Mobility Management

The robot's mobility is a multi-part system that works in a coordinated effort to control movement and direction. The core of this system is the Arduino Uno, which serves as the central control unit. It interprets instructions from the program and translates them into electrical signals that control the motors.

At the heart of the physical movement are two types of motors. The **DC motor** is the primary driver for propulsion. It is responsible for making the robot move forward and backward. The Arduino sends a signal that dictates the speed and direction of this motor, enabling the robot to accelerate, decelerate, and reverse.

There is a single gear from the motor to the axle connected to the wheels. This was required to be geared down because the motor was too fast and not that controllable on its own; besides, some extra accuracy/strength wouldn't be so bad. The DC motor, which is the driving force, has a small gear attached to its shaft. This small gear rotates a larger gear that is directly connected to the axle. When the motor spins, it rotates the small gear, which in turn rotates the larger gear and the axle. The wheels are attached to the ends of the axle, so as the axle turns, both wheels rotate simultaneously, propelling the robot forward or backward. This simple gear reduction system increases the torque delivered to the wheels, allowing the robot to move with more power.

For steering, the robot uses a **servo motor**. Unlike the DC motor, which spins continuously, the servo motor is designed for precise angular movement. It is attached to the front wheels and can turn them left or right to change the robot's heading. The Arduino controls the servo by sending a Pulse Width Modulation (PWM) signal, which sets the exact angle of the motor's shaft. This allows for fine-tuned steering and a high degree of maneuverability.

A crucial component in this system is the **L293D Motor Driver Shield.** The Arduino itself cannot provide the high current required to power the motors, as doing so would damage the board. The motor driver shield solves this problem. It acts as an intermediary, taking power directly from the battery pack and using the low-power control signals from the Arduino to run the motors. This protects the Arduino from high current loads and ensures that the motors have stable power, allowing them to operate effectively.

These components, including the Arduino, motors, and motor driver shield, work in concert to give the robot full control over its movement. The Arduino directs the motor driver, which in turn powers and controls the motors to achieve the desired speed and steering. This system allows the robot to navigate and interact with its environment.