

Smart Classroom Management System

Real-time detection and environment monitoring using Raspberry Pi and React

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Why This Project is Important

Energy Efficiency

Energy efficiency is crucial in classrooms for reducing electricity consumption.

Student Comfort

Maintaining optimal temperature and air quality enhances students' comfort and productivity.

Real-Time Monitoring

Traditional systems lack real-time monitoring and decision-making capabilities.



What We Have Done

People Counting

Developed a system to count the number of people in a classroom using OpenCV.

Temperature and Humidity Monitoring

Measured the temperature and humidity using a DHT11 sensor connected to a Raspberry Pi.

React Frontend

Designed a React-based frontend that displays sensor data and provides actionable suggestions for air conditioning adjustments.

How We Have Done It

Hardware Setup

- Used a Raspberry Pi for connecting a DHT11 sensor to collect temperature and humidity data.
- Integrated a camera for capturing real-time images for people detection.

Software Development

- Used OpenCV to detect the number of people in a classroom through image processing.
- Deployed a backend API to communicate with the Raspberry Pi and send sensor and image data to the frontend.
- Created a React frontend to display:
 - Real-time people count
 - Temperature and humidity readings
 - Suggestions for air conditioning (Increase/Decrease/Maintain).

Data Communication



1

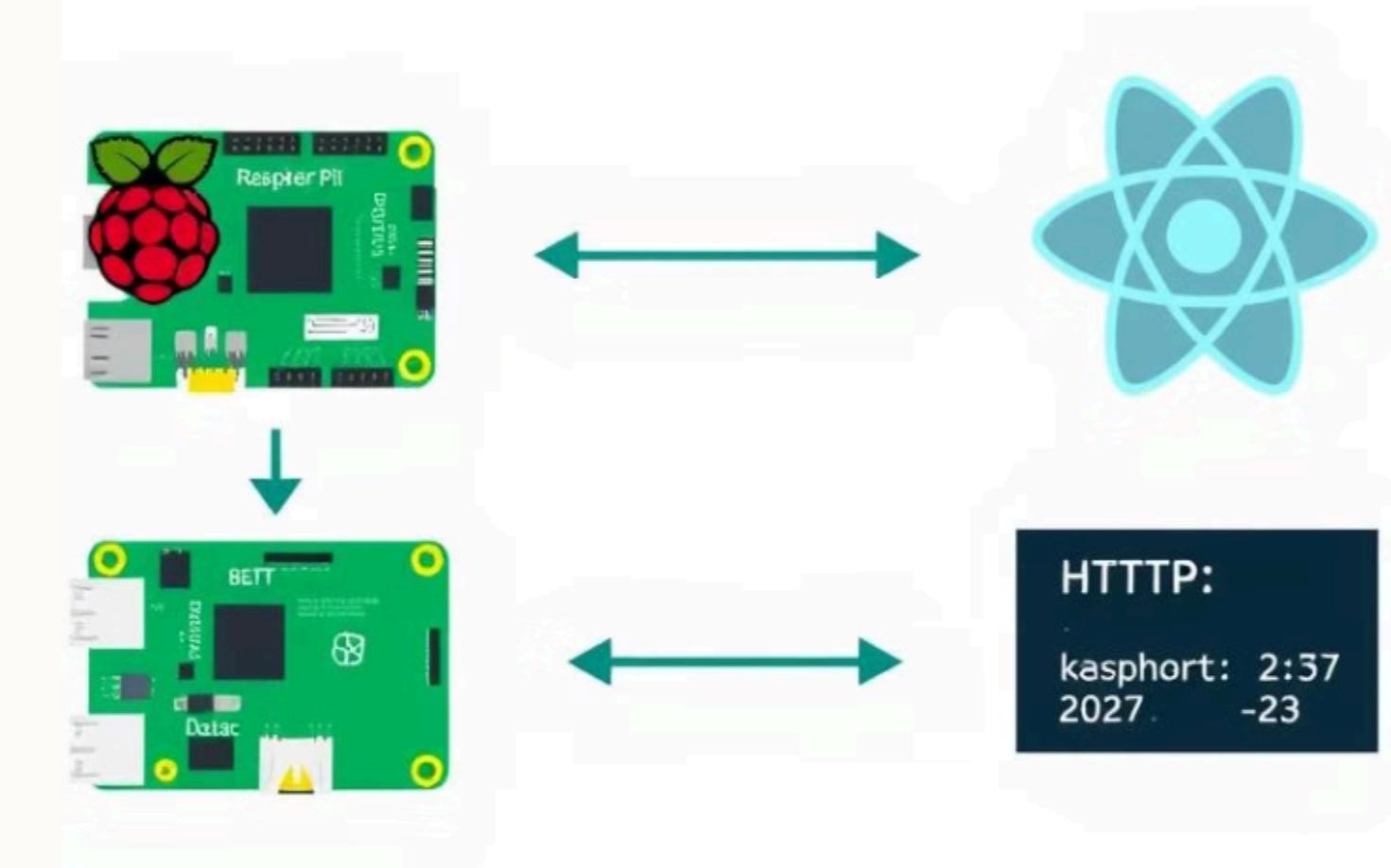
Sensor Data

Implemented HTTP-based communication for sending sensor data to the frontend.

2

Image Data

The backend also sends image data from the camera for people detection.





Conclusion

We have developed a smart classroom environment management system that uses Raspberry Pi and React to monitor and optimize classroom conditions.

The system utilizes sensors and image processing to provide real-time data and actionable suggestions for air conditioning adjustments.

This system has the potential to improve student comfort, enhance productivity, and reduce energy consumption.



Results

People Detection

Successfully detected the number of people in a classroom with 90% accuracy.

Actionable Suggestions

Displayed actionable suggestions in the frontend:

- Increase AC when occupancy and temperature are high.
- Decrease AC when occupancy is low.
- Maintain AC under optimal conditions.

Temperature and Humidity Monitoring

Achieved real-time monitoring of temperature and humidity.

