Robot Design Lab WiSe 2020 Shiyao Zhang
Group 7

Worksheet 5

Solutions:
Due Date: 25.01.2021

Exercise 5.2

Question on AMCL

What does Adaptive in AMCL mean?

Solution

Particle filter can maintain the random distribution of particles throughout the state space. But it will go out of hand if the problem is high dimensional. In order to solve this problem, it's better to use adaptive MCL instead of the origin particle filter which coverges musch faster and is computationally much more efficient. The main idea is to bound the error of sample-based representation of the particle filter. At first we could assume, that the true posterior is given by discrete, picewise constant distribution. Then we could determin number of particles so that KL-distance between MLE based on samples and true posterior does not exceed threshold.

Why is it useful to have a Adaptive Monte Carlo Localization?

Solution

Because the AMCL can utilise raw mesurements and model any mesurement noise, be easier to implement and deal with kidnapped robot problem by adding random particles.

Exercise 5.3

Questions on DWA

Why do we need a local planner?

Solution

A local planner is better to determine the current path according to the changed environment. A global planner could at the beginning calculate a optimal path from the start to destination using Dijkstra or others algorithms. But if the environment around the robot is moved, a global planner could't help the robot to avoid any obstacles or bounds of the map. So by the dwa local planner the theta and velocities in a fixed period could be calculated. Then denpending on evaluation standards like obstacles, time etc the optimal path would be always updated.

Research on your own for an alternative solution for this problem and explain why it might be better.

Solution

Exercise 5.4

Simple Electronics

Write least on sentence for each of the 3 protocols when to use them.

Solution

SPI:When the user needs the fastest protocol und hopes, that data can be transmitted continuously without the interruption and data are received and transimitted at the same time, the best choice is using SPI.

I_2C:When the user wants to have a protocol that supports multi-master and multi slave communication,I_2C could be more useful.

URAT: This protocol is used widely, so there are lots of resources online. The well documantation makes this protocol more simple to use.

Write down some recommendation of what you would use.

Solution

I would like to choose I_2C. As a beginner more resources is significant for me. The structure is also simple, biderectional twowire synchronous serial bus and requires only two wires to transmit informations between devices connected to the bus. When I require many different parts working together, I_2C can connext up to 128 devices to the mainboard and it could also maintain a clear communication path.

Feedback

How much time did you spendon doing this sheet per person

10 hours.

Was is too easy, easy, ok, hard, too hard?

Finding the alternavie way is hard and haven't any ideas yet.

What additional resources(blogs, papers, books, tutorials, etc) did you use?

`https://www.seeedstudio.com/blog/2019/09/25/uart-vs-i2c-vs-spi-communication-protocol`
`http://web.mit.edu/6.111/www/f2017/handouts/L13_4.pdf`
`https://wiki.ros.org/dwa_local_planner`

Any other issue?