EGN 4905 Autonomous Systems

Laboratory Exercise 2-B Module 3: Updating the RACECAR software, streaming and collecting data

In this module you will update software on your RACECAR and run it with all the sensors working. You can stream the data to visualize it on your computer as well as collect data which will be useful for testing your algorithms offline.

For this module you can `ssh` into the RACECAR through your VM using the following steps:

1. Power on the router and connect it to an ethernet socket for internet access.
2. Power on the RACECAR.
3. Connect your computer to wireless network with SSID: `racecar-ap-[car no.]` and password: `g0_fast!`
4. Change VM Network Adapter setting to `Bridged` and connect to `RACECAR-Static` from the available network list.
5. Check if you have internet access.
6. Run `ping 192.168.100.[car no.]` to check connection with your RACECAR.
7. Run `ssh -X racecar@192.168.100.[car no.]`; password: `racecar@mit`
8. Once you are logged in, run `screen`.

Updating the RACECAR software

You need to install ROS packages for the ZED stereo camera and structure.io depth sensor on your car by running the following commands in the `ssh` terminal:

1. `cd /usr/local/zed/tools/`
2. `./ZED Settings App`
3. In the GUI that pops up, change `Baseline` to 0.12 and click `Save configuration`.
4. `cd /home/racecar/racecar-ws/src/`
5. `git clone https://github.com/stereolabs/zed-ros-wrapper.git`
6. `gedit zed-ros-wrapper/launch/zed_depth.launch`
7. Update `<group ns="camera">` tag as `<group ns="camera/zed">`
8. `cd ..`
9. `catkin_make`
10. `sudo apt-get install ros-indigo-openni2-launch`

Restart the RACECAR Jetson TX1 by running `sudo shutdown -r now`.

Connect to the RACECAR again using the steps above and test whether the ZED stereo camera works by running these commands on the RACECAR Jetson:

1. `screen`
2. `source racecar-ws/devel/setup.bash`
3. `roslaunch zed_wrapper zed_depth.launch`

4. `ctrl a+c`
5. In the new screen: `rostopic list`

You should see a list of topics with `/camera` namespace.

Go back to the launch screen using `ctrl a+n` and kill the process.

Streaming sensor data

You can now launch several nodes to stream data from the RACECAR sensors. However, camera data does not stream well. Follow the commands below in a terminal you used to `ssh` into the RACECAR:

1. `screen`
2. `source racecar-ws/devel/setup.bash`
3. `roslaunch racecar teleop.launch`
4. `ctrl a+c`
5. `source racecar-ws/devel/setup.bash`
6. `roslaunch zed_wrapper zed_depth.launch`
7. `ctrl a+c`
8. `roslaunch openni2_launch openni2.launch`

Before you further set up for streaming data, identify the IP address of the `eth0` interface of the VM. In a new terminal on the VM, follow the commands below:

1. `export ROS_IP=[IP address of VM]`
2. `export ROS_MASTER_URI=http://192.168.100.[car no.]:11311`
3. `rostopic list`

You should be able to see all the topics running on the ROS Master on RACECAR Jetson. In the same terminal, follow the steps below to view the streaming data:

1. Run `rqt_image_view`
2. Select `/camera/zed/rgb/image_rect_color` from the dropdown menu - the stream is very delayed.
3. Kill the process after you have played around for a bit.
4. Run `rviz`
5. Select `base_footprint` in the `Fixed Frame` global option.
6. Click `Add->By topic->LaserScan->OK` - you should see the laser scans.
7. You can run the car using joypad and view the laser scans simultaneously.
8. Kill RViz when you are done.

Collecting data

You will now collect data using the `rosbag` tool. Since there are so many video sensors on the RACECAR it consumes an enormous amount of space. As such, we will provide you with a 250GB SSD on the Jetson during lab hours. The SSD is formatted and has device name `/dev/sda1`. You should mount it at a convenient location and navigate into the directory before recording the data using the command:

- `rosbag record -a`

Simply kill the process when you want to stop data collection.

You can then unmount the SSD, unplug it from the RACECAR Jetson and plug in onto the desktop Jetson or to your computers using an adapter to get the data.

Addendum: Mounting SSD

Following are the instructions for mounting the SSD provided:

1. Install the given SSD on the SATA port of the RACECAR Jetson (shown in the picture).
2. Run `blkid` in a remote terminal to check if you see `/dev/sda1` in the device list.
3. Create a new folder named `data` in the home directory of the RACECAR Jetson.
4. Mount the SSD by running the command `sudo mount /dev/sda1 ~/data/` in the remote terminal.
5. Set write permission to the mounted drive by running `sudo chown $USER ~/data/`.
6. You should now be able to record data using `rosbag`.
7. You should unmount the drive using the command `sudo umount -l /dev/sda1` before unplugging the SSD from the Jetson.