Localization lab and homework
Work to be done

Preparation

1. Retrieve the file `StudentDocsLab1.zip` from the Hippocampus Moodle.
2. Create a folder for the lab.
3. Decompress the contents of the zip file in the folder.
4. Read the documents in the following order: the present document, then the "system description" document and then the "programs and data" document. "System description" is fundamental to understand the equations and some parts of the code you have to provide.
5. Using "`ShowOdometry.m`", check the various paths corresponding to each data set. Don't forget to look at the speed data.
6. The files "`EvolutionModel.m`" and "`MagnetLoc.m`" contain missing code which you need to provide. The missing code is replaced by "`***`". You can use the localization book to help you in this task.
   To check your own version of "`EvolutionModel.m`", rename "`EvolutionModel.p`" so it is not used by `ShowOdometry`, and check that you obtain the same odometry results with your own function.
7. Put all noises to zero in "`DefineVariances.m`" and execute the program. You will get a lot of warnings from Matlab. Ignore them and use figure 7 to evaluate the measurement noise.
8. Once you have a measurement noise you consider reasonable, set the initial covariance matrix `Pinit`. The standard deviation `sigmaWheels` is now your tuning parameter. If the measurement noise value and initial covariance matrix have been properly set, you should be able to find a proper value for `sigmaWheels`.
9. There is a last important parameter to be set: the threshold for the Mahalanobis distance (`mahaThreshold`). This parameter is normally set by using the Matlab `chi2inv` function. You must understand for this function does and use it to determine a proper initial value for the threshold.

Report

The aim of this lab/homework is to understand how the Extended Kalman Filter (EKF) works and is tuned. Using the graphs (and possibly others you might want to add), you must be able to justify when your filter is correctly tuned.

I am not just interested in the values of the noises and a few graphs. I want you to find and explain a **methodology** to set the noises. You will need **criteria** to evaluate the quality of a given set of parameters.

Your report should also show that you understand the role of the various parameters you have set.