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Plant helper - plant caring system with application

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Class: Intermediate Project

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Abstract

The project assumed the development of a desktop application with an addition of an external system that combined would allow a user to control the state of a collection of house-plants. It was aimed to aid a person who does not know how to take care of the plant, most importantly how often to water it and what sunlight intensity is accurate.

Majority of requirements for the success of the project was met. The external electronic system can easily connect with PC application and continuously send the humidity and light intensity measurements to it while the desktop program is responsible for plotting the data, allows user to save their plants and regularly check on their status. It also informs the external device which plant is now analyzed and automatically watered.

1 Introduction

Various plant caring systems are widely known among house-plant enthusiasts who do not have much time to take good care of their plants or who lack some plant caring skills. Such systems mostly are phone apps or electronic devices that autonomously water or illuminate the plant. The downside is that rarely those systems combine the app with the latter, or even if that combination is available then it is quite expensive. There often is the case that the user has to adjust light or humidity levels by himself, which can be a challenge for amateur care takers.

This project envisions cheap construction of a watering system, along with measurement collection, that already has built-in adjustments for each of the plants from the database.

2 Description of the project

This section describes in detail what measures where taken into account through development of the project and what modules or programming libraries where used.

2.1 Electronic system

To successfully collect data and in dependence of humidity level water the plant following parts where used:

- Raspberry Pi 3B+ board with built-in Wi-Fi module,
- APDS 9960 light sensor from adafruit
- DRV8838 single channel motor controller
- ADS1115 analog digital converter
- FC28 soil moisture sensor
- 3V3/5V mini pump

On Figure 1 we can see the connection graph.

RaspberryPi function as main MCU. It is powered by a common phone-charger via USB cable. WiFi module built-in the microcontroller allows for connection between the desktop application and the external electronic system. Communication is established using MQTT Protocol which is a lightweight messaging protocol for small sensors and mobile devices, optimized for high-latency or unreliable networks. To the Raspberry several modules are connected. One of which is APS1115, which is an external analog/digital converter, with four independent channels. It allows to expand the system in the future, so multiple plants could be simultaneously taken care of. Directly to it, humidity sensor is connected. This sensor uses the soil as a capacitor, which stores part of an electric charge that is run through two electrodes inserted into the soil. The pump is connected via a motor controller which receives a PWM signal from the RaspberryPi and generates an output current enough to run the pump motor. On figures 2 and 3 we can see the assembled system, connected to the plant. The software for this part was developed using Python 3.8

