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 seven 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 connect IMUs.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
roslaunch lpms_imu galen_imus_ndi.launch
```

The fourth one is used to record data from EM tracker by using *rosbag*.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
rosbag record
/ndi_01_3B911400_610066___T6D0_S01764/position_cartesian_current
```

The fifth one is used to record data from IMU 1A by using *rosbag*.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
rosbag record /imu_1A/imu
```

The sixth one is used to record data from IMU A6 by using *rosbag*.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
rosbag record /imu_A6/imu
```

The seventh one is used to plot data.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
rosrun plotjuggler PlotJuggler
```

Also we could use the following command to see all data in time sequence.

```
cd catkin_ws/
source ~/catkin_ws/devel/setup.bash
rostopic echo /imu_1A/imu
```

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