**Linux and ROS environment setup documentation**

This documentation will guide you how to install IMU measurement software and EM tracker software in Linux and ROS system.

Firstly, please ensure the Linux and ROS system are installed.

1. Install cisst/ROS integration packages

a. search “cisst build ros” on google

b. click <https://github.com/jhu-cisst/cisst-ros> (the resource and help documentation)

c. run the following bash command in terminal

source /opt/ros/melodic/setup.bash

mkdir -p ~/catkin\_ws/src

cd ~/catkin\_ws

catkin init

cd ~/catkin\_ws/src

git clone https://github.com/jhu-cisst/cisst-saw --recursive

# make sure we are in the right place

cd ~/catkin\_ws

# make sure you have the proper ROS environment variables

source /opt/ros/melodic/setup.bash  # or whatever your ROS distribution is

2. Install dvrk/devel

a. search “dvrk/devel” on google

b. click <https://github.com/jhu-dvrk/sawIntuitiveResearchKit/wiki/Development> (the resource and help documentation)

c. run the following bash command in terminal

cd ~/catkin\_ws/src/cisst-saw

git submodule foreach git checkout devel

git submodule foreach git pull origin devel

git submodule foreach git submodule init

git submodule foreach git submodule update

3. Install three package which useful for IMUs data collection

a. Get permission from Anton

b. Log in <https://git.lcsr.jhu.edu/>

c. download three package (‘galen-trackers/lpms-lib’,’galen-trackers/lpms\_imu’, and ‘galen-trackers/timesync’) using git clone. That is running the following bash command in terminal

git clone <https://git.lcsr.jhu.edu/galen-trackers/lpms-lib>

git clone <https://git.lcsr.jhu.edu/galen-trackers/lpms_imu>

git clone <https://git.lcsr.jhu.edu/galen-trackers/timesync>

Now, all packages are installed. The next step is how to run ROS and how to collect data from EM tracker and IMUs.

We need four terminals open at the same time.

The first one is used to open ROS system.

source ~/catkin\_ws/devel/setup.bash

roscore

The second one is used to connect EM trackers.

cd catkin\_ws/

source ~/catkin\_ws/devel/setup.bash

rosrun ndi\_tracker\_ros ndi\_tracker -s /dev/ttyUSB0

Here we can use the following command to find USB’s name.

ls /dev/tty *tab tab*

The third one is used to record data by using *rosbag*.

cd catkin\_ws/

source ~/catkin\_ws/devel/setup.bash

rosbag record -a

rosbag play *bagfile\_name*

The fourth one is used to plot data.

cd catkin\_ws/

source ~/catkin\_ws/devel/setup.bash

rosrun plotjuggler PlotJuggler

rostopic echo /imu\_1A/imu

roslaunch lpms\_imu galen\_imus\_ndi.launch

rosrun ndi\_tracker\_ros ndi\_tracker -s /dev/ttyUSB0

rosrun plotjuggler PlotJuggler

roscore

**Appendix**:

How to connect IMUs using Bluetooth?

Firstly, please ensure both computer’s and IMU’s Bluetooth is opened.

Secondly, in Bluetooth setting, pair IMUs to the computers. We could see IMUs’ address here. It would be XX:XX:XX:XX:XX:XX.

Thirdly, a password will pop up. Click ok to connect.

Now, IMUs should be connected to your computer.

However, if no, you should do connection in terminal by running following commands.

# bluetoothctl

[bluetooth]# power off

[bluetooth]# power on

[bluetooth]# scan on

[bluetooth]# connect XX:XX:XX:XX:XX:XX (your bluetooth address)

[Arc Touch Mouse SE]# trust

[Arc Touch Mouse SE]# pair

More help information could be found in this website: <https://askubuntu.com/questions/1040497/bluetooth-problem-ubuntu-18-04-lts>