Deliverable F: Prototype I and Customer Feedback

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Abstract

The Department of National Defense requires an automated, user-friendly and cost-efficient robotic arm that can provide the potential to assist crew members on ships to complete certain tasks with minimal supervision. The design criteria were taken into account when we calculated budget and timeline restrictions. For this deliverable, we have laid out a plan for our materials such that we remain within the allotted budget and we accomplish our goals within the specified time constraints.

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Introduction

In this deliverable, the team has constructed the first prototype and tested each subsystem's functionality. Throughout the report, you will be presented with the detailed design from the onshape application and the images of the physical prototype. Furthermore, the following objectives were included to complete the project: the customer and teaching assistant feedback, the prototyping test plan for prototype two, the analysis, and, lastly, future test plan objectives.

1. Customer Feedback

- T.E.: Increased effort needs to be put into inverse kinematics; determine how many degrees the robot needs to move from base
- T.E.: Focus less on painting over rust, should focus on logo drawing
- T.E.: GUI for boatswain: how? Mobile app?
    - J.C.: Proposed MIT App Inventor
- V.B.: Robotic arm will be given; shared amongst 14 groups
- T.E.: Less maintenance should be needed for this; up to 9 weeks out at sea
- V.B.: Budget reform to $50
- Much of the project was revealed to have changed during this feedback session. During the initial session, the customer stated that they wanted a robot to destroy and then paint over rust. During this session, the client stated they wanted a logo-drawing robot. During the first client meeting, the budget was $100. The second meeting revealed a budget change to $50. Also, it was stated that the arm would now be given to us as opposed to us designing an arm.

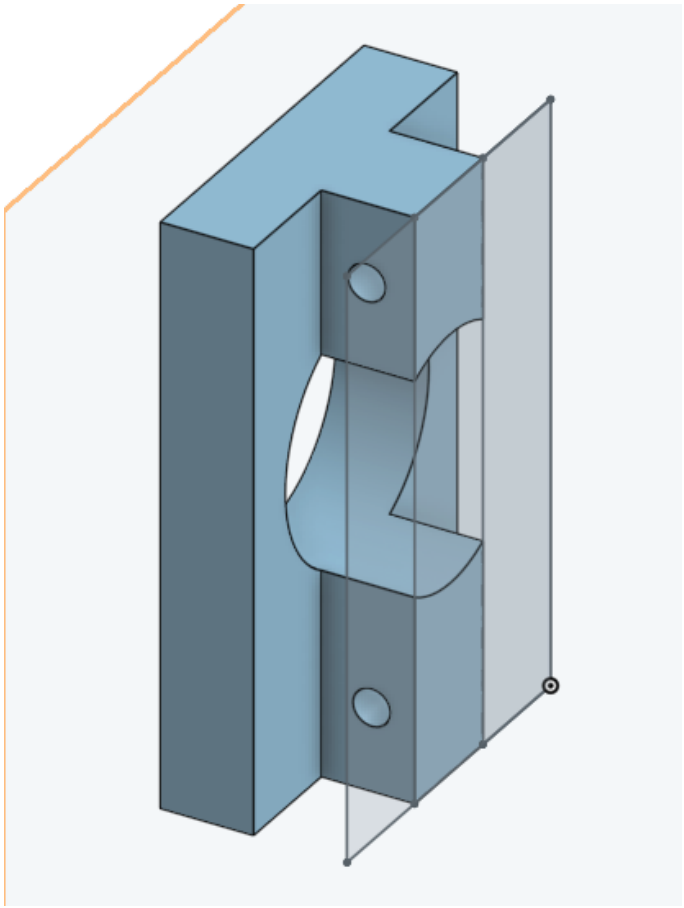
2. Analysis

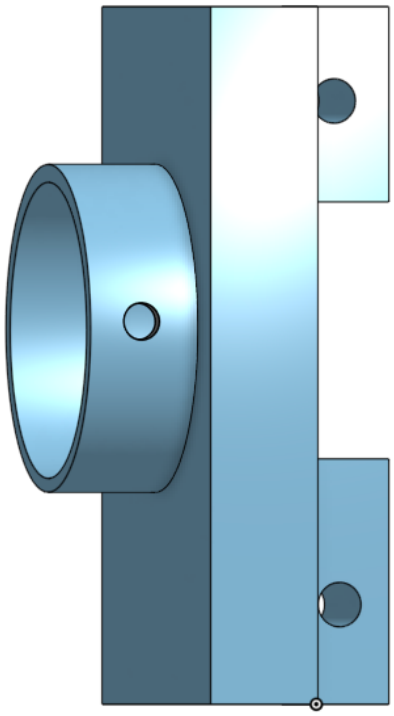
The critical components focused on this prototype was mainly the end effector design and meeting certain target specifications. Prototype 1 centers around establishing the feasibility of the automated robotic drawing arm concept. Information on the robotic arm has been gathered through Onshape and in person in order to incorporate the accurate dimensions and such onto the end effector design. This was an important step as it will determine how to attach both components together and if any adjustments should be made. It’s been determined that the end effector design is mostly appropriate as it can support its weight and dimensions are somewhat accurate. The robotic arm has been discovered to be in working condition as well which will lead to another set of objectives for prototype 2.

