

# **Pacific Garbage Patch**

## **Operational and Assembly Manual**

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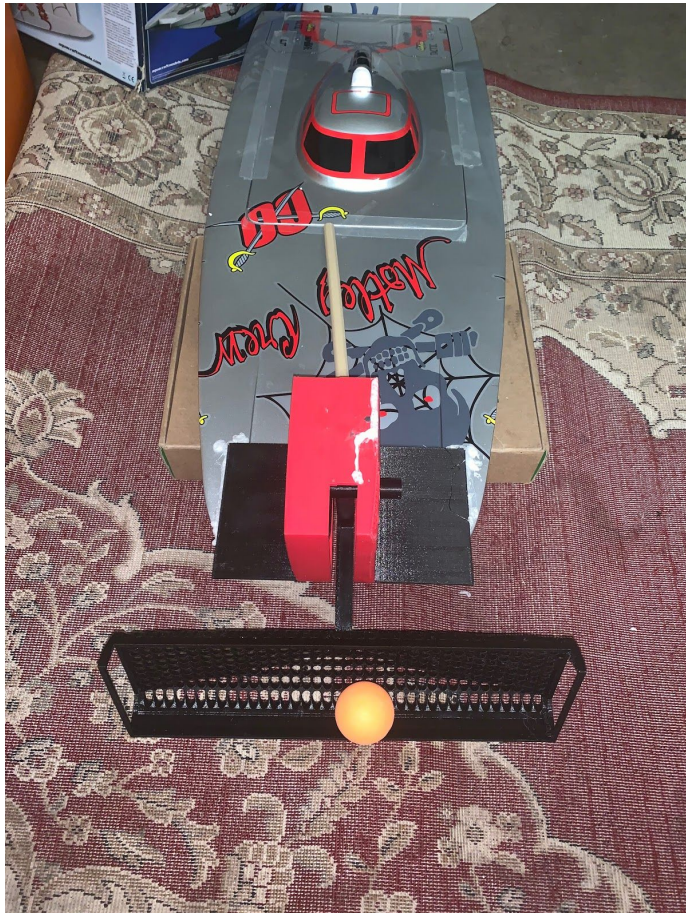
**Project Sponsor: Dr. Trevas**

## Operation Manual

There are two modes of operation, manual and autonomous. Both modes use solar power, the grabber assembly, net, and two motors.

In manual mode, a remote controller drives the boat using a motor towards plastic. The remote controller lifts the grabber up with a second motor when someone sees plastic close to the grabber. The grabber rotates and places plastic in the net. Once the driver sees the plastic is in the net, they lower the grabber back to the starting position.

In the autonomous mode, the boat drives around autonomously using solar power. The on board camera senses the location of the plastic. The boat moves towards the plastic using the steering motor. Now that the plastic is close, the grabber will activate and scoop up the plastic with the grabber motor. The grabber then rotates and drops it into the boat. The grabber then rotates back to the starting position and the process repeats.

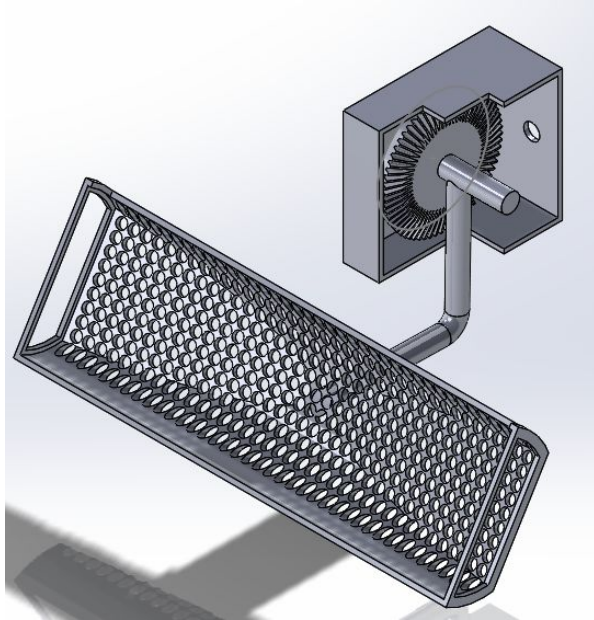


**Figure 1:** Grabber Dropping Balls in Boat

Figure 1 shows the grabber dropping off the plastic in the boat before rotating around the front of the grabber

