



CS 331  
Computer Networks

# Smart Guard IoT-Based Environmental Monitoring System

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# Introduction

- Smart Guard is an IoT-based environmental monitoring system designed for classrooms and labs.
- It collects real-time data on parameters like:
  - Temperature, Humidity and Light Intensity.
- Uses ESP32 microcontrollers connected to sensors to capture environmental data.
- Data is transmitted to a central server via HTTP and visualized on a React-based dashboard.
- Enables live monitoring, historical analysis, and alert notifications when conditions cross predefined thresholds.
- Designed to be modular, scalable, and easy to maintain, supporting multiple rooms and sensor types.

# Objectives

**Main Goal:** Build a scalable, real-time IoT system for monitoring environment conditions in classroom and labs.

## Specific Objectives:

-  **Sensor Data Collection:** Use DHT22 (temp + humidity), BH1750 (light)
-  **Data Transmission:** Send sensor readings to server via HTTP
-  **Database Storage:** Store readings in PostgreSQL for querying and analysis
-  **Frontend Dashboard:** Visualize data using React + Chart.js
-  **Alert Notifications:** Trigger email alerts on threshold breaches
-  **Modular Design:** Easy to add new sensors or locations

# System Architecture



## 4-Layered Architecture



### • **Hardware Layer**

ESP32 Microcontroller + Sensors (DHT22, BH1750)



### • **Backend Layer**

Node.js Server – Handles data reception, preprocessing, and storage with database



### • **Database Layer**

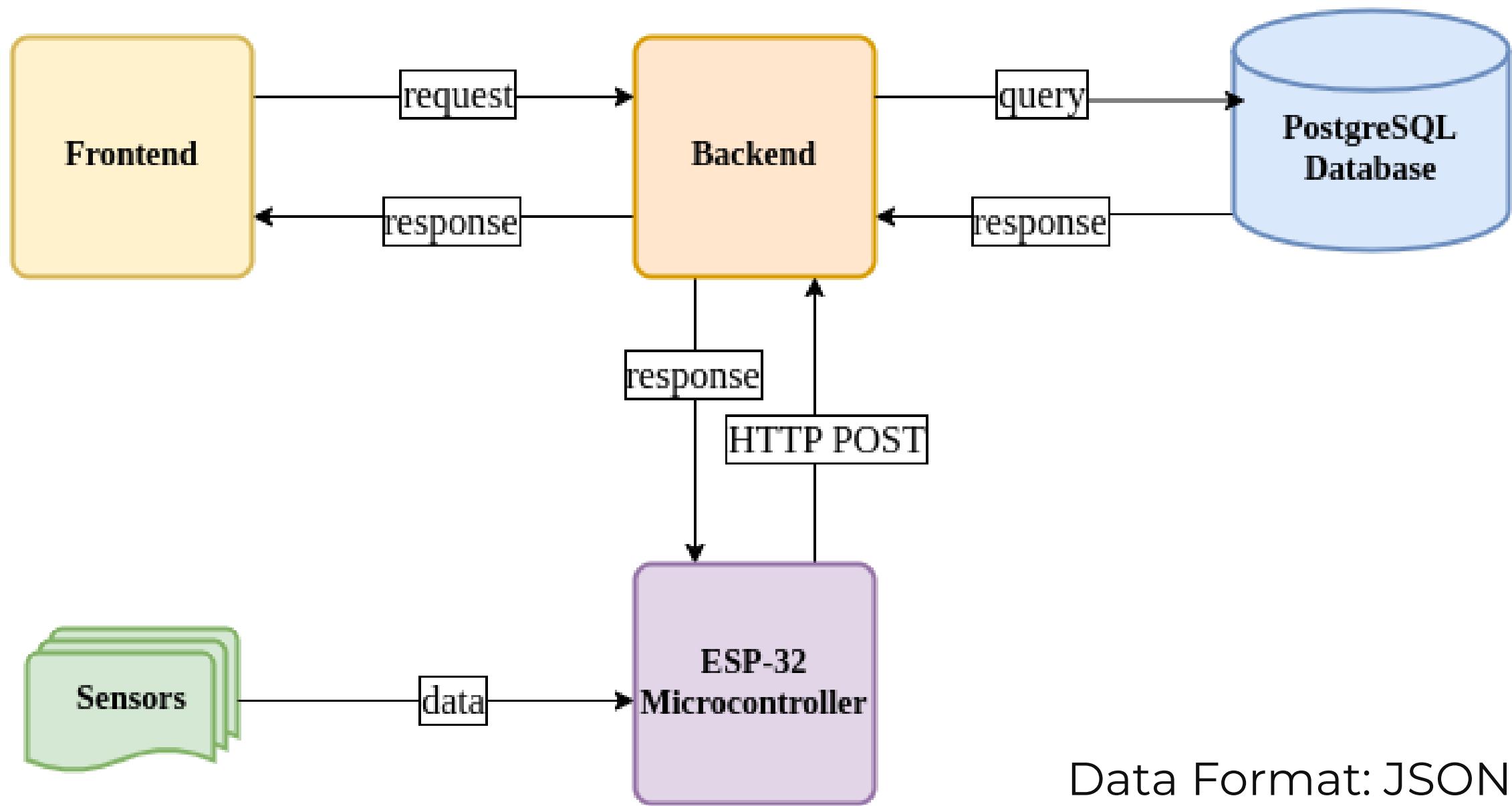
PostgreSQL – Stores time-series sensor data

