University of Central Florida
Department of Electrical and Computer Engineering

Hydroponic Implementation for Gardening Herbs Divide and Conquer Group 7

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1.0 Description

Keeping a small herb garden in your kitchen can be very convenient, providing fresh herbs whenever you need them and ultimately saving money in the long run. Due to these benefits, many people find themselves wanting to start their own small herb garden, but for the average person who might not have much experience with plants this can be a complicated task. Even a few small herb plants require sufficient sunlight, careful watering, nutrient supplements, and more.

The motivation behind this project is to create an automated plant care system that can help the average person grow their own plants in their home. The system will be lightweight and can fit on a table top or in a windowsill so it can be implemented in compact spaces like a kitchen or apartment. The system will focus on growing common cooking herbs, like basil and thyme. A hydroponics system will be used to water the plants and provide nutrients. Various sensors will measure the ambient temperature around the plants, the water level within the reservoir, the amount of light the plants are receiving, and the pH level of the water. This data will be used to determine when the plants will be automatically watered, if the grow lights need to be turned on and for how long, and if the temperature is appropriate for the plants. The system will be able to water the plants, add nutrients to the water, and adjust the grow lights automatically. Additionally, the system will send alerts to the user if the water in the reservoir needs to be refilled. The data gathered by the sensors will also be displayed on a screen on the device itself.

Figure 1 shows a sketch of how the system is expected to look upon completion, along with desired features in the design.

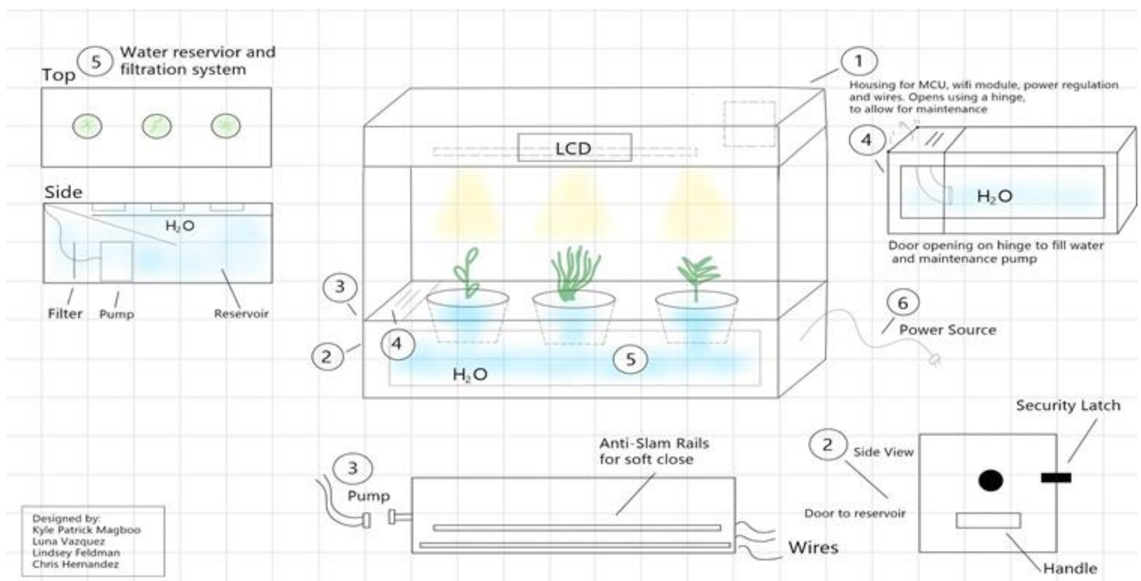

Figure 1: Design Sketch of System

2.0 Goals and Objectives

The goal of this project is to design and create an automated plant growing system that is easy to use so that anyone can easily grow their own herbs in their kitchen. The system should be contained in one device and be powered by a wall outlet. The system is to be automated allowing for it to function using minimum observation. Data will be recorded from the sensors to determine any adjustments that need to be made in the system. The recorded data will be compiled and available for view by the user in a web based interface. Examples of adjustments include lighting, water and nutrients. The user is alerted when a change in the system is made and if they need to do any maintenance to keep the system running properly. These alerts will be sent over wifi. Another goal of the device is ease of use; the system should be user-friendly and convenient. The system's purpose is to grow common cooking herbs, keeping them alive and healthy.