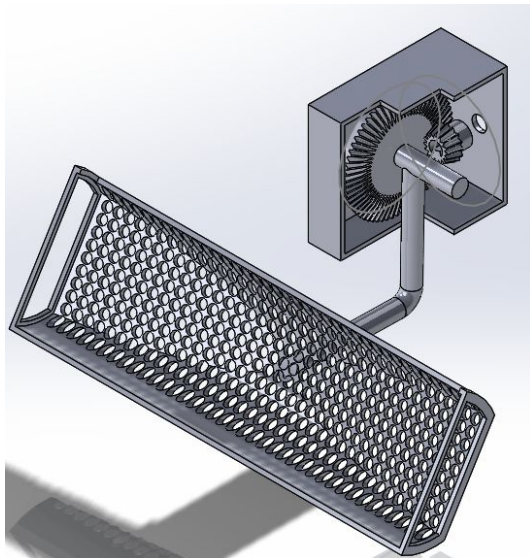
## Assembly Manual

### Grabber Assembly Steps



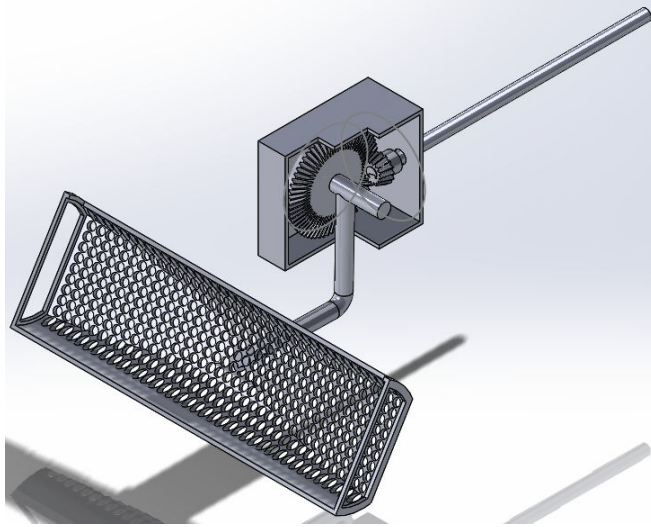
**Figure 2:** Grabber Assembly Step 1

**Step 1** Insert the end of the grabber shaft with the gear into the large hole in the gearbox. The end of the shaft sticks out of the gearbox a little. The gear should be close to the inside edge of the gearbox.



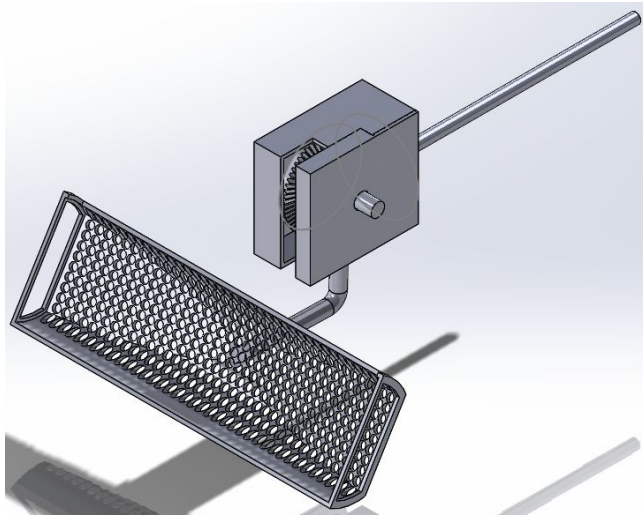
**Figure 3:** Grabber Assembly Step 2

**Step 2** Place pinion inside the gearbox next to the smaller hole. It should be between the grabber shaft and the small hole in the gearbox.



