# Assembly Guide

*Instructions on soldering the PCB are found under the Wiring section.*

# Setup

The first step in building this project is to git clone the github repository using this link: https://github.com/poganyg/Glassify.git

From here open the folder Models_Of_Hardware. This contains all necessary 3D models. These must be printed using a 3D printer.

2. Once these parts are ready you must first remove and trim down the errors incurred through 3D printing using a box cutter. This is most important for articulating parts such as the bearings. This must be done for any part with visible extra edges also.

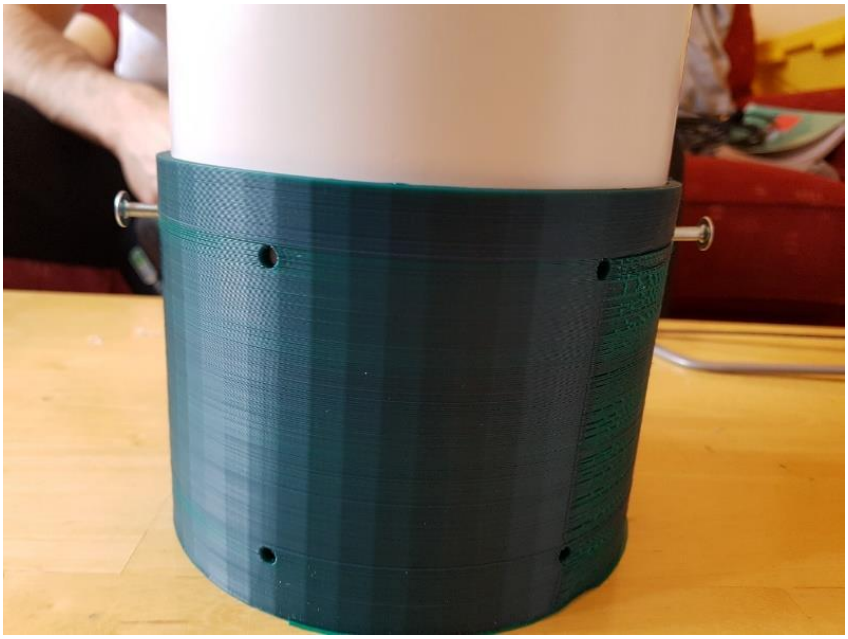

## Assembly

## Rotating Portion

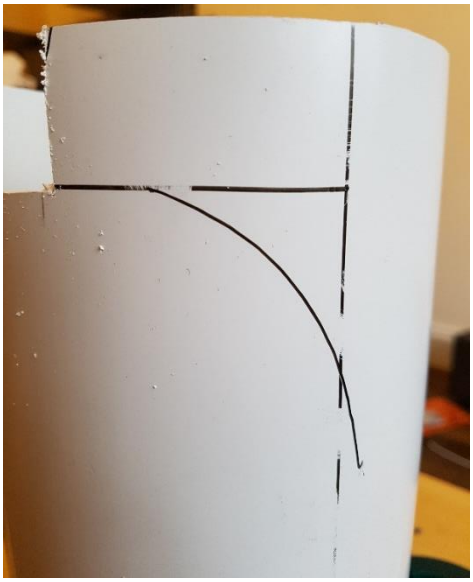
1. First it is wise to assemble all necessary parts to ensure all setup work is completed.

**2.** Place the large drill guide around one of the 120mm pipes.

**3.** Drill into the holes in the drill guide. Once you have drilled the first two holes use two bolts to ensure the drill guide does not move.



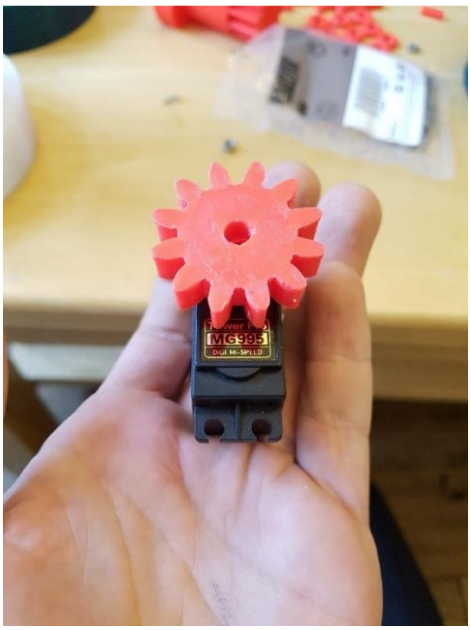
**4.** Outline the area on the pipe you plan to remove, we advise leaving 3cm at the top to aid in attachment to the input pipe and using curved edges. Remove this section using a saw or strong scissors.

