ILR #9: Progress Review 10

Zihao (Theo) Zhang- Team A

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Individual Progress

Since the last progress review, I have been facilitating progress on the system integration. I found it quite urgent because we have not had a detailed and well-organized plan for system integration, especially given that the Spring Validation Experiment will be approaching soon.

With my own limited knowledge, I tried to find various resources from the Internet and acquaintance to help the team finalize the choice of platform we will use for our system integration. Based on the result, the team has decided to integrate our perception system on the Robot Operating System (ROS). As our perception system contains multiple modules that require frequent communications between one and the others, I believe the well-established inter-process communication mechanism that ROS offers can provide us with many advantages on our system integration tasks.

I have also made a draft layout for our system integration in ROS, as shown in the Figure.1 below. Each ellipse in the figure represents a module built as a node in ROS. The arrow between two nodes represents the flow of messages under a certain topic (topic name shown as the text next to each arrow) that are published by one node and subscribed by the other node.

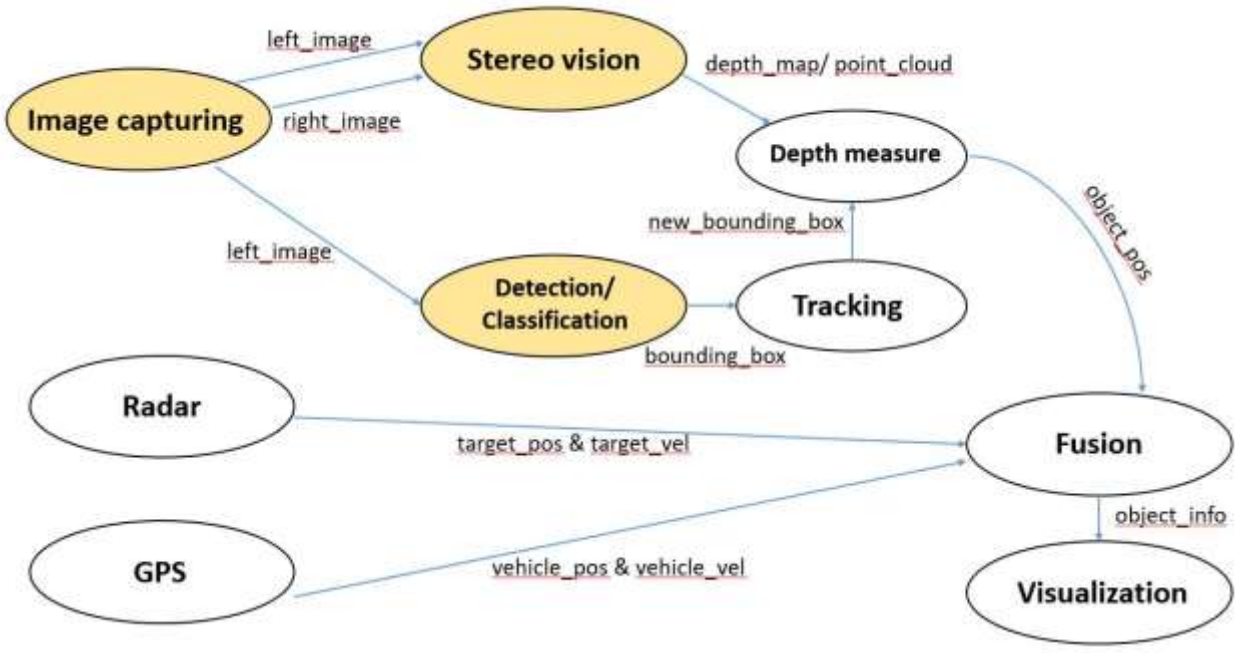
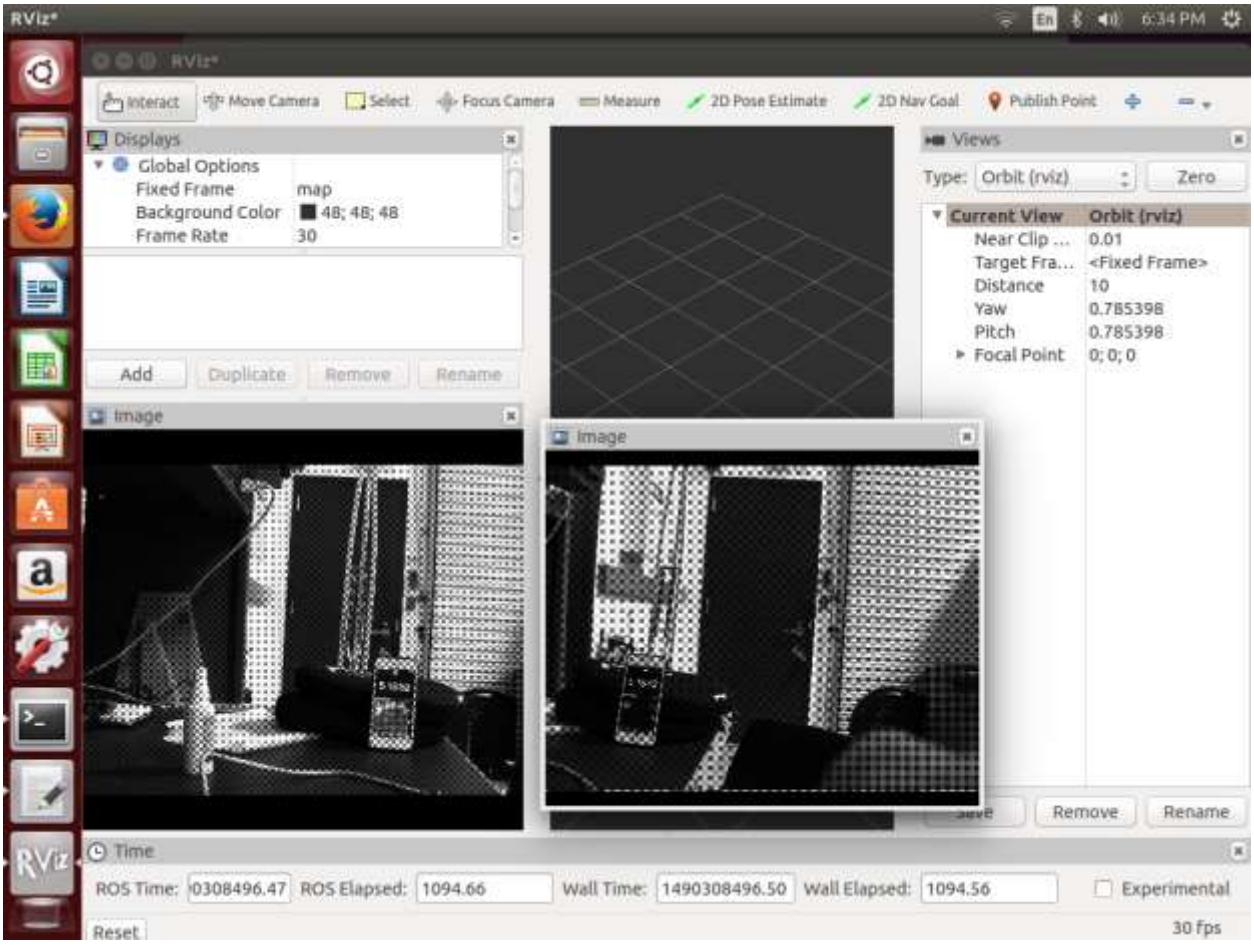


