Project Proposal

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1 Introduction

1.1 Problem

During the pandemic, growing plants have been both a way to sustain people's moods and also elevate their mental well-being. Many people desire to consume fresh and organic produce, but lack the means to get it. Many college students don't have cars to go to the store all the time and organic food is usually above their budget. A great alternative is to grow organic food at home, this also includes an added benefit of relieving stress-induced depression. This however presents issues as many working-class people don't necessarily have the time, knowledge, or means to keep their plants thriving all the time.

Making fresh food resources expensive only increases the already existing food gap for those with lower incomes and their ability to eat healthy and sustain themselves.

1.2 Solution

Our solution is to create a vertical-farming based automated system that provides the best growing conditions for a variety of different plans. It will be designed with LED grow lights and watering schedules to match the needs of the designated plants.

This setup can be placed anywhere, without the constraint of being near windows for the natural light, or to optimize space. There is a built-in lighting system that allows for this flexibility. The lighting and watering is controlled by a micro controller which contains the details of the needs of several different plants, with a focus on produce.

1.3 Visual Aid

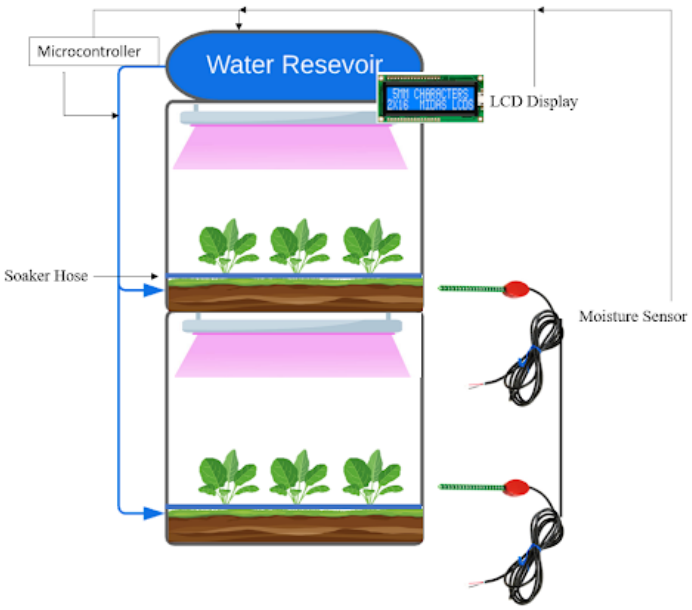

Figure 1: Design mock-up

1.4 High-Level Requirements List

- The metric display should show time until the next watering and notify user when water level in reservoir is low.
- The device should dispense the appropriate amount of water when instructed by micro controller, and water should be evenly distributed over surface of soil.
- Device turns light on/off when instructed by micro controller, and light stays on for duration required.

2 Design

2.1 Block Diagram

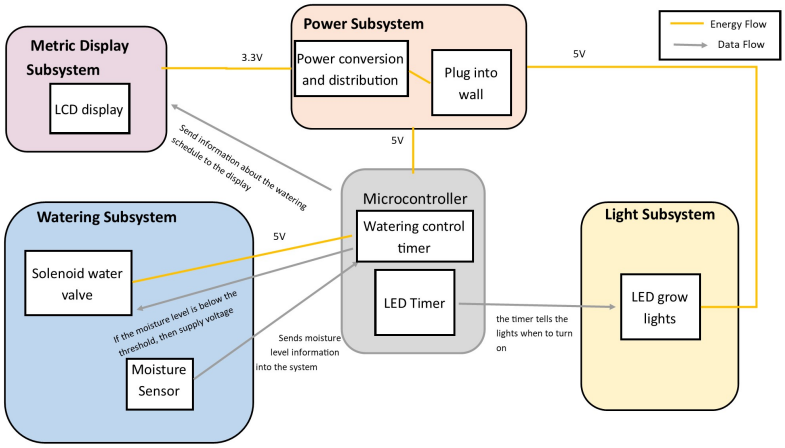

Figure 2: Block Diagram

2.2 Subsystem Overview

2.2.1 Watering

For the watering system, we chose to have a water reservoir on the top that will flow down with the help of gravity, to each plant bed. From the water reservoir there will be a tube or PVC pipe to bring the water down to the soil. Laying on top of the soil in each plant bed there will be another tube or PVC pipe with small holes around it to let the water out into the soil. To connect these two segments of pipe will be a solenoid water valve. This valve is normally closed when there is no voltage going to the solenoid and opens when there is voltage running to it. This solenoid will be connected to our micro controller where we can control the amount and duration of plant watering. One of the most common problems with indoor gardening is over watering. To avoid this from happening we will put moisture sensors in the soil in each plant bed. These sensors will be connected to the micro controller to tell the system how moist the soil is and if it needs to skip a watering cycle. We would program the micro controller so that it will water for x amount of time at the same time every day unless the moisture level is sufficient then it will skip that water cycle and water the next day. Underneath the plant racks, there will also be a draining storage area for extra water to run off and be stored (to prevent inconveniencing the user with spotty water runoff)

2.2.2 Lighting

The duration of light administered can be monitored and maintained by programmable light timers. Depending on the needs of the plants, the lights would turn on and off accordingly. To prevent lighting from one plant affecting another, there will be some sort of blackout material present between the racks. Another important aspect of lighting is the distance from the bulbs to the tops of the plants. As the plants grow taller the structure should be adjustable so as to maintain the needed distance. This can be achieved by creating a structure that has manual adjustable capabilities.

Out of the three kinds of grow lights (fluorescent, high-intensity discharge, and LED), LEDs seem to provide the most optimal results. They use significantly less power to produce more light than traditional CFLs, and they produce very little heat.

2.2.3 Metric Display

Without some sort of display, the user is rendered blind as to what is going on with their home grow system. An LCD screen will be implemented into our system to allow the user to have some information about the plants. The display will provide information on the watering schedule and alert the user when it will be watered and when there is a delay in the program. The display will potentially also provide an alert if the moisture sensors indicate to the micro controller that the soil is drier than anticipated. Information from the micro controller will be sent to the LCD display to tell the user updates on its watering schedule.

2.2.4 Power

In the interest of usability of the device, it will be powered by a standard wall outlet. A battery pack would allow for increased mobility, but having to monitor when the battery dies and the time to replace. An outlet system will make it easier for the user and for the plants.

3 Ethics and Safety

3.1 Safety

Water in combination with electricity poses dangers. In order to prevent any issues with this we are keeping the water and electric components on opposite sides of the product. We decided on a pipe watering method instead of an overhead watering so that the lights and the water would avoid contact with each other. However, the water release valve needs to be connected to power. In this case, we will keep the wires and water double-insulated to ensure the safety of the user. In addition, the solenoid valve being used is designed for water usage, and should not pose any issues either.

3.2 Ethics

We are not liable or responsible for plants not approved for growing in US.