HW3 - Kalman Filter Exploration

As the numeric results from the experiments with Kalman were lost with my MacBooks HDD during travel, it is impossible to provide appropriate graphs. I can however provide my recollections of robot's behavior and results I remember, and this is the point of this wiki entry.

In this experiment, a gaussian noise was added to a Nomad virtual system, allowing to turn the pitch-perfect sensor readings of the system into slightly less perfect, but consistently disorted readings, that could be processed with Kalman filter (as the noise is gaussian and system linear).

Default Measurement

During the default measurement (ratio 1:1) I observed, that the robot tended to take a smooth path to approach the wall and consistently read around ~40, in a few different iterations. Moving the wall caused it to smoothly return to the valid point, again around ~40. State values, were rather closely (compared with later results) correlated with the real readings, while the noise itself, while with shape roughly following the shape of real readings, was pretty much dispersed within a certain margin (+/- 20) of the real reading.

Trials

With ratios smaller then 1 (i.e. noise lower then estimate)

Running trials on the ratios smaller then one, i.e. for noise lower then estimate, the robot would approach the wall much closer then originally planned. The values of noise introduced to the system would be very large, and the movement itself rather rough.

With ratios larger then 1 (i.e. noise higher then estimate)

The noise and noise estimate featured close correlation for small values of noise and estimate, making the approach very smooth (also, approach would be much cloaser to the object then planned, due to noise not taken into account), but further down the road would ultimately lead to a system, that would keep on oscillating and not be able to catch a wall in certain place (as noise would introduce so much damage to the signal, it would consider itself too close or too far from wall in the appropriat esituations.

With ratios around 1 (i.e. noise is estimate)

Running trials on such configurations, the noise path would roughly follow the real path, and the entire state estimate would be more or less similar to the real path. A few trials, including the original one confirmed, that this would not continue on higer values, where the general shape would be saved, but not much more than that. The approach, with increasing values of noise and estimate would be less and less smooth.

Summary

To sum it up,for the low noise values, the system tended to answer best, when the estimate was similar. It is usually good to have the higher estimate, as it allows one to avoid accidental hitting of objects (as with ratios larger then 1, some noise may not be accounted properly, leading to hitting the object.