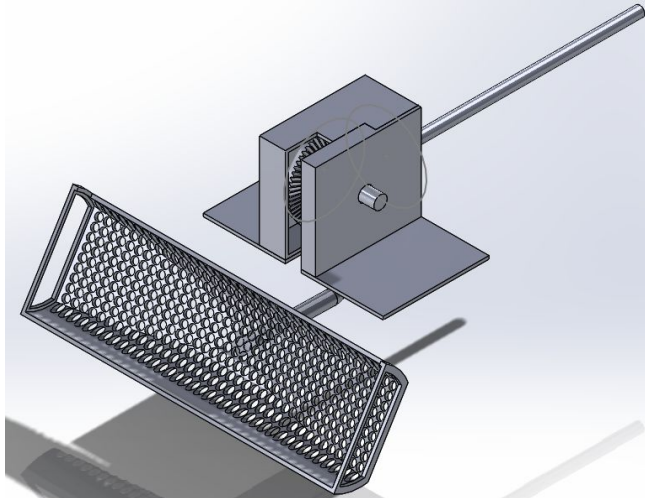
**Figure 4:** Grabber Assembly Step 3

**Step 3** Connect the pinion and the shaft together inside the gearbox by snapping them together. The key and corresponding keyhole should be aligned. The outside edge of the pinion should be close to the hole.



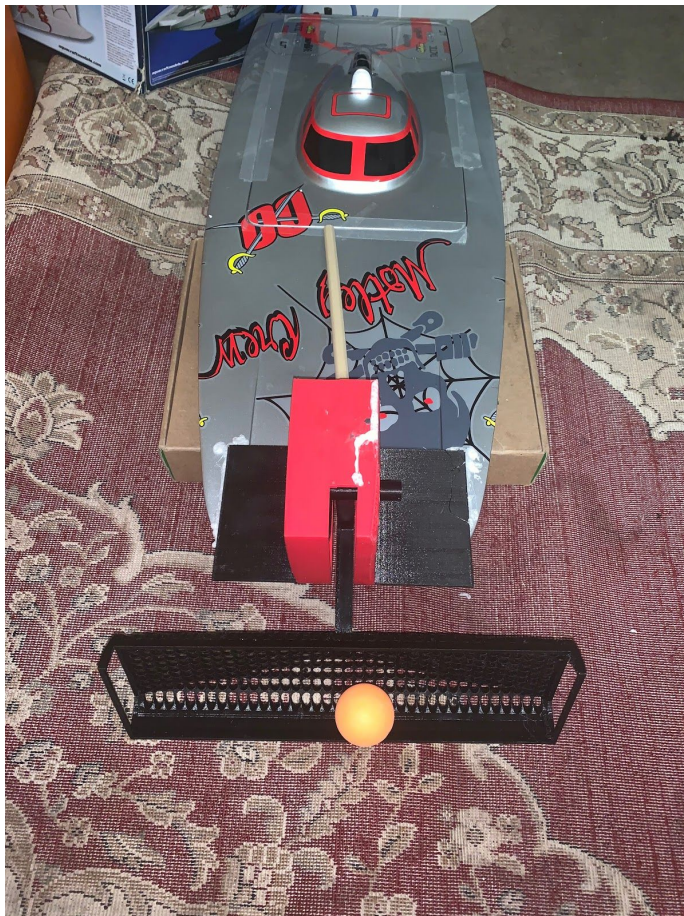
**Figure 5:** Grabber Assembly Step 4

**Step 4** Connect the gearbox to the gearbox attachment to the gearbox with superglue. The side of the grabber shaft without the gear should fit inside the grabber attachment hole. The shaft sticks outside of the attachment hole



**Figure 6:** Grabber Assembly Step 5

**Step 5:** Connect the gearbox platform to the bottom of the gearbox. The gearbox platform and gearbox can be connected with screws, nails, bolts, or superglue.



**Figure 7:** Grabber Assembly Step 6 Final Step

**Step 6** Attach grabber platform to the front of the boat. The grabber platform should be centered with 1cm overhang on each side for glue, screws, nails, or bolts etc.

### **Troubleshooting**

If the grabber stops moving, check to make sure the batteries have enough power. If not, place the boat outside to collect solar power.