3.0 Requirements/Specifications

Based on the nature of this project and the objectives established by the team, the following engineering specifications were set (**Table 1**).

Attribute	**Value**
Weight (empty)	15 lbs.
Dimensions	32" x 8" x 28"
Water Volume	8 liters
Sensor Measurements	Once every hour or on demand with override
Communication	Wireless
Interface	LCD screen and companion phone app
Camera	Once a day or live feed on demand
Grow Lights	Red, blue, and green LED lights

Table 1: Engineering Specifications

Power Supply: The system will be powered from a wall outlet.

Control: A microcontroller will be used to gather data from the sensors and control the watering and nutrient systems.
Communications: We will communicate with an online database wirelessly. The user can interact with the device through the LCD interface or remotely using the companion phone app.

Sensors: A water level sensor, pH sensor, temperature sensor, and light sensor will be used.

Hardware: The system will include 3 spaces to hold different plants, a reservoir for water, and pumps and filters to water the plants, add nutrients, and maintain the water.

Software: The system will be handling the input from the various sensors and control the hardware used to regulate the growth of the plant. This data will be outputted to an LCD screen attached to the device as well as a companion web interface.

4.0 Project Block Diagrams

In order to depict the functions of our design, the system is broken down into two major block diagrams, the first is hardware (**Figure 2**) and the second is software (**Figure 4**). The following sensors will collect information: temperature, pH, photoelectric, and water level. Additionally, a camera will be used to monitor the plants and take photos. The microcontroller takes in all of the data collected by all of the sensors and camera. The data is processed by the microcontroller and set via wireless communications to the web-based interface. The microcontroller is able to use the data from the sensors to determine if action needs to be taken with the following items: the grow lights, pH regulator, water pump, and nutrient dispenser. An LCD interface will display data collected by the sensors and offer the user control of the system. The entire system is supplied power via a wall outlet.

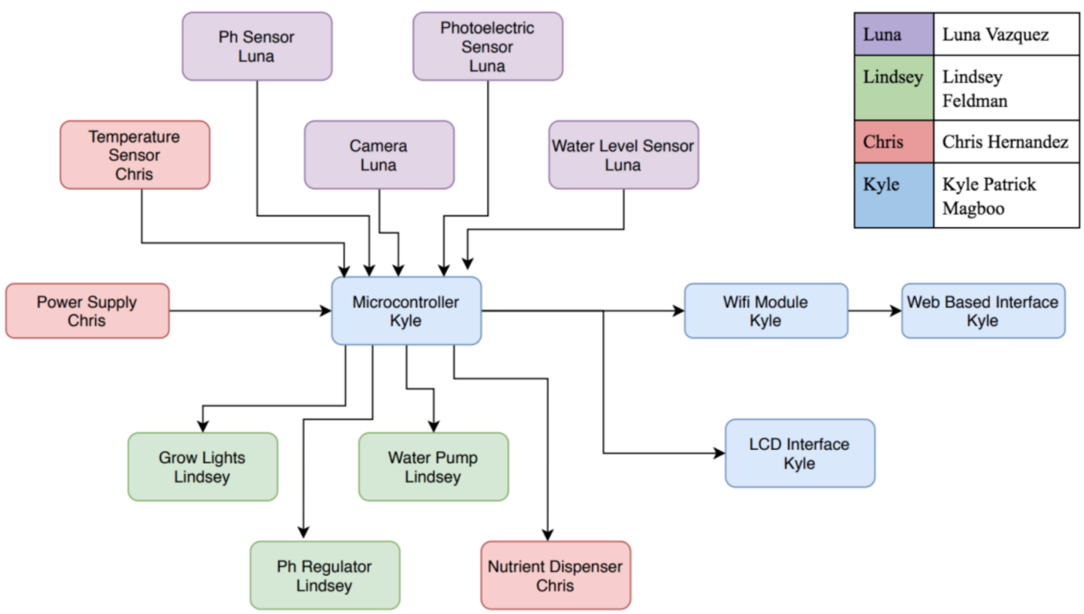

Figure 2: Hardware Block Diagram

The software block diagram begins by reading the data collected from the sensors. This data provides information about the levels of various conditions of the ecosystem. Each level has flags associated with the specified settings. Once triggered, the system will send the appropriate output to correct the triggered flag. At this point, the system will double check for any remaining flags. After each level is cleared of all flags, the software will remain on standby until the next set time interval. The system will continue to recheck the sensor levels using the implemented timer. All data collected is sent to the web interface as well as displaying on the external lcd screen. The software repeats this checking process continually, to ensure that the system is running properly.

