EEP 545 Racecar Setup

This document will illustrate the processes for powering, charging, launching, and visualizing the race-car. **Please note the version of the car that has been assigned to you.**

A. Powering the racecars

V2 MuSHR uses three batteries: one located in the chassis that powers the motors, and two connected in series located near the back that powers everything else. In order to power the racecar:

V3 MuSHR uses two batteries: one located in the chassis that powers the motors, and the other on the base that powers the Jetson Nano.

In order to power the racecar:

1. Plug the chassis battery into the VESC motor controller. Make sure that the plugs are securely fastened to one another (doesn't hurt to double check the color connections)

Image: VESC battery connection in v2

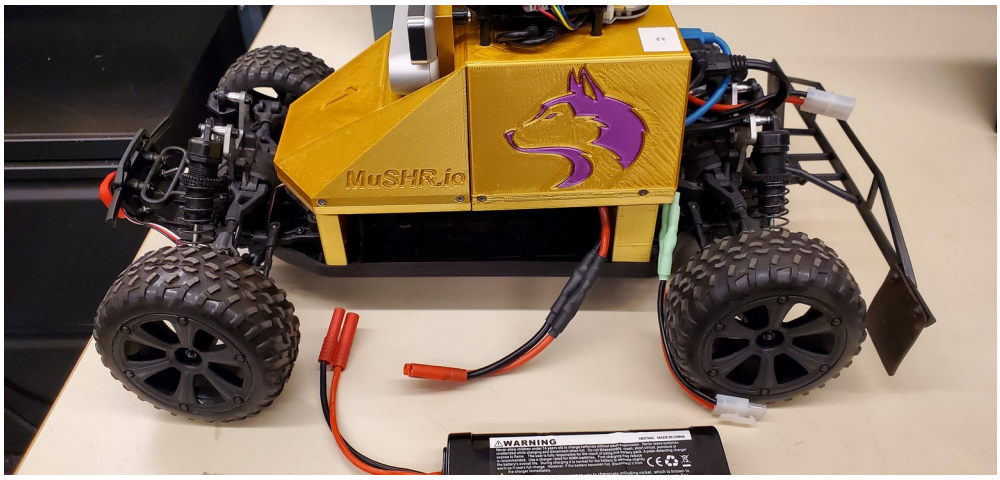


Image: VESC battery connection in v3 (Note the different battery connectors)

2. **In v2 cars** two batteries in series power the Jetson. For this there are two female plugs; one connected to a female barrel cable, and one connected to the two NiMH batteries in series. Also note the male plug that protrudes from a red PCB containing an LED display. Connect this male plug to the NiMH battery female plug.

