

## Engineering Requirements

	Client Requirement	Engineering Requirement	Verification Method	Testing Process	Testing Pass Condition
1	<b>System will notify the user of faults detected during the self-diagnostics test.</b>	System will send out an email notification within 5 minutes of detecting a fault from the system-diagnostic test.	Test	<ol style="list-style-type: none"> <li>1. Before power-on, disconnect a component that the system can self-diagnose</li> <li>2. Power on the system and start the timer</li> <li>3. Monitor the email address connected to the system until fault notification email is received and stop the timer.</li> </ol>	Email notification is received within 5 minutes of power on
2	<b>System will be able to self-diagnose faults.</b>	System will run a self-diagnostic test that can detect at least 4 different system faults. It will start the test within 5 minutes of power on.	Test	<ol style="list-style-type: none"> <li>1. Before power-on, disconnect a component that the system can self-diagnose</li> <li>2. Power on the system and start the timer</li> <li>3. Monitor the web server until affected subsystem is reported to be performing unexpectedly and stop timer</li> <li>4. Repeat steps 1-4 to produce a total of 4 different faults</li> </ol>	For each fault, the web server reports that the affected subsystem is performing unexpectedly within 5 minutes of powering on.
3	<b>System will regulate hydroponics</b>	System will maintain reservoir pH levels within +/-10% of user	Analysis	<ol style="list-style-type: none"> <li>1. Input the desired pH of the reservoir solution into the web</li> </ol>	Measured pH level is within +/-10% of

	<b>solution pH levels</b>	defined parameters.		server 2. Calculate pH levels of the reservoir solution 3. Measure actual pH level of reservoir using separate pH sensor	defined parameter
4	<b>System will automate hydroponics water system</b>	System will begin pumping water to/from trays at intervals within +/- 5% of user-defined watering frequencies (how often watering occurs).	Test	1. Set a watering frequency for a node using the web interface 2. Start time when node's filling period (when water is flowing) begins 3. Stop the time when the next filling period begins	Timed watering frequency is within +/-5% of user-defined watering frequency
5	<b>System will regulate solution nutrient levels</b>	System will track and increase nutrient levels in the solution. Nutrient levels will be kept within +/-10% of user-defined levels.	Analysis	1. Input the desired nutrient levels of the reservoir solution into the web server 2. Calculate nutrient levels of the reservoir solution 3. Measure actual nutrient level of reservoir using separate sensor	Measure nutrient level is within +/-10% of defined parameter.
6	<b>System information will be remotely accessible</b>	System information will be updated and visible on the web server at least every minute.	Test	1. Manually add water into reservoir and start timer 2. Stop timer when water level change is updated on web server	Timer reads less than or equal to 1 minute when each change is updated on web server.
7	<b>System will run automatically from power on</b>	The system will automatically start hydroponics software and notify that the system is started within 5 minutes of power on.	Test	1. Ensure system is completely powered off 2. Power on system and start timer 3. Stop timer once local display indicates the system is on	Timer reads less than or equal to 5 minutes once system begins to run

8	<b>System will accurately transfer data over a wireless connection.</b>	Data must be wirelessly transmitted to the web server with at least 95% accuracy to values in database.	Analysis	<ol style="list-style-type: none"> <li>1. Examine files in database</li> <li>2. View files on web server.</li> <li>3. Compare files and on database and web server</li> <li>4. Calculate the percentage of error-free packets.</li> </ol>	95% of packets delivered to the web server are error free.
9	<b>System web interface will be easy to use</b>	9/10 users will be able to adjust the watering frequencies within 15 minutes.	Test	<ol style="list-style-type: none"> <li>1. Have volunteers start up the system from a cold boot (power on) and start timer</li> <li>2. Stop timer when volunteer has powered up the system and adjusted parameters</li> </ol>	9/10 users could adjust watering frequencies within 15 minutes.
10	<b>System will be able to accept additional trays</b>	System will allow for at least 4 trays per node with at least 2 nodes.	Inspection	Visual inspection of the system will show 2 or more nodes, each with 4 or more trays.	The system has a minimum of 2 nodes and each node has a minimum of 4 trays.
11	<b>System nodes can accept plants with unique watering periods</b>	System will allow users to define different watering frequencies (how often watering occurs) for each node on the web interface.	Inspection	Set two different watering frequencies for the two nodes using the web interface	The filling period for each node begins at different times
12	<b>System will display information locally</b>	System information will be accessible from a local display	Demonstration	View system information on local display	Local display shows system information