AUTOMATED AGRICULTURE FRONTEND

Supervisor: Christian Muise
Members: Eric Jin, Caleb Lam, Juergen Shantz

Queen's UNIVERSITY
COMPUTING

INTRODUCTION

The Automated Agriculture Frontend Team worked with the MIB lab and MuLab to build a frontend for a lab-scale autonomous agriculture platform. The project consists of three components: Home Assistant Dashboard, Video Scrub Dial, and Kibana, Elasticsearch Database. Together, these elements form the backbone of a robust frontend system, designed to revolutionize the way we monitor, analyze, and manage the health and status of plants within an automated agricultural setting.

The Home Assistant Dashboard offers a user-friendly interface that provides real-time insights into the operational dynamics of the agriculture platform.

The Video Scrub Dial allows for rotating through time-lapse videos capturing plant growth.

Kibana, serves as the visual interface to the Elasticsearch Database, a powerful analytical engine capable of processing vast amounts of data generated by the sensors in the agriculture platform.

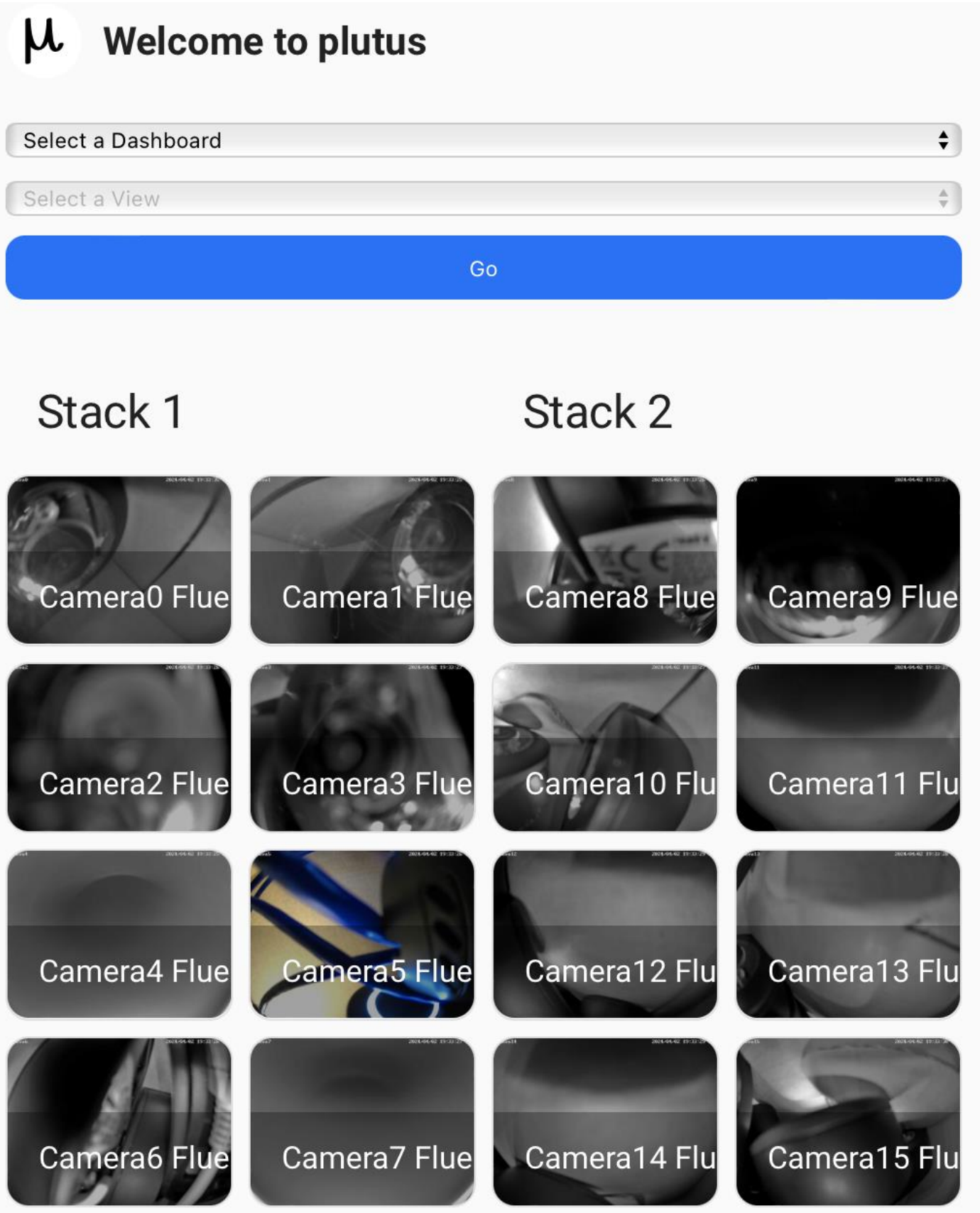

Figure 1. Vertical Farm Illustration.

Figure 2. Main Dashboard in Home Assistant.

HOME ASSISTANT DASHBOARD

The dashboards implemented in Home Assistant (HA) platform stands at the forefront of the plutus' user interface. The dashboards are developed for the vertical farm using JavaScript and configured in YAML in HA.

The main dashboard provides users an overview of the system, the ability to select a target view to navigate to, as well as all camera footage in the layout of the actual vertical farm.

The two stack dashboards provides camera view of each grow zone. A simple click on a camera transports users into a full-screen live feed. By pressing and holding on any camera view, users can seamlessly navigate to a dedicated view for that specific grow zone. Additional card groups can be found in the grow zone views, designed to incorporate each individual plant sensors, and historical graphs of the sensor data.

Overall, the home assistant dashboards allow users to seamlessly monitor and manage the vertical farm.

VIDEO SCRUB

Our hydroponics system has a Microsoft Surface monitor next to it that monitors the status of the plants. Users can utilize the Microsoft Surface Dial to scrub through recorded videos of the plants through its various features.

My (Caleb) task consisted of testing the possible interactions of the dial through Javascript, and using those interactions to help users navigate through the dashboard and videos of the plants. One of those interactions is the rotation of the dial. A scrub through a loaded video of the plants would occur when the user places the dial on the screen and rotates it.

A method that I used during the first phases of the project was to write a Javascript code that attempts to capture all events of the dial using an Event Listener, then uses the information given by the events to implement them in a future code. For example, the Wheel event in Javascript captures perfectly the rotation of the dial. I can detect and use it to change the progress of a given video in my code. With this interaction, users can scrub through a video of a plant in a given grow zone simply by moving the dial there and rotating it.