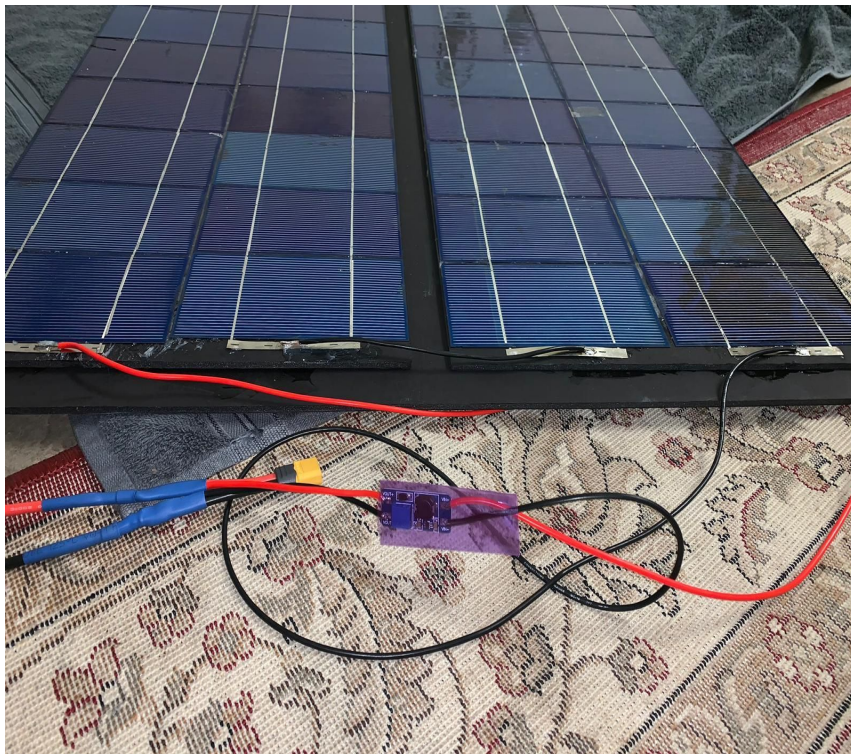
If the gear is not rotating, make sure the pinion shaft is angled slightly to the right when viewed from the front. Otherwise the gear is separated from the pinion and thus the gear does not rotate.

If the gearbox, gearbox attachment, gearbox platform, and/or boat disconnects, reglue, screw, bolts, etc the parts together.

If the shaft, pinion, gear, or grabber squeak, apply lubricant to the location of the noise such as the gear teeth, or shaft and hole.

