BRADLEY University

Project Notebook

Area Coverage Optimization

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Contents

Wednesday, May 08, 2019

Dr. Miah gave me an introduction to the project and what's has been done so far. he walked me through the senior project presentation and documentation.

Thursday, May 09, 2019

We had a short meeting with Dakota and Eric and we discussed the prerequisites for the area coverage project and we agreed to meet again to go over the simulation and the implementation of the project.

I have to setup the following on my laptop:

- Ubuntu
- ROS Kinetic
- Putty
- Winscp
- VRep
- Matlab robotics toolbox (on the lab's pc)

Friday, May 10, 2019

I met Eric and Dakota in the robotics lab to transfer the project work.

They walked me through the basics of the project and a quick hadwaving on the simulation and physical implementation.

Dr. Miah wanted me to run at least on Demo on my laptop. However we figured out in order to do that i will need two machines one with ROS and other with matlab toolbox on it.

Wed, May 22, 2019

I met Dr. Miah Regarding the computer lab access and he sent to following email to Mr. Mattus the lab director:

Dear Chris,
Amr Elhussein is an ME graduate student and is currently working on a robotics project under my direction. He needs access to a computer in the robotics lab (JOB 254). I'd appreciate if you could please give him access to one of the computers in JOBST 254 as soon as possible. He needs to run some simulations immediately.
I know it's moving time but he will be out of the lab before moving starts.
Thanks,

The project documentation will be using Latex, and we also set the github account to put all the project material on.

We also set up a weekly presentation session to update the Robotics and mechatronics research group on the progress of the project.

The first two presentations will be :

- an introduction to ROS.
- Matlab Robotics toolbox.

Tue, May 28, 2019

We had a Skype meeting to discuss the content of my presentation. Dr. Miah reviewed the presentation and he ponted out some remarks which i edited immediatley.

Fri, May 7, 2019

We had our first RAM group meeting, Caleb and Dylan gave a presentation on Mobile Robot Localization using Trilateration, Brian gave a presentation on BEMOSS and its enhanced applications and i gave the presentation on ROS.

Tuesday, June 4, 2019

We had a skype meeting on which we decided to install trial version of matlab on my laptop and use one of the other laptops available in the lab to run v-rep on.

Dr. Miah also wanted me to create a list of available programable quadcopters that we can purchase for our project.

Currently the official ROS website contains the following quadcopters:

- AscTec Pelican and Hummingbird quadrotors: cuurently unavailable.
- Berkeley's STARMAC: unavailable commercially developed by Berkeley.
- Bitcraze Crazyflie: costs around 205.00
  https://www.amazon.com/Seeed-Studio-Crazyflie-V2-1-Quadcopters/dp/B07QLVRXN9/ref=asc_df_B07QLVRXN9/?tag=hyprod-20&linkCode=df0&hvadid=343224652930&hvpos=1o1&hvnetw=g&hvrand=13584647834092143486&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1016766&hvtargid=pla-757568426634&psc=1&tag=&ref=&adgrpid=71764766791&hvpone=&hvptwo=&hvadid=343224652930&hvpos=1o1&hvnetw=g&hvrand=13584647834092143486&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1016766&hvtargid=pla-757568426634
- DJI Matrice 100 Onboard SDK ROS support: mainly for developers but it's very expensive around 3K.
  https://www.dji.com/matrice100
- Erle-copter: didn't find a commercial one for purchasing.
  http://docs.erlerobotics.com/erle_robots/erle_copter
- ETH sFly: commercially unavailable, developeed by ETH zurich Autonomus sytems labs.
- Lily CameraQuadrotor : currently unavailable, the project was shut down.
- Parrot AR.Drone Costs around 174.00
  https://www.amazon.com/Parrot-AR-Drone-Quadricopter-Power/dp/B00D8UP6I0/ref=asc_df_B00D8UP6I0/?tag=hyprod-20&linkCode=df0&hvadid=343187928718&hvpos=1o1&hvnetw=g&hvrand=22991436406516486 65&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1016766&hvtargid=pla-523888688318&psc=1&

tag=&ref=&adgrpid=71716366209&hvpone=&hvptwo=&hvadid=343187928718&hvpos=1o1&hvnetw=g&hvrand=2299143640651648665&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1016766&hvtargid=pla-523888688318

- Parrot Bebop: costs around 169.99
  https://www.amazon.com/dp/B00OOR9060/ref=dp_cr_wdg_tit_nw_mr
- Penn's AscTec Hummingbird Quadrotors

For DJI drones the only ones that are supported by ROS are quite expensive. so we either have to choose from the list or build our own drone.

Wed, Jun 5, 2019

I contacted Mathworks.com to get a free trial for matlab robotics system toolbox and i got it installed on ubuntu 16.04 along with ROS.
The next challenge was to figure out a way to connect matlab robotics toolbox and ROS connected on the same machine as all the tutorials on mathworks website talks about connecting Matlab and ROS on different machines.

