aPLANT: A Low Cost Greenhouse Manager System

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I. Statement of the Problem

Most small to medium sized greenhouses have a distinct disadvantage when it comes to the price of plant management devices. While a relatively new concept, plant management on an individual basis has a very valid and measurable impact on the production of crops. Indoor greenhouses are the future of increased yield in limited space, and part of that is minimizing loss better. The problem with most of the implemented systems on the market is the price per feature versus the total number of end units you get for each feature. So with current devices on the market, the user needs to have a sensor per pot to get individual control over a variable in the “growing” equation such as moisture control, ph control, and temperature control. Some things are easily managed with other techniques ex. temperature control. . The modules are usually separate, and typically don’t expand functionality easily to more than one pot. The amount of money for the full sensor array is staggering for most of these systems.

The problem is further exacerbated with the need for these systems to improve in the future to combat the population growth with responsible use of chemicals to nourish and improve growth in an environmentally conservative way. The responsible use of resources contributes to a more utilitarian use of the land to create spaces for people to live and thrive with cheap access to affordable crops or/and an easy home solution.

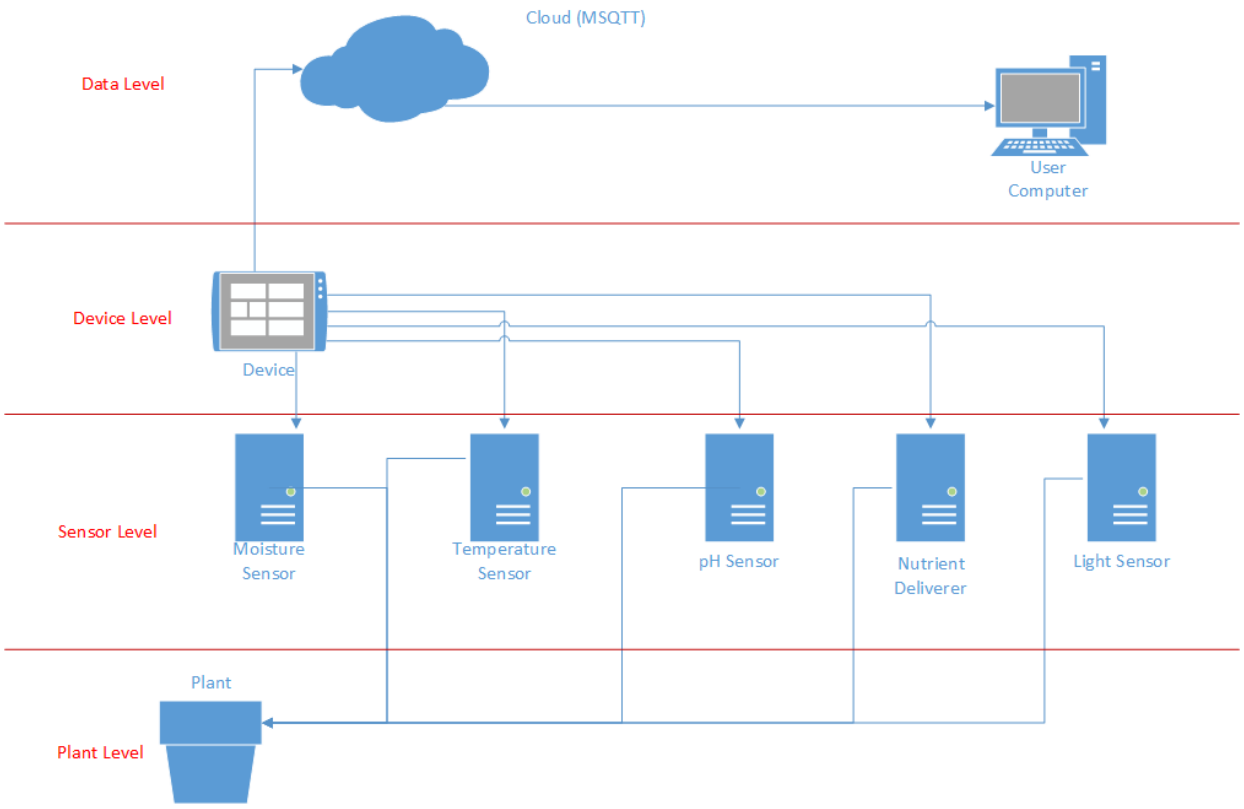

Figure 1: Flow Diagram

II. Functional Requirements

A. Purpose

We intend with this section to give the flow of the project and give a listing of the flow levels. This is not meant to show the physical configurations of the devices most of those will be done at the hardware level using the c environment that is provided by the manufacturer of the ESP8266. The labeling of Figure 1 is not to give a engineering description, but segment based on the users relationship to the system.

B. System Flow Levels

Data Level: The Data Level contains the cloud MQTT (Message Queuing Telemetry Transport) database that has the sensor data arranged into files per sensor type and further divided based on the specific pot from which the data was taken. It will be responsible for outputting the data to the user end to make evaluations from and set up the sensors.

Device Level: The Device Level contains the individual pots arranged by an esp8266 chip designated as the “Controller”. The controller serves as the vehicle for our modularity and maintains connections to the data going to the server, and the configuration requirements that the user wants to set. Our plan is to have a controller be an esp8266 device set solely for this purpose in this functional level.

Sensor Level: The Sensor Level contain all of the sensors and devices to be connected to the plant locally restricted to one esp8266 chip. The different sensors, from moisture to light, will be localized on one esp8266, but for the interest of showing how they will be initialized and implemented it is useful to show them as separate entities, as shown in the flow diagram in Figure 1 on page 3.

Plant Level: The Plant Level will only contain the plant itself, the ends of the sensors, and the connection to the esp8266 module that is interpreting the data and sending it upward to the Sensor Level.

References

1. Simon, M. (2017, November 20). The Hydroponic, Robotic Future of Farming in Greenhouses. Retrieved from https://www.wired.com/story/the-hydroponic-robotic-future-of-farming-in-greenhouses-at-iron-ox/
2. Thomas, P. A., Westerfield, R., & Pennisi, S. V. (2006, June 01). Growing Ferns. Retrieved from http://extension.uga.edu/publications/detail.html?number=B1318&title=Growing Indoor Plants with Success