F1tenth Platform

QuickStart Guide

Fall 2023

Instructor: Prof Madhur Behl (madhur.behl@virginia.edu)
Teaching Assistants: Amar Kulkarni (ark8su@virginia.edu), John Link (jwl9vq@virginia.edu)

F1tenth Teams 2023

Team	Member 1	Member 2	Member 3	Member 4	Member 5	Team Code
0	Kevin Moody	Robert Gay	Justin Brady	Matthew Nicoud	Fares Cherchar	pascal
1	Fardeen Khan	Rishi Mukherjee	Matthew Samuel	Ryan Wood	Daniel Boachie	kepler
2	David Mead	Ben Sporysz	Cole Blackman	Justin Zhang	Pranav Singh	curie
3	Nathan Lindley	Pranav Ramkumar	John Zoscak	Esther Cowan	Kyle	ampere
4	Yumi Kim	Sylvia Tan	Ellery Sparkman	David Xiang	Weta Aninye	hopper
5	Abhir Karande	Dhruv Batra	Garrett Burroughs	Jacob McDaniel	Ali Ausaf	lovelace
7	Siddharth Lakkoju	Shrisha Yapalparvi	Srikar Gouru	Sully Beck	Kevin Chung	tesla
8	Johnathan Middleton	Tyler Lynch	Ian Le	Madeleine Deadman	Esam Abdellatif	volta
9	Christopher Barfield	Neal Dhar	Pranav Ravichandaran	Ryan Adoremos		maxwell

Each team should setup a webpage and a Github page

Use private git repositories and invite the instructor and the TA to the repo.

- Update the webpage regularly for each lab assignment:
- Videos and pictures of progress
- What you tried, what worked, what did not work.
- Videos of your demo and practice run. (use as backup in case of trouble during the lab demos)

Each kit contains

1) 1 fully assembled and tested F1tenth car
2) 2 Batteries - 2Cell LiPo (Blue), and 3Cell LiPo (Red)
3) 1 Logitech wired Joystick controller
4) 1 Aluminium workstand/lift for the car
5) 1 team ubuntu laptop (with ROS melodic pre installed and network configured) + laptop charger.

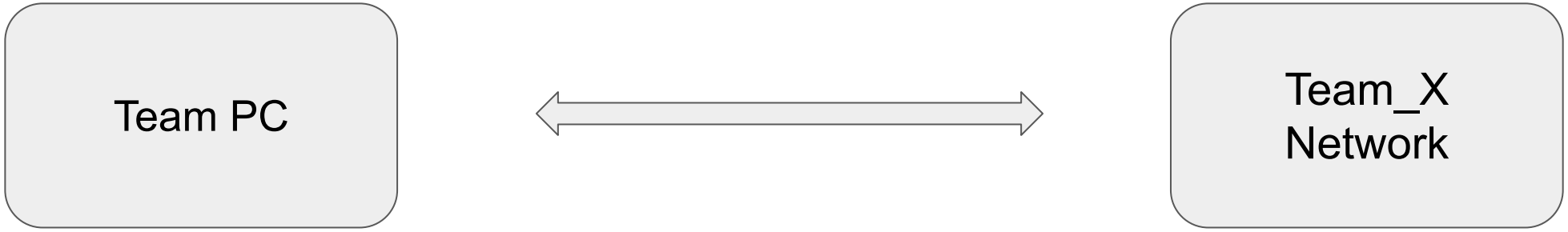
Password : f110

Pre Startup

Connecting to the Racecar

1. Power up the Racecar (Red (rear) battery to DC power board using barrel jack)
2. Wait for Pico-station lights to come up
   a. *Wait until 2nd from bottom is flashing green light*
   b. *Pico-station is connected to Jetson*
3. Connect to you team's network (eg: team_9)
   a. Password: f110uva123
4. Network settings on local computer
   a. Set IP address as 192.168.1.X (where X is not 1 or 20)
   b. Set Netmask to 255.255.255.0
   c. Set gateway to 192.168.1.1

Your network config is configured exactly like this



On Host Machine:

Connect to Team_X
Set the following Manual IP Settings:

IP: 192.168.1.10X
Netmask: 255.255.255.0
G/W: 192.168.1.1

No changes needed on the racecar network.

Configure ROS OVER NETWORK Settings

- We are telling our Ubuntu Machine that the ROS master will be running on the Nvidia TX2 and not on the local machine.

