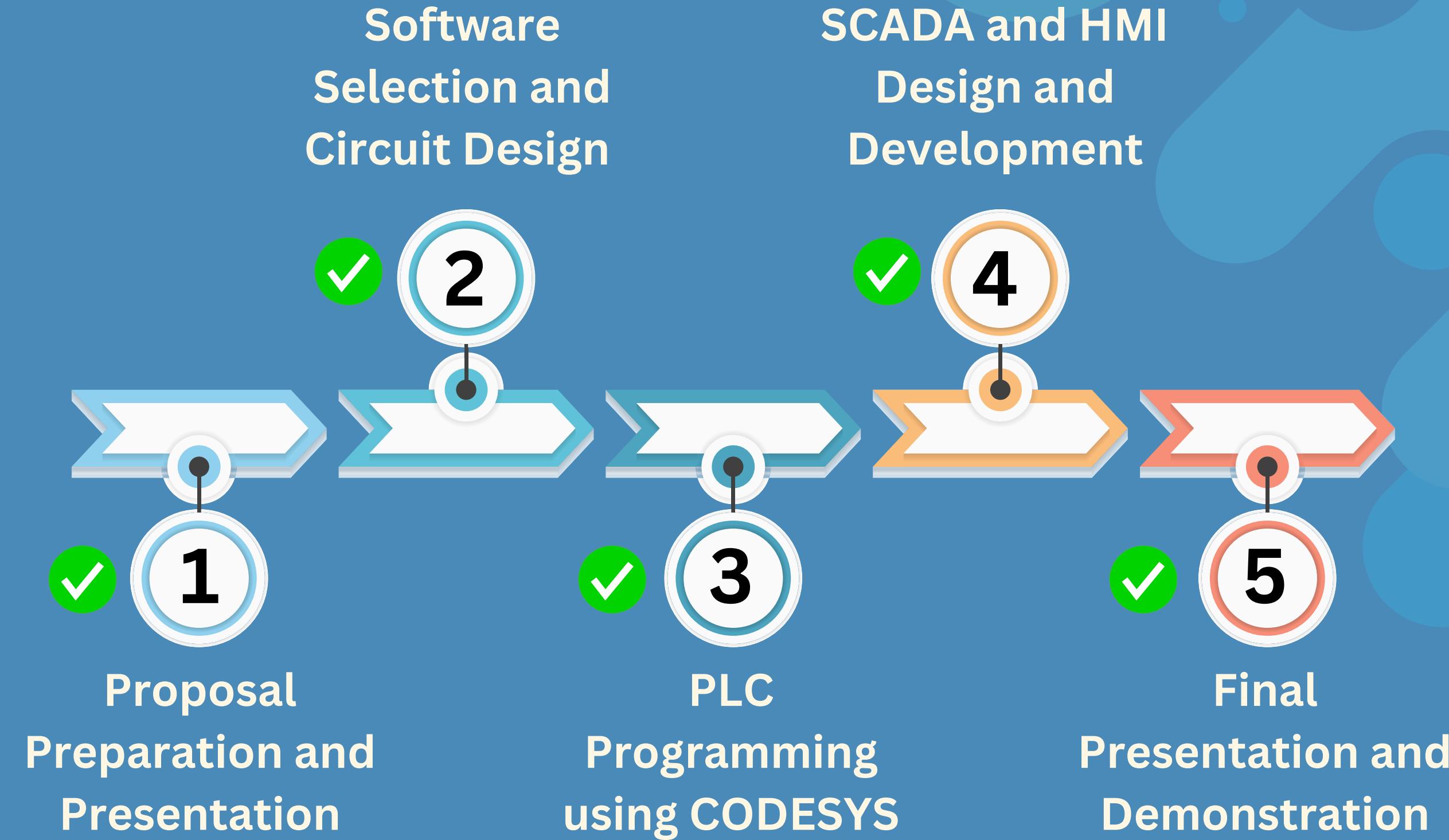
Security Camera Live Monitoring



GANTT CHART

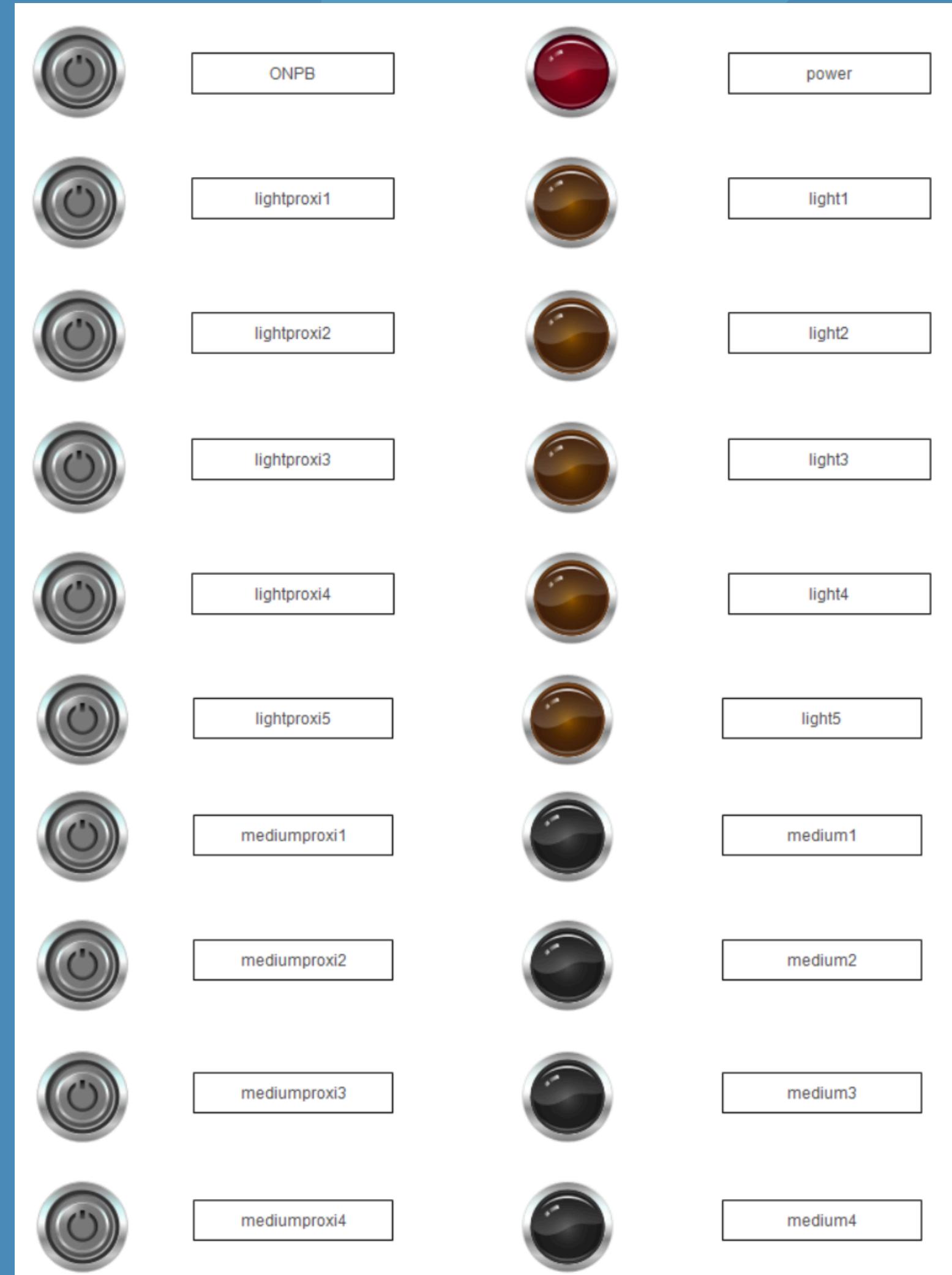
	Week 1 - 3	Week 4 - 6	Week 7 - 9	Week 10 - 12	Week 13 - 15
Theme Selection & Project Planning					
Components selection & Circuit Design					
PLC programming					
SCADA & HMI Design					
Presentation & Demonstration					