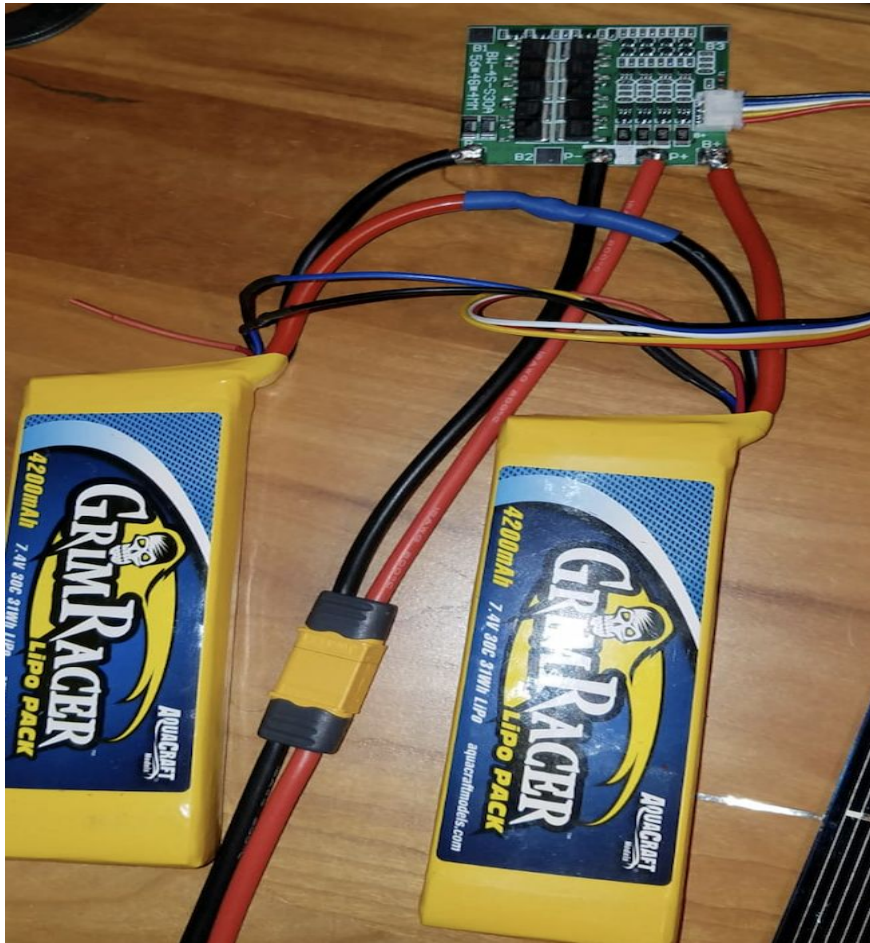
### **Solar Panels & Platform:**

Solar panel is very important to our device to recharge the batteries and make the device continuously run and clean the ocean. In the figure below, the panels are wired together in 4 series and 10 parallel. Also, to get the voltage that we needed to achieve the purpose of using solar panels is that we added DC converter to convert the small voltage to a higher voltage for the batteries could charge. The length of the solar panels is 12x32 inches.



**Figure 8:** Wired Solar Panels and DC Converter

## RC Boat Batteries:



**Figure 9:** Batteries Wired to Battery Management System Board

The batteries are connected to a one battery using Battery Management System (BMS). The team will have to cut the wires that soldered on the BMS and connect the wires to the boat and the black and red wires (soldered together) will cut these and connect them to the solar panel.

## Platform:



**Figure 10:** Solar Panel Installed on Platform

In Figure 10, the platform is made from foam board and it is 3x2 feet. The solar panels are already installed on the platform. In Figure 9 & 10, the platform is ready to install with stick supporters, but the team decided to wait until the camera and the motor are wired to the boat.





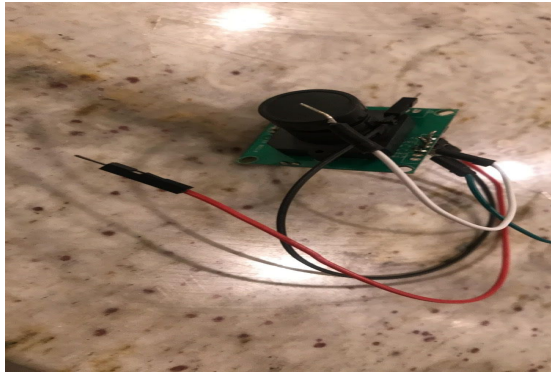
Figure 11: Platform Bottom View



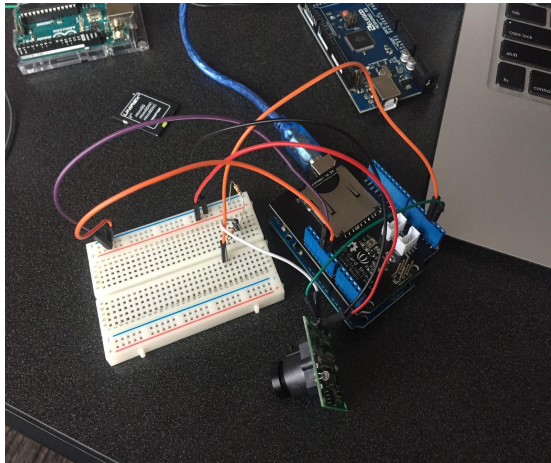
Figure 12 Stick Supporters for Platform

## Camera:

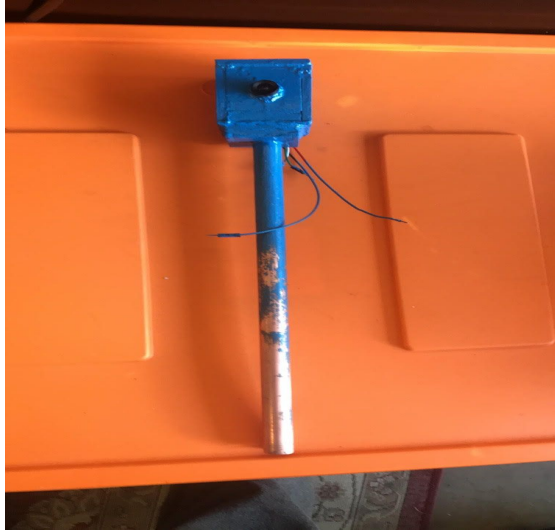
The camera is very important to our project. We use it to detect the location of the ping pong ball in the swimming pool. It takes a picture every minute through arduino coding and that will help us to collect as many as we want. We worked hard to know how can we make the camera work and how we can protect it, So the figures will explain the idea perfectly, so in figure 13 shows how can we protect the camera from water when we test a device in swimming pool by building a tower and small box to make the camera stand by make a space between the platform. The wiring will then run from the camera, down the tower, to inside the device where there electronics are located. The UNO board connected to the camera will have the program stored and have an attached SD Shield (along with a sd card) to store and read the captured images.