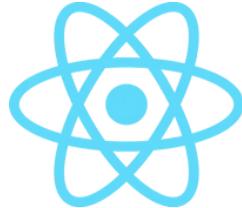


### • **Frontend Layer**

React Dashboard – Visualizes real-time and historical data

# System Architecture





# Frontend

## ⚙️ Built with:

React.js, Vite.js, Typescript



### UI Features

- Room-based filtering
  - Live graphs
  - Date-range selection
  - Alert Visualization
- GREEN GEMINI DESIGN ELEMENT
- Designed for intuitive use and scalability.



### ⚙️ Key Technologies

- **React.js** – SPA for real-time interactivity
- **Chart.js** – Visualize sensor data using responsive graphs
- **Context API** – Global state management across components
- **Axios** – API calls to backend



# Backend

## 🔧 Key Responsibilities:

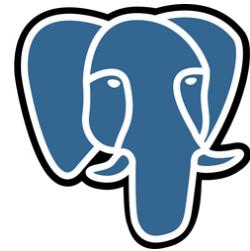
- Receive sensor data via HTTP requests
- Validate & preprocess data
- Store it in PostgreSQL
- Expose REST APIs for frontend

## 📧 Email Alert Integration:

- Uses Nodemailer
- Sends emails when sensor thresholds are breached

## ⚙️ Built with:

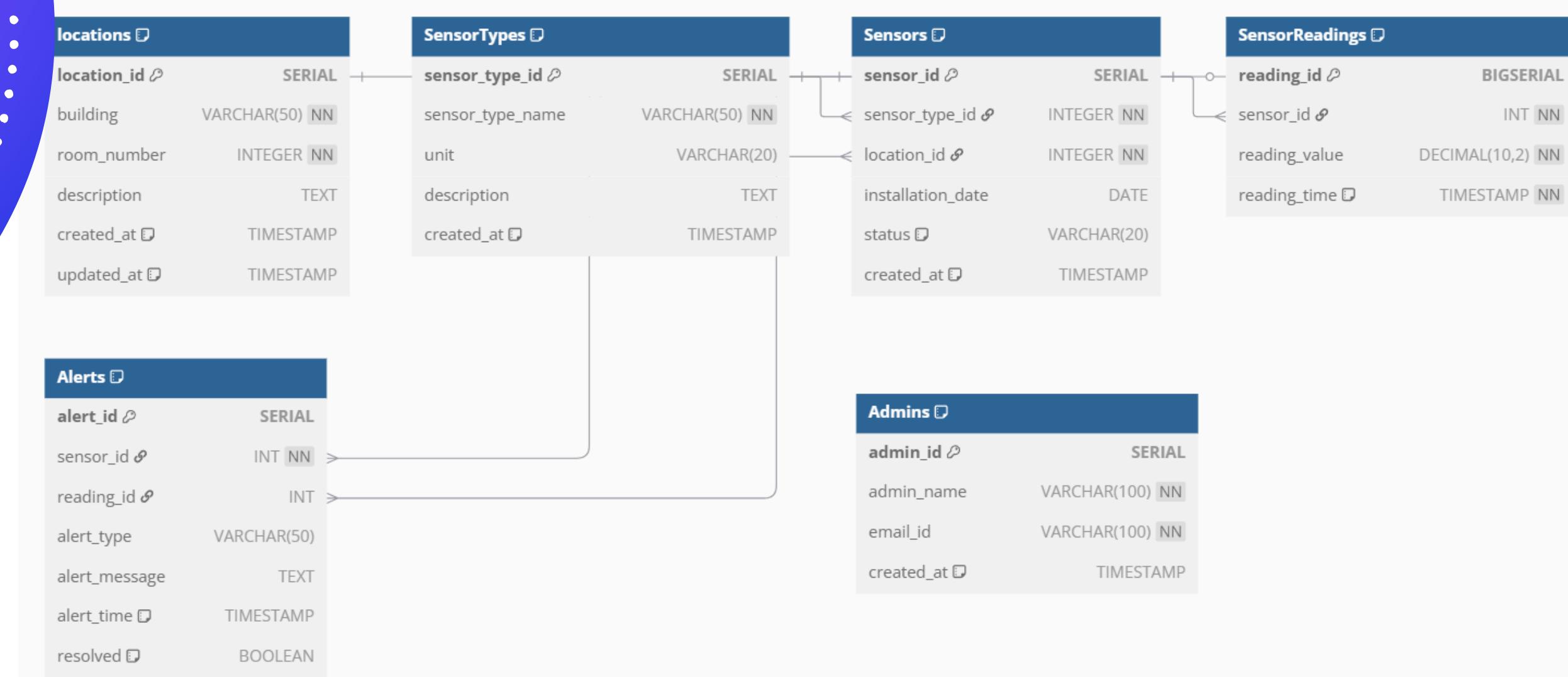
Node.js, Express.js, TypeScript



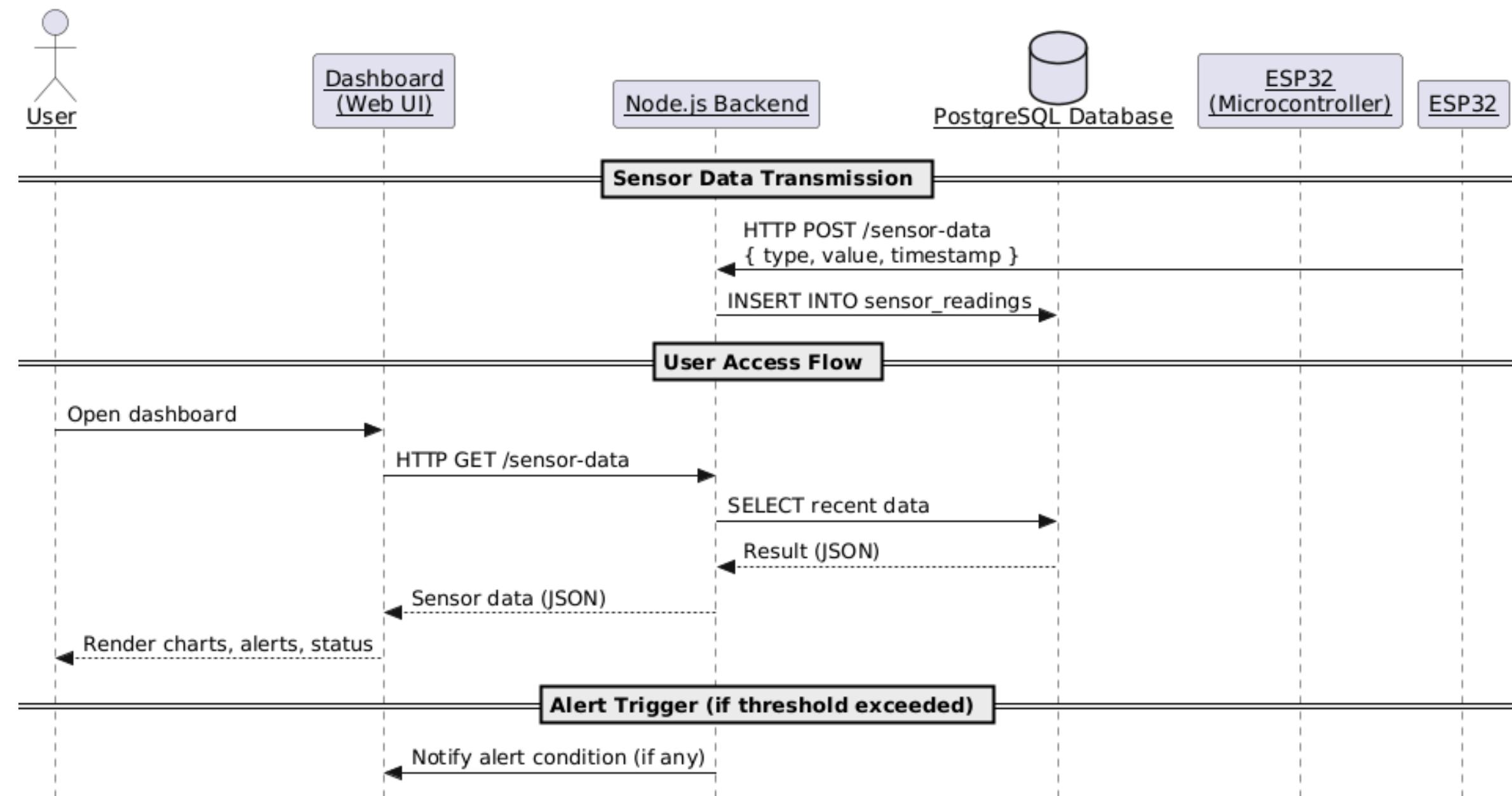
# PostgreSQL Database

## ⚡ Optimized for:

- Time-series data
- Fast querying for historical trends
- Scalable storage



# Data Flow



# Objectives Achieved

## Sensor Management:

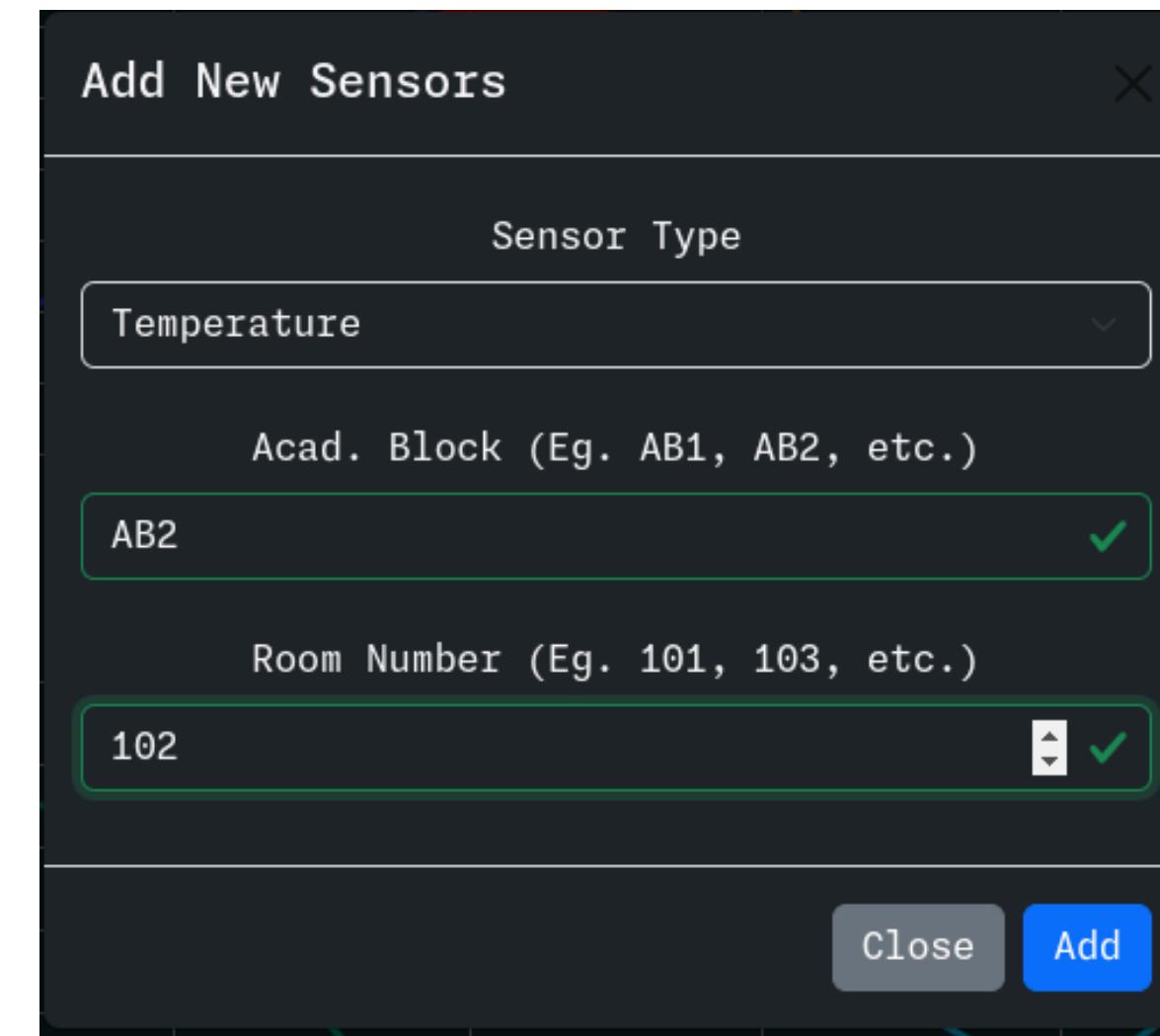
Add New Sensors X

Sensor Type  
Temperature