PROJECT MILESTONES

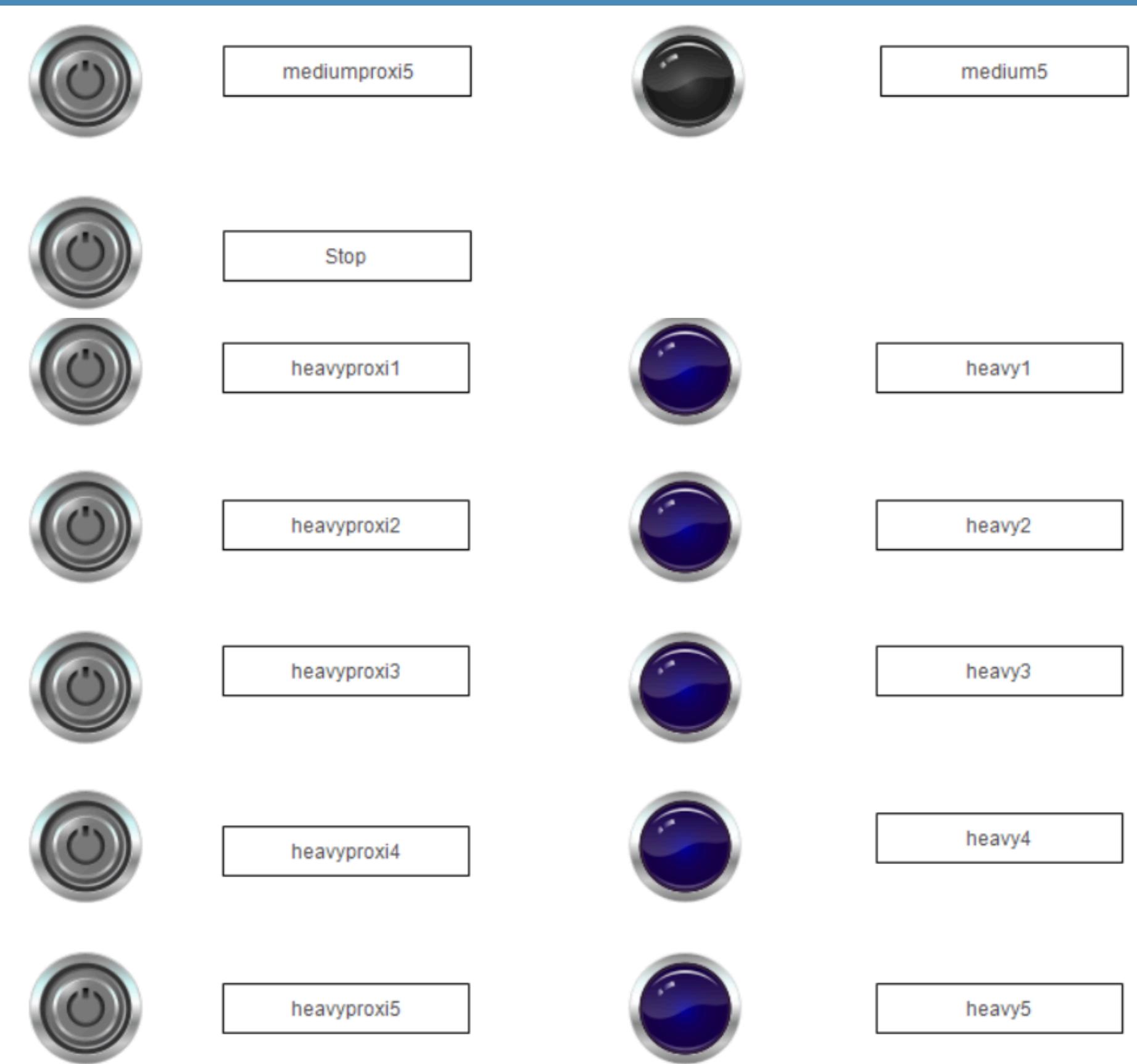


VARIABLES

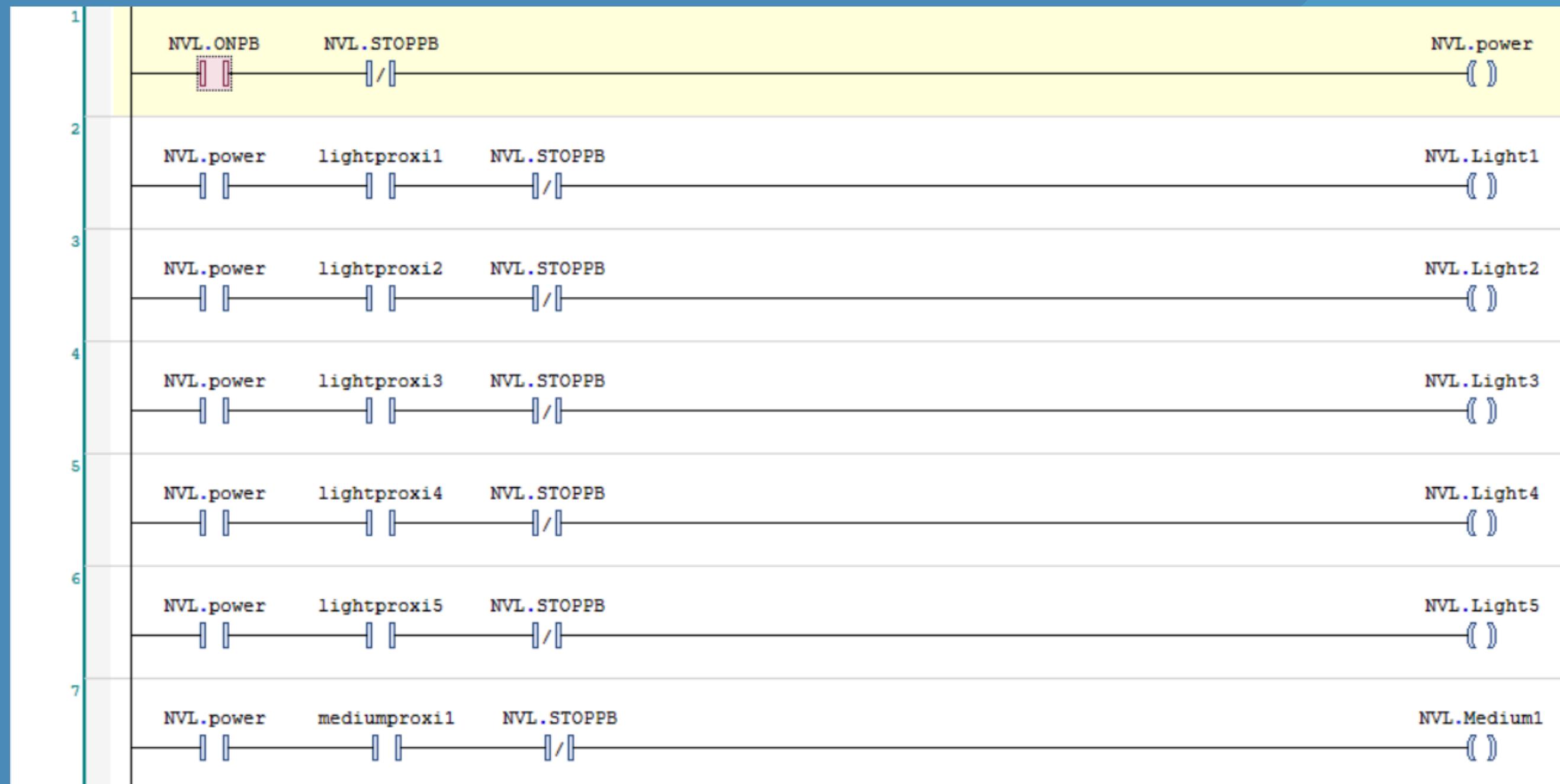
```
let status = {  
    light1: false,  
    light2: false,  
    light3: false,  
    light4: false,  
    light5: false,  
    medium1: false,  
    medium2: false,  
    medium3: false,  
    medium4: false,  
    medium5: false,  
    heavy1: false,  
    heavy2: false,  
    heavy3: false,  
    heavy4: false,  
    heavy5: false,  
    temp: 30,  
    alarm: false,  
    power: false,  
}
```



