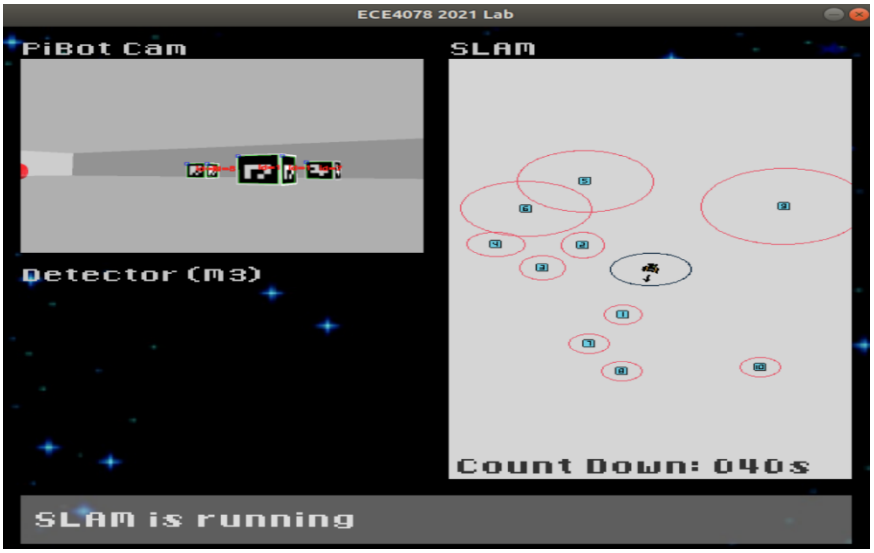
Milestone 2: Simultaneous Localization And Mapping (SLAM)

SLAM Evaluation

After running operate.py, you can start SLAM by pressing ENTER. Drive the robot around manually to identify the ARUCO markers.



When you are done, press “s” to save the generated map, and press ESC to exit the program. You can find the generated map in lab_output/slam.txt, which contains a list of identified ARUCO makers, their estimated locations and the covariances of the estimation.

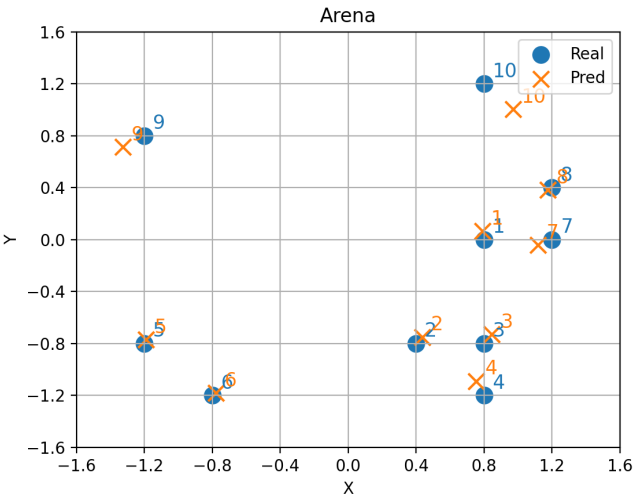
An evaluation script SLAM_eval.py is provided for evaluating the map generated by SLAM against the true map, TRUEMAP.txt (ground truth marker location). Move the files to your working directory and run:

```
python SLAM_eval.py TRUEMAP.txt lab_output/slam.txt
```

You should see a printout of the evaluation results. You can edit the TRUEMAP.txt according to the position of the markers on the arena.

```
Number of found markers: 10
RMSE before alignment: 2.7539308018860544
RMSE after alignment:  0.11440860632612498

Marker  Real x    Pred x      Δx      Real y    Pred y      Δy
------------------------------------------------------------
  1      0.80      0.79      0.01      0.00      0.06    -0.06
  2      0.40      0.44     -0.04     -0.80     -0.75    -0.05
  3      0.80      0.85     -0.05     -0.80     -0.73    -0.07
  4      0.80      0.75      0.05     -1.20     -1.09    -0.11
  5     -1.20     -1.19     -0.01     -0.80     -0.77    -0.03
  6     -0.80     -0.78     -0.02     -1.20     -1.18    -0.02
  7      1.20      1.12      0.08      0.00     -0.04     0.04
  8      1.20      1.17      0.03      0.40      0.38     0.02
  9     -1.20     -1.33      0.13      0.80      0.71     0.09
 10      0.80      0.97     -0.17      1.20      1.00     0.20
```



To allow for best performance of your SLAM module, you will be marked based on successfully finding the 10 ARUCO markers and the RMSE after alignment between your estimations and the true locations of these markers during a live demonstration in a new map in Week 5. You'll have control over how the robot drives around in this marking arena and can use calibration parameter optimized for your developing environment.

Demo

1. Demo is in Week 5. You can request to demo earlier.
2. Submit your implementation before demo (see Submission section below).
3. Each live demo session should take 10-15 minutes. You will be presented with a new arena map (ARUCO markers at random locations).
4. Download your M2 implementation submission from Moodle.
5. Unzip the submission, then open the unzipped folder, open the "lab_output" folder and delete "slam.txt" if exists.
6. Place your robot in the center of the arena. You have 1 minute to discuss among the group how you would like to drive the robot in this new arena.
7. Run operate.py and remember to press ENTER to start the SLAM. You will have 5 minutes (countdown shown on GUI) to perform SLAM. Other group members can make suggestions to the driver during SLAM too.
8. You are allowed to drive the robot to a different location before pressing ENTER. Driving to another location is included in the 5 minutes countdown of live demo.
9. While driving, your robot should not hit any of the markers and should not leave the arena bounds.
10. A visible attempt has to be made to generate pose estimations of all the markers. When you are done or when the timer runs out, save the generated map by pressing "s", and then exit the program by pressing ESC. You only have one try.
11. Rename the generated slam.txt (see Submission section below) and submit it to Moodle.

Submission

There are two submission portals for milestone 2 on Moodle:

1. M2: SLAM
   - For your codes. Zip the whole milestone2 folder and submit the zip file.
   - Rename the file as M2_Labsession_Group.zip, e.g., if you are group 1 from Thursday 12pm, rename as M2_Thu12pm_G1.zip.
   - Submission deadline is Week 6 before your lab session.

2. M2: Map
   - For the output file (lab_output/slam.txt) after your SLAM demo.
   - Rename the file as slam_Labsession_Group.txt, e.g., slam_Tue8am_G3.txt.
   - Submit the file in front of your demonstrator right after your demo.