Startup Procedure

Outline

1. Connecting Hardware
2. Turning Power On and Off
3. Connecting the Controller
4. Starting the ROS2 Stack
5. Driving Around
6. Visualisation (Optional)
7. Powering Down

1. Connecting Hardware

Before connecting any wires, make sure to turn off the power output from the BMS (Battery Management System). See how to do this in **2. Turning Power On and Off**.

When the robot is in the off state it should also be the case that the battery should be entirely disconnected.

Looking at the robot from behind, i.e. with the camera case furthest away from you; connect the components according to the following steps:

1. First lower the Orin into the robot between the two VESC motor controllers.
2. Connect the power barrel jack to the Orin on the right hand side.
3. Connect the right VESC with a micro-USB to USB-C to thr left side of the Orin.
4. Connect the left VESC with a micro-USC to USC-A to the lowest USB-A port on the right side of the Orin.
5. Now connect the battery to the components through the two 3-way split wires.

At this point it you can turn on the power as described below.

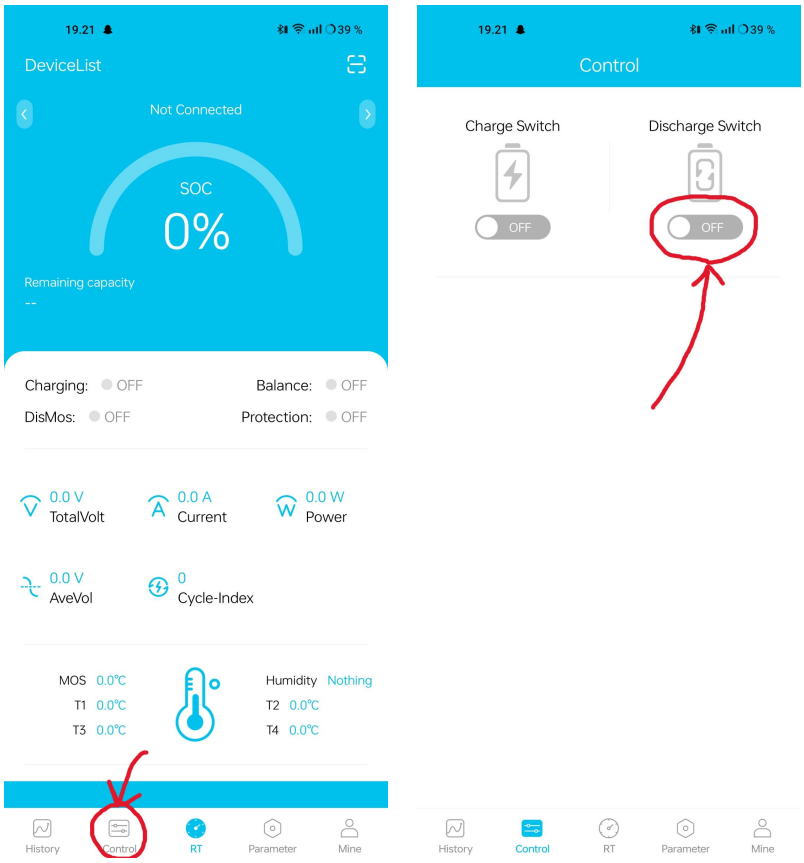
2. Turning Power On and Off

To turn the robot or off, you will need the XiaoXiangElectric app from the Play Store on Android or the App Store on iOS. The image to the right shows what it looks like in the Play Store.

Connect to the BMS on the robot on the initial screen of the app through bluetooth. If it asks for you to log in, there should be a button to “Jump Login”.

When connected there should be a switch that says “discharge”; when this switch is on the battery is allowed to discharge its power to the other components, meaning it is ON. And vice versa, when discharging of the battery is off, the components will not receive any power.

See the screenshots to the right for reference.



3. Connecting the Controller

The DS4 controller should be paired with the Orin such that when powered on by pressing the “PS” button on the controller, it should connect entirely automatically. If this does not succeed, proceed with the steps below:

**When initially connecting to the Orin through `ssh`, a `zellij` multiplexed terminal environment will launch automatically. Pay no mind to this, and simply use the big pane.*

1. Go to the Bluetooth command line with the command `bluetoothctl`. Here you can manage your device’s Bluetooth connections.
2. Turn on the controller now such that it is in a blinking state.
3. A prompt will pop up in the `bluetoothctl` command line tool, where you simply type `yes`, and the controller should be connected.

If this fails, it means that the DS4 controller is no longer paired to the Orin. This can also be done through the `bluetoothctl` tool, however it requires a few more steps. Follow the steps described on this guide.

4. Starting the ROS2 Stack

When the robot is powered up and the controller is connected through bluetooth, it is time to start up the ROS2 stack. As mentioned in **3. Connecting the Controller**, a `zellij` environment will launch on startup, which we will be using now. Some of the panes in this environment are `ros2 topich echo` commands, which are delayed with 10 seconds, so within this time, the stack should be started with the command:

```
ros2 launch arc_bringup test-setup.launch.py
```

If you have had to set up the Bluetooth connection through the command-line, or otherwise have exceeded the initial 10 seconds after `ssh`. the `zellij` layout can always be reset:

1. `Ctrl+q` will quit `zellij`.
2. `zellij` will launch a new `zellij` session, setting up the panes anew.
3. `ros2 launch arc_bringup test-setup.launch.py` before the 10 seconds go by!