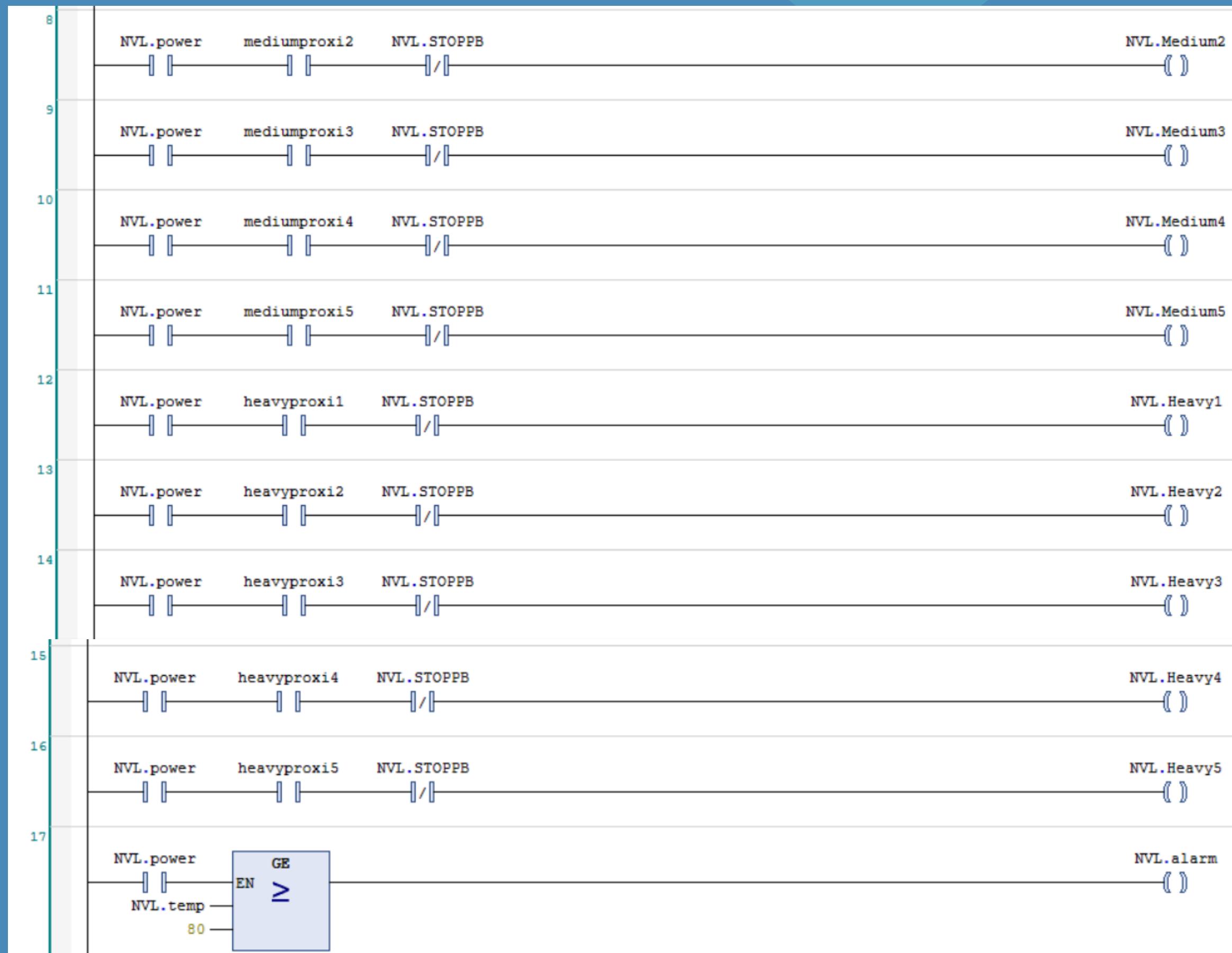
CODESYS: VISUALIZATION



CODESYS: LADDER DIAGRAM



CODESYS: LADDER DIAGRAM



DATABASE : MYSQL

```
const NVL = iec.STRUCT({
    ONPB: iec.BOOL,
    STOPPB: iec.BOOL,
    Light1: iec.BOOL,
    Light2: iec.BOOL,
    Light3: iec.BOOL,
    Light4: iec.BOOL,
    Light5: iec.BOOL,
    Medium1: iec.BOOL,
    Medium2: iec.BOOL,
    Medium3: iec.BOOL,
    Medium4: iec.BOOL,
    Medium5: iec.BOOL,
    Heavy1: iec.BOOL,
    Heavy2: iec.BOOL,
    Heavy3: iec.BOOL,
    Heavy4: iec.BOOL,
    Heavy5: iec.BOOL,
    temp: iec.INT,
    alarm: iec.BOOL,
    power: iec.BOOL,
});
```

```
Wed Jun 12 2024 09:16:47 GMT+0800 (Malaysia Time) Data Received {
    ONPB: false,
    STOPPB: false,
    Light1: false,
    Light2: false,
    Light3: false,
    Light4: false,
    Light5: false,
    Medium1: false,
    Medium2: false,
    Medium3: false,
    Medium4: false,
    Medium5: false,
    Heavy1: false,
    Heavy2: false,
    Heavy3: false,
    Heavy4: false,
    Heavy5: false,
    temp: 0,
    alarm: false,
    power: false
}
```

