Individual Lab Report #5

Akshit Gandhi

Team H (PhoeniX)

April 11, 2019

Team Mates:

Shubham Garg
Parv Parkhiya
Zhihao Zhu

Individual Progress

The tasks to be completed by the Progress Review 4 for me were: -

1. Indicate fire-fighting task using a laser pointer

Fire Fighting task:

Task was to detect fire using the classifier completed as a part of the previous progress review and send a signal to the microcontroller to turn on the laser pointer when the fire is within a certain radius of the center of the camera. The task was extended as a stretch goal by John to incorporate the UR5e arm and show the movement of the arm towards the fire location which originally was a part of the next progress review. The UR5e arm is manipulated only with 2DoF, i.e in the x and y direction. The task was accomplished by me by using a P controller with the error being the difference in the image coordinates of the fire location and the camera center. The outcome of this task can be seen in this video. Other responsibilities in this task was to select the joints to be manipulated and mounting the camera onto the end effector along with the laser pointer. The below image shows a red dot which is the camera center (Fig 1) and the blue dot in the green bounding box shows the fire centroid. The red dot turns green when the lazer is supposed to be activated as seen in Fig 2. More information could be gathered with this video.

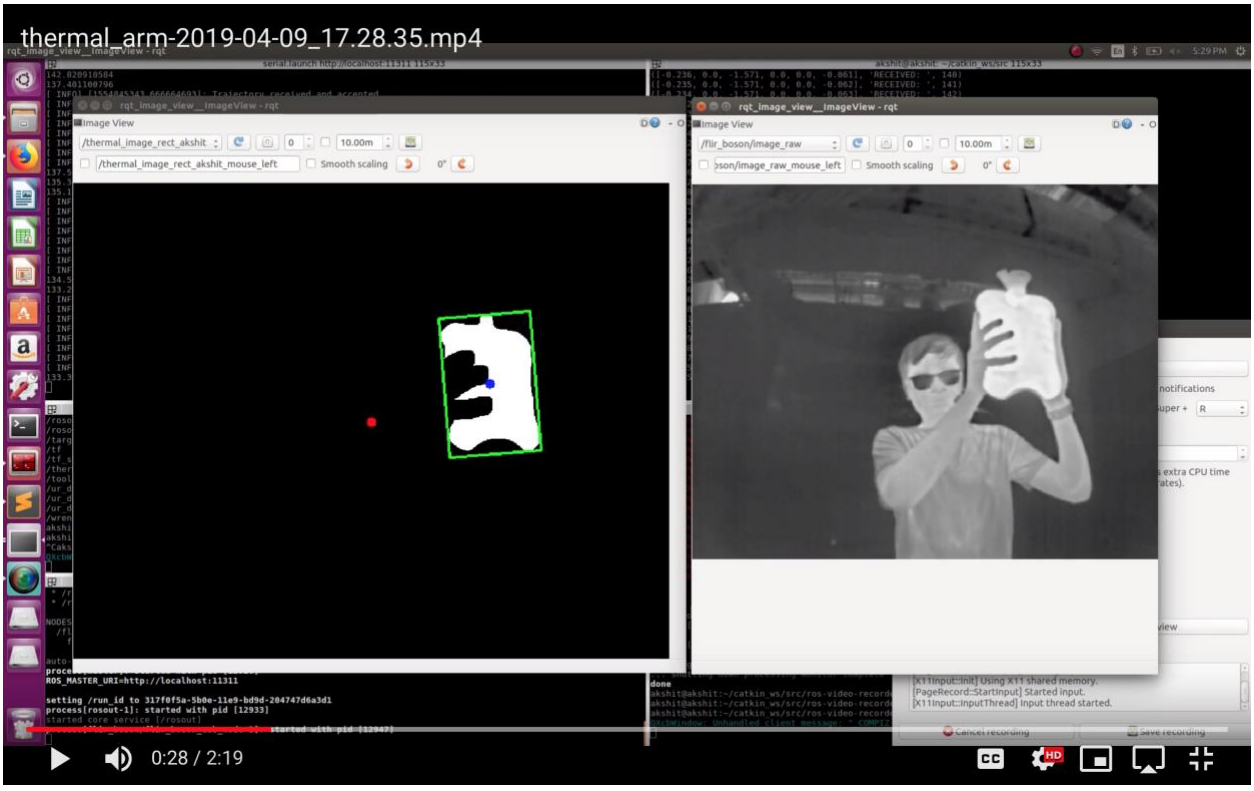

Figure 1: Laser not activated as target is away

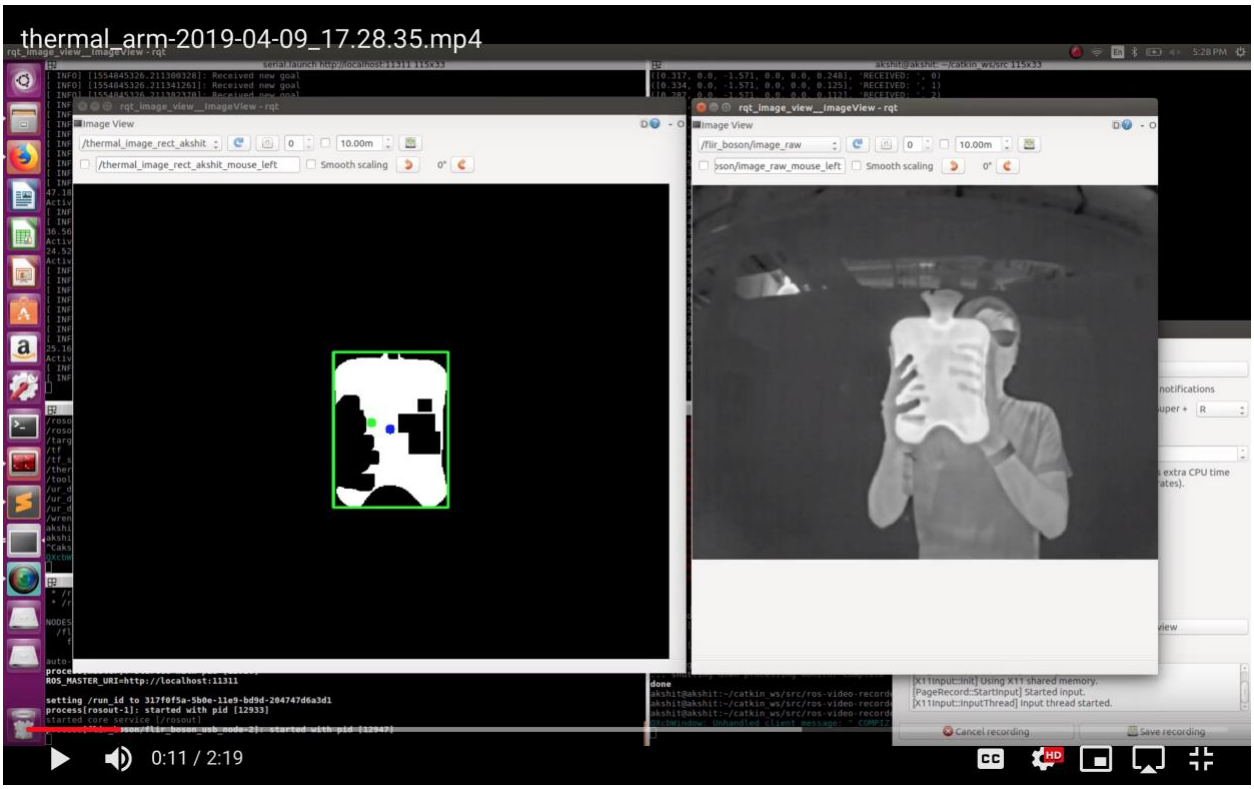

Figure 2: Laser activated as target is close to the center

Other minor tasks:

1. Yaw Setpoint issue: With a pertaining challenge on controlling the yaw of the UAV in simulation and in real, I undertook more debugging into this issue and finally fixed the issue by using the rostopic mask which was basically ignoring all of my yaw commands before and due to lack of proper documentation on “IGNORE” params in the ROS message; I couldn’t resolve the issue previously but now we have the drone controlled along all the degress of freedom in simulation.
2. Rosserial Python issue: For the fire extinguishing task my duty was to publish a string “1” or “0” value on a rostopic which would be subscribed by the microcontroller and the controller would have an if-else loop to turn on and off the laser light. The responsibility of the microcontroller code was with Steve but he faced issues with the if-else statement basically the decision making part. He was able to subscribe to my topic but comparing thr message payload did not work for him, he tried several approaches but he couldn’t resolve the issue so I stepped in and resolved the issue by using a temporary local string variable as the type conversion from string to int for ros messages in cpp for teensyduino did not work properly or we made some silly errors. The conversion of string “1” to int fetched a weird number like 590xxx so