Fri, Jun 7, 2019

We had our Robotics and Mechatronics Reseach Group (RAM) meeting in which Caleb presented a brief introduction on Multi robot loclization using trieleration. Then I presented a brief introduction on Matlab Robotics Toolbox and its intergration with ROS and the challenges that needs to be tackled.

Tue, June 11, 2019

I solved the problem of integrating Matlab Robotics Toolbox and ROS on the same machine. it appeared that you need to intilize ROS master in the terminal and then in matlab if you typed :

```
rosinit
```

it will connects to that existing ROS master node.

Thu, June 13, 2019

I followed turtlebot 3 tutorials on mathworks.com to verify the connection between Matlab and ROS.

Fri, June 14, 2019

We had our weekly meeting via Skype, we discussed my recent progress and we agreed on the next step which is implementing the three demos on my laptop.
We set our weekly meetings back to 3:00 pm if no presentation sessions are required.
in the Upcoming weeks I'll spend more time in the lab working with the actual robots.
Dr. Miah expressed his intent in writing a proposal grant to fund the project in which I'll be part of.
Dr. Miah asked me to check the pricing of the Matlab robotics toolbox for students which i discoverd later was around 100 USD including simulink.

Fri, June 21, 2019

Presnted my progress in RAM Group meeting, and i demonstrated the three simulation demos on my laptop.

Fri, June 28, 2019

Started working on the actual robots but didn't know the login and password till the end of lab hours.
I also worked on the cad modeling of the eduMOD robot, waiting for Eric to provide the most recent files to work on.

Tuesday, July 2, 2019

Completley modeled the eduMOD robot in solidworks but when it was exported to v-rep nothing is visible. I used SW2URDF plugin.

Fri, July 5, 2019

Presented the 3d model in the RAM group bi-weekly meeting and demonstrated the concept of URDF and my future plans on understanding it in more depth.

Fri, July 12,2019

Back again to working on the actual robots, after sucessfully interfacing MatlabRobotics Toolbox and the beaglebone i didn't know the names of the packages and executebles to run on the beaglebone as there is no any documentation in that area.

Tuesday, July 16,2019

started working in the lab at 1:30 later on Eric Joined me to discuss over the problems that i was facing, we sucessfully run the linefollowing implementation and i then worked on the leaderfollowing implementation , However regarding the area Coverage algorithm i couldn't find the matlab code to run it.
Also a small incident occured where the caster on one of the robots was disattached to the base as the glue that supported it became weak, i told Eric about the problem to see what type of Glue they used.

Fri, July 19,2019

we had our progress presentation sesssion , Brian, Caleb and I presented our work up to the moment. we also discussed our future plans and deadlines.
After that i worked on implementing the line follower and leader follower and sucessfully generated the plots and videos. i am still waiting for the area coverage code and i'll also start looking at modifying the simulation code to serve my goal.
Regarding the simulation i also tried what Eric suggested by running . ./vrep.sh when i intially start vrep but for some reason it didn't work.
I also glued the caster for robot No.2 and waiting for it to dry.

FRI, July 26,2019

I met with Dr. Miah and we discussed the progress of the project, we agreed to give the priority to understanding the actor critic network and its implementation on the area coverage project.
During the lab hours i worked on modifying the area coverage simulation code to suite implementation purposes, i modified the publishers and subscribes names and data type and i sucesssfully sent data between the three robots and the robotic toolbox, however the robot didn't act as the they should, they kept rotating around them self i am suspecting that is due to some errors in specifying the intial positions of the robots or maybe in updating those values.
while working with robot No.2 i experienced some issues, when first attempting to connect through ssh the beaglbone only had bin and it indicated that this image was from 2017, upon trying multiple times it worked but i probably need to back up the image and then resotre it again.

Fri, Aug 2, 2019

I presented my progress in our group meeting and i demonstrated the line follower and line following implementation and i discussed with Dr. Miah and Eric the problem i'm facing with the area coverage algorithm not working sucessfully.
Eric and I head to the lab afterwards to look into the problem more closely and we discovered that the distance between the two wheels is set to the pioneer and also the left and right wheel were flipped in the matlab code, we also edited the gain values and the algorithm worked sucessfully.

Fri, Aug 9, 2019

Dr. Miah ordered a new laptop for the project so i went ahead and edited the codes to work with the new laptop. Unforunatley there was a problem configuring the new laptop with our framework so i called it off that day.

Tue, Aug 12, 2019

I found out that the problem was from the firewall on the new laptop so i asked Dr. Miah to disable the Firewall using adminstrative login and that solved the problem.
Before implementing the area coverage algorithm i had a problem with the Beaglebone No.1 which it's SD card suddenly stopped responding which resulted in me not being able to ssh the beaglebone, I backed up the beaglbone No.2 and then restored it on the first one, i changed the topics names and then built the package and then it worked sucessfully.

Wed, Aug 13, 2019

I implemented the area coverage algorithm and i took videos for the presentation, I noticed that the plotting function is not updating the positions of the robot and it's stuck in the intial positions so I'll look into it.