

Power Distribution System PCB - Conceptual Design

Team I - Lunar ROADSTER

Ankit Aggarwal, Bhaswanth Ayapilla, Boxiang Fu, Deepam Ameria, Simson D'Souza

1. Power Source:-

Battery: 3x Vanon Power Tools Batteries

Nominal Voltage: 20V

Nominal Capacity: 5.0Ah

Energy: 100Wh

Chemistry: Li-ion

Cell Configuration: 5s2p

Number of Cells: 10

Monitoring: Using Turnigy® Watt Meter and Power Analyzer (180A).

Specifications: Operating Voltage Range: 4.6~60 V

Measured Voltage Range: 0~60 V

Current Range: 0~180 A

Overvoltage Protection:

A. Primary: 30 A Blade Fuse (each)

B. Secondary: Push Button Emergency Stop

2. Subsystems:-

| Subsystem | Voltage Range | Regulation Required | Continuous Current/Peak Current | Number of Connectors | Current Capacity of Connectors (Current/Peak) |
|-------------------------------|---------------|---------------------|---------------------------------|-------------------------------|---|
| 2x Drive Motors | 6~12 VDC | Yes | 1.7 A/20 A | 1 each (XT- 30) | 15 A/30 A |
| 2x Steering Motors | 6~12 VDC | Yes | 1.7 A/20 A | 1 each (XT- 30) | 15 A/30 A |
| Linear Actuator | 12 VDC | Yes | ~246mA | 1 (JST-XH) | 3A |
| 3x Roboclaw Motor Controllers | 6~34 VDC | Yes | 15 A/30 A | 6 Screw Terminals 1 JST-XH | – 3A (JST-XH) |

| Subsystem | Desired Efficiency | Output Voltage after regulation | Peak output current | Maximum required operating voltage | Overvoltage Protection |
|-------------------------------|--------------------|---------------------------------|-----------------------|------------------------------------|------------------------|
| 2x Drive Motors | 60% | 12 VDC | 20 A (per motor) | 12 VDC | 10 A Blade Fuse |
| 2x Steering Motors | 60% | 12 VDC | 20 A (per motor) | 12 VDC | 10 A Blade Fuse |
| Linear Actuator | 60% | 12 VDC | 246 mA | 12 VDC | 5 A Blade Fuse |
| 3x Roboclaw Motor Controllers | 60% | 12 VDC | 30 A (per controller) | 12 VDC | 10 A Blade Fuse |

3. Description of the system:-

- The system is powered by three 20V, 5.0Ah Vanon batteries. One of these batteries directly powers the Jetson AGX Xavier through a Turnigy® Watt Meter and Power Analyzer, which monitors and displays power parameters in real time.
- The remaining two 20V batteries are connected in parallel to serve as the primary input to the Power Distribution Board (PDB). These batteries provide power to the various subsystems of the robot.
- A 30A blade fuse is placed at the primary battery output for overcurrent protection. Additionally, an Emergency Stop (E-Stop) switch is integrated into this power path as a secondary safety mechanism.
- The PDB will step down the 20V input to 12V, as all connected subsystems require an operating voltage of 12V or higher.
- To ensure safety, the PDB will be equipped with overvoltage protection fuses, preventing potential damage to the connected subsystems.

3.1. Motor Control System

- The robot features two drive motors (one at the front and one at the rear), which are controlled via RoboClaw motor controllers (RC1 and RC2). These motor controllers include built-in H-bridges for efficient bidirectional motor control.
- Additionally, the robot has two steering motors (one for the front steering and one for the rear steering), which are also controlled via RC1 and RC2.
 - RC1 manages both the front drive and front steer motors.

- RC2 manages both the rear drive and rear steer motors.

3.2 Linear Actuator for Dozer Blade Control

- The system includes a linear actuator to control the dozer blade. This actuator is powered and controlled separately using a third RoboClaw motor controller (RC3) or an alternative proprietary linear actuator controller.

3.3 Additional Components

- Several additional components, including the Arduino Due, ZED 2i camera, and VectorNav VN-100 IMU, are powered by the Jetson's 5V DC output.
- Since these components do not connect directly to the PDB, they are not considered in the conceptual design of the PDB.