MiniRHex Assembly Instructions

1. CAD Files available in /CAD
    a. The foundation.dxf file is also located here.
    b. Any updated or changed SolidWorks parts will be uploaded here

2. Print the following (PLA)
    a. 6 servo sleeve parts,
    b. 4 shaft-edge parts,
    c. 2 shaft-mid parts,
    d. 1 battery case part,
    e. 6 leg parts.

3. Use the foundation.dxf file from /CAD to laser cut 3-mm thick acrylic to serve as the foundation for the robot.

4. Obtain the mainboard for the robot: Robotis OpenCM9.04.
    a. http://www.robotis.us/opencm9-04-c-with-onboard-xl-type-connectors/

5. Obtain the battery for the robot:
    a. 2 cell, lithium polymer, 7.4 V, 1900 mAh.
    b. Recommended battery: LBS-40
        i. http://www.robotis.us/li-ion-battery-3-7v-1300mah-lb-040/

6. Prepare the mainboard for use.
    a. Solder two male header pins onto **one positive pinhole and one negative pinhole** for power. The location on the board is indicated below.

7. First, connect the battery case and mainboard to the foundation.
    a. Connections:
        i. Battery case: **M2.5 button head x 10 mm, M2.5 nut**
        ii. Mainboard: **M3 standoff x 6 mm, M3 button head x 8 mm, M3 nut**
    b. Battery case is near the center of the foundation.
    c. The mainboard's micro-USB port should face out.
    d. The mainboard will be towards the **front** of the robot.

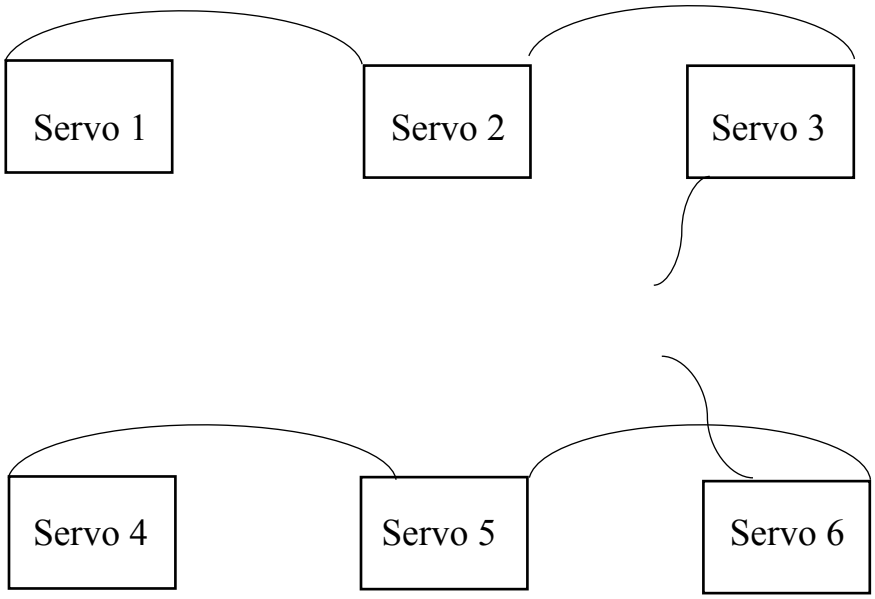
8. Next, prepare the legs by using Plastidip (either dip or spray) and coating each of the six legs at least four times until high friction surface forms on each leg.
    a. Between each coat, let dry for at least one hour.
    b. Make sure the dip is evenly coated around the leg.
    c. **Do not cover the through holes for the screws.**

9. Connect four of the six legs to edge shafts (shorter shafts).
    a. Align the leg through holes with the holes on the cut-out portion of the shaft.
    b. Connection: **M3 socket head x 20 mm**
    c. For two of the four connections, **be sure to switch the orientation of the leg** because those will be attached to the opposite side of the Mini.

10. Connect the other two legs to the mid shafts (longer shaft).
    a. Align the leg through holes with the holes on the cut-out portion of the shaft.
    b. Connection: **M3 socket head x 20 mm**
    c. For one of the two connections, **be sure to switch the orientation of the leg** because those will be attached to the opposite side of the Mini.

11. Connect **each shaft-leg apparatus** to the Dynamixel AX-320 servo motor.
    a. Orientation: Make sure the half circle each leg forms **faces the front of the robot: towards the side with the mainboard.**
    b. Detach the center screw in the servo horn, and pry off the horn itself.
        i. The horn looks like a small, black plastic cylinder.
    c. Align the 4 through holes on the servo horn with the 4 holes on the shaft face (the shaft length doesn't matter).
    d. Through each hole and into the shaft face holes, insert:
        i. 2-56 ¼ inch flathead
    e. Those screws will transmit the torque produced by the servo motor into the shaft.
    f. Align the horn (now connected to the leg apparatus) to its key on the body of the servo.
        i. Once the horn is flush against the body, connect the horn/shaft/leg apparatus to the servo motor.
        ii. Connection: **M2.5 button head x 16 mm**

12. Take electronic wires that come with the servos, and connect them like in the image below.



13. Slide each servo into a servo sleeve.

14. Connect each servo sleeve to the foundation.
    a. Orientation: **Be sure all legs face forward (semicircle faces the mainboard).**
    b. Connection: **M3 button head x 14 mm, M3 nut**

15. Connect the servos to the mainboard.
    a. Two ports should be used.
    b. Connect such that no wires interfere with leg rotation (tie down if necessary)

16. Charge battery(ies) and check voltage(s).
    a. **For two batteries,** voltage must be between 2.7 and 4.2 volts for each battery.
    b. **For one battery,** voltage must be between 7.1 and 8.4 volts.
    c. Connect the **black female terminal of the battery to the negative male terminal** soldered on the mainboard.

17. Upload code using the micro-USB port.
18. Toggle through gaits with the user button
19. LEDS on back of servos are battery indicators (green is fully charged, yellow is warning and red is change immediately)