OBJECTIVE: MINIMIZE MECHANICAL STRESS TO DECREASE NOISE

**Motors**

**Brushless DC Motors (BLDC)**

is a type of electric motor that operates using direct current (DC) electricity, but unlike traditional brushed motors, it doesn't rely on mechanical brushes and a commutator for switching current in the rotor windings. Instead, it uses an electronic controller to manage the flow of current through the stator, creating a rotating magnetic field that causes the rotor to turn.

Pros

* High Torque and Power Density: These motors can deliver high torque per weight (power-to-weight ratio), making them ideal for applications where size and weight are critical, such as drones and electric vehicles.
* Precise Control: BLDC motors offer smooth and precise control over speed and torque, allowing for better performance in applications that demand high accuracy, like robotics, drones, and medical devices.
* Higher Speed Range: BLDC motors can operate at higher speeds than brushed motors, making them useful in applications that require high-speed rotation, such as in power tools, drones, and industrial equipment.

Bads

* Complex Control System: BLDC motors require an Electronic Speed Controller (ESC) to manage the switching of current in the stator coils. This adds complexity and cost to the system, and the controller itself needs to be tuned properly for optimal performance.
* Lower Torque at Low Speeds: At very low speeds, BLDC motors can produce lower torque compared to some other motor types, such as stepper motors, without advanced control methods like field-oriented control (FOC).

**Stepper Motors with Microstepping**

A stepper motor with micro stepping is a type of stepper motor that operates with finer control over its movement, breaking down each full step into smaller "micro steps." This improves the smoothness and precision of the motor's rotation.

Pros

* Increased Precision: Microstepping divides each step into multiple smaller steps. For instance, if a stepper motor operates with 16 microsteps per full step, the step angle can be reduced to as little as 0.1125° (from 1.8°).
* Smoother Motion: The smaller increments between steps reduce the vibration and noise typically associated with stepper motors. This makes microstepping ideal for applications where smooth motion is required, such as in CNC machines, 3D printers, and camera gimbals.
* Reduced Resonance and Noise: Microstepping helps minimize the mechanical resonance that can occur at certain speeds, making the motor operate more quietly and with less vibration.
* Better Low-Speed Performance: Stepper motors with microstepping provide smoother and more consistent torque at low speeds compared to standard stepping modes.

Bads

* Reduced Torque: At very fine microstepping levels (e.g., 16 or 32 microsteps per step), the motor’s torque can decrease slightly because the current to each phase is reduced to achieve finer control.
* Controller Complexity: Microstepping requires more sophisticated motor drivers to precisely modulate the current in the motor coils.

Personally speaking, either is fine as i think the Stepper motor with finer steps is essentially a more accurate BLDC motor but i have read in some places that i might be a little louder than BLDC at higher speeds. Regardless of which motor we choose, Our applications of a low speed robot will not induce any noise.

**Wheel**

The ideal material for wheels is **rubber**, as its soft, elastic properties naturally dampen vibrations. Adding a suspension will enhance this effect, **shock absorbers** can be added to the wheels, reducing suspension rigidity and further minimizing noise. Additionally, consider installing **vibration dampeners**

**Pneumatic rubber wheels**

Soft rubber wheels provide excellent noise reduction because they cushion the robot’s contact with the ground, absorbing vibrations.These wheels are ideal for robots operating on hard surfaces like tiles or linoleum, where typical plastic or hard rubber wheels would be noisy.

**DLC**

If we are going to use castor wheels, **it has to be made out of rubber** and have a **shock absorber**

**IMPLEMENTATION: EASY**

**Omni Wheels (Rubberized Rollers)**

omni wheels with rubberized rollers rather than plastic to reduce the sound from friction with the ground. These allow for smooth, quiet, omnidirectional movement.

**IMPLEMENTATION: MEDIUM-HARD**

**Mecanum Wheel (Rubberized Rollers)**

Mecanum wheels are a type of omnidirectional wheel featuring angled rollers around their circumference, allowing movement in any direction—forward, sideways, or diagonally. When equipped with rubber inserts, these rollers help absorb vibrations and reduce noise during operation. The rubber material also improves traction and ensures smoother, quieter movement, making them ideal for robots that need precision maneuvering with minimal sound.

**IMPLEMENTATION: HARD**

**Motor Controller**

This one is going to be difficult as there are plenty of motor controllers out there with different specs, sizes, and use cases. I guess we can prioritize budget constraints over performance. Also another consideration is how pliable or malleable the motor controller is as we wouldn’t want to work with a controller whose company went defunct.

List of motor controllers  
<https://github.com/cajt/list_of_robot_electronics>

Another list

<https://www.superdroidrobots.com/store/motor-controllers>

Robo claw looks very familiar

Notes to self

Motors with encoders