User-Friendly Irrigation System

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Introduction

- Climate control systems are critical in greenhouses to survey an array of conditions such as water flow, water temperature, light levels, and the electrical conductivity of soil.
- Constant monitoring of the irrigation system paired with active work in the greenhouse is necessary to solve any problems that arise, making easy accessibility to the system crucial.

Problem: The MacFarlane Greenhouses on Main Street struggle with this access issue as well as remotely retrieving data since their irrigation dashboard is confined to a single desktop computer. Despite the existence of other solutions, they are expensive and upgrading outdated systems are also very costly.

Objective

To improve their current irrigation system, we have created a web application that is both simple to navigate and remotely accessible. Sprout aims to become an affordable irrigation web app that increases the efficiency, convenience, and responsiveness of greenhouse work.

Methodology

- The greenhouses are already equipped with irrigation hardware, so, this project focused on developing a controller that connects to the existing hardware.
- The controller utilizes an external server to transmit data and receive commands.
- Users interact with the system through the front-end in the form of a website by setting watering schedules and viewing statistics for internal conditions and water usage.
- The website then communicates with the backend based on the actions of the user.

Data Flow

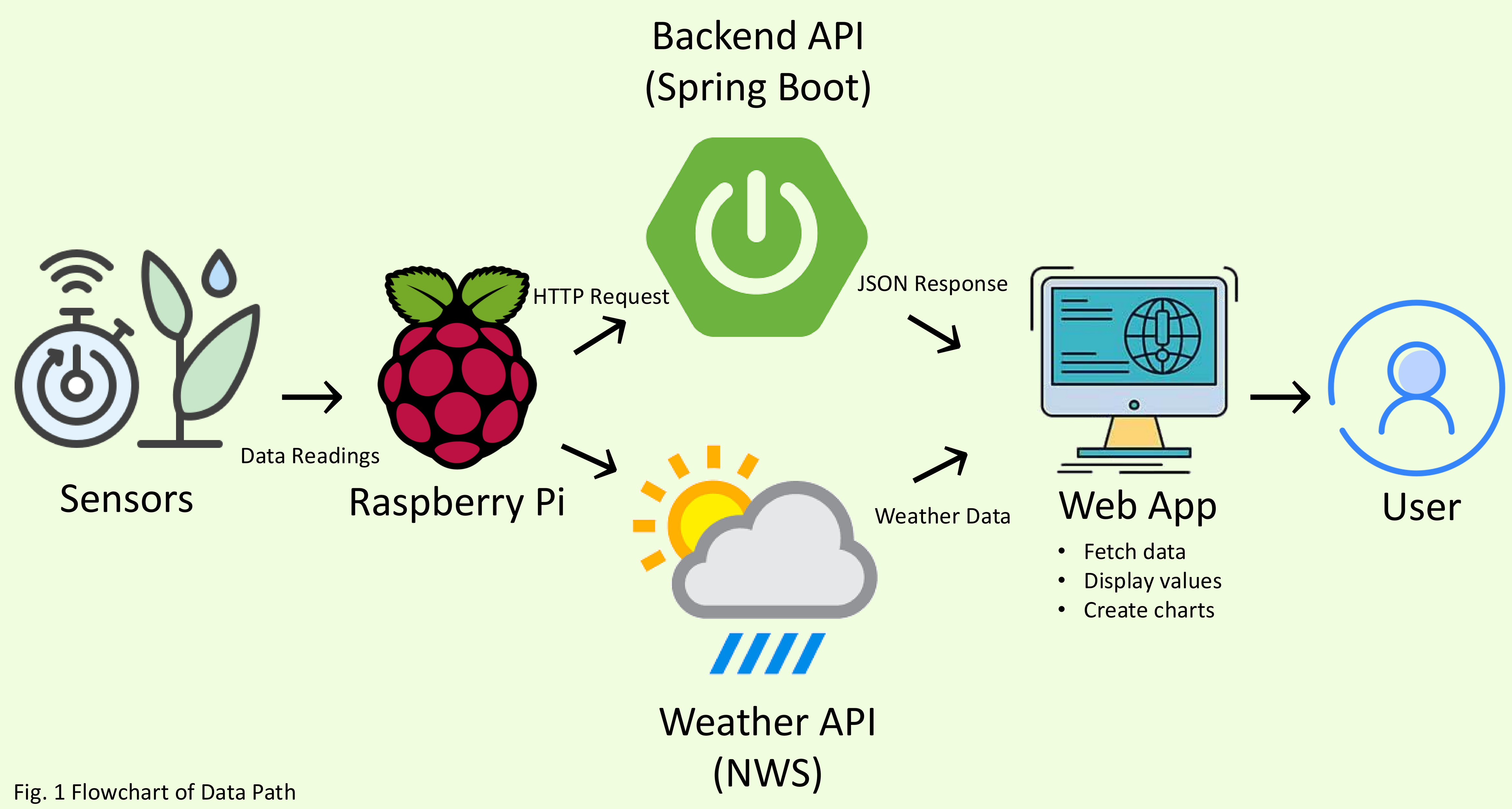

Fig. 1 Flowchart of Data Path

Visuals

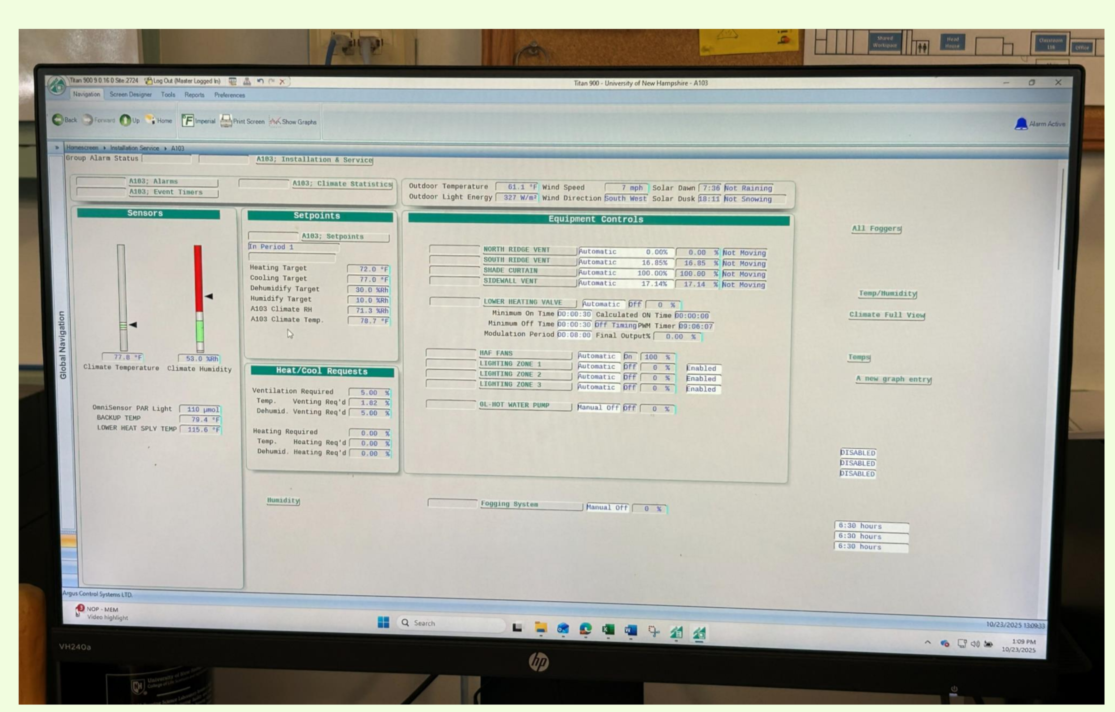

Fig. 2 Desktop computer displaying control dashboard of current system

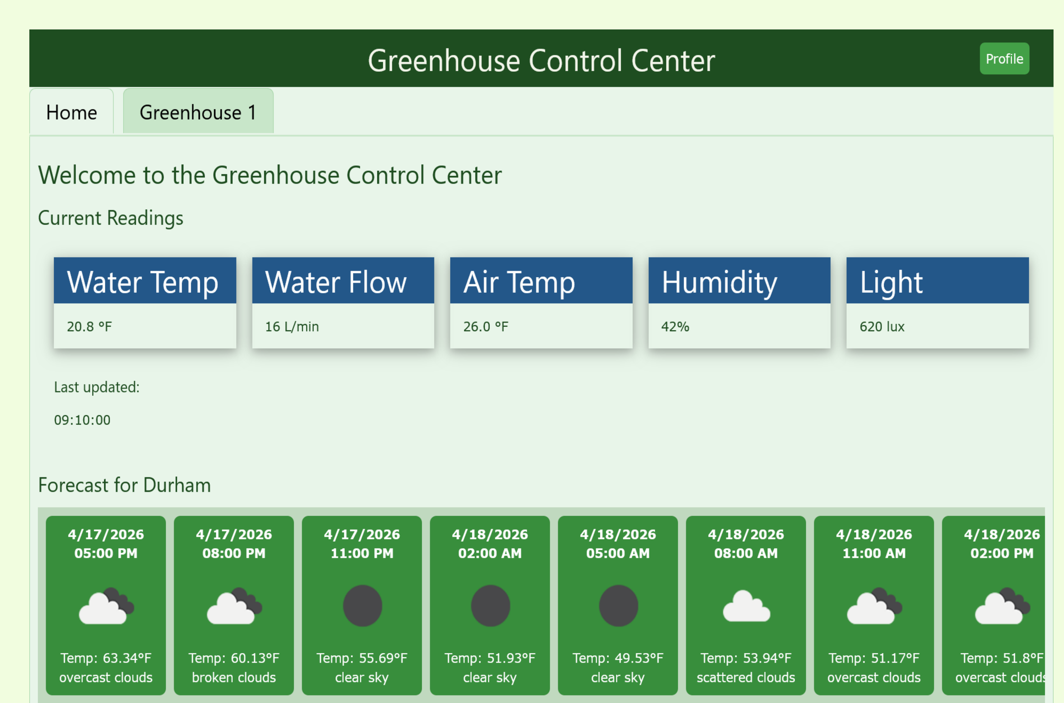

Fig. 3 Screenshot of Sprout Dashboard

Fig. 3 Greenhouse's current control box

Fig. 4 Greenhouse's current watering/sensor system

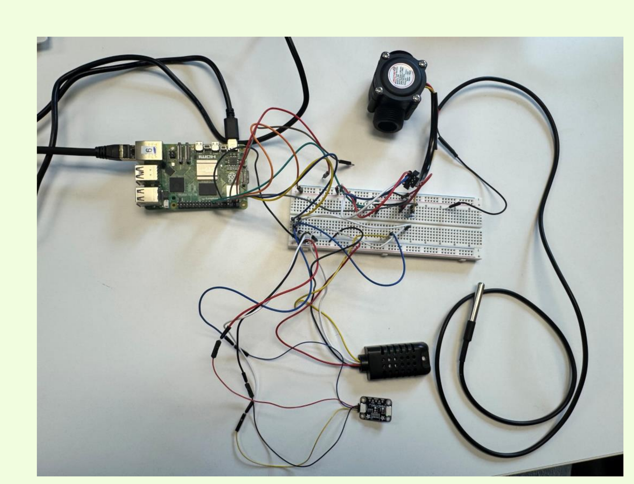

Fig. 5 Our system's architecture

Conclusions

Outcome:
- Data readings visualized on web app
- Weather data from API also displayed

Takeaways:
- Understanding mechanics of greenhouse irrigation systems
- Implementation of responsive web design
- Utilization of Spring Boot Java framework to build embedded server and store data
- Configuration of raspberry pi with sensors
- Parsing JSON response using FETCH API and front-end scripts to load data onto website
- Wiring of numerous sensors onto same breadboard without conflicts
- Familiarization with version control, GitHub, and HTML for adjusting sites
- System architecture

Future Work

- Hosting server on AWS to manage data without compromising security
- Addition of watering schedules, notifications, and data clearing
- Testing the system at the greenhouse
- Expand hardware coverage—multiple zones
- Addition of more sensors (pH, electrical conductivity, CO_2)
- Scaled up for real agriculture, mobile apps
- Implemented in home gardening & urban farming

Acknowledgements

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