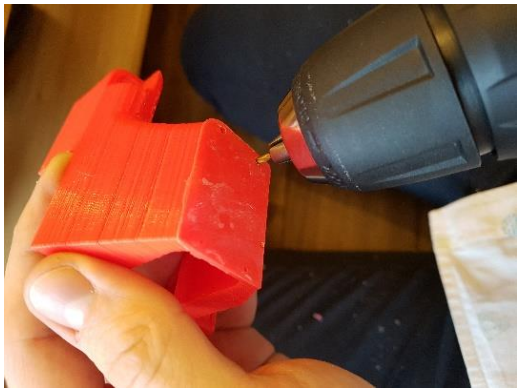
**5.** The secondary drill guide can then be used on this pipe. In order to align this correctly (with the centre hole in the centre of the enclosed region). It is advisable to use a straight piece of string to mark this region.

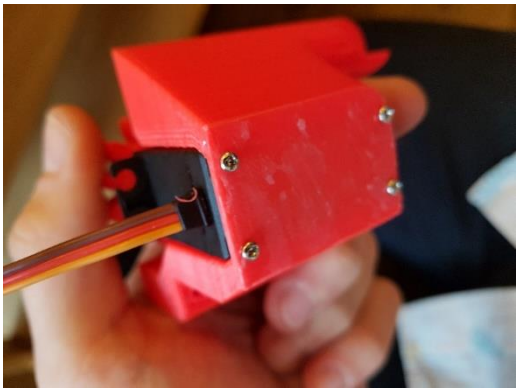
**6.** This is drill guide can then also be used on the second 120mm pipe.

**7.** Take the servo and place the gear on top. It should fit snuggly. Using an M3 screw firmly attach the motor and gear.

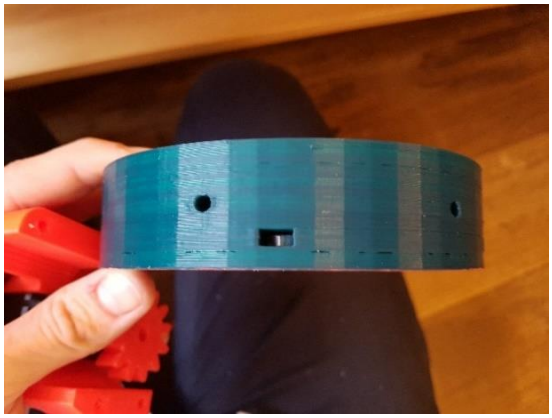


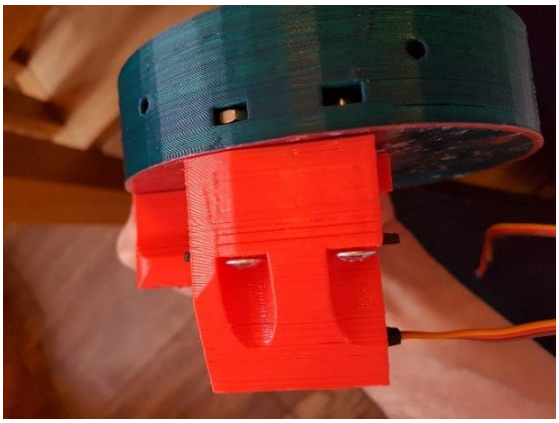

**8.** Remove the four screws from the servo motor. Using these screws attach the servo motor to the servo holder.





**9.** Insert nuts into the side of the bottom disk. Align the servo case and screw this into the bottom disk.





**10.** Take the bottom disk with attached servo motor and inset nuts into each of the gaps in the inner ring. It is also useful to insert the bearings at this point. If you have not already remove the drill guide from the pipe. Then insert the disk into the bottom of the pipe. Align the holes in the disk with those previously drilled in the pipe and insert the bolts using the drill.

**11.** Take the central rotating portion and insert the top of the shaft into the hole on the base. This should fit snuggly. If the shaft does not fit initially sand the top down until it does. After the shaft is inserted insert nuts into the central parts base and screw the shaft-holder into place.

**12.** Run your servomotor script to ensure that it is set to 90 degrees. Now place the central piece into the pipe ensuring it is facing forwards and the shaft gear has mated with the servo gear.

