Background

Agriculture in its current form is about the mass production of certain crops. Over the years techniques and crops have changed through genetic engineering. The push to grow bigger plants with larger yields has detracted from the overall flavor profile of the plant, desaturating the flavors and reducing the amount of nutrients.

To reverse the negative impact that the current system has developed, the future of produce production needs to change. Development of a system that can deter away from having the most yield and instead create produce that is made to accent their flavor profile and truly nourish the body. An inexpensive home-based system that is easy to sustain and allows each individual to tailor their produce to their own personal tastes. Catering to the amateur as well as experienced gardeners alike.

Project Objectives

- Successfully floods and drains plant housing within 10 minutes
- Automatic Flora Micro Regulation
- Automatic Flora Bloom Regulation
- Automatic Flora Grow Regulation
- Automatic pH Up Adjuster which normalizes pH within +/- 0.4 pH of setting within 30 minutes
- Automatic pH Down Adjuster which normalizes pH within +/- 0.4 pH of setting within 30 minutes
- Lighting responds to manual commands through mobile application more than 90% of the time
- User friendly application design determined through usability testing feedback survey
- Successfully connects to Raspberry Pi Wirelessly
- Allows User to set Automatic Lighting Schedule
- Allows User to set Automatic Watering Cycles
- Allows User to setAutomatically Regulated pH Level
- Allows User to view current Sensor Values
- Allows User to view past Sensor Data Graphically
- Allows for complete Manual Shutdown of System within 5 minutes given user indication
- System Successfully Monitors Sensor values at 10 minute intervals
- Sensor Values received are successfully stored
- Successfully controls hydroponics system motors and pumps through Arduino relay
- Successfully controls nutrient regulation in response to sensor values
- Successfully conducts lighting day/night cycles

Hydroponics

- Ebb and Flow Variant
- 2 Liter Tank holds water supply
- Nutrients delivered directly into tank
- Root chamber flooded for 30 minutes
- Brushless aquarium pump floods and drains root chamber

Nutrient Delivery

- 3 plant nutrients, 2 pH stabilizers
- Delivered by 5 peristaltic pumps
- Deliver 1mL of fluid per second at 10 V
- Automatic pH regulation
- Nutrients during periodic water cycling

Lighting

- 12 Red LEDs with 640nm wavelengths
- 16 Red LEDs with 660nm wavelengths
- 4 Blue LEDs with 445nm wavelengths
- 4 Blue LEDs with 455nm wavelengths
- Each LED capable of 3W, the driver reduces power to the lights for a total of 48W
- Red encourages growth of vegetation
- Blue strengthens stems and branches

RESULTS

Android

- User friendly interface
- Allows user to set schedules for automated features
- Create custom plant profiles
- Communicates with Pi through Asynchronous HttpURLConnection
- SQLite database holds sensor data for graphical viewing

Raspberry Pi

- Keeps time for automated scheduling
- Sends commands to Arduino via serial USB
- Requests sensor data from Arduino at periodic time intervals
- Stores sensor data in SQLite3 database
- Communicates with Android through PHP WebServer

Arduino

Based on preliminary test results and general feedback we believe this product can generate high interest among growing enthusiasts. It’s ease of use, versatility and expansion capabilities make it an attractive option to both amateur and experienced gardeners.