



Smart Rack Monitoring Platform

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Objective

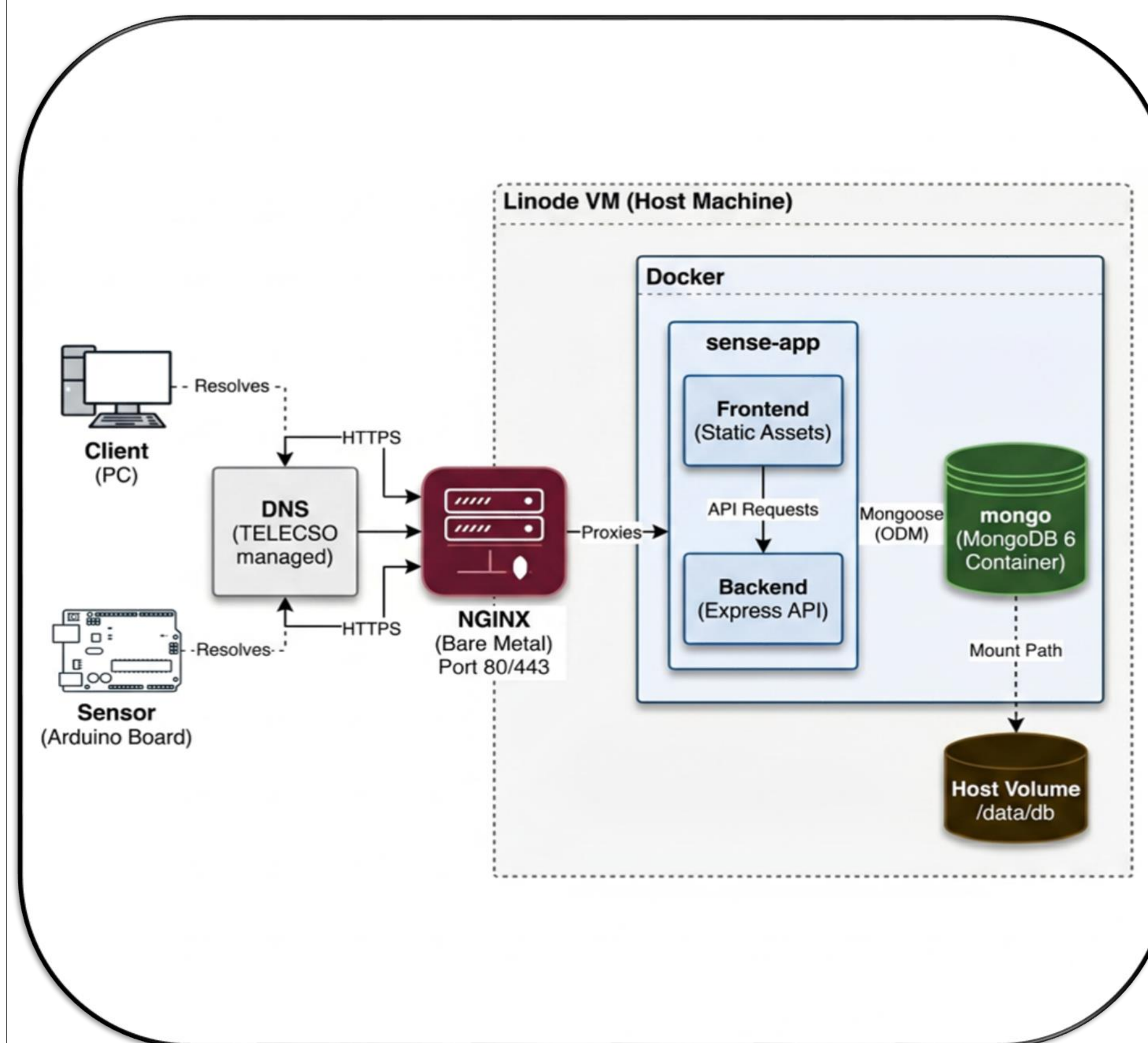
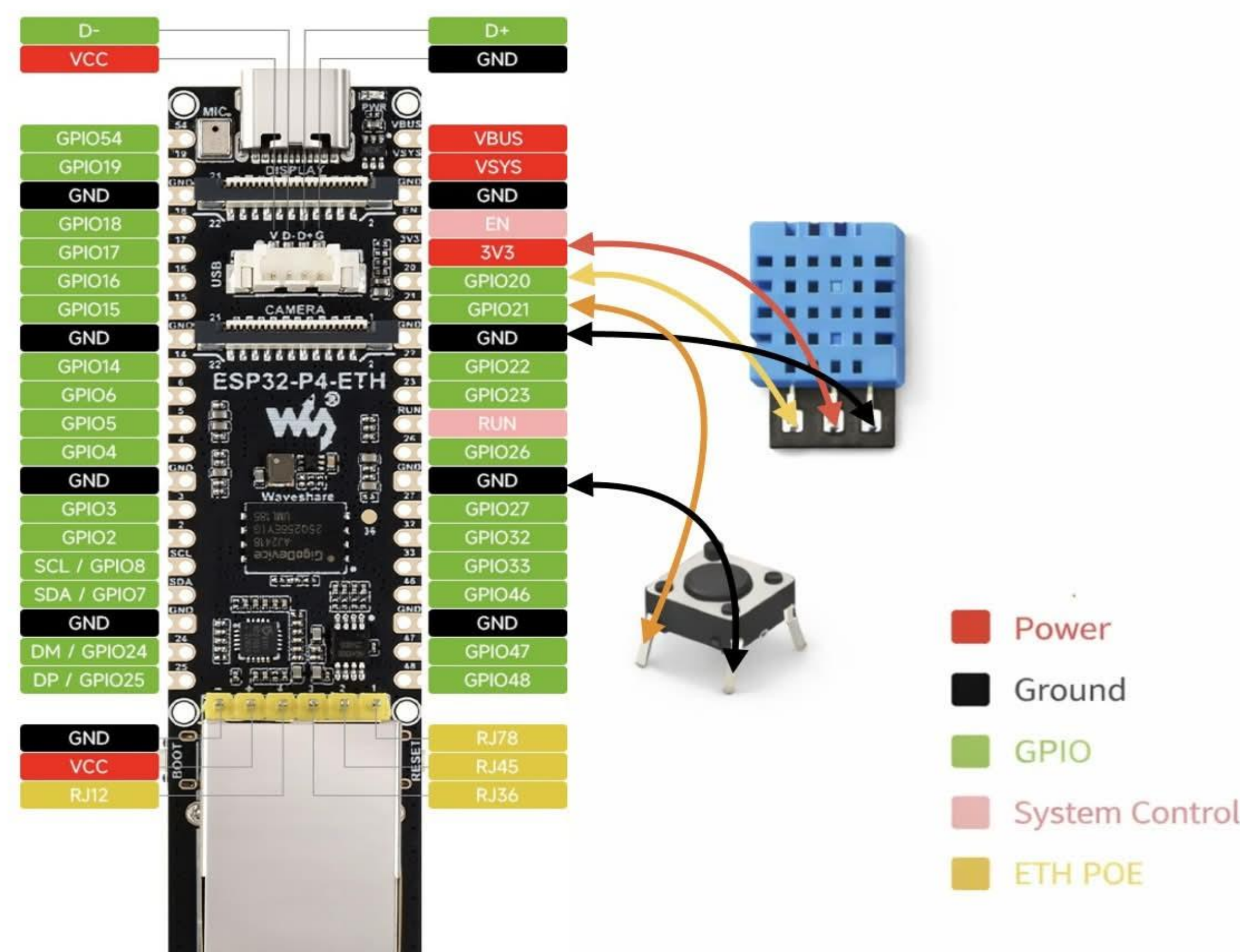
The Smart Rack Monitoring Platform (SRMP) provides real-time environmental monitoring of server racks. The system tracks temperature, humidity, and door status, delivering data to a secure cloud-hosted web dashboard accessible by teams and organizations