DATABASE : MYSQL

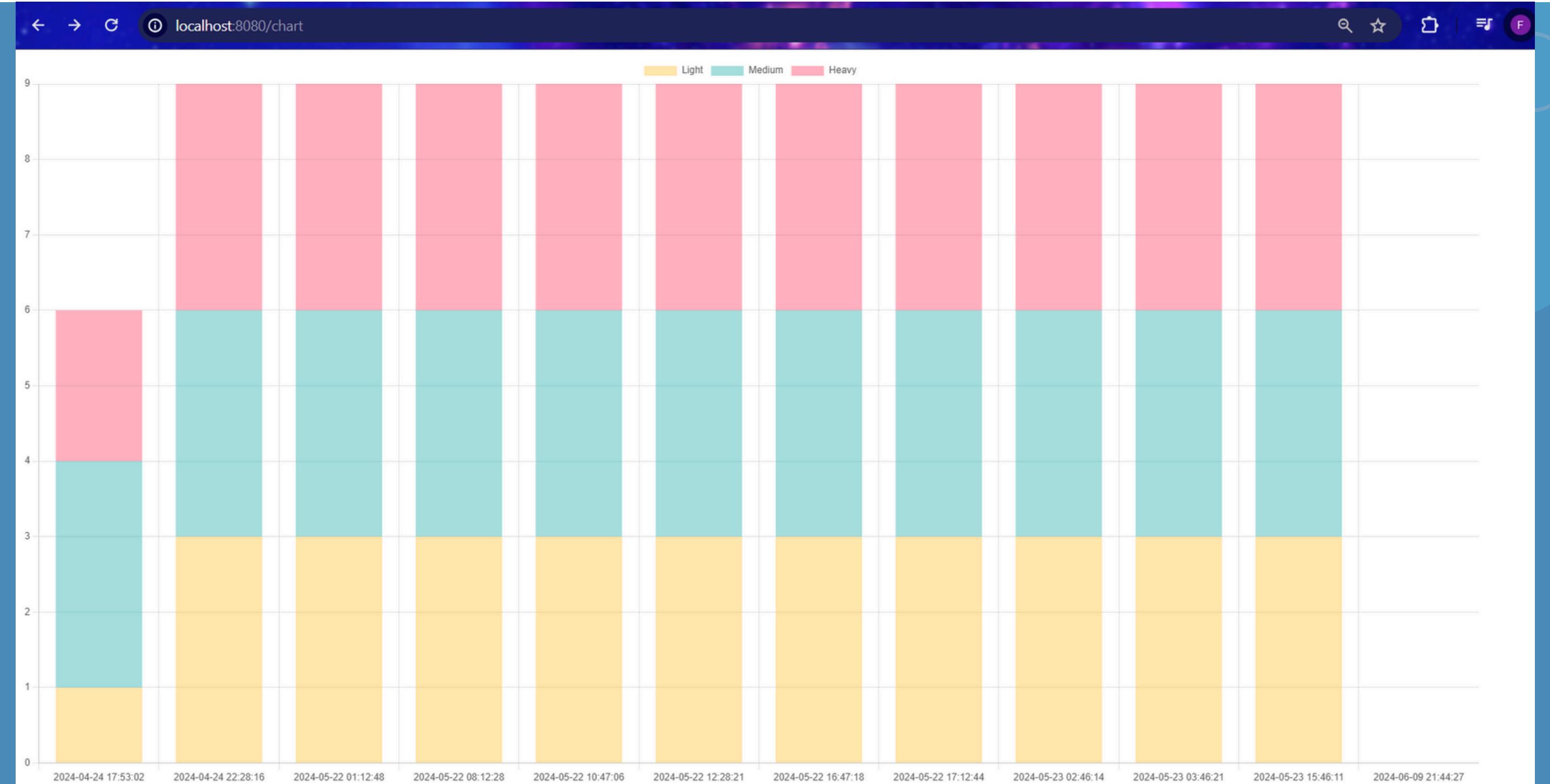
	<input type="button" value="←"/>	<input type="button" value="→"/>	<input type="button" value="▼"/>	id	Status	<input type="button" value="Date"/>	1
<input type="checkbox"/>	 Edit	 Copy	 Delete	794	{"ONPB":true,"STOPPB":false,"Light1":false,"Light2":...}	2024-06-09 23:52:26	
<input type="checkbox"/>	 Edit	 Copy	 Delete	793	{"ONPB":true,"STOPPB":false,"Light1":false,"Light2":...}	2024-06-09 23:52:21	
<input type="checkbox"/>	 Edit	 Copy	 Delete	792	{"ONPB":true,"STOPPB":false,"Light1":false,"Light2":...}	2024-06-09 23:52:16	
<input type="checkbox"/>	 Edit	 Copy	 Delete	791	{"ONPB":true,"STOPPB":false,"Light1":false,"Light2":...}	2024-06-09 23:52:11	