Figure 1. Draft layout of system integration in ROS

The three ellipses marked in yellow stands for the modules that we have been working on in ROS. Among all three nodes in progress, I have been working on building the image capturing node and the stereo vision node.

For the image capturing node, I adapted the flea3 package from Kumar Robotics on the GitHub. The node should take raw images from both the left and right camera of our stereo vision system continuously, process them into undistorted images, and published the images in *sensor_msgs/Image* type.

Currently, the raw images from both cameras (published by the stereo_node) can be visualized in rviz, as shown in the figure below:



Even though the stereo node used software (asynchronous) triggering mode for the two cameras, it was demonstrated that the discrepancy was within millisecond and could be treated as negligible.

For the stereo vision node, I am taking reference of the ELAS package on ROS, which wraps the Library for Efficient Large-Scale Stereo Matching (LIBELAS) by Andrew Geiger. The node should take the rectified images from both the left and right cameras and be able to publish the point cloud (depth map) subscribed by the depth measure node. The package has been built successfully in my ROS workspace but have not been tested yet.

I also worked with Yihao to setup our new desktop. We have installed Ubuntu system with the Flycapture2 SDK and ROS.

Challenges

The biggest challenge that I have been facing now is the amount of time available for learning the ROS. I personally do not have much background in ROS except for the three brief homework assignments in ROS from last semester's project course. It takes time to build new knowledge, but the current situation (given the amount of time left for this project) requires a significant amount of work to be done within a limit period of time and does not really allow a steady pace for learning. It is no doubt a huge mistake that the team did not make this decision of using ROS carefully until recently, but I will have to face the reality and will lead the team to achieve as much as we can on system integration by putting extra amount of effort from now.

Another challenge for the whole team is the current trouble on our testing vehicle caused by the recent traffic accident. I do hope that we will get the car repaired as soon as possible so that we will still have enough time to finished integrating the system on the testing vehicle for SVE.

Teamwork

Amit Agarwal:

Amit has been working with Harry on the radar. They just acquired data in human-readable format from the radar through Ethernet connection.

Harry Golash:

Harry has been working with Amit on the radar. They just acquired data in human-readable format from the radar through Ethernet connection.

Yihao Qian:

Yihao has been working on the object tracking since the last progress review. He was able to show the initial result from the object tracking algorithm with decent performance by this progress review. He also worked with me to set up our new desktop for system integration.

Menghan Zhang:

Menghan worked on building our object detection and classification module in ROS. Specifically, she has been working on integrating Caffe into ROS and building the node for the Single-shot Multibox Detector (SSD) neural network in ROS.

Plans

Before the next ILR/ progress review, our team would like to achieve the following goals on our project of developing the perception system using Stereo Vision and radar:

1. Combined object detection and tracking in ROS
2. Overlay of radar and stereo vision data
3. Initial radar and stereo vision fusion in ROS

This means that we will need to have the ready-to-use image-capturing node, stereo vision node, detection/classification node, depth measure node, and tracking node by the next progress review. The GPS and Fusion (Master) node should be at least in progress by then.

In term of individual work, I will still be leading the work on system integration. I will finish my current work on the image capturing node, the stereo vision node, the GPS node, and the proper communication among them. I plan to work together with Yihao and Menghan to get the rest of the scheduled work for system integration done in ROS by the next progress review.