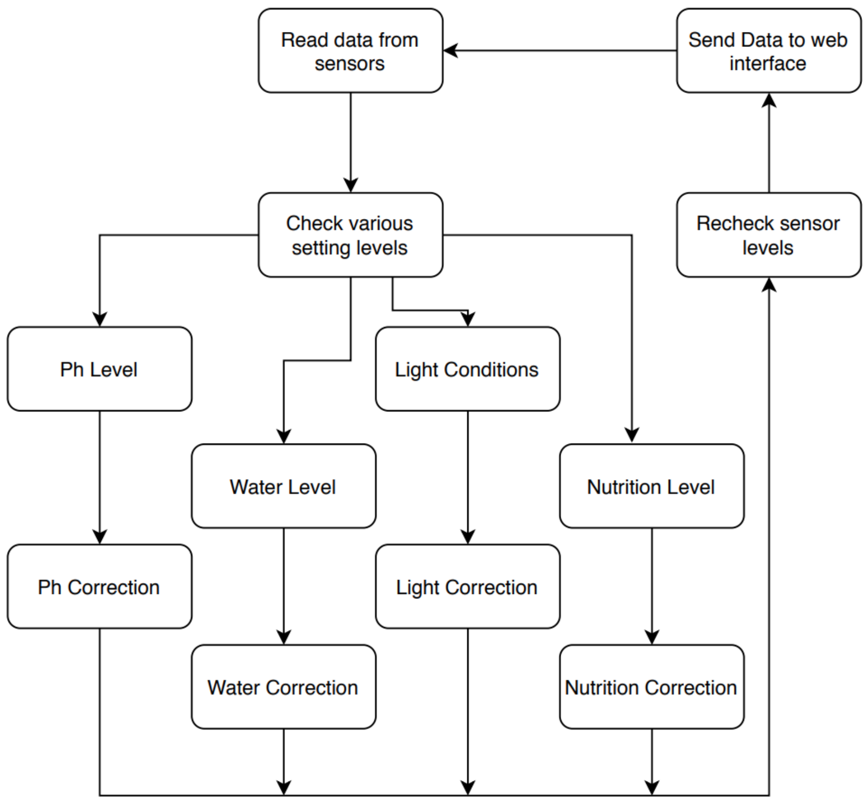

Figure 3: Software Block Diagram

Block Status: At the time of writing, all blocks are currently *To be Researched* and *To be acquired.*

5.0 Project Budget

Based on research and planning, the following estimated costs of materials were established to generate this tentative budget, shown in **Table 3**.

Item	**Cost**
Microcontroller	$40
Wireless Modules	$55

Water Level Sensor	$5.99
pH Sensor	$30
Temperature Sensors	$3
Camera	$30
Water Pump	$20
Touchscreen Display Screen	$35
Grow Lights	$40
Construction Materials	$60
PCB / Power	$70
Total	$389

Table 2: Software Block Diagram

6.0 Milestones

The project is broken up into smaller sections that are to be completed across the next two semesters. The different sections have been divided amongst the group, not only to evenly distribute the workload, but to ensure that all areas of the project are covered. **Table 4** below shows the milestones for this project. The tasks are split, so there are at least two members working on a given portion of the project. This method allows for the group members to assist each other in trouble shooting and to allow for multiple tasks to occur at once.

Senior Design I (EEL 4914)														
Project Task	Name		Weeks											
			1	2	3	4	5	6	7	8	9	10	11	12
Planning/Research	Everyone													
Documentation	Everyone													
Ordering/Testing	Everyone													
Prototyping	Everyone													
Senior Design II (EEL 4915)														
Hardware	Chris	Lindsey												
Sensors	Luna	Kyle												
MCU/I/O	Kyle	Luna												
Power	Lindsey	Chris												
PCB	Chris	Lindsey												
Communications	Kyle	Luna												
Software	Kyle	Luna												
Testing	Everyone													
Final Documentation	Everyone													

Table 3: Milestones