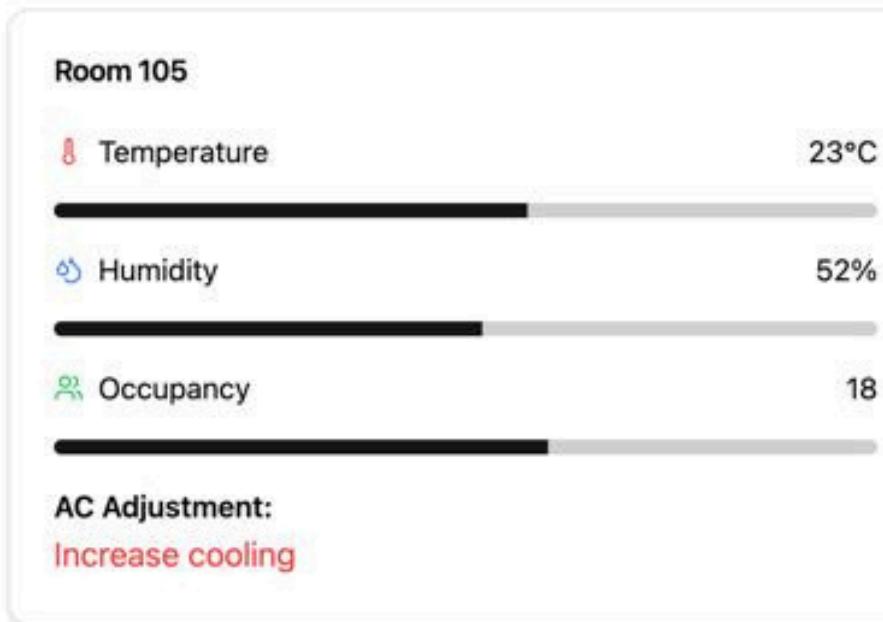
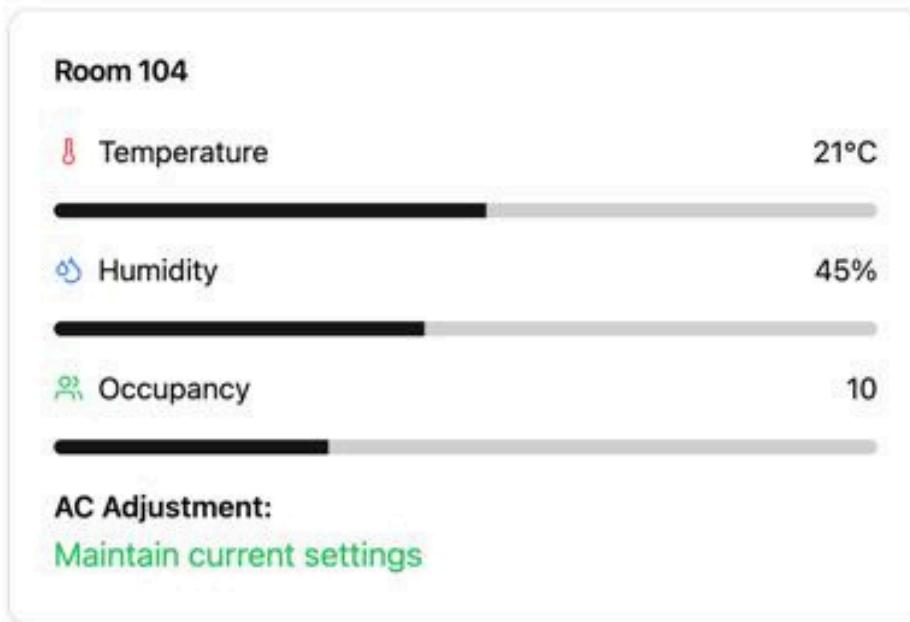
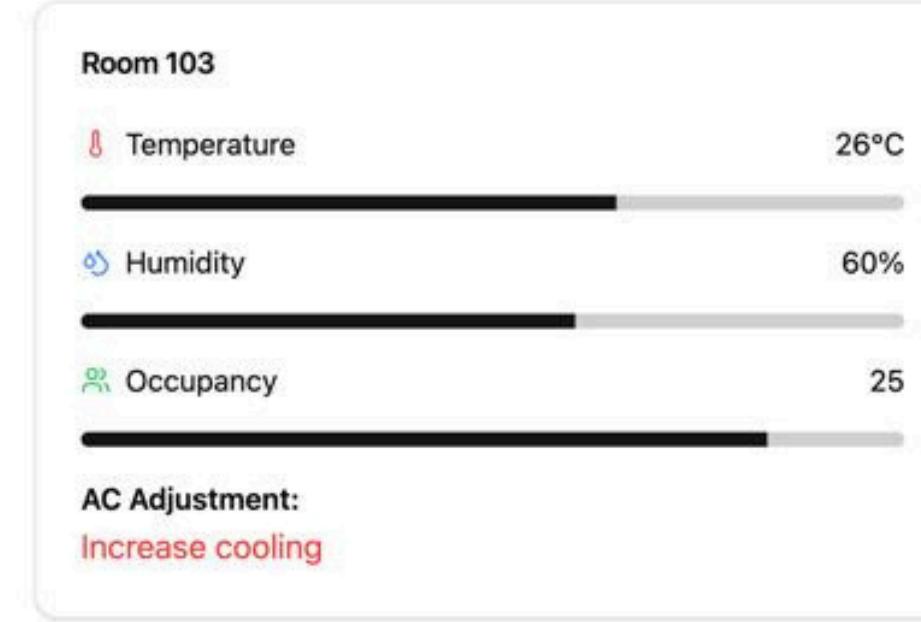