Core requirements

- **Organizations:** The platform supports multiple organizations with fine-grained, role-based access control (RBAC) to manage user permissions and device visibility
- **Device configuration:** Administrators can securely register, name, and locate physical devices using unique access tokens and per-device shared keys
- **Over-the-Air (OTA) Updates:** The system enables remote firmware delivery, allowing developers to patch bugs or deploy new features to field devices without requiring physical access to the hardware

Device Requirements

- **Microcontroller:** The hardware centers on the **ESP32** microcontroller, utilizing the Arduino framework for efficient data collection and transmission
- **Sensor Integration:** The device utilizes **DHT11/DHT22** sensors for environmental readings and a **reed switch** to detect door security events
- **Power and Connectivity:** Devices leverage **Power over Ethernet (PoE)** capabilities for reliable, continuous monitoring and low power consumption



Technical Stack

- **Frontend:** React + TypeScript, Vite, Tailwind CSS, react-i18next
- **Backend:** Node.js, Express.js
- **Database:** MongoDB 6
- **Device:** ESP32 Arduino — DHT11 sensor, door reed switch
- **Deployment:** Docker Compose stack



Target Audience & Core Infrastructure

SRMP is designed for TELECSO for organizations requiring robust, scalable, and secure environmental oversight of critical remote infrastructure.

The platform is built on two primary technology pillars:

- **Internet of Things (IoT):** By utilizing a network of intelligent physical sensor nodes, the platform uses built-in connectivity to automatically monitor and report environmental data, creating a seamless real-time oversight loop.
- **Cloud Infrastructure:** The backend is hosted on a cloud-based virtual machine (such as Linode), making the platform accessible globally. This architecture ensures that critical data is available to authorized teams whenever and wherever it is needed.

System Requirements & Architecture

The SRMP adopts a three-tier architecture distributed across three integrated layers to ensure modularity and scalability.

- **Device Layer:** ESP32 microcontrollers collect physical sensor data and transmit it as JSON packets to the server
- **Server Layer:** A Node.js and Express.js backend manages business logic, validates device authentication, and coordinates data storage within a MongoDB database
- **Web Application Layer:** A responsive React dashboard serves as the primary endpoint, allowing users to visualize live data and download historical reports from any modern browser
- **Deployment:** The entire environment is containerized via Docker Compose, ensuring a consistent and reproducible setup across different hosting platforms

Future Work

- Develop a **mobile-responsive PWA** (Progressive Web App) featuring push notification alerts for critical events
- Implement **graphical threshold alerting** with configurable email and SMS notifications
- Introduce a **QR-code based registration** workflow for streamlined device provisioning
- Expand **sensor support** to include CO₂ levels, power draw, and network latency monitoring
- Transition to a **microservices architecture** to support large-scale deployments exceeding 100 devices

Acknowledgements

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VIEW DEMO →