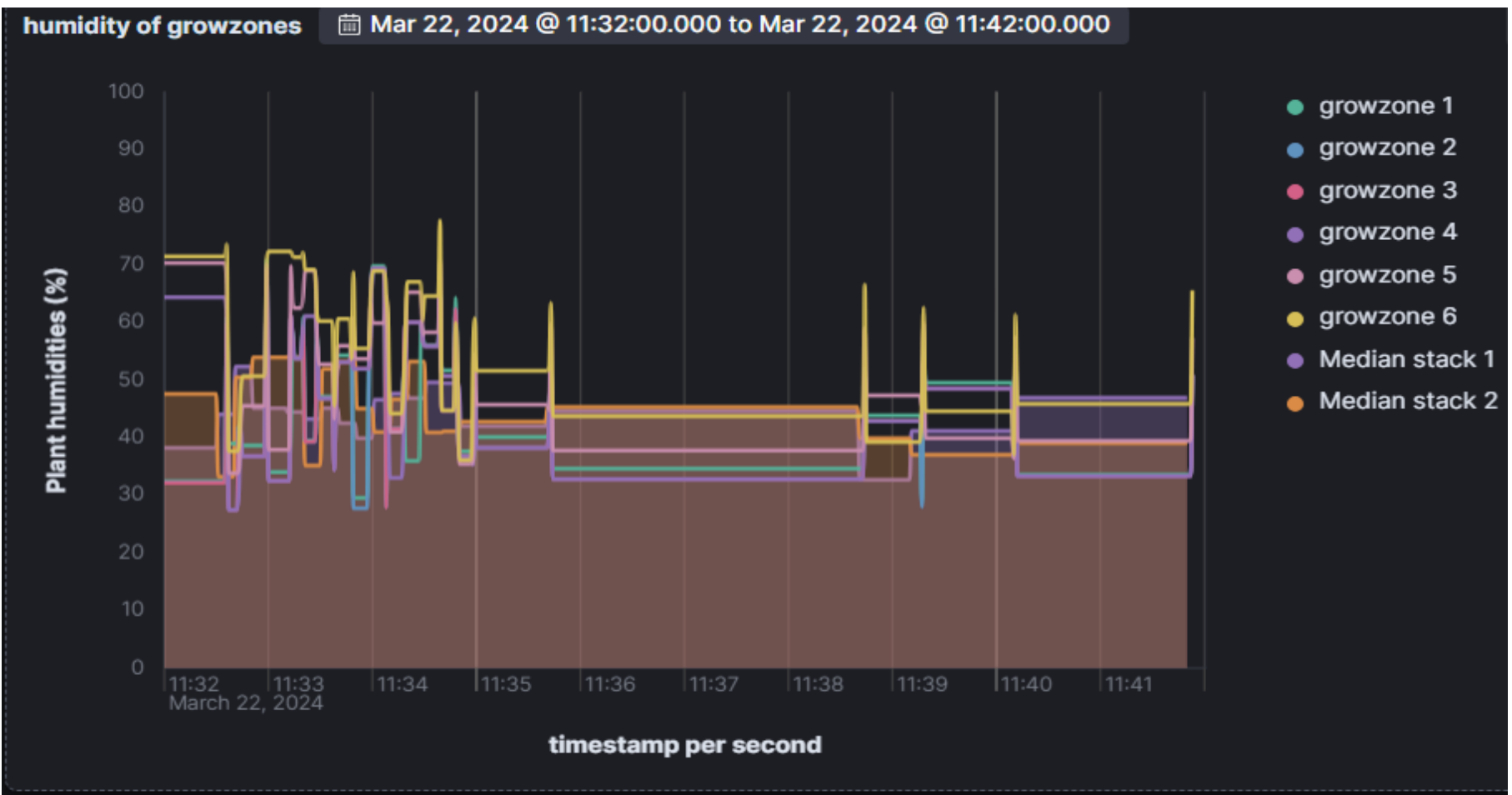*Figure 3. A user pressing on the Microsoft Surface Dial*

Figure 4.iKibana visualisation of current brightness levels in the lab.

KIBANA AND ELASTICSEARCH

The MuLab Vertical farm logs a massive amount of data on any given day on every plant's health, including their moisture levels, temperature, and brightness levels. To securely log the data, and to create meaningful plots with the data, we have used Kibana and Elasticsearch.

The data visualization of Kibana end Elasticsearch is impressive. With so much data available from the smarthome sensors we needed a way to securely log the data, as well as visualize it to make experiments and the monitoring of plant health easier. Kibana is a robust data-visualization software that implements Elasticsearch, a powerful search engine for logged data.

The average of the moisture levels, brightness levels, and temperature are all on display in Kibana, for each plant on every tray and every stack. Other graphs include the standard deviation for each metric, median, and count of unique values. Built in filters were built for each stack, tray and grow zone which provide researchers with easy access to the stats they need, as well as data sliders to narrow the time results for each graph.

In the lab, the Kibana dashboards will be displayed on the smart home dashboard for each plant growzone, allowing the researchers to look at the plants stats real time before adjusting brightness, temperature, etc. from the smarthome dashboard.