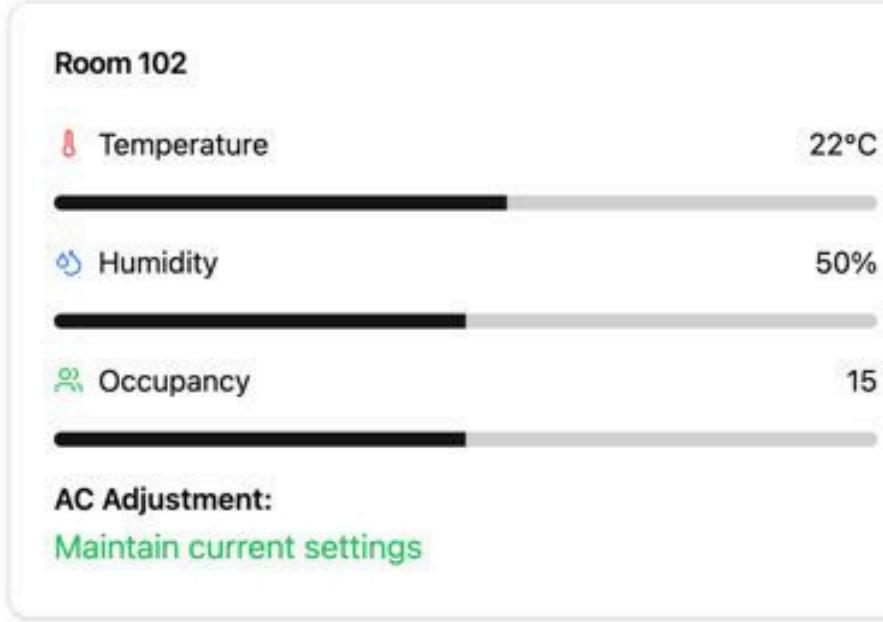
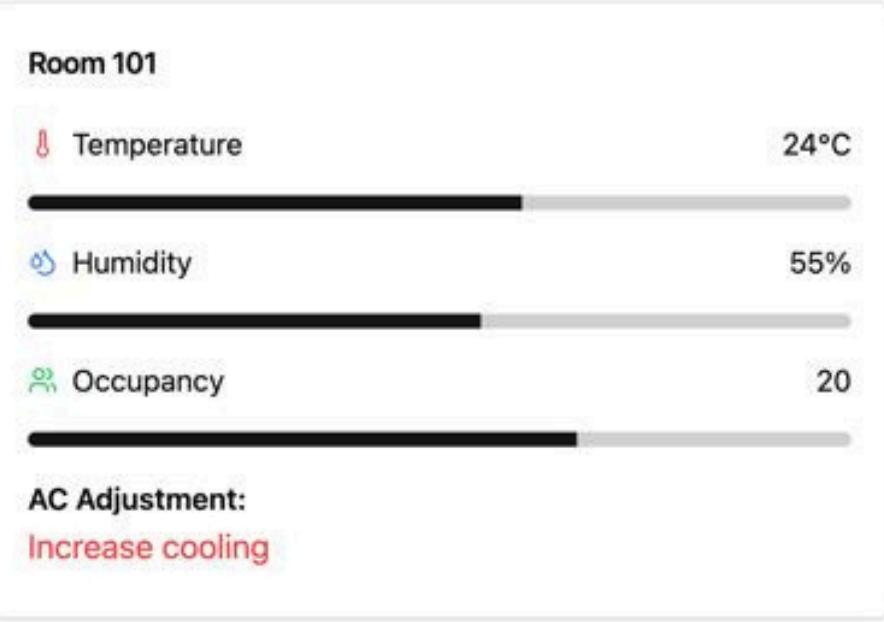
Energy Savings Potential