**13.** The bearings and nuts must now be inserted into the top disk. In order to insert the top disc the setup must be inverted and the bolts screwed in. If the rotating portion is not held in place during this step the bearings in the bottom disk may become dislodged. It is recommended to have someone help you with this step. Once the disk is in place drill the bolts in as previously.

**14.** The 100mm pipe can now be sawed to remove a third of its circumference down to approximately half of its length. Use the final drill guide to drill holes in this pipe. Ensure to do this at an appropriate angle.

**15.** The edges at the back end of this pipe must then be cut to leave space for rotation.

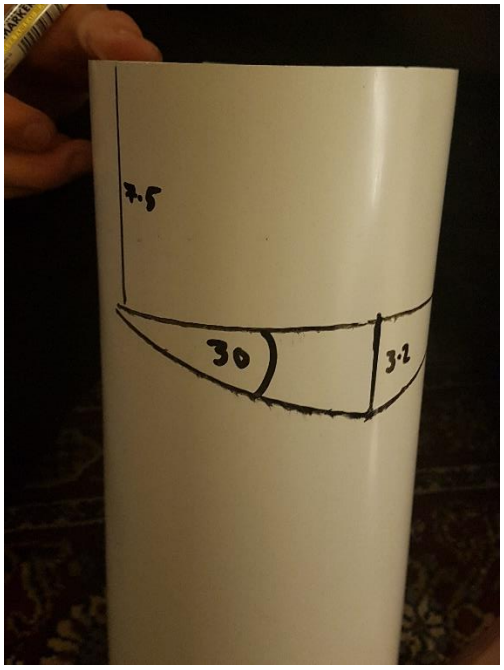
**16.** Insert nuts into each available hole on the central piece, this should be 4 in total. Using the drill bolt the 100mm pipe to the top of the rotating part.

Incorporating the 3D printed bolt shield here reduces the impact of the bolts on the bottle.

## Input and Classification Tubes

1. The second 120mm pipe can then be marked using the LED PCB/Camera enclosure. These markings should be used to saw a hole to allow these pieces to be inserted at a later point.

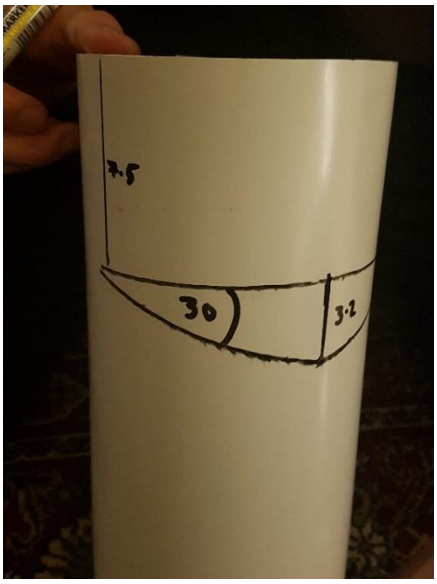
**2.** Cut 3cm down and then cut a 30degree curve in the remaining gap. As previously we advise marking this out before cutting.




**3.** Attach the tube to the prebuilt assembly using the holes drilled earlier.

**4.** Take the final 120mm tube and the switch enclosure. Using the switch enclosure draw an outline of the base onto a low point of the tube around 5cm from the end. Saw a hole into the pipe following this outline.

**5.** Mark the pipe at half circumference and draw a large ellipse 7.5.cm up the pipe. Leave 3.5cm in between and mark a much shorter 30 degree curve on the opposing side. Saw these shapes ensuring the flaps are left uncut.




**6.** Using a heat gun heat the flaps. Rest the 30 degree cuts upon one another and form the flaps to the top of the pipe.

**7.** Bolt the flaps to the top of the central pipe.

**8.** Place the screw enclosure into the previously drilled hole. Insert the switch into the switch enclosure and screw it in place.

# Wiring

The wiring in this project is centred around two PCBs, these are the central and LED PCBs. The files required to manufacture these PCBs can be found in the hardware/PCB section of the GitHub repository. Once manufactured, the components must be soldered onto it. The list of these can be found in the list of materials, at the beginning of this document

For the main board first make sure that the via coming from the ground pin is soldered onto the back layer which acts as a ground plane. Then, solder the resistors onto the front of the board. Make sure that the left leg of the top resistor from the voltage divider is also connected to the ground plane. Then solder the transistor on, paying special attention to the orientation, the base leg should be the on the bottom. The power jack can be soldered on, but its leg ends need to be bent so they can stand on the SMD pads on the board. The 2$^{nd}$ pad will not be used, so no need to worry about that. Then connecte the MOLEX connectors to the front plane. Lastly, attach the female pin headers to the back side of the PCB.

