Prototype III Budget and Results

GNG1103 - Engineering Design

Deliverable H - Prototype III

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Introduction

This document outlines the costs of the materials that are used in the final version of the hydroponic system, It also provides background information regarding the test objectives of the prototype, the variables that will be tested and measured, the cost of the prototype, and the investment potential.

Reason for Testing

*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.*

Prototyping is used to provide a sample of the design to test whether it meets the customer needs addressed in the earlier parts of design thinking. The purpose is to find out what is not working in our design or what unexpected things need us to change in the design based on the overall proof of concept. The idea is that we, as a design team, present the design through building a real model. At this point, a prototyping test has already been performed with a proof-of-concept model to present the general idea of what our objective is with this model. Because this prototype focuses on the whole system, the testing method is a physical simulation. This means that the model of the product is expected to work functionally well in all aspects.

Test Objectives Description:

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

The specific test objectives of this prototype is based on the notion that this prototype is fully functional; our clients should be able to take it back to their food center and be able to grow plants as they see fit. The testing of this prototype is not as direct as this intention, however, but the presentation should give the clients the immediate confidence that they can take the model and make full use of it. This includes the understanding of the previous prototypes, in which the focuses were on the proof of concept and the functional subsystem, along with the intended goal of being fully useful for Growing Futures.

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

The information being communicated through this prototype is a complete picture of the final design and how it will be used for the needs of the Growing Futures company. This prototype is expected to be fully functional in all aspects of what our clients are looking for, while showing the specific adaptations towards portability and improved usability. Essentially, the objective is to demonstrate how our design compares to conventional products, but focuses on how ours is a better investment.

What are the possible types of result?

The first type of result is that the prototype does not achieve its intended function; quite simply, it might not work. However, seeing as this design is the product of a semester's worth of planning, calculating, modelling, and designing, this result is highly unlikely as efforts have been made to ensure that the design will work.

It is also possible that a smaller unforeseen error can emerge upon the completion of the prototype. It is possible that our idea, while functional, might require modifications in order to better suit the needs.

The last type of result is what we look forward to see: the prototype can works just as we expected. This means all the parts in our prototype can do their job properly and our design model can meet the needs of our clients.

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

The result would not help us a lot in term of improving the design since it is our final vision, but still, it can help us adjust some features of our final prototype.

What are the criteria for test success or failure?

If the test result goes the same as our previous expectation of the prototype, then we regard it as a success. If the system is able to perform its intended folding mechanism, its reservoir is not leaking, and the wheels can make the system transport easier than before, then it is considered to be a success. Otherwise, we regard it as a failure.

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.*

The prototype we are currently building is a comprehensive prototype. As this is the final prototype we will design and construct for the client, we would like the client to have the ability to properly envision the hydroponic system as a whole.

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

The process begins with identifying the purpose of the test. In this case, the purpose is to modify our design into a real product. To elaborate, based on the test results of our previous prototypes and design blueprint, our final prototype constructs by 5 parts: the frame, the hinge, the wheels, the tubing, and the pumping system. In order to accomplish them, we will access Brunsfield several times to build the frame made with sheet metal. As soon as we have built the frame, we can put our hinges onto the frame to make the frame unfoldable. After we have done that, we can settle wheels on the bottom to make our prototype movable. In the end, we well add the pump and our tubing system onto the frame.

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

The information being measured is full dimensions of the top and bottom brackets (includes the holes on the brackets). Also, the height of the system is essential to be measured. In terms of functional measurements, the focus will be the ability for the prototype to fold, to move, as well as the flow rate of the plumbing in the system.

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

Being observed is the functionality of the folding mechanism; the intent is to make sure that whole system is fully functional, as it is the key aspect of our design. We will perform a number of tests to make sure that it can fold repeatedly, and these results will be noted down. Also, we will check how well our wheels works on this hydroponic system by moving it around. Additionally, we will also measure and record the flow rate of the plumbing in the system.

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

The materials used in this prototype are sheet metal, metal hinges, PVC tubing, screws, and pump. The overall materials cost around $90 as some of them are obtained from the Makerspace workshop while the rest of them are from Lowe's.

(Economics Assessment -- looking at the the cost of the design, what they will save from making use of it, how it compares to other models that are currently on the market -- try to make ours sound like a better investment).

Compared to other hydroponic system currently sell on the market, our solution offers in a more reasonable price. Most of the hydroponic systems on the market with a similar size and productivity would sell on average of $650 while our product's setup price is $450. Moreover, all the materials in our product are easy-replaced. This character can easily erase the concern of the user who worries about what if some assembles are broken at work. If any parts of our product goes wrong while you cannot reach our service, the user can always find those assembles in a local store.

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

Research on the right materials to purchase and what work best for our prototype meanwhile fitting our clients' needs. Also, benchmarking is necessary to collect information of similar product on the market. By doing that, we can know what are their advantages and drawbacks so as to be able to produce a well functional prototype.

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)?*

This last prototype mainly depends on the feedback from our clients when we collected from the presentation. After a careful analysis and discussion, we collect some valued feedbacks and implementate them into our design. We use this feedback to clarify any aspects of the overall proof-of-concept and then transfer the information in the entire system that is being built.

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

From the testing result in prototype 2 we are able to implement this in our final prototype.

Based on a Net-Present Value Analysis, why would this design be the right choice for investment?

With advantages like *saving space and water, using nutrition effectively, and having better grow rates. Hydroponic system is an improved implication in agriculture. Therefore, a

good hydroponic system has great economic potential in the future. Our design model has capability of growing (features of our model, reservoir size,etc)(estimate how much money they would make after investing in our project, try to estimate the amount of plants that they could grow and how the portability will assist in helping them harvest plants more frequently)

Conclusion

This document shows a detailed explanation of our prototype 3 in terms of "how, why, and what" would be done. To elaborate, the building plans for the 3rd prototype is concluded in this document which consists of what is being recorded, how much of the cost, what is our test plan, etc. Prototype 3 is regarded as our final product that should be built upon the understanding of all possible risks and setbacks and fully tested, before it is done, based on the references of our previous two prototypes. Therefore, the prototype 3 should be a fully functioning model that can allow the clients to see the entire design in action, and also allow them to test it out based on their needs. Even though, some aspects of our prototype may not completely match with our clients' expectation, but we regard it to be the best solution of all the accessible possibilities due to constraint of times and fees.

Reference:

20 Advantages & Disadvantages of Hydroponics That You Should Know. (2017, June 19). Retrieved March 24, 2018, from https://www.greenandvibrant.com/advantages-disadvantages-of-hydroponics