Pacific Garbage Patch C3

Hardware Review 2

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From Hardware Review 1

Stephen worked on the grabber. He 3D printed an original prototype. The length was too short, the depth and the arm were too long. After the boat was shipped in, Stephen redrew the grabber to the proper dimensions He placed in the order on Wednesday before the hardware review. Unfortunately, the maker lab was down to one large 3D printer, and it was having malfunctioning. Stephen picked up the misprinted grabber to show the proper dimensions of the final product.

Mohammad worked on the motors. He used the information from the grabber to determined the torque needed for the motor. After Mohammad decided with the team and Dr. Trevas in the staff meeting, He research about a motor that work in the boat to make the grabber carry the bing pong ball from the water. He found a motor (TETRIX W39530) which is good with torque and speed. He decided with the team to go with this motor. Dr. Trevas give us the guarantee to order it. Mohammad ordered the motor and he got it three days ago. Mohammad will work with team, stephen specially to make the motor worked with grabber. We decided to have a gear to make the motor carry the grabber.

Salman worked on the solar cells. Compared the values resulting from various configurations (how many in series/parallel) of the cells. He looked at the efficiency and the possible collection in order to calculate how many cells would be necessary given the boats electrical components. Given the calculations, a platform has been designed to be mounted above the boat in order to fit the necessary amount of cells. He ordered the panels, which will be mounted on the designed platform ensuring enough power is collected for the device to run continuously. The cells will be connected in series (and some in parallel if necessary), then wire them to the boat's battery. To work towards the next hardware review, Salman will continue working with the cells to optimize the energy output and connect it to the boat's battery to run the boat as long as the battery is charged from the solar cells.

Jake attended arduino club meetings to learn how to program all the components to work autonomously. He has also worked on multiple CAD parts including all of the original CAD assembly and assisted on both the original grabber prototype and the cell platform prototype. He assessed the updates to the grabber dimensions needed for Stephen to update the part including the height, width, and thickness of the grabber as well as the radius of arm to attach the piece to the boat. To meet the needs of the next

hardware review, Jake will continue pursuit of arduino to automate the device. He will also continue assisting the CAD designing of parts.

Nader worked on the camera. Originally he tried to use a thermal camera to sense the balls in the water. Yet, the thermal cameras were too expensive. Nader then decided to do many research to help the the team. Nader found a Ov7670 Arduino Camera. Its a visual camera which can help the team to figure out where is the location of the ping pong ball. The size of the camera is ⅛ inch and this good for the boat. Nader discussed with Dr. Trevas about the camera that he found. Dr. Trevas was happy about this type of camera, so he encouraged him to order it early. Ov7670 Camera works by connecting some wires in Arduino. In addition, this camera can more easily be coded to sense the balls in the water.

Since Hardware Review 1

The Pacific garbage patch cleanup bought all the parts needed, except the platform to build the cleanup device that collects ping pong balls in the water autonomously. Dr Trevas and the team realize that there is a lot left to do to test and correct potential unseen errors in order to prepare for UGRADS. The group must test the device manually and then get it to work autonomously with Arduino.

Stephen bought 24 ping pong balls from Big 5. He created two shafts on SolidWorks that connects the grabber and motor. The shaft diameters are slightly smaller than the bore diameter so they can fit inside the gears. The pinion gear shaft connects the pinion gear and the motor. The main gear shaft connects the main gear to the grabber. After realizing the bevel gears was too big heavy, he found two bevel gears on rushgears.com. The bevel gears have a 4:1 gear ratio. The gears have a pitch of 16. The bevel gears had a 4in and a 1in pitch diameter for the pinion. The bevel gear and pinion gear have 64 and 16 teeth respectively. The pitch angle is 20 These gears were too massive. He used solidworks to scale them down to 4cm and 1cm for the gear and pinion respectively. The gears have a bore diameter of 0.625cm and 0.5cm respectively. The shafts and gears were printed from Makerlab PLA plastic and the NAU Cline Library. The new bevel gears and shafts and corresponding shafts are shown in Figure 1.

Salman built a platform from wood that has holes which will be helpful for the wire connections. He tested each cell before sours them and figure out that he needs to connect some of the cells in parallel and the rest in series so the cells could provide the amount of voltage that we needed. We need at least 26 cells to cover a 12V battery. Salman faced some troubles during connecting the cells, some of the cells stopped working after testing them and wire them. He have been replacing the cells every time this happened and after he talked to the solar plane team he will do what he missed in the first place which is getting an item that connect to the cells and do one connection instead of three connections. If some of the cells did not work after the adjustment he will consider getting a pre tabbed solar cells that would be a lot easier to connect and much cleaner.

Jake has continued attending arduino club in an attempt to combine all the components of the device. These components include the boat specific components of a servo and motor, as well as the additional components of the grabber motor and camera. The arduino must also automate the process of locating the orange ping pong ball, whether it be through the color or IR, and collecting the ball. Some delay due to alterations to the camera product.

Nader attended the Arduino club to test the Camera with Dr. Trevas , but he noticed that the OV7670 camera did not have a library source in Arduino, so he did research with Dr. Trevas to find a camera that can support the team. He Found a new camera (TTL Serial JPEG). During this week, In the Arduino Club he tested the camera by connection some wires and run a code in Arduino. The result made the team

happy because the camera take a picture almost less than 3 seconds and in different size, so this new camera will make us go forward in our project.

