**Control Board**

A green circuit board with many small green objects

Description automatically generated with medium confidence

Features:

* 5V DC Input via USB Micro (for microcontroller and sensor power)
* 2x 7.2V DC Input (for motors)
* 2x Motor DC Motor Drivers
* 2x Ports for Encoder sensor
* 3x Ports for Buttons (for user interaction)
* 4x Ports for Limit Switches (Bumper Sensors)
* 3x Ports for Cliff Sensors (to detect edges)
* USB Micro Port for serial out data
* 6 axis IMU/Gyroscope
* EEPROM Flash Memory
* MicroSD port
* User Programmable LEDs
* Port for attachable GPS module
* Ports for other Serial Outputs (if needed) such as SPI, UART, and I2C
* Ports for General Purpose I/O

Function of Board:

* Perform low-level processing of sensors
* Perform low-level control of motors
* Communicate with onboard computer (provide sensor data to computer, and receive commands from computer)

Cost of Electronics: ~$90 to include everything (although we may find it unnecessary to include some of these features) + ~$90 for batteries, cords, and chargers

**Mobile Robot**

A wooden object with wheels

Description automatically generated with medium confidenceA model of a machine

Description automatically generatedA wooden object with wheels

Description automatically generated

Features:

* 2-wheel drive by two motors with encoders for wheel speed odometry
* 2x Skate Wheels and 2x casters for balance
* 3-inch standoffs between layers
* Platforms are laser cut to provide flexibility---can easily add other layers to the robot (i.e. for LIDAR, camera, etc)
* Components are 3D printed when possible to provide easy and cheap compenents

Total Cost of Robot Mechanical Components: ~95 for the hardware (includes motor, wheels, shafts, standoffs, etc.)

Additional Components not Shown:

* LIDAR: [RPLIDAR A1](https://www.adafruit.com/product/4010) ($100)
* Camera
* On-board computer: [NVIDIA JETSON ORIN NANO](https://www.arrow.com/en/products/945-13766-0000-000/nvidia) ($500) or [NVIDIA JETSON NANO](https://www.arrow.com/en/products/945-13450-0000-100/nvidia) ($150)

Compare to [Turtlebot 4](https://www.robotshop.com/products/clearpath-robotics-turtlebot-4-lite-mobile-robot) ($1300), which contains approximately the same features, but only has a Raspberry Pi 4 as the on-board computer (much less compute than the NVIDIA boards)