Demonstrated potential energy savings by optimizing AC usage based on environmental and occupancy data.

RESULTS

Classroom AC Adjustment System

Classrooms Analytics



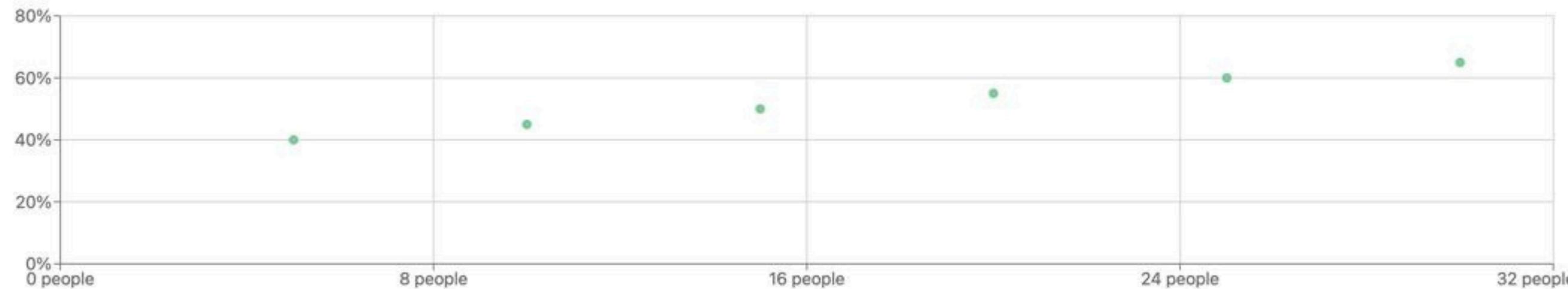
Classroom AC Adjustment System

Classrooms Analytics

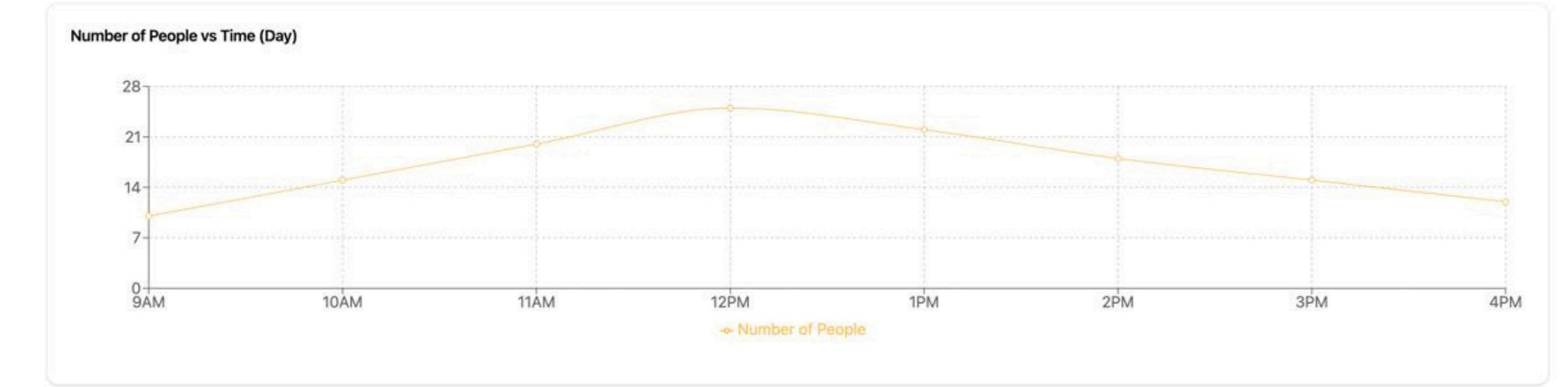
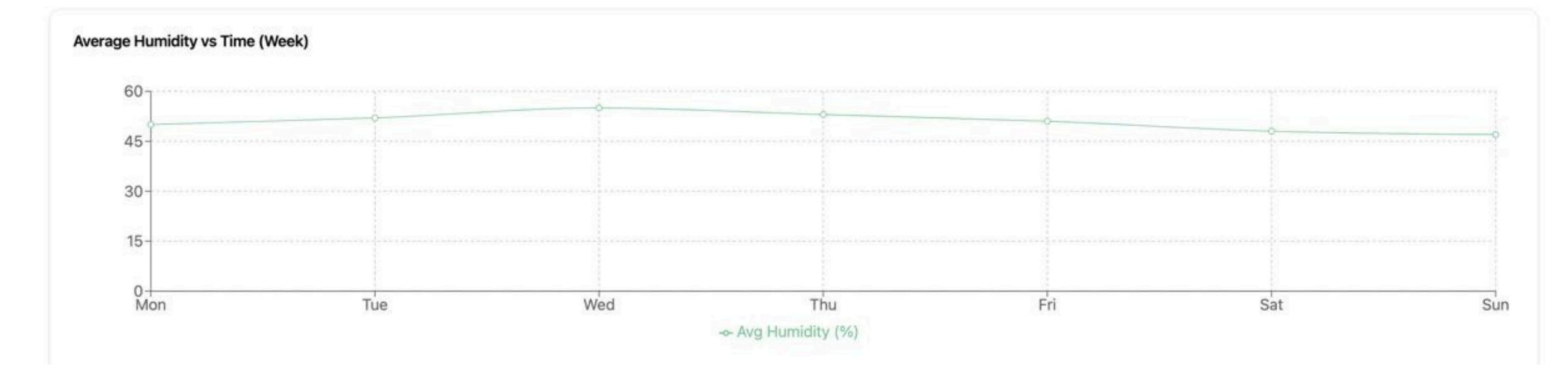
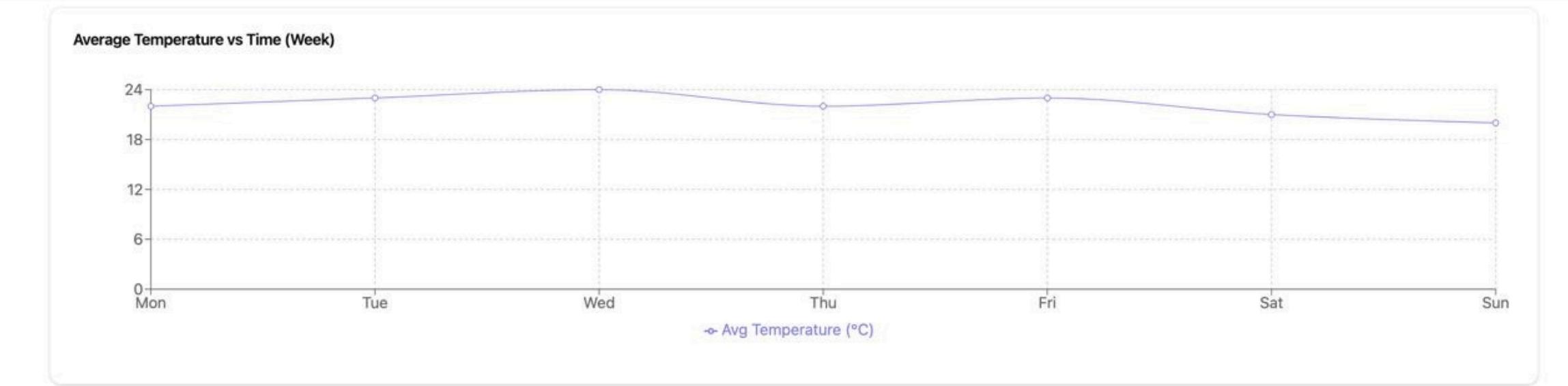
Number of People vs Temperature



Number of People vs Humidity



Average Temperature vs Time (Week)



How It Can Be Taken Forward

IoT Integration

Integration with IoT devices:
Direct control of air conditioning
systems based on the suggestions.

Improved Accuracy

Improved Accuracy: Use advanced
AI models for more precise people
detection.

Cloud Integration

Cloud Integration: Store and
analyze long-term data for better
energy management insights.

Scalability

Scalability: Expand the system to monitor multiple
classrooms and generate centralized reports.

Additional Sensors

Additional Sensors: Include CO2 sensors for better air
quality monitoring and adjustments.