Need Identification and Problem Statement

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INTRODUCTION:

With the production of plastic waste rapidly growing year by year, it is possible for plastic to outweigh fish in the ocean by the year 2050. All of this starts with litter that recreational beaches accumulate, this is a big problem here in Ottawa. After the first client meeting, we gathered the information about the project's background, functionalities, purposes, as well as the client's desires for the improvement on the robot to help environmental restoration. In this document, we will do the problem analysis, create and prioritize a list of needs of client, set up the problem statement, identify all relevant information about existing product, and finally create the metrics for the product to develop target specification.

PROBLEM ANALYSIS & LIST of PRIORITIZED NEEDS & PROBLEM STATEMENT:

Bowie from Robot Missions is a robot that travels through the sandy Ottawa beaches and picks up after OUR waste. There are five different replicated robots and these robots have collectively travelled over 1200 meters, collected 3.1 kg of non-natural debris. There have been various updates for the robot since the organization was started by Erin Kennedy in 2016, but the robot still experiences its troubles and requires maintenance at times. The continuous intake of soft sand creates a problem for Bowie when the robot is travelling through sand. A key focus is having a secure storage where Bowie can go to, to dock and recharge when placed there. Erin wants to also focus on wildlife monitoring and remote surveillance adapted into the robot. When there is rainfall, the user will usually just place a raincoat over Bowie in order to protect it from the rain, but it is not very efficient. Another problem is the breaking mechanics for the robot, as it can sometimes hit a hard object and cause the robot to lose control/tip over.

- Prioritized listed of needs:

Number	Needs	Importance (5-1)
1	Reduce the amount of intaking soft sand.	4
2	Short batter runtime	3
3	Better wildlife monitoring and remote surveillance.	2
4	Have the ability to works in certain weather.	4
5	Undependable Breaks.	5

- Reason for needs' importance:

  During first client meeting, Erin mentioned that there is not a way yet for robot to deal with the situation of roll-over, which means if the robot flips over, the robot will return back to work only if people find it and flip it back. This process will definitely involve extra works and reduce the efficiency of robot, so we rank this as most important need. Secondly, both continuous intake of soft sand and cannot works in certain weather are big limitations for robot, so we rank these into second importance. The problems of 'charge manually and often' and 'wildlife monitoring and remote surveillance' are the minor limitations which will not affect the efficiency and ability much, so we give them importance of 3 and 2 respectively.

- Problem statement:

A need exists for Robot Missions to improve functionalities and efficiency of Bowie robot for environmental restoration by create and set up more valid accessories to solve the problems of intaking soft, short battery runtime, wildlife monitoring and remote surveillance, limitation of weather, and dependable break.

METRICS & TARGET SPECIFICATION:

- Information about client and robot:

  Our clients terminate goal is to improve the natural environment by achieve serval applications, such as environmental clean-up, observation, and rehabilitation, with the help of robots. Thus, come up useful ideas and create valid prototypes that can add to existing robot as an accessory to improve the efficiency of robot for environment restoration are the needs of clients. Furthermore, the robot had already tested for the applications of clean up small size population, wild observation, and artic exploration during the summer.
- Parts of technical Information of existing robot:

Size and Weight	
External dimensions (L x W x H)	Arm raised: 30cm x 30cm x 50cm Arm extended 45cm x 30cm x 40cm
Hopper capacity	30cm x 10cm x 6cm
Weight	~3kg
Ground clearance	12cm

Speed and Performance	
Max. payload (in hopper)	~0.6kg of small debris / sand within 1L volume
Max. speed	0.4 m/s
Max. inclination	15 degrees
Drive power	6.8 kg-cm per wheel

Reference: *Robot Missions Bowie Robot Platform Technical Specifications* [WORD]. (n.d.). Robot Missions.

- Metrics & specifications:

Metrics #	Needs #	Metric	Imp	Units	Marginal Value	Ideal Value
1	1	Shaking frequency for storage tank to remove sand.	4	Hz	>5	<10
2	2	Recharge automated location for Bowie.	3	A	1.1	1.1-8
3	3	Number of Cameras on Bowie for wildlife monitoring and remote surveillance.	2	#	1	2-4
4	4	Specialized outfits size for different types of weather.	4	mm	100x100x60	100x100x60
5	5	Breaking Speed for breaks/sensor that senses dangerous nearby objects and prevents Bowie from tipping.	5	m/s	0.4	>0.4

CONCLUSION:

Our client devotes to improve the natural environment with the help of robots at a low cost. The robots had already been created with some of its functionalities tested during this summer, and we were asked to create more accessories that could add to the robot as an improvement for it. There are mainly four aspects need to improve: continuous intake of soft sand, secure storage, wildlife monitoring and remote surveillance, and any other ideas for environmental restoration. This project is definitely an effective way to rehabilitate the environment, and also is an experience for us to learn how to imply engineering knowledge for solving real world problem.