Deliverable C: Design Criteria and Target Specifications

Jaber Chowdhury, Sara Barbosa, Josh Larocque, Kathryne Truong, Nikita Neyshtadt

University of Ottawa

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David Knox

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Introduction

In this report, requirements for the product requested by Theodore Eastmond will be identified to provide a clear vision on the project's foundation. Additionally, benchmarking will be performed to examine current products on the market and their ability to perform similar functions. Finally, there will be a list of design specifications which has been modified based on the client meeting.

1. List of Design Criteria

Priority	Design Criteria	Interpreted Needs
1	Cost ($)	- Budget $100 - Need cheap but reliable parts
1	Safety	- No sharp edges; must be grinded/blasted - Remove all tripping hazards - Red flashing working light - Bright colours
2	Autonomous	- Needs to function by itself without supervision - Can work through the night - Programmed to orient itself on the ship and paint the side, needs to be able to identify colour in image and change the colour that the brush is using
4	Mobility	- Three degrees of freedom along the x, y, z-axis (pitch, yaw, and roll.) - Translational movement along those axes, which can be thought of as moving forward or backward, left or right, and up or down.
5	Constant power (voltage)	- 120-volt plug - Strong/ durable cable - Cannot be easily unplugged or pulled out
6	Simple parts (quick connections)	Quick disconnect wiring, and larger components for carrying and storage
7	User Experience	- Needs to be easy to understand for non-tech savvy users. - Easy to read code built on a common language (C++, python) and well documented

8	Weight (lbs)	-Rugged but lightweight materials -The structure must weigh 20 pounds or lighter or needs to be disassembled and weigh 20 pounds.
9	Lights	Needs to be able to see in dark corners of the ship and around pipes So 3D lighting around the final arm of the robot

2. Technical Benchmarking

Idea	Product	Details
Light	LED W5W bulb maybe	Cheap and easy to wire
Power	Power Supply	12V power supply 2.2 meter long
Materials	3D printing provided by the University	-Plastic on the outside for rain and wind cover (+cheap) -Limited to 8-hour prints at a time at the University, $$$ after 8 hours
Quick connect parts	Lego,clips, Snap Circuits	-Minimal exposed cables and parts -Easily to assemble and disassemble
Brains of robot	https://www.robotis.us/uL2d2/	$29 1.00 LBS (9g) 48mm x 18mm x 14.6mm USB communication converter that enables control and to operate the DYNAMIXEL with the PC.
Mounted to the ground	P-50iB/10L	The mounting mechanism on this robot includes four bolts and could include a pedestal so that the ground doesn't have to be drilled.

Mobility	“Three degrees of freedom robotic arm”	- Forward and inverse kinematic equations are used. forward, for determining the arms position in the task space; and backwards, for determining the joint parameters necessary for the robot. - Contains 3 degrees of freedom
Motors	DYNAMIXEL X-Series Smart Servo Motors.	*AX-12A model : (?)* Cost : $48.90 Weight : 0.2 pounds Fully integrated DC Motor + Controller + Driver + Sensor + Reduction Gear + Network in one DC servo module

3. Target Specification

Design Specification	**Relation (=,< or >)**	**Value**	**Units**	**Verification Method**
Functional Requirements				
Degrees of freedom	=	3	Degrees	Analysis
Power	=	120	Volts	Analysis
Portable around tight spaces	=	N/A	N/A	Physical Test
Constraints				
Weight	<	20	lbs	Scale
Cost	<	100	$ (CAD)	Receipt Tally
Non-functional requirements				
Safety: Visible	=	Yes	N/A	Visual Test
Product Life	=	24	Hours	Visual Test
Water Resistant	=	Yes	N/A	Visual Test
Reliability	=	Yes	N/A	Visual Test

4. Client Meeting Reflection

Initially, there were many unclear aspects and unknown variables about this project. Prior to the meeting, each team member had devised a question to present to the client in order to fully understand the requirements. The client meeting had sparked an insightful vision of this robotic arm which led to many changes to the design and end goal. After the meeting, it had been established that our focus is to develop the robotic arm to draw a shape or logo instead of performing multiple actions. We decided it was better to perfect one specification as opposed to dividing our time between many specifications.

As the end goal had been identified, our team took all the notes from the client meeting and evolved them into the design criteria and specifications. The client, Mr. Eastmond and his director had presented many guidelines on the robotic arm which has opened up opportunities for our team to envision the different concepts.

The list of requirements that had been displayed in Deliverable B hasn’t drastically been impacted by the client meeting. The outline for the design has begun to take shape. This is mostly due to the client meeting taking place before the completion of Deliverable B. As a result, this has led to a solid identification of needs which translates to the design criteria of the project.