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Project Deliverable H: Prototype III and Customer Feedback

GNG 1103 – Engineering Design Faculty of Engineering – University of Ottawa

Prototype III Design

Materials Required

Material	Cost	Source
Camera	$15.54	https://www.gearbest.com/car-dvr/pp_009321484798.html?wid=1433363
Wood seal	$9.71	https://www.amazon.ca/ProTapes-Pro-Flexible-Weather-Shield/dp/B00DYN28AU/ref=sr_1_15?ie=UTF8&qid=1542555319&sr=8-15&keywords=flex+seal
Reinforcement Wood Blocks	$0	Donation from Marathon Underground Constructors Corporation
Solar panel	$11.14	https://www.gearbest.com/other-camping-gadgets/pp_351066.html?wid=1433363

Table 1

Prototype III Test Plan

Tests shall be performed on Prototype III to determine whether the current design is capable of accomplishing the desired tasks effectively for the client. These tests will permit us to notice issues with the design and modify them for future secure portable storage methods.

Test Objectives

1: Testing the impact of weather on the shelter
2: Testing the effectiveness of the camera and the motion detector in low light
3: Testing the stability of structure
4: Testing the solar panel for charging ability

Objective	Test methods
1. Weather impact	● put mock object in box and shower with water
2. Camera	● record views in different light spectrums (day/night)
3. Additional stability	● force applied at various angles on structure
4. Charging by solar panel	● charge the camera and a battery pack

Table 2

Test Criteria

Objective 1:
The shelter is able to withstand all weather conditions that will occur during tests and can protect Bowie from water and other natural elements. If the prototype is able to stop water from a showerhead from coming into contact with Bowie's components, we know that it will significantly lower the risk of Bowie's expensive electrical parts requiring repair.

Objective 2:
The camera picture quality is clear enough to identify individuals and detect motion in various light spectrums. If a third party is able to identify the position of each five of the group members in a test video, then we know that the camera is effective at monitoring the whereabouts of Bowie.

Objective 3:
Prototype II was the base structure of the Secure Portable Storage Unit made from plywood. The overall objective of this base structure was to ensure the dimensions are suitable for Bowie. At this point in time, the team has faced a design error and this will be addressed later. It was determined during Prototype II that extra wood blocks would be applied to the corner edges of the structure. The storage unit should be able to withstand exterior forces without a destructive impact on the unit.

Objective 4:
The solar panel will be tested for efficiency on charging the camera attached to the storage unit and a battery pack. The panel will be set in sunlight as a renewable energy source and plugged in to the camera and battery pack at the same time.

Test Objective Description

The team is performing these tests to determine that the add-ons to the unit are efficient. The prototype will provide feedback from the client and other uses as it is the final product. These tests will permit notice issues that could be changed for future designs.

The test objectives for Prototype III are outlined in Table 2. The first objective is to test the impact of weather on the storage unit. The second objective is to test the effectiveness of the camera and the motion detector in various light spectrums. The third objective is to enforce the plywood structure to withstand external forces that may affect Bowie. The fourth objective is to test the efficiency of the solar panel on the camera and battery pack.

This final prototype will help the client, the users, and future design teams to learn and

improve our design to enhance a storage solution for Bowie. The prototype is being used to communicate the functionality of add-ons and strength of the shelter to the client.

The possible types of results the design team could endure for Prototype III are: the tape sealant not being up to par for local weather impacts, a lower quality vision than expected from the camera, the additional wood blocks used for reinforcements not being sturdy enough to protect Bowie from external forces, and the solar panel not charging efficiently. The results could also communicate that the objectives being tested are indeed suitable for the Secure Portable Storage Method.

The criteria for test or failure will be: no water damage to Bowie while inside the storage unit, the stability of the storage structure, efficiency of both the camera and solar panel for capturing images and effective charging, and no damage from the external forces applied.

Prototype III is a comprehensive prototype because there is testing for multiple objectives. The comprehensive prototype is preferred to analyze technical objectives and the final strength of the unit. The physical prototype is mandatory for our testing as our unit will be mobile for the purposes of a portable storage unit.

The final attributes to be tested for the unit are the technical aspects of the camera and solar panels and the physical aspects of weather proofing and stability.

The wood sealant tape has been applied to the edges of the storage unit. A heavy flow of water is poured on the top of the unit with a water bottle. The pour is completed at a steady rate due to risk factors, however it is best to test the worst possible case i.e. heaviest flow and therefore the entire water bottle is poured. No water is leaked in the inside of the storage unit which leads to the conclusion that Bowie will stay dry.

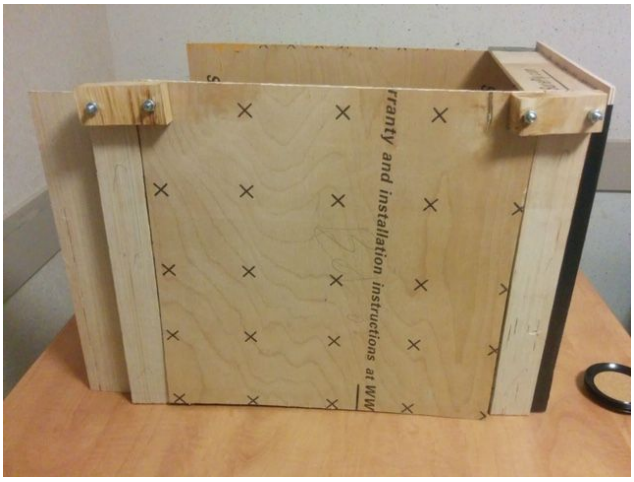
Prior to pour

Water strains but no drips on inside of unit

The camera to be attached in the storage unit is tested for different lighting. It is crucial to be aware that the camera requires a SD card that is 32GB or less. The camera has a wide visibility with a 130̊ angle. The visibility in moderate light is very precise, however the visibility falls short in extremely bright lights and darkness. Bowie will commend most of the travels during the daytime in regular sunlight, therefore visibility should not be an issue. An issue that would arise is if the camera is pointing directly in the sun, in which it will not. Nor will Bowie be running in complete darkness.

The additional wood is placed at the corners of the inside of the unit to provide additional stability for the structure. Prototype II had been based on the dimensions provided in the Technical Specifications section for Bowie's information. The original structure had been built at 40cm x 40cm x 60cm. This allowed for enough room for Bowie to enter and exit the storage unit with no obstruction. On November 15th, the commencing date for building Prototype III, it is realized that the external dimensions provided did not consider the wheels on Bowie. There is a Bowie in the Makerspace Lab where construction is taking place. Measurements are taken to expand the storage unit at an angle for Bowie to still enter. During this change, the additional

wood blocks are securely screwed on the outside edges of the extended wood required for the correct dimensions.



Dimensions expanded

Additional wood blocks

The solar panels will be placed on the top of the unit to collect sunlight for renewable energy to charge Bowie's battery pack. The battery will connect to the camera allowing for the camera to be charged at the same time. The solar panel is left in sunlight for half an hour following the retrieval of the panel and then the battery pack and the camera are both assembled to charge efficiently. The results observed prove that the charging system are suitable for the Secure Portable Storage Unit when Bowie will be stowed or travelling.

Prototype III was built from Thursday, November 15th to Saturday November 17th with testing taking place directly after the final build on Saturday afternoon.

A Gantt chart for the tasks and testing had been completed during the planning phase. There have been recent edits to the schedule. Prototype III encountered the roadblock of insufficient structure dimensions for Bowie's wheels, therefore the completion took longer than expected.

This prototype is the final product for Bowie's storage method.