Mohammad was researching about the motor. He researched until he found a good motor that will help with our project. He calculated the turqe for the grabber to get the hood motor that we should work with. He got the motor that Dr. Traves agree with it. Which is (TETRIX® MAX DC Motor (W39530)). Then he researched about a good bevel gear that should work with our project. The gear should be connected with the motor and grabber. To make the grabber go up and down. He got the good Bevel gear that we should go with it. But when we got it, it was heavy gear was made from steel. So we suggested to make the bevel gear by 3D printer. He will workstephen specially to make the motor worked with grabber by connect them with the Bevel gear and shaft.

Action Items

The Pacific garbage patch cleanup team must complete several action items before UGRADS. The new action items must focus on completely building the final product with all its parts. Jake must continue to attend and work towards the automation of the device as it is still untested. The grabber might be redesigned to have two lever arms for stability as well as increasing the lever arm length and adding holes for the shaft. The edges might need to be increased as the current version had a hairline fracture. One of the ends might have to be cut right after the holes to allow the ball to fall into the container faster. Unfortunately, the main bevel gear teeth might have been too close together for the Makerlab. Thus the shafts and gears might have to be scaled up and reprinted. The group must also build the platform for the solar panels and the collection bin below for the ping pong balls. All makerlab parts might need to be sanded to reduce friction and roughness. The camera must recognize the plastic ping pong balls. The signal must then tell the boat to drive to the balls at defined speeds (speed over when far and then slowly approach once close). Then the grabber must scoop up the ball and drop it into the on-board collection bin. The team now needs to conduct extensive testing and create the display for UGRADS.

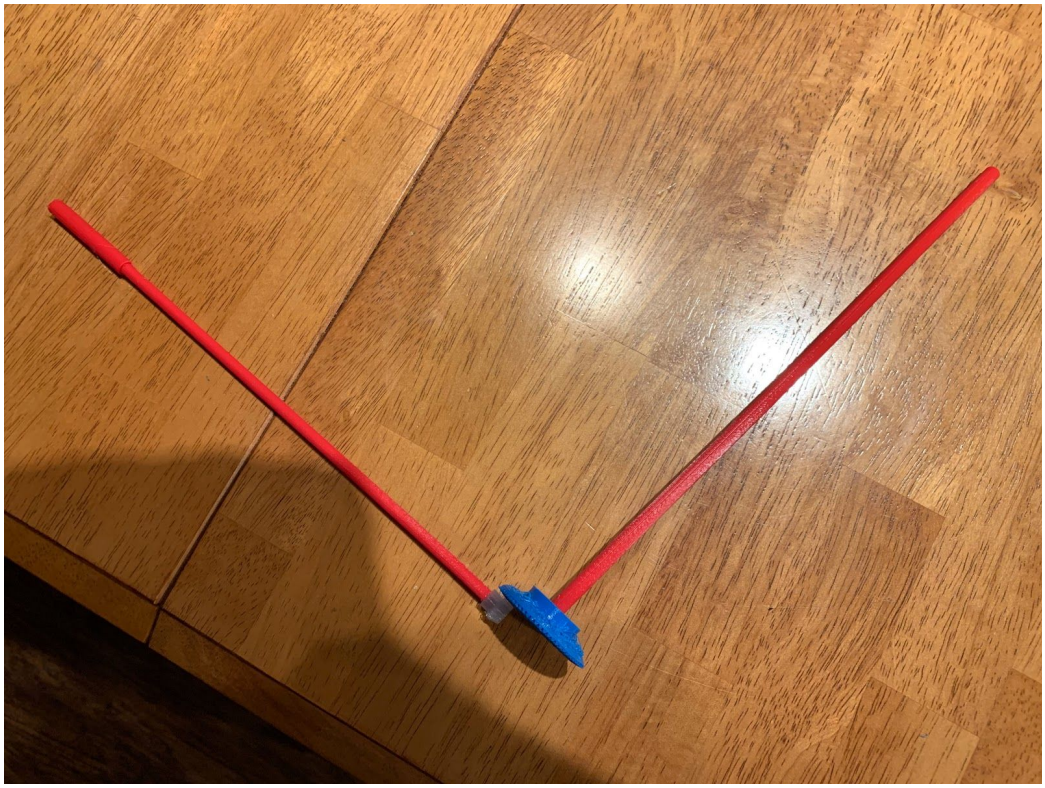

Figure 1: Bevel Gears and Shafts

The bevel gears and shafts were created from Makerlab PLA plastic at the NAU Cline Library. The large gear is in blue while the clear gear is the pinion. The two shafts are each 25cm long.

Figure 2: Grabber with Orange Ping Pong Ball

Figure 2 shows the most recent 3D printed grabber. This grabber has a lot less mass than the previous versions. The holes are also spaced closer together reducing weight.

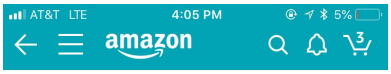

Figure 3: Steel Gear

Figure 3 is the original gears that were used. However, due to their size and weight the team could not use them and had to create new ones to 3D print. The shafts had to be redesigned as the bore size shrunk.

Figure 4: Solar Panels

Figure 4 displays half of the designed platform which will be mounted above the device. Connecting the cells will have to be completed as well as the connection to the inside to charge the batteries.

Figure 5: Motor for Grabber

Figure 5 shows the motor for the grabber. This motor will be given instructions through Arduino. This motor rotates the shaft, which turns the main pinion gear. This gear rotates the main bevel gear and shaft. That shaft then rotates the grabber, which collects the ball and drops it into the boat.

Figure 6: All Components

Figure 6 shows the boat, motor, grabber with ping pong ball, camera, and steel bevel gear. The solar panels are not included due to their fragility. The new shafts and gears are not located in this picture as the just finished printing and the team has not had time to meet since then.