- Open .bashrc file in an editor (e.g., $ vi ~/.bashrc)

    - Add the following two lines at the end of .bashrc file:

        - export ROS_MASTER_URI=http://192.168.1.1:11311
        - export ROS_IP=192.168.1.10X

Verify Network config

- Verify network configuration on the Ubuntu Machine:
  - **ping 192.168.1.1** from the Ubuntu Machine
- Use ssh on Ubuntu Machine
  - Open terminal: **ssh nvidia@192.168.1.1**
    - password: nvidia (never change this)
    - First time authentication? Type “yes”
- Now from within the SSH session terminal, try to ping back your Ubuntu Machine
  - **ping 192.168.1.10X**

If you can SSH into the Nvidia Jetson TX2, and ping your Ubuntu Machine from inside the SSH session then everything is set properly

Test F310 Joystick on the Ubuntu Machine

- Connect the F310 joystick to the Ubuntu Machine
- Use jstest-gtk to verify joystick functionality
  - To verify: jstest-gtk
  - Select joystick in GUI: (check if name is “js0”)
  - Move axes and press buttons
  - Check response on GUI
  - No response: inform TA
- *If the port is not /dev/input/js0 then we need to edit the remote_teleop.launch file.*
  This file is located in the Ubuntu Machine in the move_base package. You can roscd move_base..then cd into /launch..and edit the port in the launch file.

Putting it all together: Startup Sequence

(follow this in strict order)

1. Plug the 3-Cell battery (Red/Rear) to the Power Board using the female DC barrel jack at the rear of the car [DO NOT plug in the 2-Cell battery (Blue/Bottom)].
2. The car should startup; verify lights on TX2, Pico Station, and Hokuyo Lidar.
   a. The 2nd from bottom Pico-station light to blink green.
   b. Wait for 1 minute (to allow Linux to fully boot up),
3. Connect local computer to your team's network (eg: team_9)
   a. Verify IP configuration on team laptop - Do the ping/SSH test from the laptop into the Nvidia.
4. Connect F310 joystick to local computer and verify the correct port.

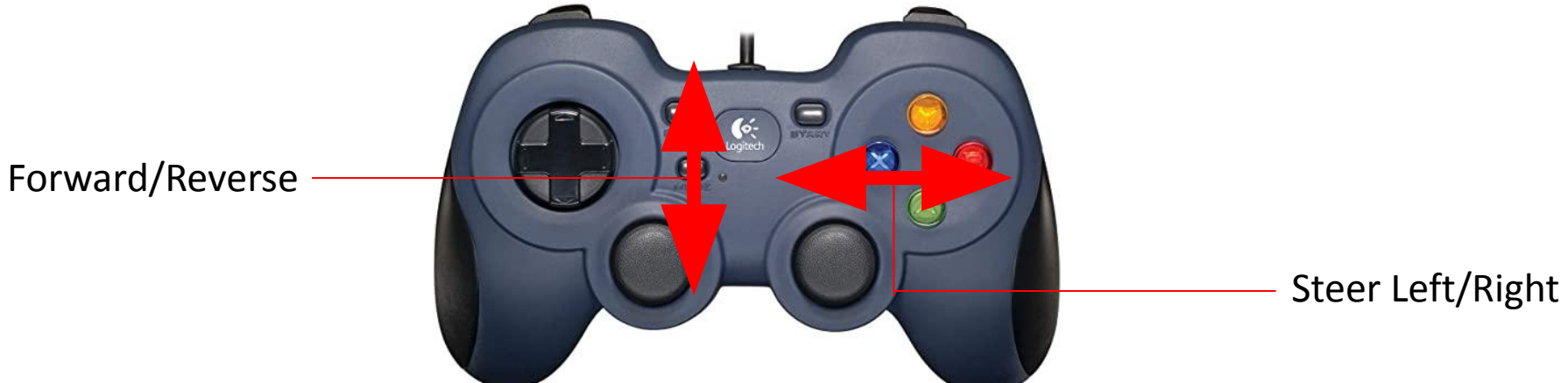
When all the above steps are successful, we are now ready to start the software on the car and on the laptop

Teleoperation

- If you are just testing the car - please ensure the car is kept on a stand and the wheels are not touching any surface.
- Plug in the 2S battery (Blue/Bottom), watch out for polarity!
- Wait for 30 secs to allow the VESC to boot up.
- In a **SSH session on the Racecar >>**:

  source depend_ws/devel/setup.bash
  - roslaunch move_base move_base.launch
- On **the Ubuntu Machine:**

  source depend_ws/devel/setup.bash
  - roslaunch move_base remote_teleop.launch



Offboard Control

Understanding the control sequence

- Racecar listens to /car_x/multiplexer/command topic
  - Type: ackermann_msgs::AckermannDrive
    - Subfield steering_angle: [-100, 100] = [max left, max right]; float with 0.0 center
    - Subfield speed: [-100, 100] = [max reverse, max forward]; float with 0.0 stop

Offboard Control

Enable offboard command passthrough

- Node ‘command_multiplexer’ uses ‘listen_offboard’ param to enable/disable offboard_control
  - On racecar: roslaunch move_base move_base.launch listen_offboard:=true
  - Launch remote teleop on local computer