SYSC3010

Project Proposal

Last Revised: September 29, 2019

Group: W11

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Problem Overview

Increased productivity, enriched health and wellbeing and a decrease in stress are just some of the benefits that you will attain from growing an indoor plant with SmartGrow. Indoor plants provide a significant boost to the indoor living-quality of our lives by bringing the great outdoor fresh air into our homes. Listed are some of the benefits of having indoor plants.

Figure 1: Benefits of indoor plants [1]

Maintaining and growing indoor plants can be a difficult task for us to balance with our work, school and social life. The SmartGrow makes it easier for the user to grow multiple plants in our homes by:

- Automatically watering the plant by tracking the soil moisture
- Adjusting the light environment by tracking the light intensity of the room
- Providing feedback on the air temperature and air moisture of the plant
- Providing customized preferred growing conditions for a large range of plants

SmartGrow takes the hassle of growing indoor plants from your hands into ours while providing a better home environment.

Design Solution

The following figure presents an architectural overview of the system as a collection of distributed systems that communicate through Wi-Fi, ethernet, and serial layers.

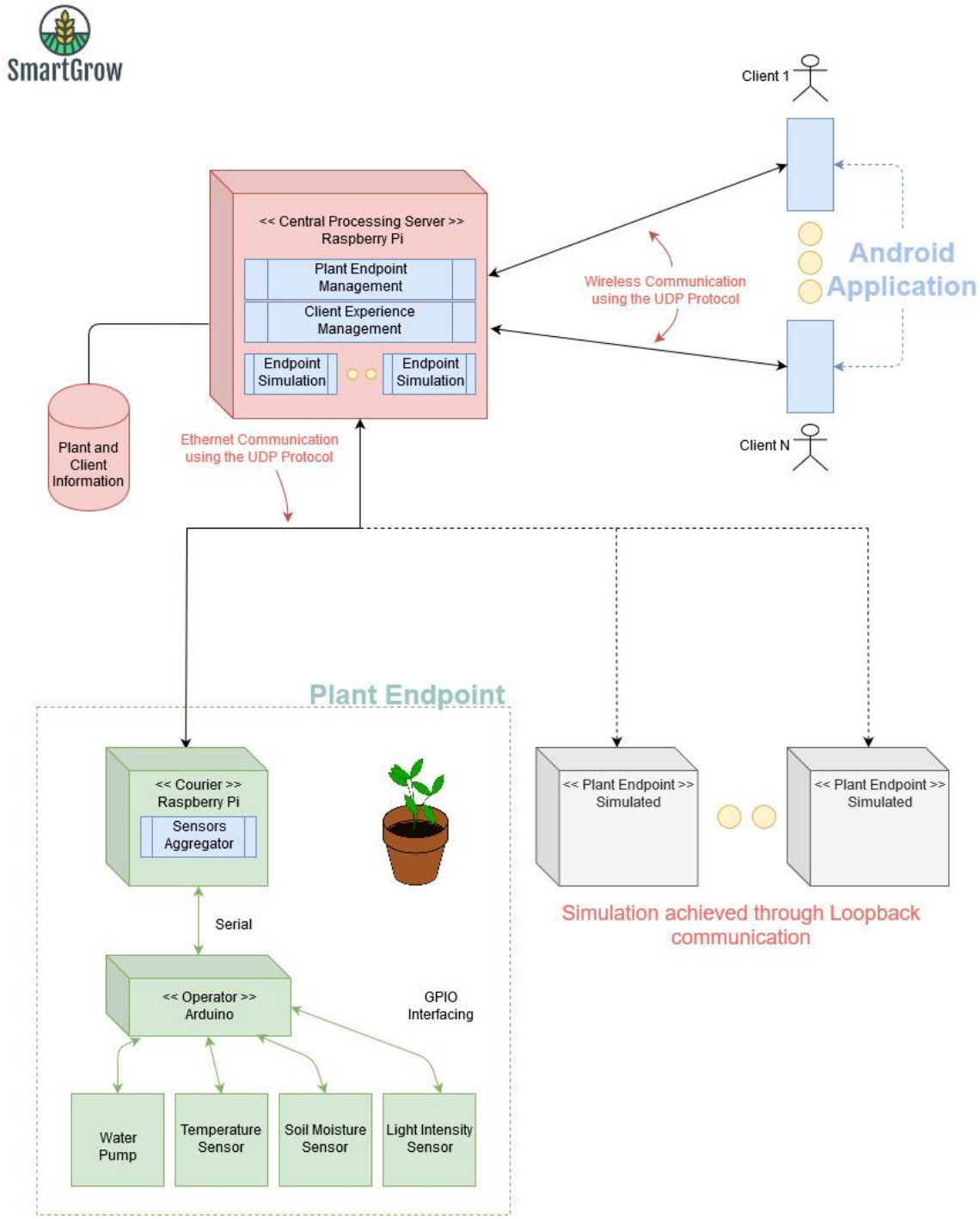

Figure 2: Architectural Overview of the SmartGrow System

The SmartGrow system is composed of 3 subsystems: **Plant Endpoints, Central Processing Server,** and **Android application**.

Plant Endpoints

A plant endpoint is a system that is spatially located on the target plant to allow for sensory data collection. The endpoint system consists of a **Courier**, **Operator**, and **sensors**.

- **Courier**
  - Sends and receives packets to/from the central processing server.
- **Operator**
  - Polls all sensors through periodic loops and transmits the data over serial to the courier.
  - Activates the water pump if requested by the Courier

Central Processing Server (CPS)

The CPS enables the flow of data from end-to-end, compares sensor data to reference data (from the database), and sends data over wireless to the appropriate clients for displaying on the android application.