3. Results

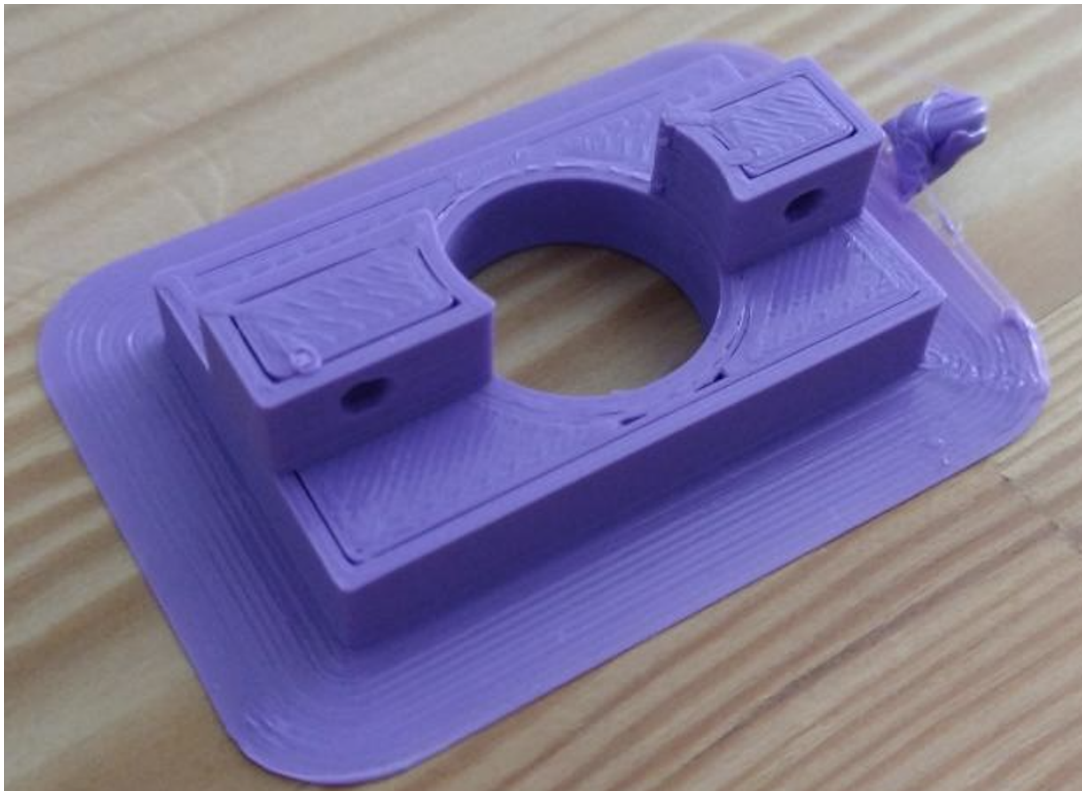
3.1. Onshape Design

- Paint pen holding mechanism (does it hold)
- General Arm movement (in all 3 degrees)





3.2. Detailed Images of Prototype



4. Prototype Test Plan

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	Acquire further feedback in order to make improvements	Present the prototype to the client/TA during upcoming meeting	Logged into a document; will be referred to during the development of prototype 2	~1 day
2	Ensuring the arm and GUI work together	Installing a bluetooth module and connecting with a phone	Checked off wrike; This will be an important subtask as it is the main control point	~1 day
3	Ensure the end effector mounting system works	The vise-like mounting system will be used with the end effector	Checked off Wrike; ensuring the arm and end effector work together is crucial to the drawing component.	~3 days
4	Ensuring the end effector and arm work together with the code	The end effector will be mounted and the code will be run	Github will keep track of pull requests and we can use this to finalize our minimum viable product.	~2 weeks
5	Images will be uploaded into the arm	Uploading images is the final step to fulfilling client wants	We will document each image drawn, regardless of whether or not it worked, and modify the code so the image output is clearer	~2 weeks

5. Future Test Plan Objectives

- Scanning of the inputted logo to be printed (map logo on the face of the ship)
- Motion control (doesn't press the pen too hard against the surface, end effector can move in straight lines left, right, up and down)