

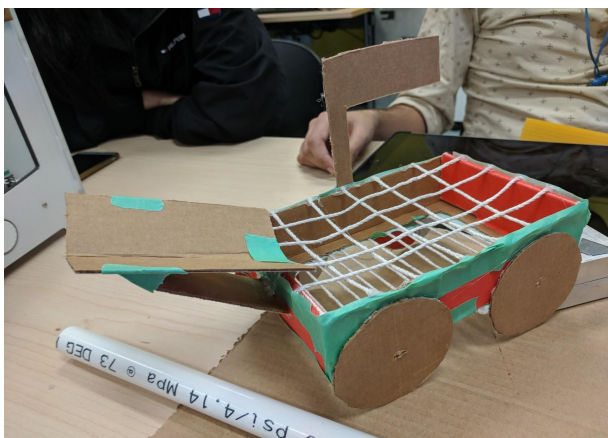
Deliverable H

Prototyping Test Plan

Our Prototype is an add-on trailer that will take the dirt that bowie collects and filter of the twigs, dirt, sand etc. from the trash. The trailer that we had designed has 2 main functions. First is a sifter that separates the plastics from the fine sands and the larger twigs. Second is an agitator mechanism in the wheels that allows the sifter mechanisms to work.

This design was initially proposed to Erin during the first client meeting. We discussed how we wanted to create a copy of bowie that would follow behind the original, using a gear agitator system to further the filtration process along with a seed distribution system. She thought that this was a new and interesting idea, but was worried about the seed system being added on being too much. This is when we introduced the idea of including a seed spreader being an add-on part of the gear agitator system so that seeds would be distributed as the trailer moves and could be implemented later on if time allowed. Her response to this was a suggestion to include motors onto the agitator since the pure movement of the trailer may not be enough to filter the sand. Overall, she was engaged with the idea and was satisfied with the direction of the design.

From the first prototype, we were able to determine the relative sizes of the mesh required to filter sand and debris despite the absence of a agitation component. There was also no testing done for the base and wheels of the bowie frame. Therefore, in this second prototype, we decided to implement the basic frame, as well as the wheel and axle component, showcasing an offset mechanism. The frame was created using stiff cardboard and the wheels/axles were all 3D printed. This is a significant improvement in regards to the first prototype, as we were able to test its movements, as in how it would coordinate with the main bowie trailer and operate as a whole. Although the sifting and agitator mechanism used to power it has not yet been implemented, this will be the focus in future prototypes and testing trials.



The specific mechanisms that we are going to be testing are, the sifters ability to filter out the sand and twigs, and the wheels ability to agitate the sifter. We will learn the size of filters we need and how much to need to offset the wheels so that the sifter is able to do its job properly. The results from the filters test will give us the sizes of the filters to be used so that we can keep the small plastic bits and lose the sand while also keeping larger objects like twigs out. The success will depend of the filters abilities to let sand through and keep larger twigs out. The wheels will be tested on how well they can agitate the the main body of the trailer so the sifting process can occur failure could mean that the trailer was able to retain sand in the lower filter while letting bigger objects fall through in the higher filter.

Our second prototype is a comprehensive prototype. We created a physical model of the project with nearly all of the working parts. There are 2 tests for the prototype:

Testing the sifter;

- For the lower sifter we find a sieve that is smaller than 2 mm and is able to easily let sand pass through
- For the higher sifter we find a sieve that is larger than 2 mm and is able to keep twigs and larger debris out
- Its ability to separate wet sand will also be tested
- Estimated cost \$20 (amazon)

Testing the Agitator (to find the proper wheel offset for the agitator);

- At rest and with a load of dirt, twigs and plastic, in the trailer,
- Move the trailer until the agitator is able filter everything properly
- It will be judged by the distance it takes for the load to be sifted
- Estimated cost free (3D printed)

Stopping Criteria

- once we run out of energy to continue the testing
 - if we repeatedly test this prototype without attaining acceptable results, it shows the prototype cannot properly function
 - we would stop testing and think of ways to alter it so that it works
- we would only have a certain amount of time to test this prototype
 - once that time is up, we would have to terminate the trial

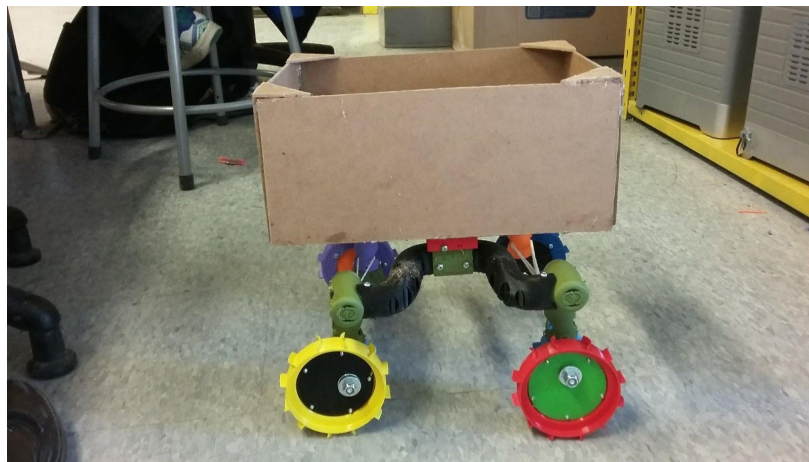
Results from the testing

- The sifters was a success and the sieve was able to let sand through while keeping bigger debris out
- The results form the agitator tests were inconclusive and will require further testing in the third prototype

For our third prototype is also a comprehensive prototype. We created a physical model of the project with all the working parts. There is only one thing to test:

BOWIE'S ability to attach to the trailers extension;

- The only way to test this is by attaching it to BOWIE robot
- The ability for BOWIE's scoop to throw sand into the slide down to the
- For the agitators Test to be conclusive from the second prototype is for a practical test with BOWIE since it was not possible to test for sandy condition in the current weather



Feedback

User feedback:

- User feedback was sourced from Engineering students separately from other science and humanities students to compare reactions from the two different types of user groups.
- Engineering student feedback
 - “Why so tall”
 - “Interesting bouncing idea”
 - “If support was attached to sides maybe better
 - Likes colours
 - Concern for axle mounts collecting sand
 - Sand in wheels? Chain link? Tube?
 - Lack of aesthetics-- it is not very appealing.
- Other feedback
 - “Really smart idea”
 - What about water? Shouldn't it be waterproof?
 - Shouldn't it be bigger?

- Erin's feedback
 - Concern for offset, unless it works nicely in the field in which case its ingenious.
 - Very interested in the concept,

The above is raw data collected from random individuals. Below is a short interpretation.

Firstly, the wheels and axle system have been questioned the most. One potential solution is the print a small tube to cover the moving parts and protect them from the sand and elements. Secondly, there are concerns over whether the offset will operate properly. This has been a concern of our team as well, and we have a plan. We are testing the prototype for different offset levels on different terrains. Since it seems to perform differently on each terrain with each offset level, we are considering producing our final project with multiple interchangeable offsets to suit differing terrains (beach, plane, forest, etc). Finally, there are several concerns that pertain to the BOWIE robot itself more than our module, and these have been disregarded, since solving the problem on our module does nothing if it is still an issue on the main BOWIE. For example, waterproofing the module is of no use since the main BOWIE is not waterproof and contains more important components, so until BOWIE is waterproof, the module won't be out in the rain anyway.