In order to achieve the previously mentioned functionality, the CPS will divide the work into three parallel entities:

- **Plant Endpoint Management**
  - Interfaces with all plant endpoints through the ethernet link-layer
  - Compares received sensory data with reference data in the database
- **Client Experience Management**
  - Services all requests initiated by clients through the android application
  - Transmits sensory data of plant endpoints to the relevant clients
- **Endpoint Simulation**
  - Comprehensive simulation of a plant endpoint to demonstrate the scalability of the SmartGrow system

Android Application

The android application is the client Graphical User Interface (GUI) for viewing the data flow in the system. Using the application, clients will be able to:

- Specify the plant type that is being monitored
- View real-time sensory information from the plant endpoint
- View graphs of sensor information over a specified period

Testing

Testing of the individual features will be done along the way to reduce the hassle that will accumulate towards the end of the process. Testing all the features collectively will be done in conjunction with other tests towards the end.

Plant Endpoints

- **Sensors** will be configured to 95% confidence level before integrating with the hardware.
- The **operator** (Arduino) will be tested ensure that each sensor is working properly. If not, an error message will be sent to the application.
- The **courier** (Raspberry Pi) will be tested to ensure that data is being sent and received. If not, an error message will be sent.

Reference results for each sensor:

Table 1: Water Pump and Soil Moisture Sensor

Reference Results	Soil sensor detects not enough moisture	Soil sensor detects too much moisture
Pump releases water	True Positive	False Positive
Pump does not release water	False Negative	True Negative

Table 2: Temperature Sensor

Reference Results	Temperature surrounding the sensor is increased	Temperature surrounding the sensor is decreased
Temperature sensor reading on the application increases	True Positive	False Positive
Temperature sensor reading on the application decreases	False Negative	True Negative

Table 3: Light Intensity Sensor

Reference Results	Light is directed to the sensor	Sensor is shaded
Light sensor reading on the application increases	True Positive	False Positive
Light sensor reading on the application decreases	False Negative	True Negative

Central Processing Server

- **Connections** to and from the central server will be tested by pinging certain websites.
- **Comparing the data** received from the plant and the data from the database will be tested for accuracy. Database will contain information about other of other plants.
- **Multitasking** will be tested by using a real plant and at least two simulated plants.
- **Communication handling** will be tested with multiple clients using the application at the same time.

Android Application

- **GUI** will be tested to ensure it responds properly to the client along with showing plant data in real time.
- **Multitasking** will be tested for handling and accurately showing the data to the proper client when there are multiple clients present.
- All the application testing will be done in Android Studio.

Engineering Process

Project Timeline

The following figure provides a weekly summary of the development and design process in order to achieve all previously outlined requirements of SmartGrow.

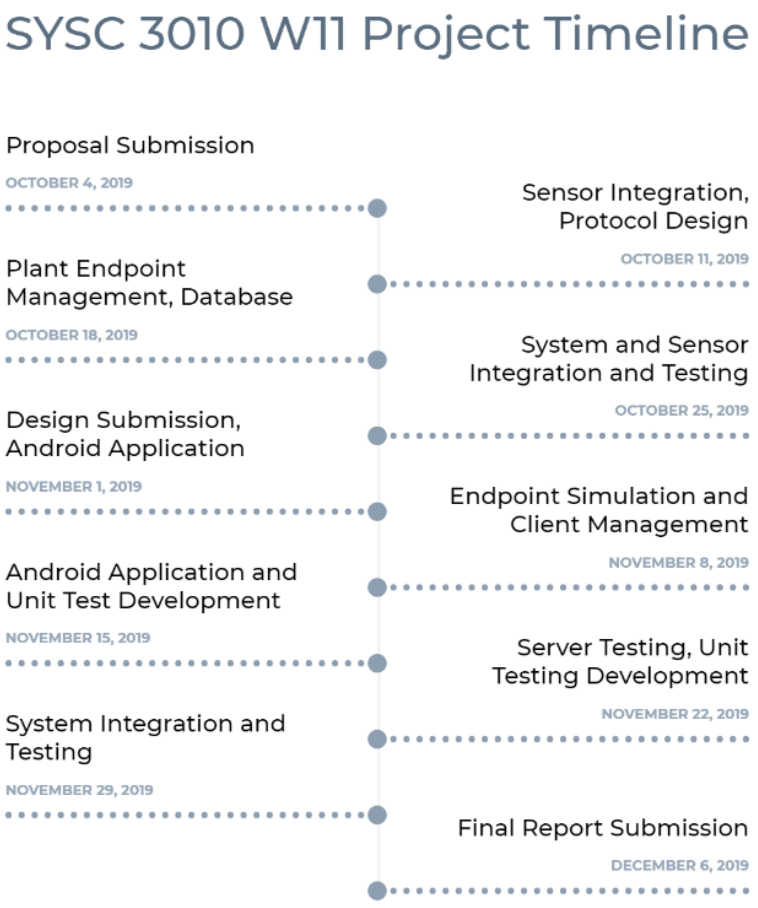

Figure 3: Weekly timeline of the deliverables for the SmartGrow Project

Roles and Tasks

Table 4: Tasks for each member per subsystem

	Plant Endpoints	Central Processing Server	Android Application
Ahmed	Plant Endpoint Management		GUI
Ashfaqul	GPIO Interfacing on Arduino	Endpoint Simulation	Data Management from Plant Endpoint
Valerie	Sensors Aggregation on Raspberry Pi	Client Experience Management	Data Analysis and Aggregation

References

[1] https://lifestyle.co.za/benefits-of-indoor-plants/