Probabilistic Robotics Lab 3
Group 31: Swapneel Bhatt, Yuteng Cao, Yifan he

___

Assignment 1.

The nodes that are part of the vision pipeline are `camera_driver`,`video_processor`, `image_mean_feature_x`.

Assignment 2.

The `feature_mean` signal is the mean of the x co-ordinates of all the feature poses published in the topic `/goodfeature/corners`. This contains all the corner point features in the door and the `/feature_mean` topic has the mean of all the x co-ordinates of these points. The detection of the door opening using the feature mean signal can work as the feature mean signal drops in value as the door opens. When the door opens, all its corner point features move towards the left, decreasing in x value, hence the `feature_mean` signal value drops.

Similarly, when the door closes, the corner points move towards the right again, increasing in x value, hence the `feature_mean` signal value increases.

Assignment 3.

A threshold value of 280 on the `feature_mean` signal can be used as threshold for the door open/close status. If the value is below 280, the door can be considered open, if the value is above 280, it can be considered partially open or closed, hence unsafe for the robot to move forward.
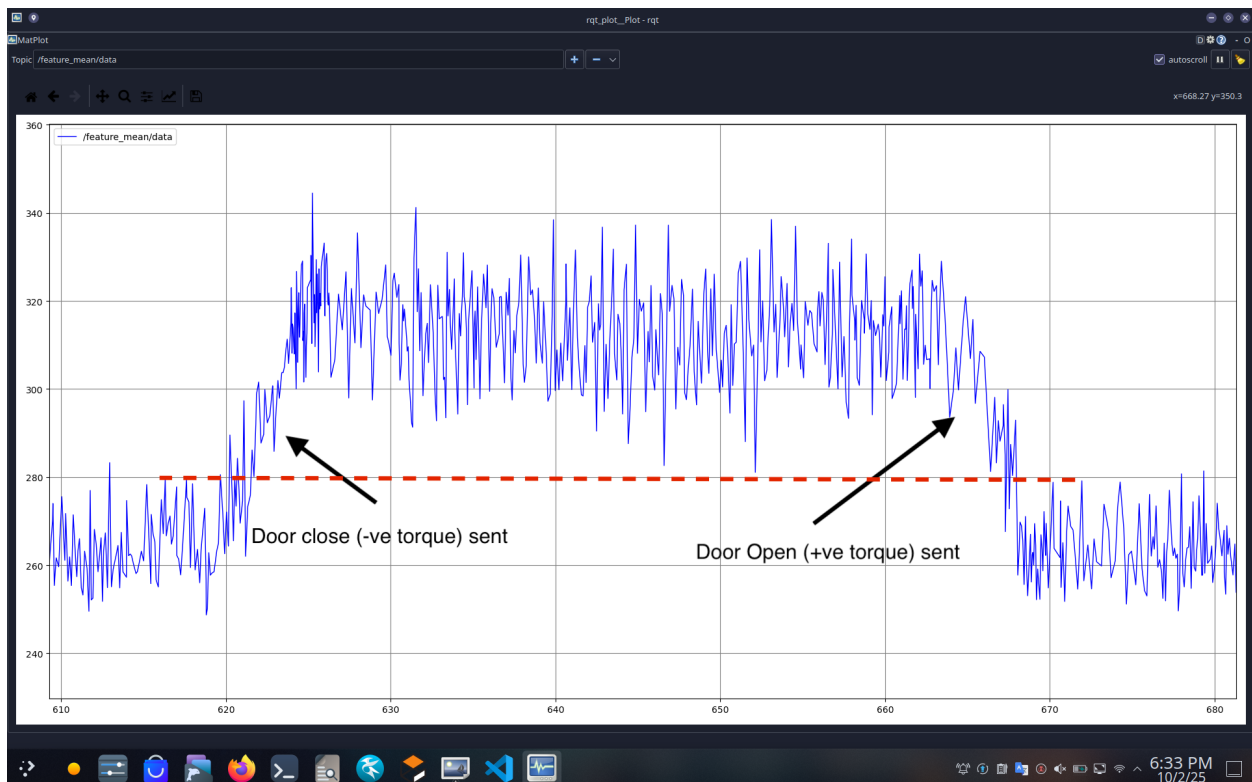

Figure 1: Feature mean signal showing the threshold of 280

Assignment 4.

1

The node is `move_through_door` and it uses the `/feature_mean` signal to decide when the robot goes through the door. Assignment 4 commit

Assignment 5.