SCADA WEBSITE

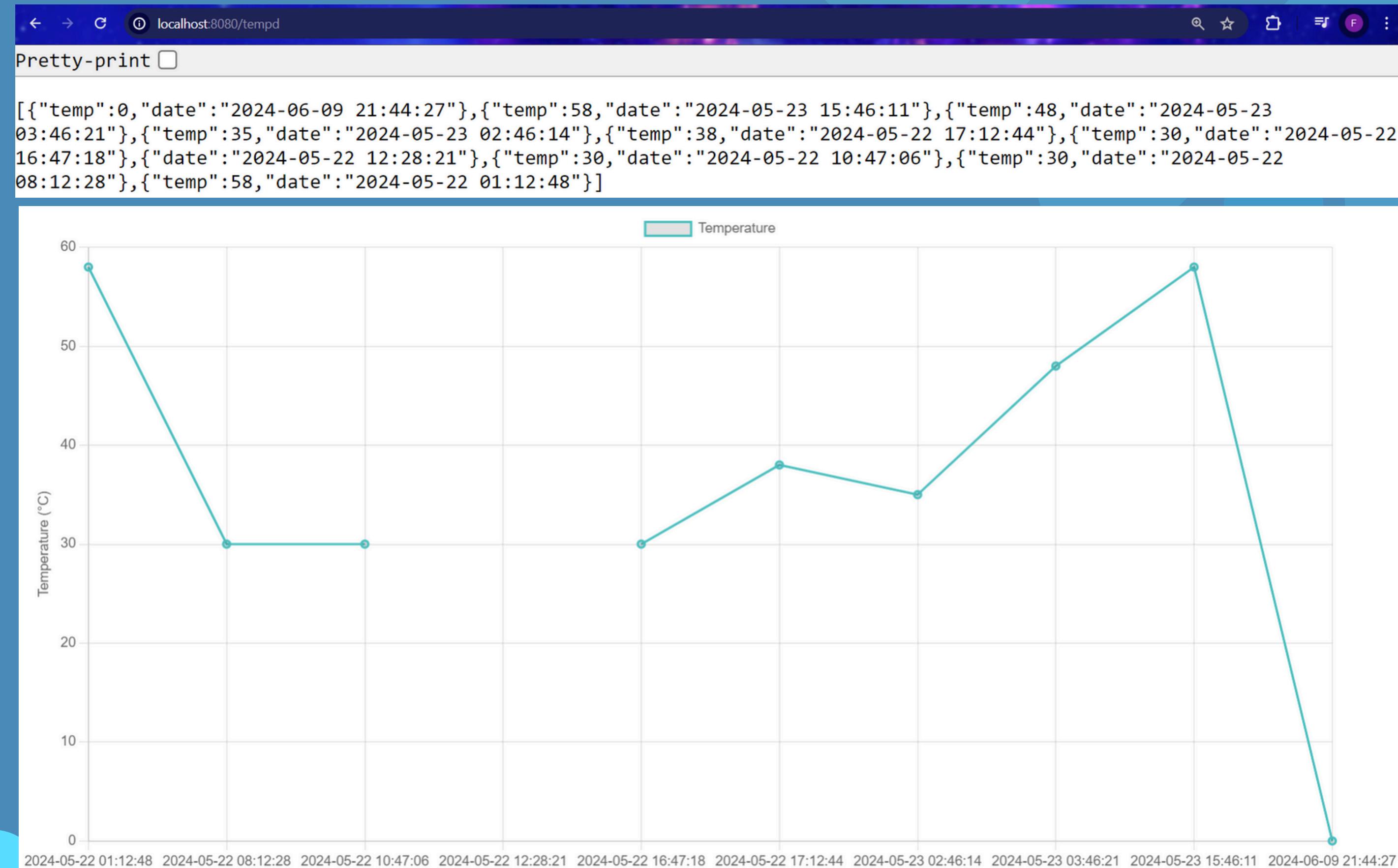
localhost:8080/data

Pretty-print

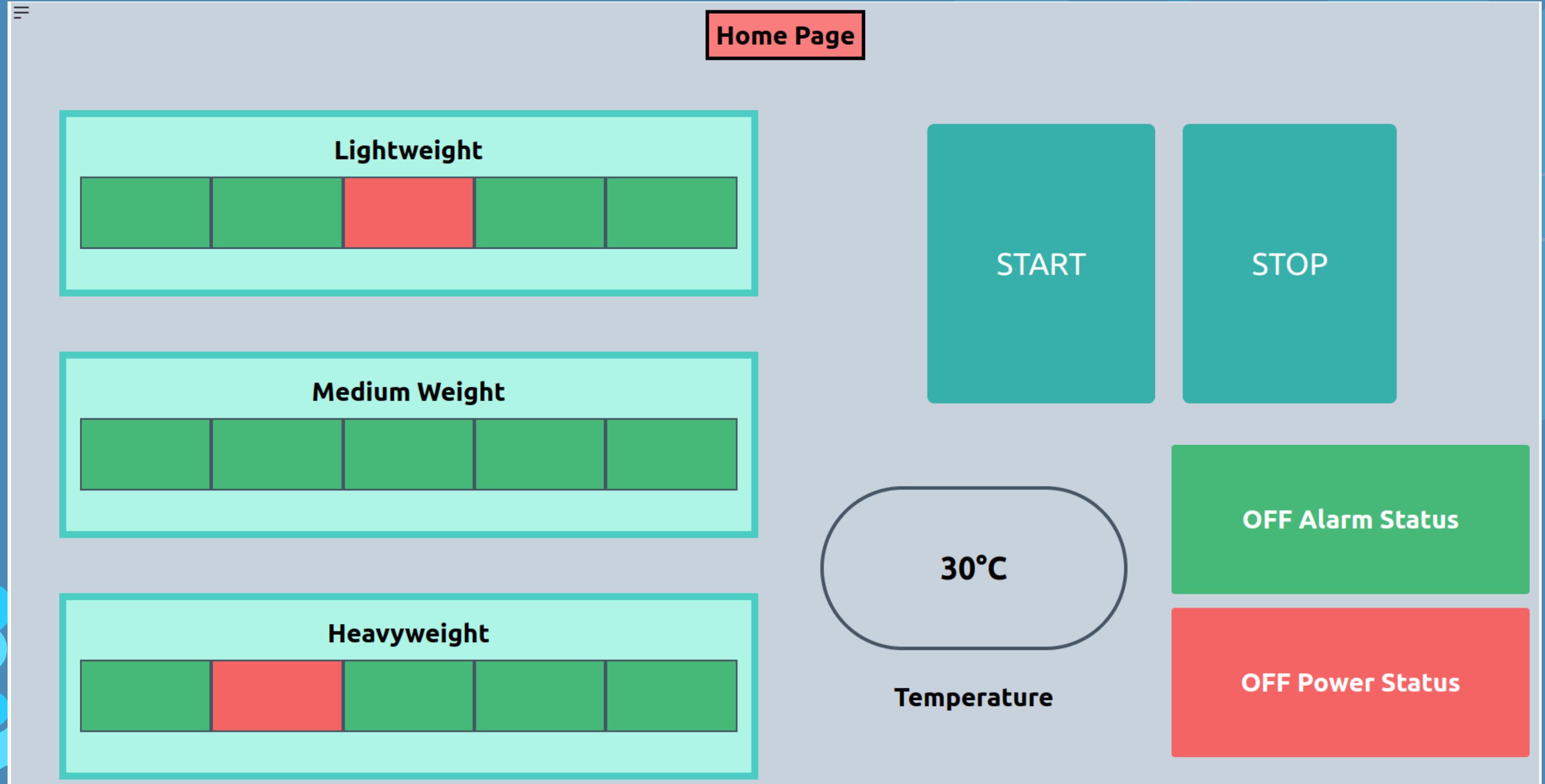
```
[{"light":0,"medium":0,"heavy":0,"date":"2024-06-09 21:44:27"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-23 15:46:11"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-23 03:46:21"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-23 02:46:14"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 17:12:44"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 16:47:18"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 12:28:21"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 10:47:06"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 08:12:28"}, {"light":3,"medium":3,"heavy":3,"date":"2024-05-22 01:12:48"}, {"light":3,"medium":3,"heavy":3,"date":"2024-04-24 22:28:16"}, {"light":1,"medium":3,"heavy":2,"date":"2024-04-24 17:53:02"}]
```