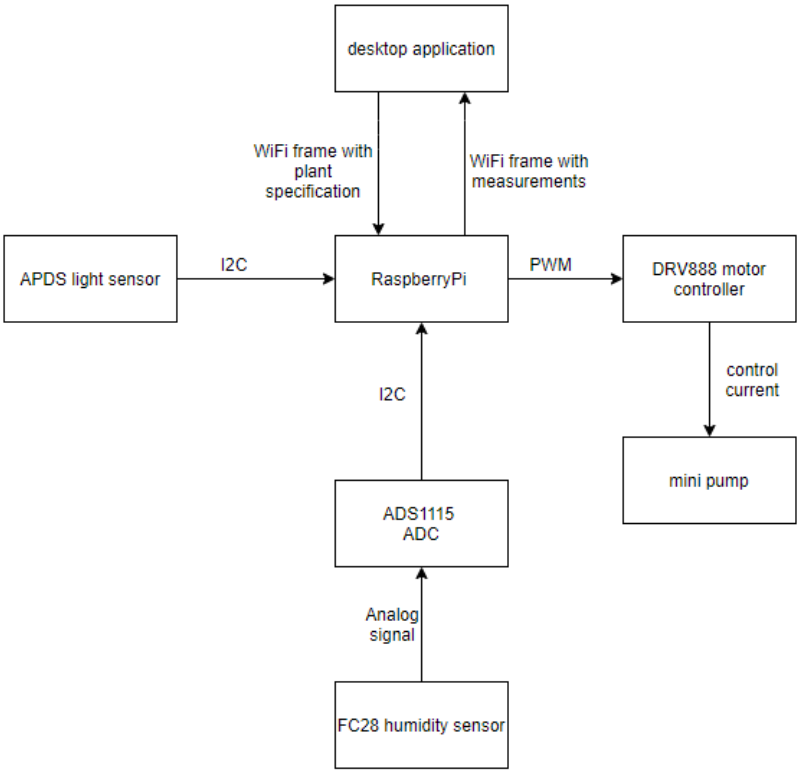

Figure 1 – Connections between modules

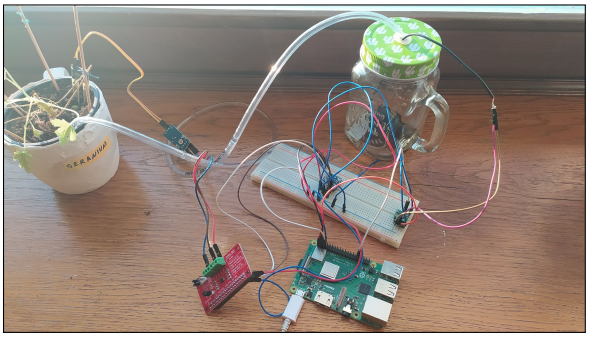

Figure 2 – assembled system

Figure 3 – plant close-up

2.2 Desktop application

The PC program was the majority of work during development of the project. Software, build with Qt libraries consists of many C++ classes connected on GUI that allow user to add, delete and manage plants. The main window is presented on Figure 4

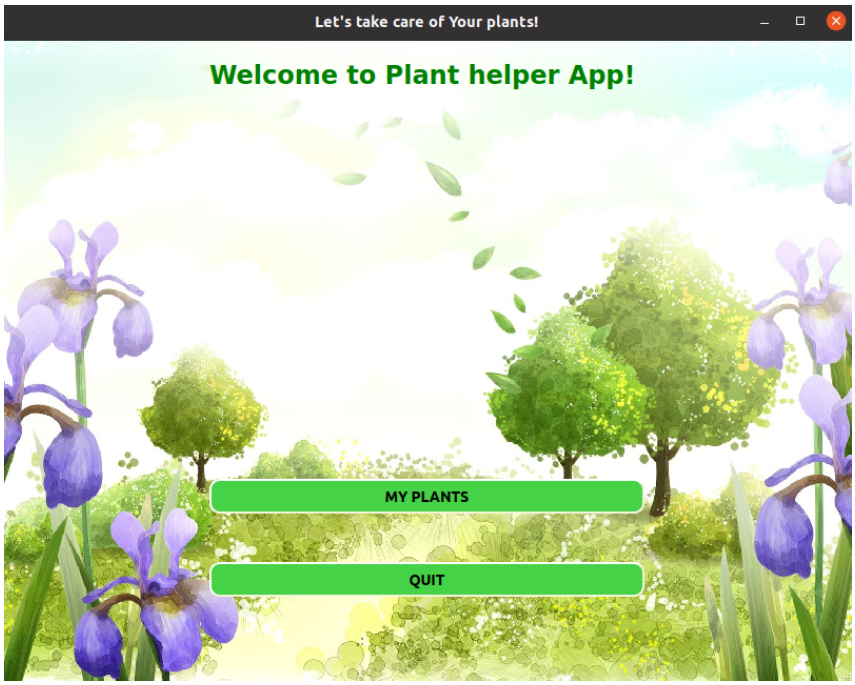

Figure 4 – Connections between modules

From there, the user can move to "my plants" page, presented on Figure 5, to manage his collection. In this window, the user if first presented with an empty page with large green button, encouraging adding new plant. After clicking it, the list of available plants is shown, so the user can click the button 'add' to accept the plant. After it is added, it is automatically saved to file, so the plant will be there every time someone uses the app. After clicking the plant picture, the user is redirected to the page of the specific plant. The example of such a page can be seen on Figure 6. On this page with have following widgets:

- humidity plot
- light intensity plot
- average humidity from last 24 hours
- average light intensity from last 24 hours
- plant picture
- plant description
- delete plant button
- automation on/off checkbox