**Figure 13:** Wiring the Camera



**Figure 14:** Testing the Camera



**Figure 15:** The Camera Tower

**Motor:**

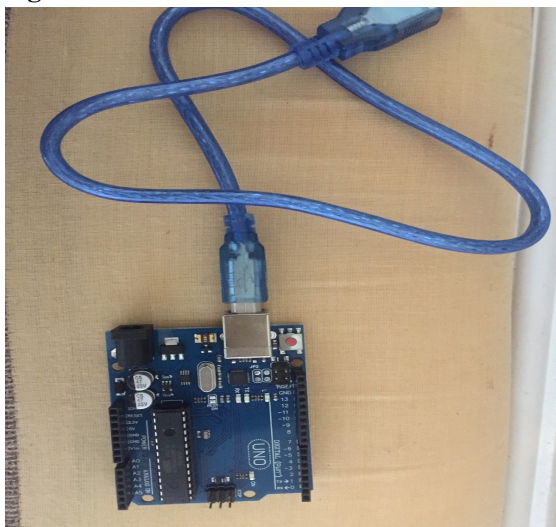
The Motor is Playing an important part in our project. By make the motor rotation, the Grabber will rotate up and down. And the motor will work with Motor shield and UNO board by connect them with the arduino. And by connect them to the arduino we will make the motor work on the perfect time that we need.



**Figure 16 :** Motor



**Figure 17 : Motor Shield**

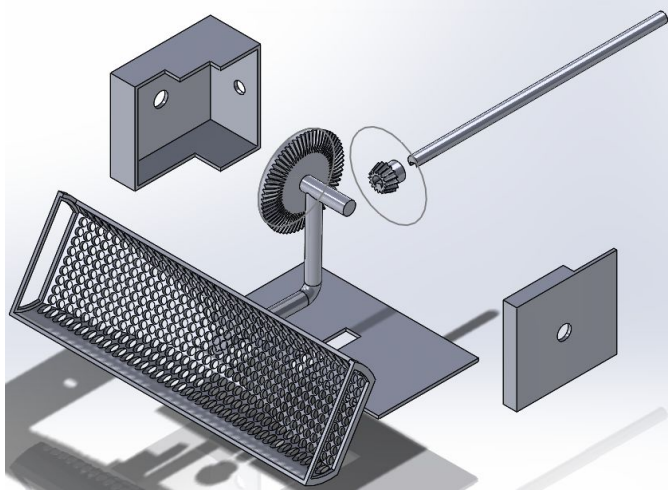


**Figure 18 : UNO Board**

**Troubleshooting:**

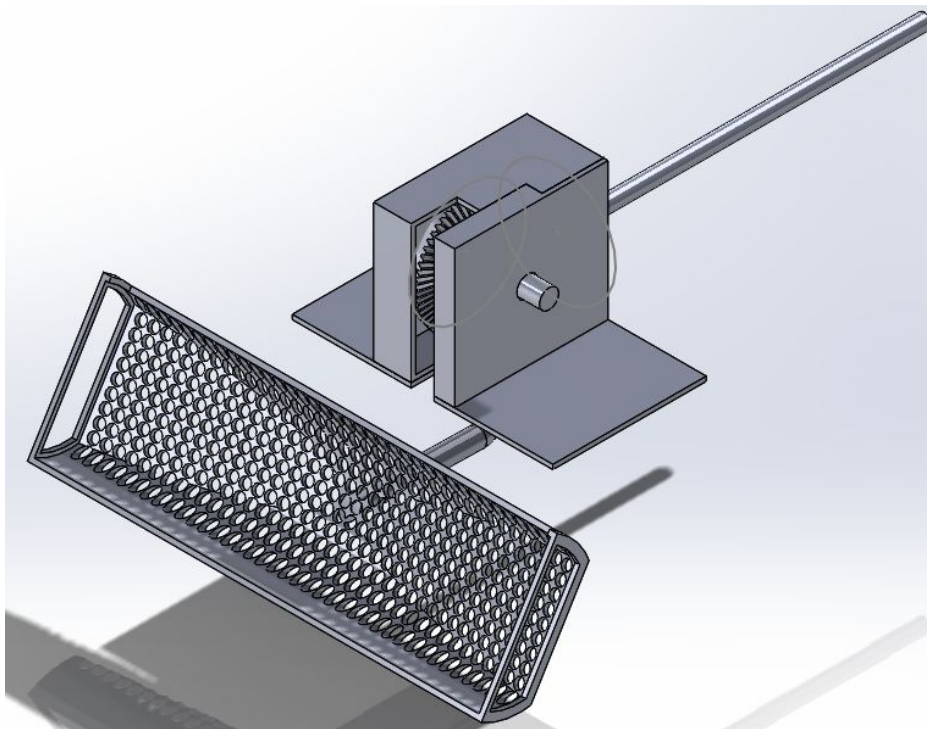
The only concern is that the batteries might overcharge which cause fire or heat to the batteries.