Acad. Block (Eg. AB1, AB2, etc.)  
AB2

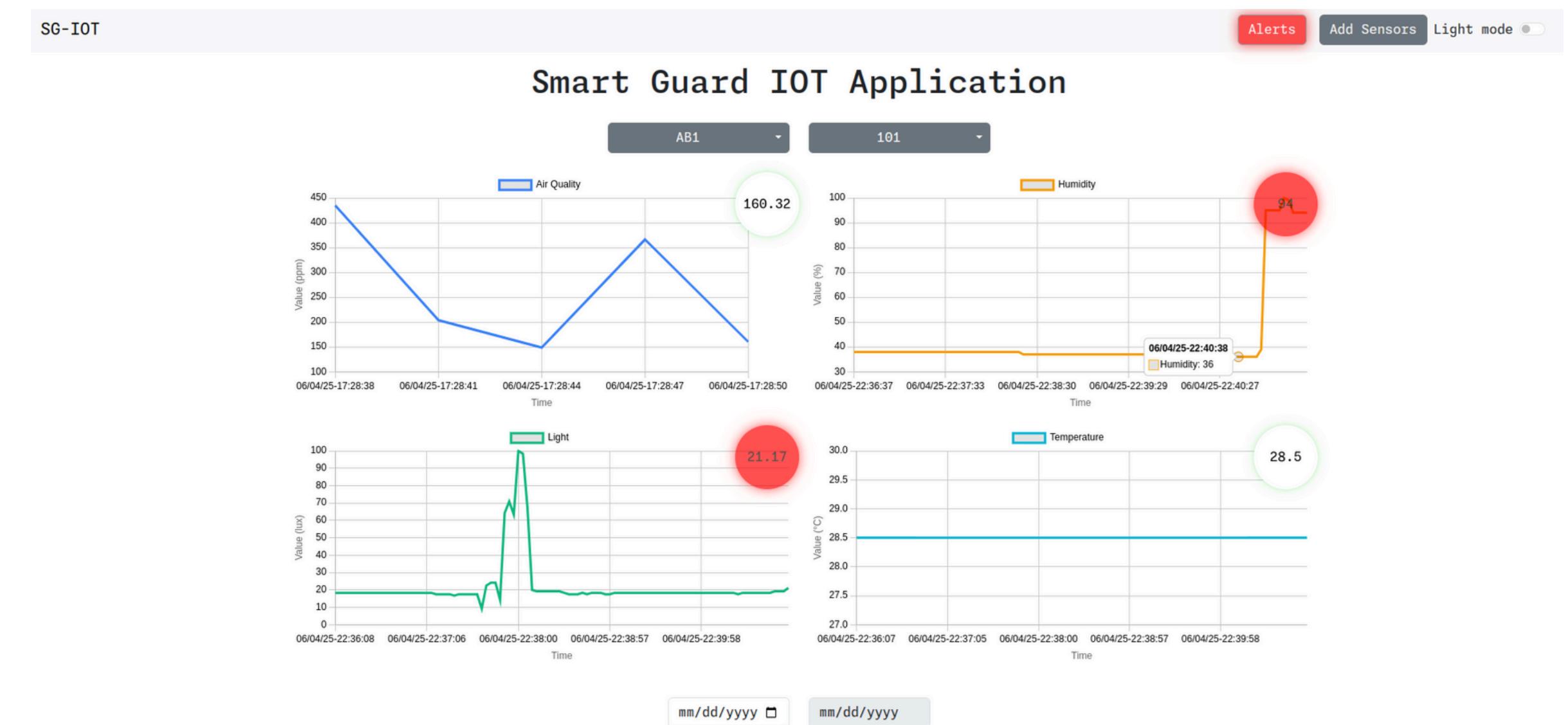
Room Number (Eg. 101, 103, etc.)  
102

Close Add



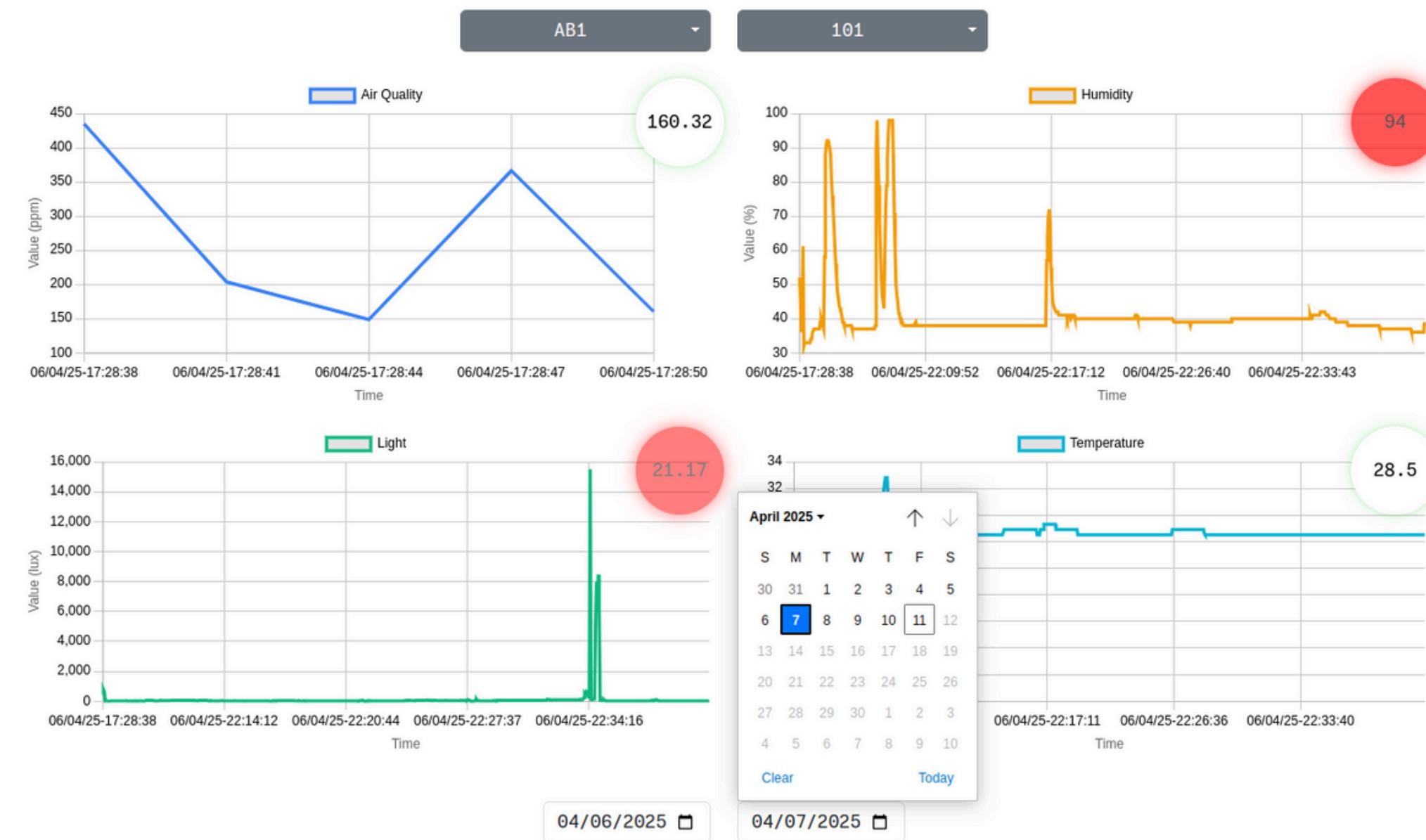
# Objectives Achieved

## Room-based Real-Time Data Access:



# Objectives Achieved

## Past Data Visualization:



# Objectives Achieved

## Alert Log Viewer:

The image shows the Smart Guard IOT Application Alert Log Viewer interface. It features a top navigation bar with tabs for "Alerts" (selected), "Add Sensors", and "Light mode". Below the navigation is a title "Smart Guard IOT Application" followed by "Alerts". There are two tables of data.