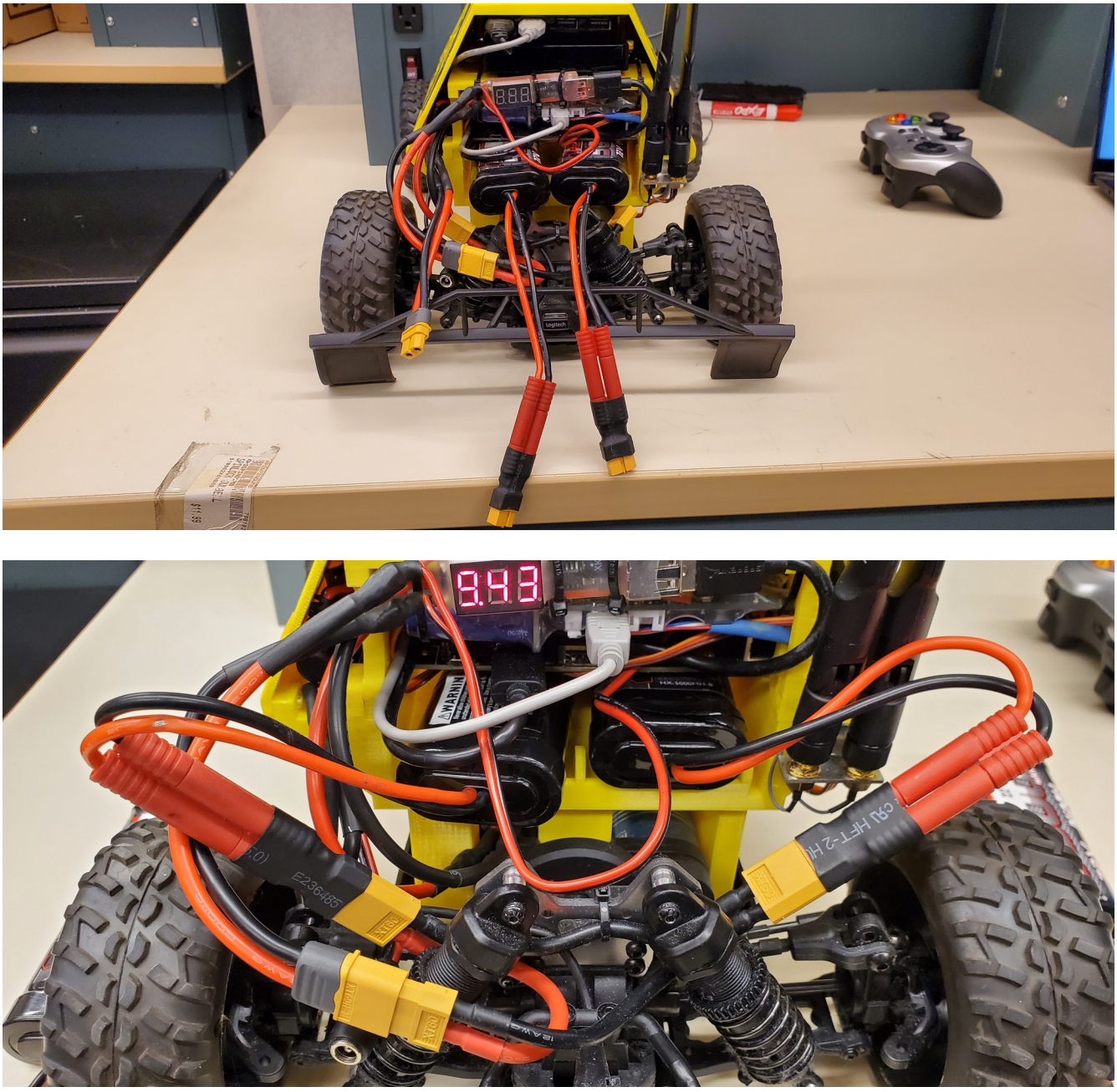


Image: Jetson Board Series Battery connection in v2

In v3 cars, the connection is similar to the VESC battery. (Note how the battery connectors are different as shown in the image below)

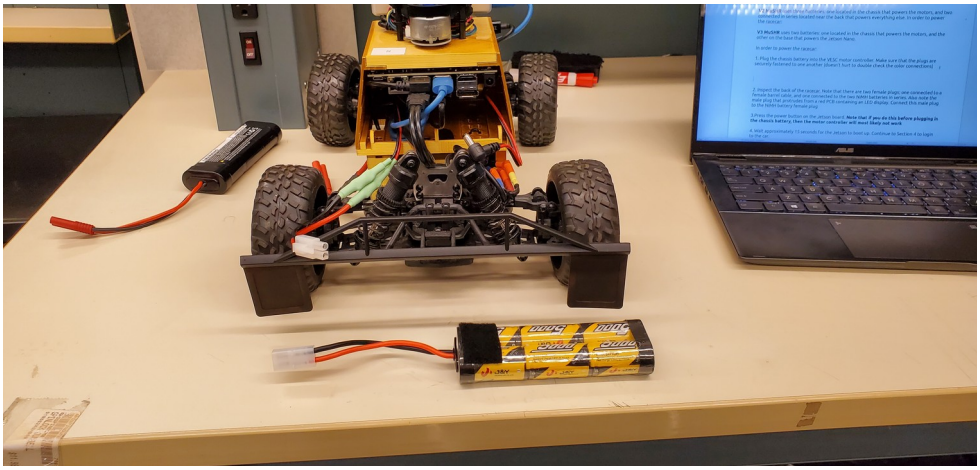
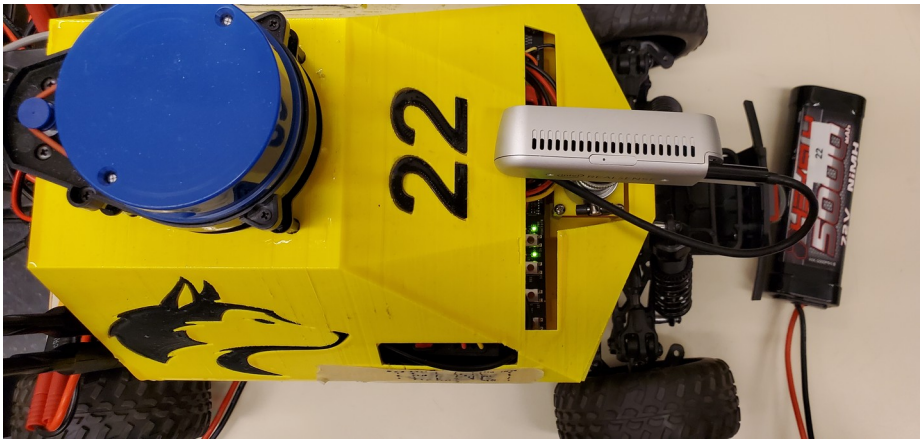
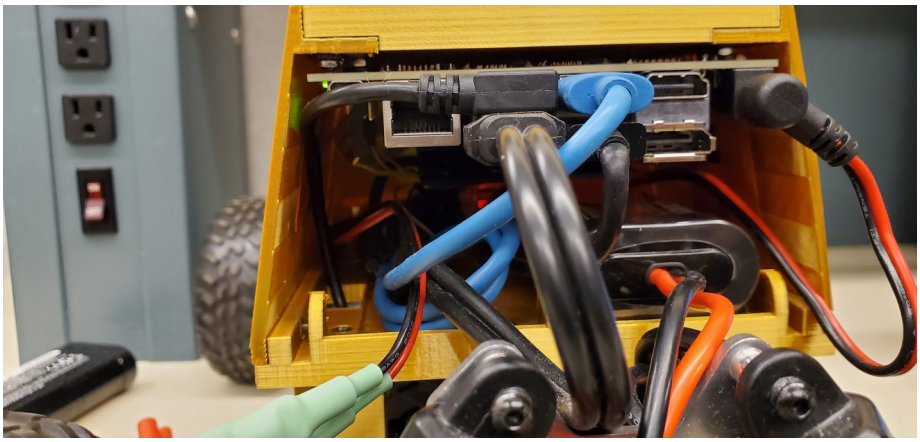


