Prototyping ar the Wilbur Powerhouse

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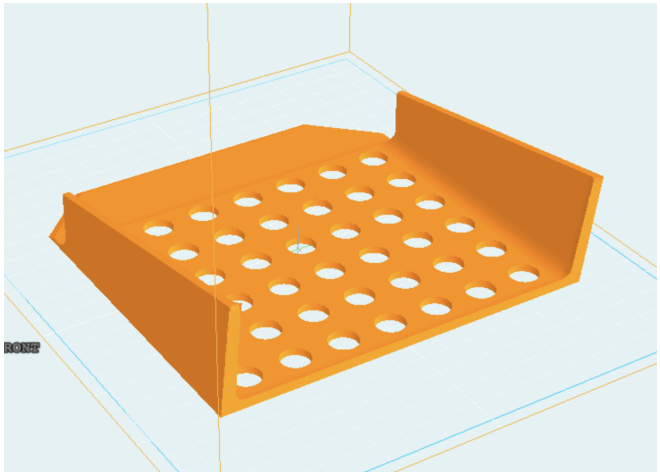

Fig. 1. *Improved shovel 3D design in Fusion 360*

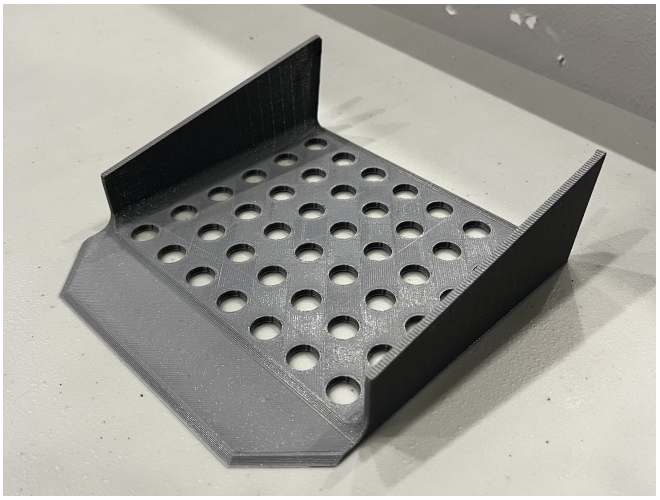

Fig. 2. *Improved shovel 3D-printed part*

***Abstract*— In this lab practice, I present a 3D design for an improved shovel for the Freenove Robot. I used Fusion 360 to model the shovel and PLA material to 3D print my design. In addition, I also designed a 2D shovel that can be cut (using a laser cutter or a knife) and assembled.**

I. Description

My design has 3 advantages compared to the one in the video. These advantages combined will help with the process of scooping and keeping the rubber ducks.

- **A sloped scoop tip**

  I added a 15 degree inclination the extended isosceles trapezoid shaped scoop tip to my design. I believe a sloped scoop tip will be better with actuating the objects. But once the objects are fully inside the scoop chamber, they should be standing on a flat platform.

- **A square shaped scoop platform**

  Unlike the scoop showed in the video, I designed the platform of my shovel square shaped rather than trapezoid shaped. In the video, the scoop loses the ducks when it made turns. Having a more enclosed space, the improved scoop will be better keeping the duck from drifting out the scoop chamber.

- **Added holes on the scoop platform**

  The surface of the PLA material is too smooth to generate enough friction force to keep the rubber ducks stay still that they will be very likely to slide off if the robot moves backward. To solve this problem, the holes create some "traps" that will prevent the rubber ducks escaping from the scoop chamber.

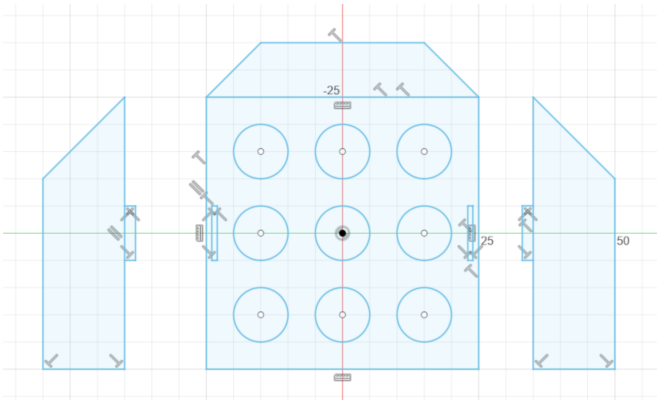

Fig. 3. *2D design for a laser cutter in Fusion 360*

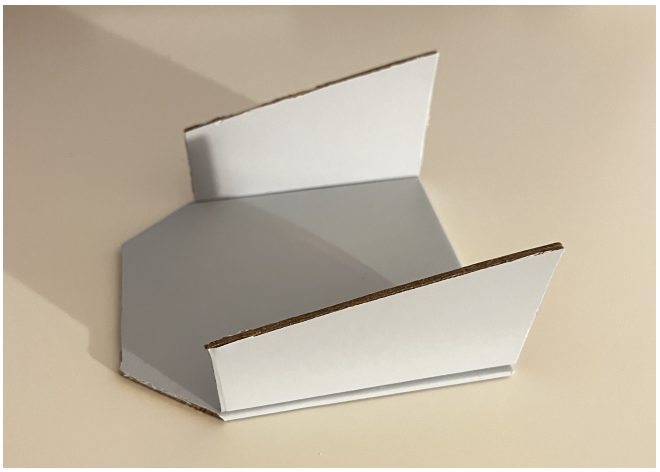

Fig. 4. *Assembled shovel based on laser-cut parts*