README.md

Greenhouse Monitor (IoT project)

A greenhouse digital twin project using unsupervised machine learning for image processing complete with IoT, Cloud, Website and Hardware infrastructure, working on RPI4's. Developed by Ioannis Tsabras and Stavros Kanias (Patra, 2023).

Censor device

Edge Computing

Website

Structure

- SQLite database
- HTML, CSS and JavaScript front end
- Node.js backend

Features

- Secure login with encrypted passwords in the database
- View the most recent greenhouse and plant measurements
- Full overview of every greenhouse including a digital twin (table of plants with colored cells corresponding to the plant's health)
- Plot showing the growth (size and leaf density) of each plant with time
- Automatic reload of the plant and greenhouse page as soon as a new measurement arrives, using a public MQTT broker and the node.js MQTT interface
- Email notification to the user after the completion of each new measurement
- Create custom test database with Python
- Start a new measurement in a remote greenhouse with the press of a button
- Register new greenhouses (to be implemented)
- Automate the measurement process by setting a standard measurement frequency (to be implemented)

Dependencies

- Front end
    - Bootstrap (5.2)
    - Ajax
        - paho-mqtt (1.0.1)
        - jquery (3.6.1)
- Backend
    - Python (3.10.10)
    - Node.js (18.12.1)
        - assert (2.0.0)
        - bcrypt (5.0.1)
        - better-sqlite3 (7.5.3)
        - body-parser (1.20.1)
        - express (4.18.1)
        - express-handlebars (6.0.6)
        - express-session (1.17.1)
        - file-type (18.0.0)
        - fs (0.0.1-security)
        - mqtt (4.3.7)
        - multer (1.4.4-lts.1)
        - node-fetch (3.3.0)
        - nodemailer (6.7.5)
        - nodemon (2.0.3)
        - path (0.12.7)
        - plotly.js-dist-min (2.17.1)
        - sqlite3 (5.0.8)

Installation and setup

1. Clone the repo
2. Install node.js (https://nodejs.org/en/download/)
3. To install the dependencies
    - cd into the Website directory
    - Run

```
npm install
```

4. In a terminal

- cd into the Edge_Compute directory
- Start greenhouse device service (on port 3000) by running

```
node controller.mjs
```

5. In another terminal
   - cd into the Website directory
   - Start the website service (on port 4000) by running

```
npm run watch
```

6. Open your browser (on port 4000) and login with the following credentials

- Username: SpanokhristodoulouErato911
- Password: 1234

A basic Measurement Use Case

To initiate a simple measurement:

1. Login
2. Tap on the 'Greenhouses' option on the taskbar
3. Choose the greenhouse for which you want to start a new measurement
4. Once the greenhouse page opens click on the 'New Measurement' button on the bottom right of the screen
5. A small popup message will notify you of the begining of the new measurement
6. When the measurement ends and its data is stored in the database a full screen popup message will notify you about the event and the page will be refreshed in order for the new data to be served to the front end.