**Left Table (Alerts):**

Alert Time	Building	Room Number	Sensor ID	Sensor Type	Reading Value
4/11/2025, 5:44:36 PM	AB1	101	2	Humidity	94.00 (High)
4/6/2025, 10:40:54 PM	AB1	101	3	Light	21.17 (Low)
4/6/2025, 5:28:51 PM	AB2	103	23	Light	4.19 (Low)
4/6/2025, 5:28:51 PM	AB3	101	27	Light	SG-IOT
4/6/2025, 5:28:51 PM	AB3	101	25	Temperature	40.00 (High)
4/6/2025, 5:28:51 PM	AB2	102	18	Humidity	0.76 (Low)
4/6/2025, 5:28:51 PM	AB1	102	7	Light	92.44 (Low)
4/6/2025, 5:28:50 PM	AB3	101	28	Air Quality	434.26 (High)
4/6/2025, 5:28:50 PM	AB2	102	20	Air Quality	441.64 (High)

**Right Table (Alert Logs):**

Alert Time	Building	Room Number	Sensor ID	Sensor Type	Reading Value
4/6/2025, 5:28:51 PM	AB2	103	23	Light	4.19 (Low)
4/6/2025, 5:28:51 PM	AB3	101	27	Light	2.22 (Low)
4/6/2025, 5:28:51 PM	AB3	101	25	Temperature	40.00 (High)
4/6/2025, 5:28:51 PM	AB2	102	18	Humidity	0.76 (Low)
4/6/2025, 5:28:51 PM	AB1	102	7	Light	92.44 (Low)
4/6/2025, 5:28:51 PM	AB1	101	3	Light	33.13 (Low)
4/6/2025, 5:28:50 PM	AB3	101	28	Air Quality	434.26 (High)
4/6/2025, 5:28:50 PM	AB2	102	20	Air Quality	441.64 (High)
4/6/2025, 5:28:48 PM	AB1	103	10	Humidity	82.59 (High)
4/6/2025, 5:28:48 PM	AB3	102	31	Light	65.81 (Low)
4/6/2025, 5:28:48 PM	AB3	102	30	Humidity	10.31 (Low)
4/6/2025, 5:28:48 PM	AB3	103	35	Light	1116.24 (High)
4/6/2025, 5:28:48 PM	AB2	103	22	Humidity	86.23 (High)
4/6/2025, 5:28:48 PM	AB1	103	11	Light	1118.05 (High)
4/6/2025, 5:28:48 PM	AB1	101	3	Light	14.22 (Low)

Below the tables are buttons for "All Logs" and "Current Logs", and a page number indicator "15". At the bottom is a footer with "Previous", "Page 46 of 48", and "Next" buttons.

# Objectives Achieved

## Email Alert System:



**cnprojectsma<sup>r</sup>tguard@gmail.com**

to bhavik.patel, me, aryan.sahu ▾

An alert has been triggered for Humidity sensor at location AB1/101. The reading value is 94%.

Alert Type: high

Sensor ID: 2

Alert Time: Fri Apr 11 2025 17:44:36 GMT+0530 (India Standard Time)

Sensor Type: Humidity

Low Threshold: 20%

High Threshold: 80%



**Let's  
Demonstrate**



**Thank you**