Engineering Design - GNG1103C

Deliverable F

Prototype I and Customer Feedback

February 6, 2022

Lab C01 Group 5

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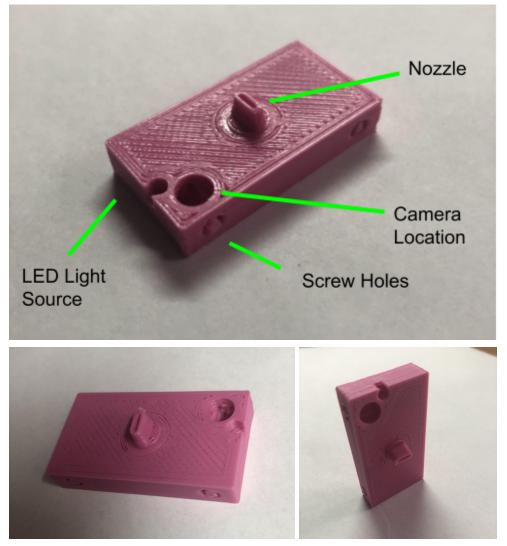
Problem Statement

Design a 3D printed mechanical arm with three degrees of movement that can perform manual tasks to a navy ship's hull, while only being operated by one person.

Introduction

Deliverable F is Prototype I and customer feedback for the end effector/robotic arm project in GNG1103. In this deliverable the team will display the first prototype created and describe its components, and how they aid the arm in performing its tasks. We will then reiterate how we plan to test our prototypes as well as creating a timetable for how we will complete these tests. Finally we will have a critical analysis of all the important physical and virtual components in our design and plan.

Prototype I



Prototype I is a 3D printed concept design of our end-effector. It was printed in the Makerspace using an Ultimaker Printer. This prototype includes a built in nozzle for pressure washing or painting. It includes two openings, the bigger of which will hold a camera, and the smaller of which will hold a small LED for lighting up the robotic arm's workspace. There are 4 screw holes on this design, two on each side to secure the end-effector to the robotic arm. The bottom of the prototype has two holes for wiring purposes. This prototype is not to scale.

Prototyping Test Plan/Test Result

Test ID	Test Objective (Why)	Description of Prototype used and of Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1. Making Predictions	Before we start with building our prototype we will plan on the different outcomes This will allow us to see what our testing will accomplish Making predictions will ensure us to prepare adequately for any possible results we will get from testing.	Using application such as microsoft excel, word document and wrike are going to help us in this phase because we can use them to write down our prediction and also track down everything we have done so far	Word Document- This software will allow us to list out our thoughts and plan out various testing strategies. This will also be used to get results from our work and if our predictions were true or not. Excel- This application will allow us make quick calculations and list various cost, various quantitative aspect of our prototype	The start date of this process will be the first time we did the very first deliverable since that was the first time we made predictions of water our robot should do. Jan 23, 2022 to March 6 2022 Yes this time frame is reasonable because all the way to our very first prototype our predictions are just predictions since we are not going to have any concrete prototype to test our predictions.

2 Scheduling	The team will create a detailed plan listing out the deadline we have and using that to plan on ways to achieve various milestones.	Using wrike By using wrike planning for different test dates and the type of test will be very easy. Since the whole team will be able to view this list and see what they are supposed to do and the deadlines	 Wrike We can turn the status of each task done to completed on wrike. And if there are milestones we have completed we can list it on the wrike application also (e.g design day). Assignment Section Of Brightspace This will allow our project managers, teaching assistance, client and professor to give us feedback on the work and will allow us to plan properly. 	The scheduling phase of our test will continue to be in progress until design day where we can show our product to the client. Jan 23, 2022 to March 30 2022 In general this time frame is reasonable but for the individual tasks in this time frame they might be subjected to change or re-scheduling.
3 3-D Printing	This is when we are going and printing out various parts needed to build our various prototypes to feel how our ideas work in real time.	By going to makerspace to 3D print components needed for our project. By following the instructions and guidance of the staff at marker we can print out materials needed to accomplish and test them out	A way to track our result would be by making a list of parts I need to print out. And whenever we completely print out a part wer check it off the list	February 24 and February 27 Yes this timeframe is reasonable since those are the day marker lab is available for 3-D printing
4 End Effectors	The end effector is a key component of our machine because it will allow us to accomplish the main task we have been	Ways To Test the end effectors i. A weight test This will ensure that the end effectors will	Placing all the findings we made on a microsoft excel sheet and comparing all the figures.	February 24 - March 17

	assigned.	be able to hold the required weight for the job. We can do this by placing Weight on the End Effector to test its limits. Test movement of arm Observe stress on arm and end effector joints	This will allow us view all the strength and weakness of our robot	
5 Tubing	The tube that will be used to pass water from the water source to outside the robot is completely safe and will not cause any leakage into the electrical component of the robot or other areas of the robot. Also we should also make sure the tubing is completely visible to ensure that any form of damage to the tube is easily noticed.	When the tubing is bought we are going to pass a constant stream of water through it to make sure that there are no sign of leakage of anyform and the water coming from the tube allows for enough pressure to form that will clean the ship	The result will be determined by how long it takes from water to travel through the tube. To do this we will require i. Stop watch ii. constant stream of water	The time frame is dependent on when we receive the money assigned for this project and how long it takes to get the tube from the supplier.
6 An Electrical Circuit Test	The robot arm is based on Arduino hardware and software however ideally we plan to replace that with an ESP32 micro-controller which has much more processing	The Arudino, micro controller and other electrical components need to be connected properly. To see how to connect Arduino and for more info on	Result will be determined by how the installation goes.	March 6 to March 30 This is also determined by when we receive funding for the project

	power, is cheaper and has superior wireless capabilities allowing for wireless control and future development of live camera feeds	micro controllers view LAB 3- Arduino Process Control AND LAB 5- Project Specific Lab		
7 The code	This is what will allow the robot to function and this will be what will be used to control the robot. Our client wants us to code in a popular language such as python, C or C++.	We already possess an open source code that acts as the skeleton of the coding operation. So the job would be to add to the code more functions we want to carry out and also make sure that the code is working properly. A code editor will be needed for this task e.g code blocks e.t.c	The way the result will be measured is if the code actually compiles and runs properly.	March 6, 2022 to March 30 2022 This part of the task is the most challenging part but with the open source material we have at our possession this would be possible in this time frame.
8 Finding out what our prototype excels at	After the analysis has been completed the team should make a comprehensive list on what the prototype was able to excel at. And use this information to see if our robot would be able to complete its task	This should be done on a google document and shared to the entire team allowing them to see what we have accomplished with the timeframe assigned to us.	Results will be imputed on google documents.	This is dependent on if all the previous tests are a success. The idea timeline for this would be March 25-30

Testing Results

The 3D printing of our first end effector prototype went according to plan and we have created the first tangible concept of the end effector. However, our first print failed and in order to complete our print in time we switched to a bigger and less accurate nozzle, which created a prototype that is not as precise as we liked. For our next prototype we will use a smaller nozzle to reduce inconsistencies in our print. The prototype we created was not too large, so in order to create a concept closer to the final product, when we create our prototype II, it will be printed accurately and at the correct scale.

Analysis Of Critical Components

Critical Component	Analysis
Code	We have access to an open source code that will be the skeleton of the entire operation. Currently it is scheduled to start between the window of March 6th to March 30th.
End Effector prototype 1	The first version of the end effector is good but further version of the end effector need to be printed in order to match the required measurement of the arm

This is the analysis of the various

Wrike Update

Wrike has been updated for Deliverable F.