HandsOn-SEA Build Guide

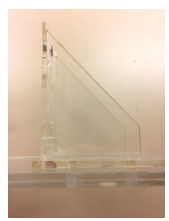
*All the pictures placed on the document can be zoomed in an out by click on them.
*Selection of different motors can necessitate some minor changes in the designs of certain parts but they don't affect the manufacturing procedure.

Assembling the base

- Components
  - Plexiglass base (Base)
  - Plexiglass base (Side)
  - Plexiglass base (Face)
  - Bearing
  - Plexiglass base (Lower plate)(Optional)
  - Super glue
  - Cloroform (Optional)
- Procedure
  1. Glue one of the sides parts and face part together.
  2. Glue the other face part to the assembly.
  3. Glue the assembly into the plexiglass base.
  4. Glue the bearing into the face.
  5. Use glue or cloroform to fix the base assembly on the lower plate (Optional)

End product of this section should look like:





Assembling the Handle, Pulley and spring steels

- Components
  - 3D printed pulley
  - 3D printed handle
  - 4x spring steels
  - Hall effect sensor
  - 3 pin single row pin header
  - 8x screws(D:2 mm, L: 15mm)
  - 8x screws(D:2 mm, L: 10mm)
  - 16x 2mm nuts and washers
  - Screw driver
  - Tooth pick
  - Positioning base
- Procedure
  1. First take out the metal pieces and then glue the 3 pin female header on the handle.
  2. Mount the hall effect sensor into the handle. 
  3. Solder the legs of the hall effect sensor with cables, use heat shrink tubes and hot glue gun to protect the legs.
  4. Mount the cube magnets into the pulley with each magnet facing the same pole towards each other 
  5. Screw in the metal strips on the handle part. Using a toothpick and positioning base is very handy for alligning the screws with nuts. 
  6. Screw in the metal strips on the pulley part. 

The end product of this section should look like: 
Note: This is the only time consuming part of the assembly.

Mounting the motor and top

- Components
  - Motor
  - Pinion
  - Motor holder
  - Shoulder screw
  - 3 mm thick PVC table cover
  - 3mm washer
  - 2x D:2 L:5 mm screws
  - Heat shrink tube (wider than pinion)
  - Hot air gun
- Procedure
  1. Cut a piece of PVC table protector and paste it along the circumference of the pulley part as it is shown in the figure. The width of the PVC strip that we use is 15 mm but this can vary. The thickness can also vary.
  2. Use the shoulder screw and a washer to screw the handle part to the face through the bearing.  
  3. Screw the motor holder on the motor. 
  4. Using a hot air gun wind a heat shrink tube around the pinion to avoid slip. Pinion's tip has a greater radius for restraining the pulley from tilting forwards during operation. 
  5. Place the pinion on the shaft of the motor. If this assembly is not tight enough the pinion can fall during the operation. 
  6. Screw the motor holder on the base. The motor holder should be in front of the face. 
  7. The height adjustment of the motor should calibrated. Pinion should exert just enough force on pulley to provide desired friction.

The end product of this section should look like 

Creating the PCB

- Components
  - Pressed/Printed Circuit Board
  - 2x Resistors
  - DRV 8801 Driver
  - Benchtop drill press
  - 3 pin PCB connector
  - 4 pin PCB connector
  - Single and double row 1" female pin headers
- Procedure
  1. Using the Eagle files press the raw circuit board 
  2. Drill through the required holes  (Note that the when printed the apperance is reflected around vertical axis)
  3. First solder the legs (male pin headers) of DRV8801 on the PCB, then solder the DRV8801.
  4. Selection of resistors for the voltage to drop the voltage from 0-5V to 0-3.3 V range. 1.5 and 2.7(green one) kOhm were used but can vary. Make sure the resistance values are high enough though.
  5. Place in and solder the other required components as seen in the pictures.

Electronic Assembly

- Components
  - PCB
  - TI F28069M Microcontroller
  - HandsOn SEA mechanical assembly
  - Jumper wires
  - 24 V power supply
  - Screw driver
- Procedure (please refer to the pictures for each step)
  1. Place the PCB on the microcontroller  
  2. Connect the hall effect sensor to 3 pin PCB connector 
  3. Plug in 6 male ends of female to male jumper wires on the motor's connector. Using different type of motor would of course change this step. 
  4. Connect the power supply wires and the motor energy supply wires to 4 pin PCB connector. 
  5. Plug in both PCB connectors and place the PCB on the microcontroller
  6. Plug in the quadrature encoder wires (GND, 5V, A, B) to their corresponding positions on the microcontroller 

The end product of this section should look like