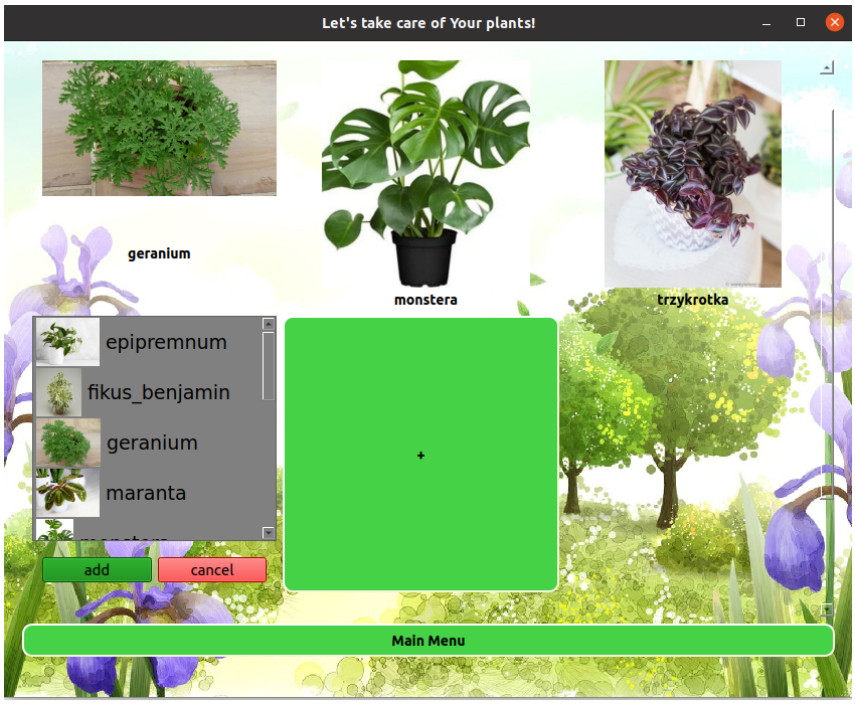

Figure 5 – Connections between modules

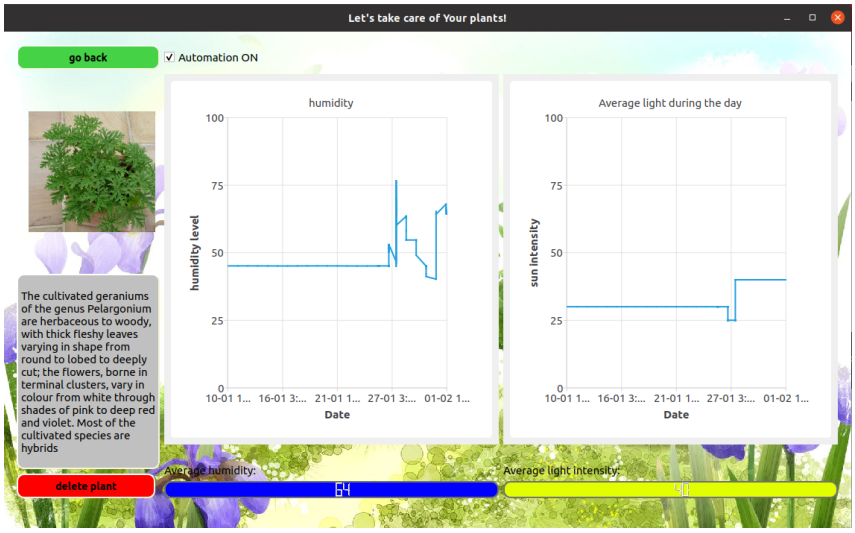

Figure 6 – Connections between modules

Each of the widgets are appropriately programmed. Most important thing for looking after of the plant are plots, which show the data provided by sensors, and sent through WiFi from the raspberryPi. Based on that, one can easily decide whether his plant is placed in good spot or if it is under or over watered. The only thing that was not programmed yet on this page is color indication whether the environmental conditions levels are too high or too low. Another function, crucial to the whole system is "Automation ON/OFF" checkbox in left-top corner. It allows the user, to set currently analyzed plant, so to change it they would only have to check the box on another plant, and switch the sensor and pipe placement. With more sensors and pumps, several plants could be checked, and the program would distinguish which data comes from which plant, as it is solved with MQTT topics.

3 Results

The project met vast majority of the assumptions, however it met all the conditions to work properly. It still can be enhanced in many ways, as there is a lot of potential to it. There are a few advantages of that system. One of which is that is powered by common phone charger, which everyone has available, another is that most of the parts are very cheap, so the actual cost for a system taking care of 4 plants is about 200zł. Another is that the system combines sensors, pumps and the desktop application. In future it could be also migrated to android system.

4 References

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