I just copied the payload in a string local variable and used the string compare method to control the laser.

3. Intel Tracking Camera setup on ZOTAC: As discussed with John in the team meetings we went ahead with the tracking camera and to quickly test the accuracy and the performance of the tracking camera on a real mission; I took up an extra responsibility to setup the camera on ZOTAC.

Challenges:

The setup of UR5e arm using ROS was difficult on my PC as the ethernet connection between the arm and the computer was not getting setup using the static IP configuration. I had to start a DHCP server on my computer when the arm was connected so that I could talk to the arm using ROS. I faced very injurious scenarios while working with the arm where in the first scenario I almost lost my left eyesight for more than 30 minutes when the laser light flashed in my eye as I was testing the tracking of my controller. Another risky moment happened when I was moving towards my desk with the hot water bag and the arm was tracking the bag but due to a delay in controller tracking, the control signal jumped up and the arm moved very fast towards me and I had to dodge my head to prevent it from hitting me; if I wouldn't had noticed the behavior it would've been fatal.

During one of the arms shutdown operation a unusual behavior happened which corrupted the OS in the SD card installed. After which the robot couldn't restart properly and we were shown the GRUB screen with a rescue drive; which also accidently got erased. This was just an evening before the progress review. I sought help of Kevin (student in Olivers lab) and Shubham to quickly resolve the issue. We took a backup of whatever we had on the SD card and re-flashed the OS onto it, after which the arm worked fine.

Teamwork:

Parv and Shubham worked on tweaking the SLAM params to work with high resolution images and to implicitly increase the number of features that we could capture from the scene. Parv additionally worked on setting up the gazebo environment as per our sponsors requirement and MBZ specs. Shubham additionally worked on the visual servoing aspect of the husky simulation where he used the onboard lidar and planning nodes to generate a path towards fire location and back to the base station. Steve worked on the rosserial connection between the teensy board and jetson along with the perception abstraction for the simulation.

Future Plans:

The future plans for the next presentation are to integrate the various components for the SVD particularly:

1. Performing UAV flight tests with the tracking camera.
2. Performing UGV mission using the tracking camera.
3. Implement the fire extinguishing task for the UAV (incorporating the yaw movement).
4. Work on fine tuning the gains for the UR5e arm (fire fighting task).
5. Populating the PCB for the next review.
6. Checking the UAV performance on the 1.5 KG payload.