GNG1103 - Prototyping Test Plan

Why are we doing this test?

*This is an introduction. Capture the reasons for the test, giving enough background information to justify doing **any** prototyping at all. Is the **general** objective one of: learning, communication, de-risking, etc.*

This second prototype is designed to provide vital information for the construction of the hydroponics system. It is divided into two parts: mechanical parameters and technical design. Mechanical parameters are a series of tests designed to provide key technical aspects for the purchasing of equipment for the final product. It is a focused prototype. It will consist mainly of testing various water pumps for their speed, head height, and power requirements. The technical design will consist of creating a full 3-dimensional design in Solidworks, which can be used to model the hydroponics system and even simulate water dynamics and stress factors. This will be a comprehensive prototype.

Test Objectives Description

*What are the **specific** test objectives?*

1. Find Technical Parameters for water pumps
2. Find required power input for water pumps
3. Stress factors for overall design

*What **exactly** is being learned or communicated with the prototype?*

The mechanical parameters prototype will enable our team to purchase equipment for the full design and ensure that the equipment will work as desired. Furthermore, the technical design will verify that the design can fit within the space allotted by the greenhouse dimensions, and to ensure that the hydroponics structure can withstand the application of common stresses, such as someone knocking against the hydroponics system.

What are the possible types of results?

The results will include how high a pump will be able to transport water in our systems. It will also tell us the power input for the pumps. It will also display constraints and limits.

How will these results be used to make decisions or select concepts?

These tests will determine which pumps are required for our prototype and will help optimize our final design. It will also help with piping selection.

What are the criteria for test success or failure?

This prototype will be said to be a success if: (1) the parameters found in testing can be satisfied with the given budget for the system, (2) the design can fit within the allotted space, and (3) the design can withstand common stresses.

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What is going on and **how** is it being done?

*Describe the prototype **type** (e.g. focused or comprehensive) and the reason for the selection of this type of prototype.*

It will be a comprehensive prototype because the deadline for the final prototype is fast approaching, so everything needs to be considered for this design. All final testings should be done at this stage.

Describe the testing process in enough detail to allow someone else to build and test the prototype instead of you.

To perform this test, various pumps found in makerspace were tested with rubber hosing. The height of the hosing was raised incrementally. The rate of water flow was measured at each height. The pumps in the makerspace were found to be able to reach the height head of the design at an acceptable flow rate. The power input for each of the two pumps was 120V AC.

*What information is being **measured**?*

The amount of power needed for the final prototype. The type of pump and how much water can be pumped (the flow rate). The final dimensions of the final design.

*What is being observed and how is it being **recorded**?*

The rate at which water is being pumped, recorded using a stopwatch and an excel spreadsheet. Making sure that all plants are being sufficiently attended to, but recording their growing rate. Etc.

What materials are required and what is the approximate estimated cost?

With this test, there was no cost as all materials used were found in the makerspace.

As for the comprehensive design, the virtual prototype fit within the allotted space and was able to withstand common simulated stresses.

What work (e.g. test software or construction or modeling work or research) needs to be done?

A solidworks 3D design will need to be constructed.

When is it happening?

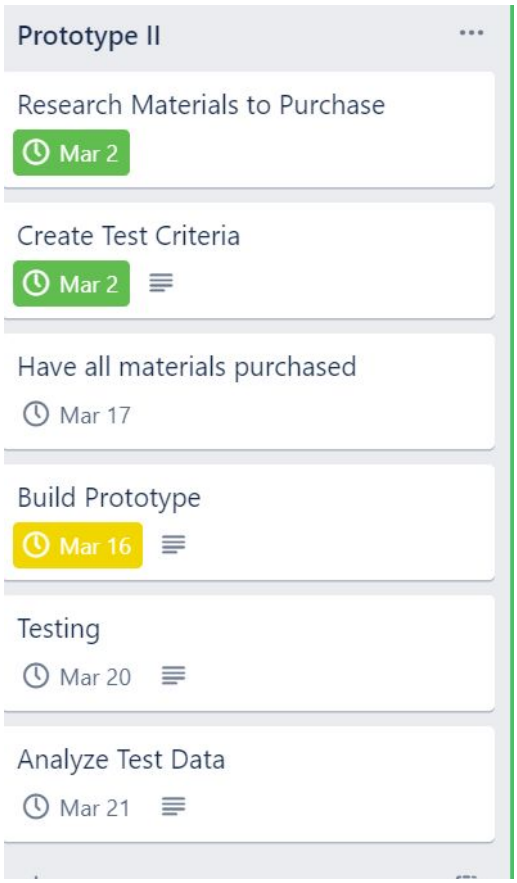
*How long will the test take and what are the **dependencies** (i.e. what needs to happen before the testing can occur)?*

In conclusion, the second prototype was a success: it provided key technical information and verified that the design was feasible given the known constraints. At this point the material required will be

purchased and the various subsystems will be assembled. Then the final hydroponics system will be fixed to the greenhouse and the product will be finished.

A separate test planning Gantt chart can be created to help making sure that the testing fits with the overall project schedule or it can be defined as part of that schedule (i.e. as a sub-task).

New task in Gantt chart:



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When are the results required (i.e. what depends on the results of this test in the project plan)?

These test results are required before the final prototype is ready and made for design day.