Introduction

The objectives and goals for this senior design project are as follows:
- Objective 1: Create a garden container ideal for a small indoor living space, such as an apartment.
- Objective 2: Give the garden container the ability to provide water, nutrients, and light to the plants autonomously.
- Objective 3: Create a garden container that is energy and resource efficient.

In addition to these goals, design requirements were gathered to help achieve these objectives.

Background

What is aeroponics?

- Removes the need of soil; uses a water-nutrient solution instead.
- Delivers water-nutrient solution to plants through periodic spraying.
- Reduces amount of water and nutrients needed for plants by spraying them directly onto the roots.
- Reduces the amount of space needed for plant growth.
- Reduces the amount of disease transmission between plants.

Conclusion

Overall, the project was a success in achieving our project objectives. Our most notable successes for this project are:
- The lighting system has LEDs of appropriate wavelengths as well as light intensity.
- The design of the watering system is a simple but effective design and allows for no water leakage.
- The touch screen interface is an intuitive way to change the settings of the garden container.
- Simple timers allow for the automatic operation of the container.

User Interface

- Intuitive touchscreen interface controlled by a Raspberry Pi microcontroller.
- Allows the user to adjust the water pump’s spray duration and rest duration.
- Allows the user to adjust the light intensity and also the daylight duration.
- Displays the amount of light the light sensor is reading (in micromoles per meters-squared per second).
- Sends data from the Raspberry Pi to the Tiva-C via USB.

Lighting System

- Consists of 4 LED Bulbs, each having 24 red (660nm), 12 orange (610nm), and 2 blue (468nm) LEDs.
- Operates on a regulated 24V DC power supply.
- Lighting intensity in controlled via PWM.
- The day/night cycle is controlled by a timer.

Watering System

- Sprays water and liquid nutrients directly onto plant roots.
- Water-nutrient solution: 5-15 mL of nutrients per gallon of water, and 1 mL of hydrogen peroxide per gallon of water.
- Water pump provides 412 GPH at 24V DC.
- Both the spray duration and rest duration of the pump are controller with timers.
- Water tank holds up to 25 gallons of water.
- Includes a water level sensor, which turns an indicator LED on when the water level is low.

On the left: colors of light that plants absorb. 
On the right: physical layout of an LED bulb.

On the right: watering system circuit diagram.