SCADA WEBSITE



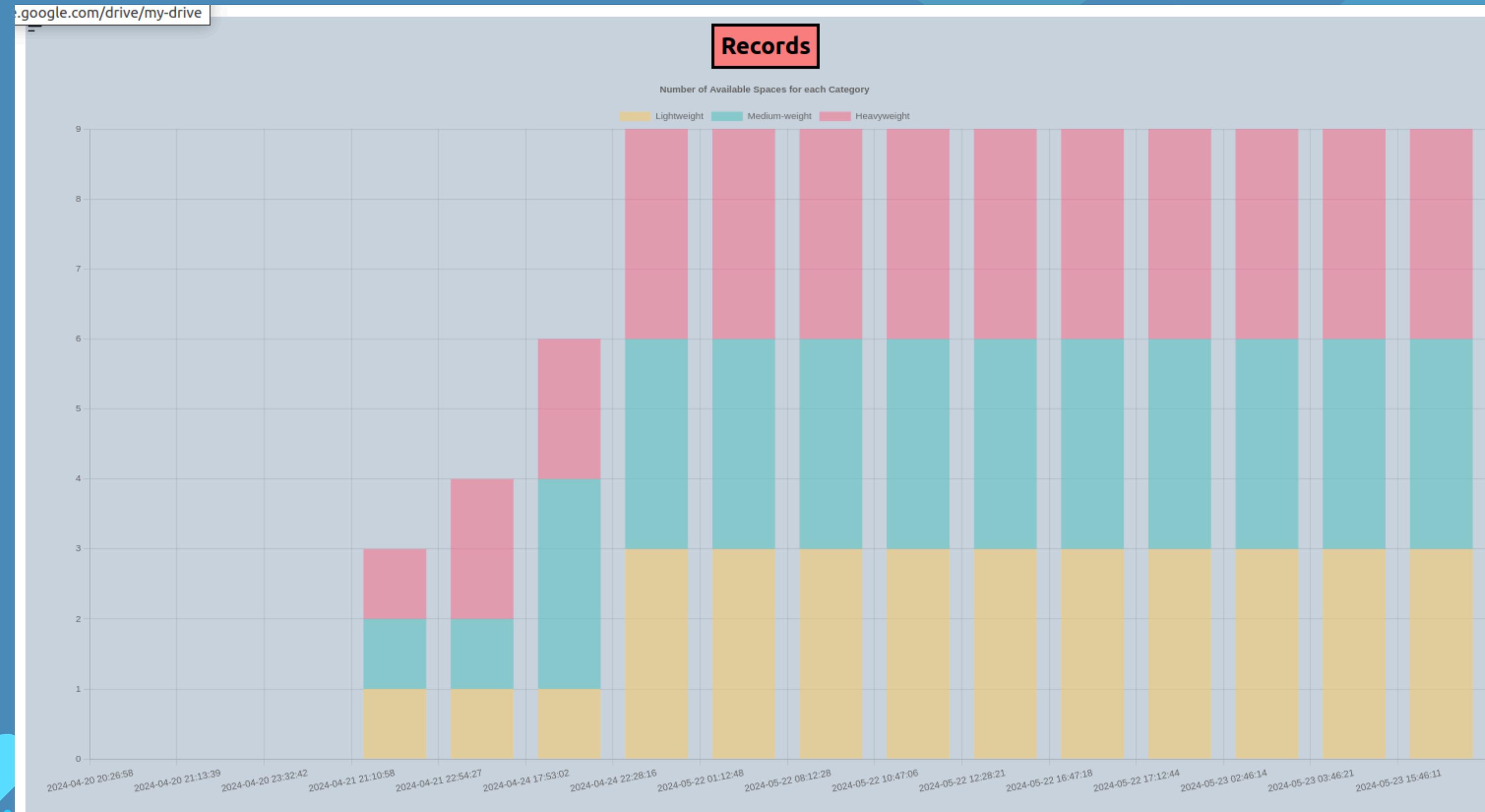
WEB DASHBOARD: HOME



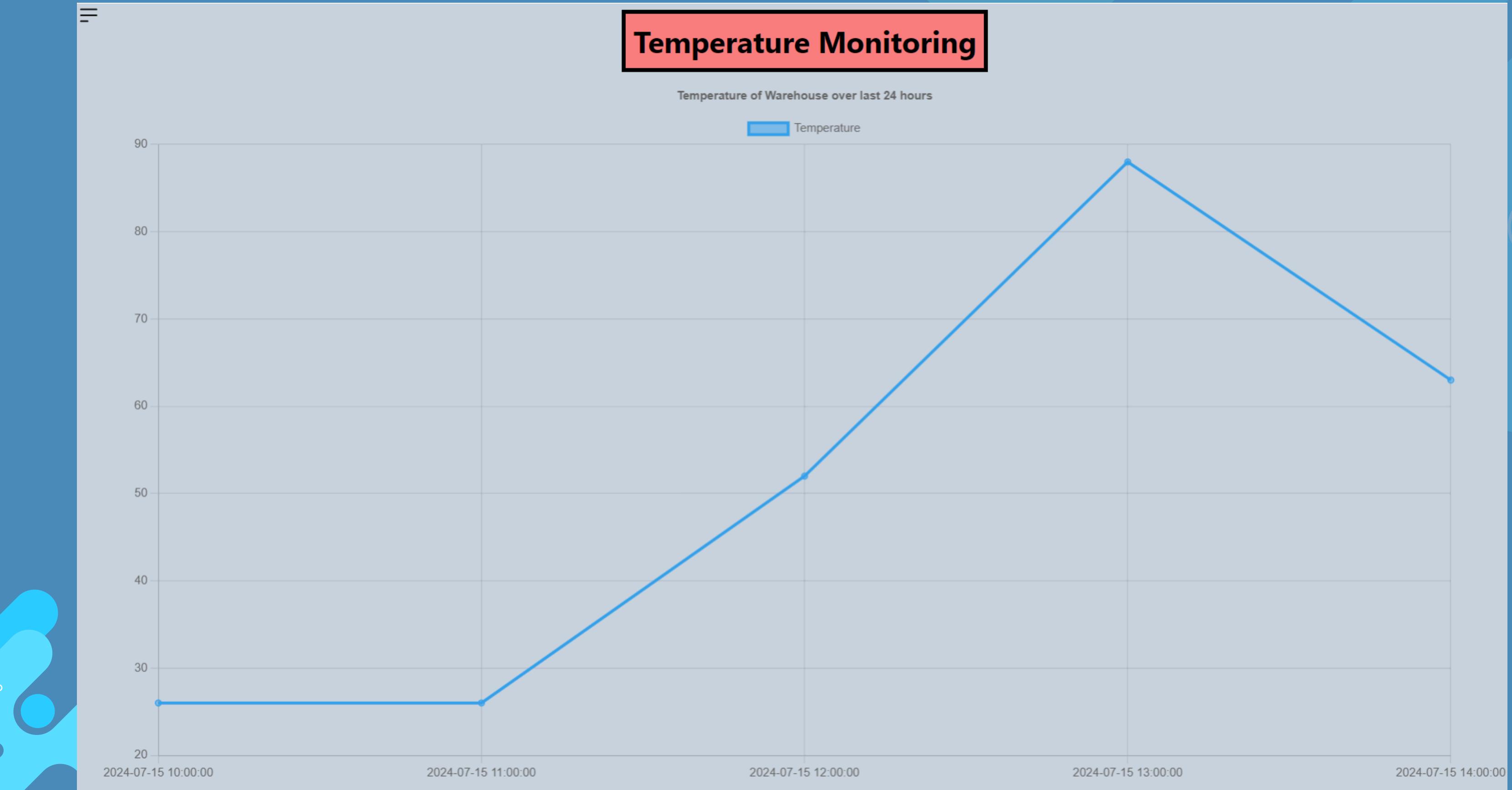
WEB DASHBOARD: CAMERA



WEB DASHBOARD: HISTORY



WEB DASHBOARD: TEMPERATURE



CONCLUSION



In conclusion, an automated warehouse shelf space monitoring and warning system is developed to optimize shelf space utilization and ensure temperature readings are within the accepted range.



REFERENCE



Adnan, M., Huda, N. U., & Zaman, U. K. U. (2022). Smart Warehouse Management System: architecture, Real-Time implementation and Prototype design. *Machines*, 10(2), 150. <https://doi.org/10.3390/machines10020150>



Palms Academy. (2021, June 23). What is Warehouse Management System? How WMS Works [Video]. YouTube. https://www.youtube.com/watch?v=_grpOkkd8p8



Talk Business Magazine. (2024).The Evolution of Warehouse Operations: Trends and Technologies Shaping the Future. <https://www.talk-business.co.uk/2024/02/16/the-evolution-of-warehouse-operations-trends-and-technologies-shaping-the-future/>



The Star. (2024). CelcomDigi partners ZTE for cutting-edge solutions in smart manufacturing and smart warehousing. <https://www.thestar.com.my/business/business-news/2024/03/08/celcomdigi-partners-zte-for-cutting-edge-solutions-in-smart-manufacturing-and-smart-warehousing>



Sasidhar, Kadiyam & Hussain, Shaik & Safdar, Syed & Uddin, Aleem. (2017). Design and Development of a PLC Based Automatic Object Sorting.





**Thank
You**