Assembly Troubleshooting & Tips for AR4 Robot Build

Introduction:
This document outlines common challenges and troubleshooting steps encountered during the AR4 robot assembly process. It includes insights from the user manual, tutorial videos, and hands-on experiences to help streamline the process.

Main tutorials used:

1. The user manual is prioritized to see key steps in the assembly: https://anninrobotics.com/downloads/
2. This video can help visualize the assembly procedure to parallelize work on several people in an efficient way: https://www.youtube.com/watch?v=1kb3n9RScHY
3. Software: https://github.com/ycheng517/ar4_ros_driver

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1. Followed Documentation

- **User Manual**: The manual was followed closely, with particular attention to mechanical assembly, motor mounting and wiring.

- **Tutorial**: The YouTube tutorial helped clarify the wiring procedure and motor calibration steps. However, the tutorial skipped over key assembly steps, so the manual was prioritized.

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2. Heads-Up Difficulties

- **Screws and Hardware**:
  Some screws (e.g., M3 x 10mm) might be difficult to find due to varying colors or lengths. It's recommended to have a variety of screws available (e.g., M3 x 8mm, M4 x 12mm).

- **Precision Fit Issues**:
  The **J1-motor to J1-aluminum box** precision keyholes did not fit perfectly.

    - Solution: Use a **metal file** to remove 0.5-1mm from the holes and the keys for a snug fit.

- **Bearing and Rod Fitting**:
  Do not force rods into bearings!

    - If the rods don't fit perfectly, ream the **bearing hole to 3.0mm** for a smooth fit.

    - Bent rods are unusable and must be replaced.

- **Assembly Process Delays**:
  Many of the assembly delays are due to rescrewing parts or misalignment during the assembly. To avoid this, consider assembling parts loosely first and tightening them once everything is aligned.

- **Messy Cables:**

  The cable lengths are not correct in the manual so they should be longer in reality. Hopefully, future versions of the AR4 robot should include a 24-pinout adapter to make the cable situation easier.

- **The J5 limit-switch:**

  Screw on **very** carefully or the screws will break the limit switch.

- **Grounding:**
  The aluminum frame can short circuit for example the J2 and J4 limit-switch. To solve this, put electric tape before attaching the limit switches.

- **Bad soldering contact surface area:**

  The wires can often have poor contact area, which is the cause of most bugs. Solution: Resolder the wires to the glitchy motors during debugging!

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3. Important Tools & Equipment

- **Metal File**: Used to adjust keyholes.
- **Torque Wrench**: To avoid over-tightening and damaging parts.
- **Screwdriver**: For careful adjustments when using the file or reaming tool.
- **Optional: Reaming Tool**: Essential for precision adjustments to bearing fits.

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4. Comments & Recommendations

- **MakerSpace**: Building at a **MakerSpace** is highly recommended. Staff and students can provide immediate assistance if unforeseen issues arise. The cost is only 150

SEK.

- **Tutorial Use**: Follow tutorials for wiring and motor calibration, but always verify with the user manual for assembly order.

- **Gripper accuracy:** Use the servo gripper for testing, but the pneumatic gripper should be incorporated with camera-vision reinforcement learning for much better performance.

5. Summary

The project could be done by up to three people in parallel. For one person it would take around 150 hours for the assembly and then 50 hours for error-debugging concerning screws-tightness, cables-lengths, messy cables, short-circuits, resoldering of bad cable-surface area contact, and software bugs.