Image: Jetson battery connection in v3

3. **In v2 cars,** press the power button on the Jetson board to turn it on. You'll see two green LEDs turned on which indicates that the board has been powered.

In v3 cars, there's no physical button, when you plug the adapter from the battery to the board it should power on. There's a small green LED on the left of the board that indicates power. **Note that if you do this before plugging in the chassis battery, then the motor controller will most likely not work**





Images: Power indication in v2 and v3 respectively

4. Wait approximately 15 seconds for the Jetson to boot up. Continue to Section 4 to login to the car.

5. In order to turn the racecar off, either hold the Jetson's power button down until all of the green LEDs turn off (in V2 cars), or execute the following command:

sudo shutdown -P now

B. Charging the racecars

All of the robot's batteries use the same charger. **Particular care must be taken during removal and re-installation of the two serially connected batteries in the v2 cars.**

1. Make sure that the robot is completely powered off.

2. Remove the batteries from the chassis. This is trivial for the v3 batteries. To do this for the two serially connect batteries in the back, unplug them from their serial connection

3. After removing each battery from the chassis, plug it into the HexFly charger.

4. Hold the START/STOP button until the battery begins to charge. The status button will turn red once charging has begun

Images: Charging batteries, spare connectors for different versions

5. The status button will turn green once charging is complete

6. Once charging is done, re-plug the connections that you undid.

Do not leave any battery plugged into a charger unattended!

V2: Do not mix batteries! That is, the two batteries connected in series in the back

must both have the same capacity (they should both be 5000 mAH) and the same charge level.

C. Launching the racecars

1. Complete steps 1.1-1.4 to turn the racecar on

2. Find the robot's Wifi network in your laptop's network list and connect to it. The SSID should be of the form Robot AP? Or Robot AP?v2, where '?' is the number of your car. The password is prl_robot

3. Login to the race car using the following command:

ssh robot@10.42.0.1

4. Launch the racecar using the following command

roslaunch mushr_base teleop.launch

5. The vesc_driver node may die once or twice (and will automatically respawn after each death), but this is okay as long as it does not keep dying

6. Once all of the nodes have finished launching, the car can be teleoperated by holding down the top left key of the joystick controller (labeled 'LB') and pressing on the joysticks

D. Visualizing the racecars

1. Complete all the steps from the previous sections

2. Execute the following commands. **Each user should only ever have to do this once, not each time that you want to interact with the robot**

echo "source /opt/ros/melodic/setup.bash" » ~/.bashrc
source ~/.bashrc

3. Set the ROS_MASTER_URI environment variable as follows so that your computer knows which ROS master to connect to:

export ROS_MASTER_URI = http://10.42.0.1:11311

4. Open rviz with the following command

rosrun rviz rviz

E. Copying files from local machine to the robot

1. Connect to the Robot as in section C: 1 to 3

2. Execute the following command:

scp -r _____ robot@10.42.0.1:~/catkin_ws/src

The above command copies the folder named _____ from your present working directory (pwd) to the **catkin_ws/src folder in the robot!**

Common Issues

Here are some common issues that may arise when operating the racecar:

• If when launching the racecar's driver and teleoperation nodes there is an error about being unable to connect to the VESC, try rebooting the Jetson. Also check that the chassis battery has been charged

• If you get the message 'ERROR: Unable to communicate with master!', check that the racecar's driver and teleoperation nodes are launched and that you have set the ROS_MASTER_URI environment variable correctly

• If nodes on the racecar do not respond to messages that were published by nodes on your computer, check that you have set the ROS_IP environment variable correctly