Note that there are some issues with the `zellij` session crashing with a buffer overflow, however this will only detach the user from the session and will NOT end all processes started within it, so it does not limit any functionality. If you want to reattach to the `zellij` simply run the command:

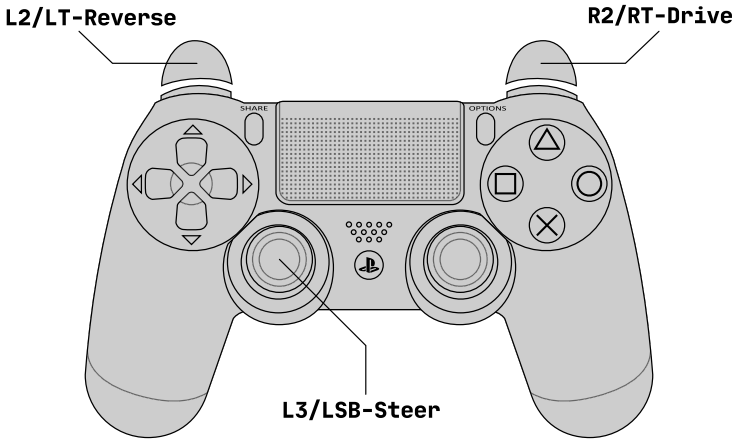
```
zellij a
```

5. Driving Around

At this point everything should be set up and you can use the DS4 controller to drive the robot.

- **R2/RT:** Positive acceleration - Drive forwards.
- **L2/LT:** Negative acceleration - Drive backwards.
- **L3/LSB:** Apply rotation around the Z axis - Turn the robot.

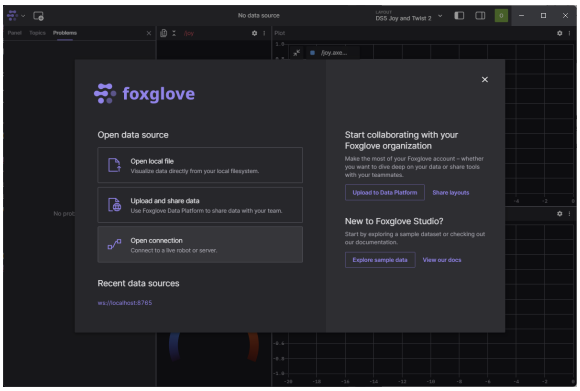
The controles are also shown in the following image:

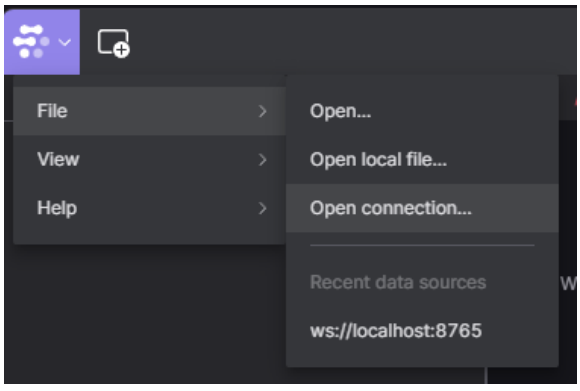


6. Visualisation (Optional)

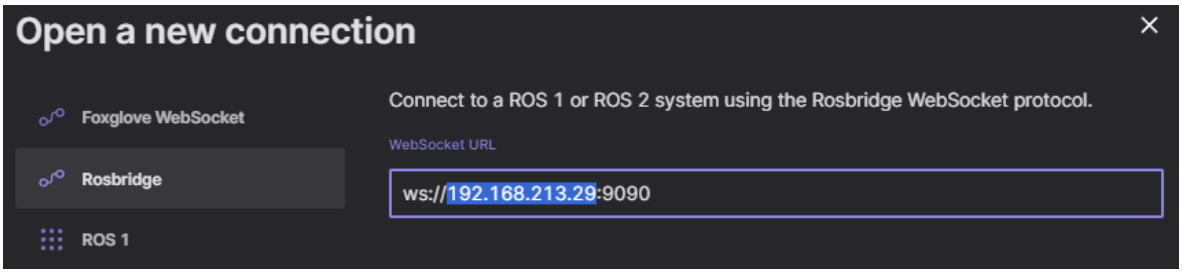
Through the launch file `test-setup.launch.py` a `rosbrigde_server` has also been launched, and if you want, you can connect to this on a different device to visualise data live. The following steps will show you how to do it with Foxglove Studio:

1. Open a connection in either on launch of Foxglove Studio:

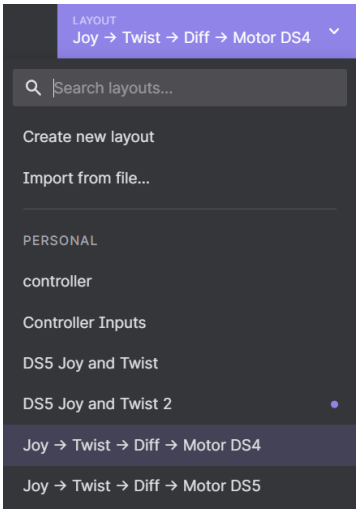




2. Choose a connection through “Rosbridge” and type in `192.168.213.29:9090`



3. Click the “Open” button and wait for it to connect
4. Choose the “Joy → Twist → Diff → Motor DS4” layout in the layout dropdown. (Access to this layout profile requires you’re logged into the orin.rnd@gmail Foxglove account.)



7. Powering Down

When you’re finished driving the robot around and want to depower the system it is quite simple. You can simply power down the robot from the BMS app, turning the discharge toggle to off as described in **2. Turning Power On and Off**.

**If you have other processes running on the Orin, e.g. `ros2 bag record`, that needs your attention before shutting down; be sure to close these gracefully and save potential output before powering the Orin off.*