The conditional probabilities obtained were:
$P(z = open \mid x = open) = 0.782$
$P(z = closed \mid x = open) = 0.218$
$P(z = open \mid x = closed) = 0.017$
$P(z = closed \mid x = closed) = 0.983$

The threshold selected was 235.0, there were 3 trials done, and the world was reset between each trial. In every trial, 1000 measurements were taken, for a total of 3000 measurements combined. The plot depicting the threshold justification as well as a noisy measurent is below To view the code for the experiment, refer to the node `bayesian_probability_calculator` at the Assignment 5 commit link
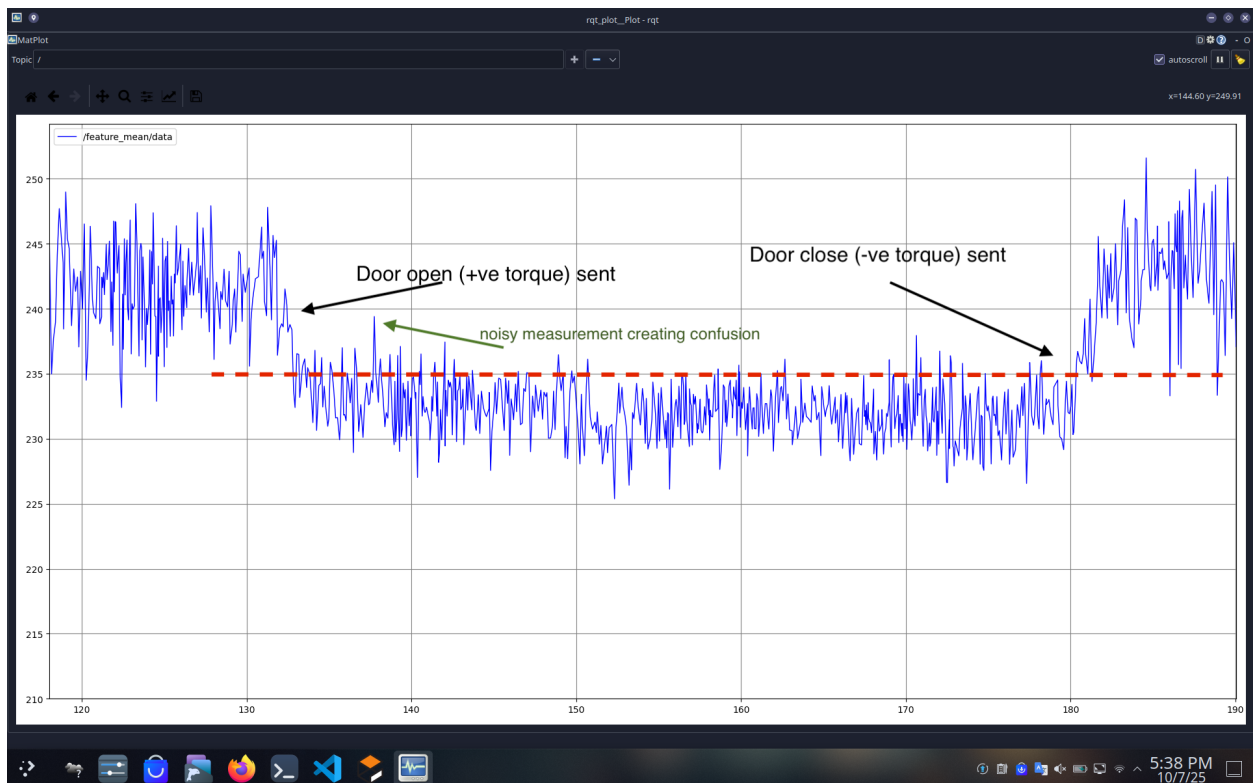

Figure 2: Threshold of 235 when the firetruck is present creating noisy measurements

Assignment 6.

The node is `move_through_door_bayesian` and it utilises the conditional probabilities obtained above. Assignment 6 commit

Assignment 7.

There were 20 trials taken, of which there were 7 failures and 13 successes. Probability of door opening with flaky door opener = 0.65 (13 successes in 20 trials). The code shows that it should have a 1/5 chance of opening, hence 0.2 probability but due to the discussed bug in the class the experimental probability is higher. 0.65 will be the probability used for the Full Bayes Filter.

2

Assignment 8.

The node is the same as assignment 6, it is called `move_through_door_bayesian`. The updated code is at the Assignment 8 commit link. A video showing the performance is at this link: Full Bayesian Filter performance video