State University of New York at New Paltz

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"Moisture, Humidity, and Temperature Control for a Garden Container"

FINAL PROJECT REPORT

Embedded Linux

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1. Project Description

The “Moisture, Humidity, and Temperature Control for a Garden Container Project” is meant to retrieve and monitor the containers current environment. For this project, various sensors that detect temperature, humidity, and moisture are placed inside a container and log the data when prompted to by a program. The project is responsible for sending the retrieved sensor data to a remote site where it will list and display the humidity, temperature, current date, and detection of moisture in the container. The user may view this information from either their desktop or mobile device. In addition to logging the sensor data, the system will detect when the plant inside the container is running low on water. In response to this, the system will then pump water into the plant for an undetermined amount of seconds.

2. Project Goals

Our overall goal for the project is to implement a system that monitors the soil and ambient atmospheric conditions of a container that holds plants. Some of the supplementary goals are to create a 3D printed encasement, making the site mobile friendly, and automating the process of retrieving and sending the sensor data to the remote website.

3. Implementation

Automation of the entire program is handled by a main “Expect” script, which then runs a series of Shell scripts. Regardless of the automation scripts, the system software can continue to function normally without them. A python script retrieves the data from the sensors and uses the MySQL library to store the information into a database once the script finishes executing. The python script also stores information to a JSON file and uses the “count” variable to determine when water should be pumped into the container. The newly inserted sensor data is then dumped from the MySQL database. After that the exported SQL data is sent to the remote web server over SFTP and places it in a specified folder on the Wyvern server. On the Wyvern server it then imports the new SQL data into its MySQL database. Once the SQL file is imported, the remote site is then updated with the newly inserted values provided the user refreshes the webpage.

4. Components

4.1 JSON Component

The JSON component is responsible for storing and retrieving persistent data from a JSON file after the python script finishes executing. It reads from the JSON file and uses that information to check if the motor should be turned on.

4.2 Automation Component

This component is responsible for the automation of all programs. The component handles everything through the use of command line arguments and a python script. This component uses Shell, Expect, SFTP, SSH, Python, and MySQL.

4.3 Website Component

The website component is responsible for interacting with the MySQL database and displaying the data through the use of a PHP script. This component uses the Wyvern web server, PHP, HTML, Initializr, and MySQL.

4.4 Sensor Component

Hardware sensoring components include the brushless water pump, YL-38 and YL-69 soil moisture sensor, and the DHT22 temperature/humidity sensor. The components were connected to a breadboard and wired to the Rasberry Pi 3. A Python software program controlled the motor and collected data from the sensors.

5. Difficulties and Successes

5.1 Project Difficulties

One of the “tough” aspects that was encountered during this project was the Wyvern server. Because regular New Paltz students do not have access to the “sudo” command, a few workarounds had to be made in order to properly get the automation working. Some of the “bad” aspects were having to use a 3rd party library to retrieve data from the DHT22 sensor, wasted development time on trying to use Wordpress for the web app, and trying to wire the temperature probe and pump. The wires on some of the components were terribly frail and impossible to connect without modification. Moreover, it was difficult to obtain documentation for the water pump.

5.2 Project Successes

The “easy” aspects was putting the website together since Initializr allows you to deploy. The “good” was how it was possible to automate everything with Shell scripting and that there was a large number of guides and documentation to help with any troubleshooting issues. Everything from the required hardware to software aspects described in the project description were successfully completed.

6. Group Member Contributions

6.1 Jason Goodman

Responsible for the creation of the website, automation scripts, MySQL database, JSON, component, documentation, python script that retrieves sensor the data, and PHP script. Was also responsible for the wiring of the DHT22 sensor, temperature probe, and soil moisture sensor.

6.2 Karen Ho

Created and implemented the python code responsible for controlling the water pump, wired the water pump for the breadboard, improved the wiring for the breadboard, and created the encasement.

6.3 Kevyn Martinez

Fixed the footer for the website.

7. Resources & References

Expect: http://expect.sourceforge.net/
Shell: https://en.wikipedia.org/wiki/Shell_script
Initializr: http://www.initializr.com/
MySQL: https://www.mysql.com/
Adafruit DHT22 Library: https://github.com/adafruit/Adafruit_Python_DHT
Apache: https://www.apache.org/
JSON: http://www.json.org/
*Github: https://github.com/N02775223/ELSpring2017
In the "Code" folder on the github page there are instructions on how to setup the entire project.