**Appendix**

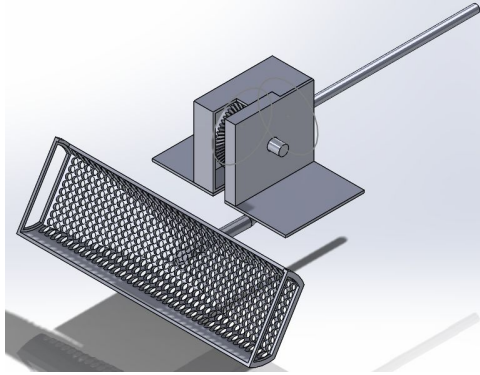


**Figure A1:** Exploded View of CAD parts (grabber, gearbox, gearbox attachment, pinion, shaft, and gearbox platform)

Figure A1 depicts all the necessary components in order to create the grabber assembly.

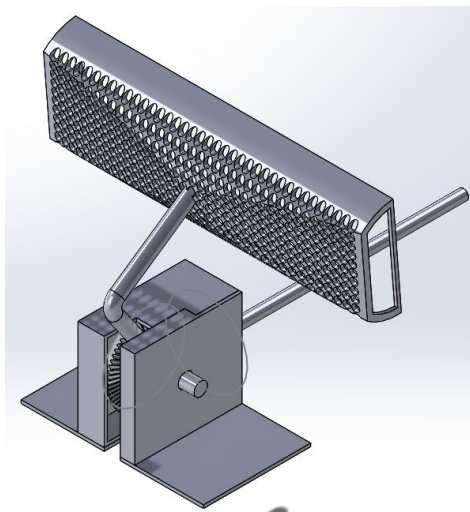


**Figure A2:** Assembly of CAD Parts



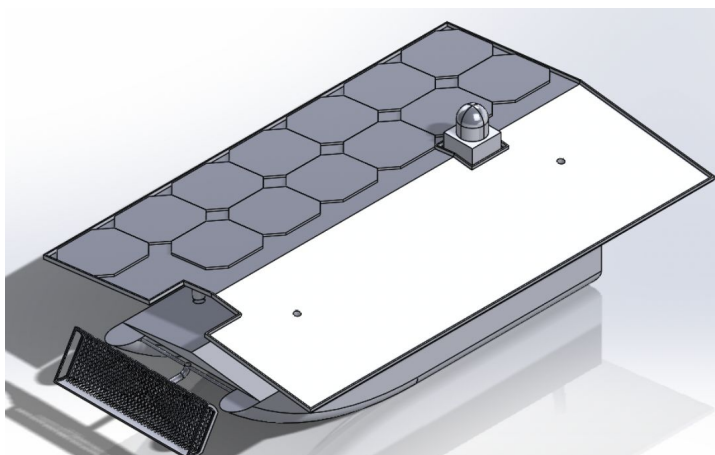
**Figure: A3 Grabber Position in Water**

Figure A3 depicts the grabber searching for the plastic. The plastic is just entering the grabber



**Figure A4: Grabber Position Releasing Plastic into Boat**

Final CAD Model



**Figure A5: Final CAD Model**

Figure A5 shows the whole device combined but here in this section we will introduce the manual assembly of the solar panels and the platform.