The LED PCB is much simpler to solder, simply attach the resistor and the LEDs, paying attention to their polarity. The outer rails are on 6V, the inner ones are

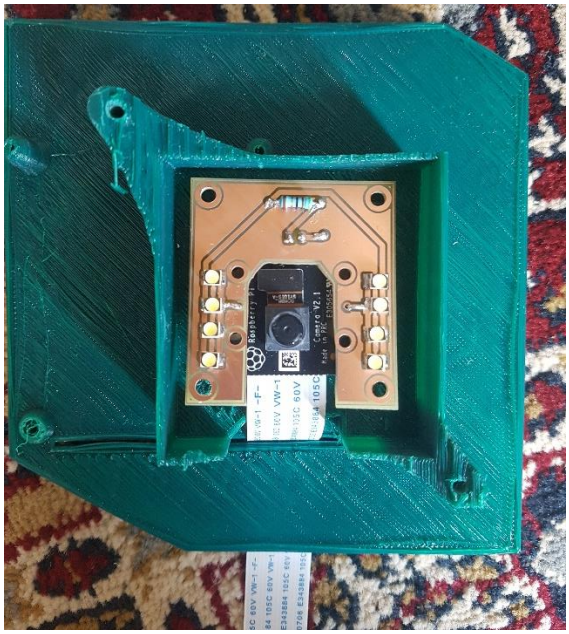
ground. Also make sure that vias on the ground traces are connected to the ground plane on the back side. Attach the MOLEX connector to the back side of the board and solder the via connecting the ground pin to the ground layer.

All cables added to components were attached through simply crimping the cable ends and attaching them to the connector housings.

Once the PCBs have been fully prepared they can be inserted into the enclosure.

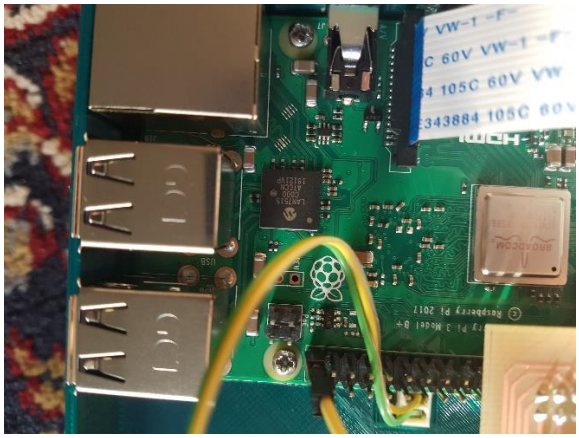
1. Insert the LED board and camera into the front of the PCB/Pi enclosure. Feed the camera cable through the slit and the LED power cables through the small square hole.

2. Align the camera and PCB in the enclosure and screw them in place. Ensure the internal bolts are passing through both the camera and PCB holes.

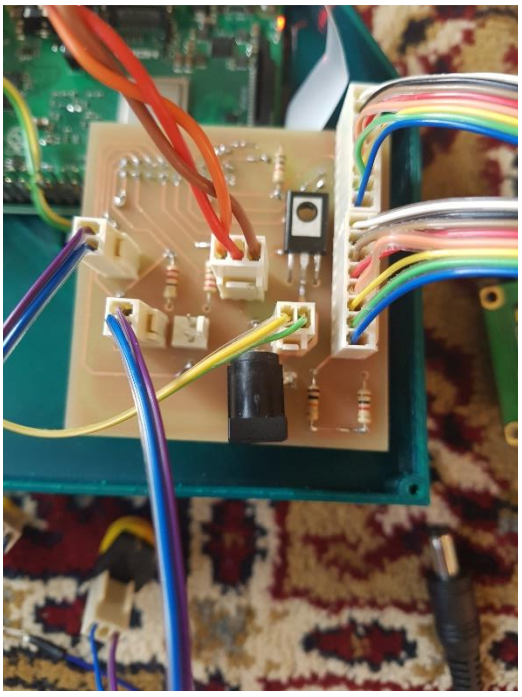


**3.** Attach this holder to the hole previously created in the central pipe. Bolts this in place using the two holes in the casing.

**4.** Insert the Pi and attached PCB and bolt these in place using the holes within the casing.



**5.** The wires from each component can then be attached to the PCB.



**6.** Position the LCD screen such that it will fit within the lid of the enclosure and attach this lid. Align the buttons within this casing also

Congratulations you have now constructed a fully functioning glass sorting device.