Testing and Refactoring NDT-MCL

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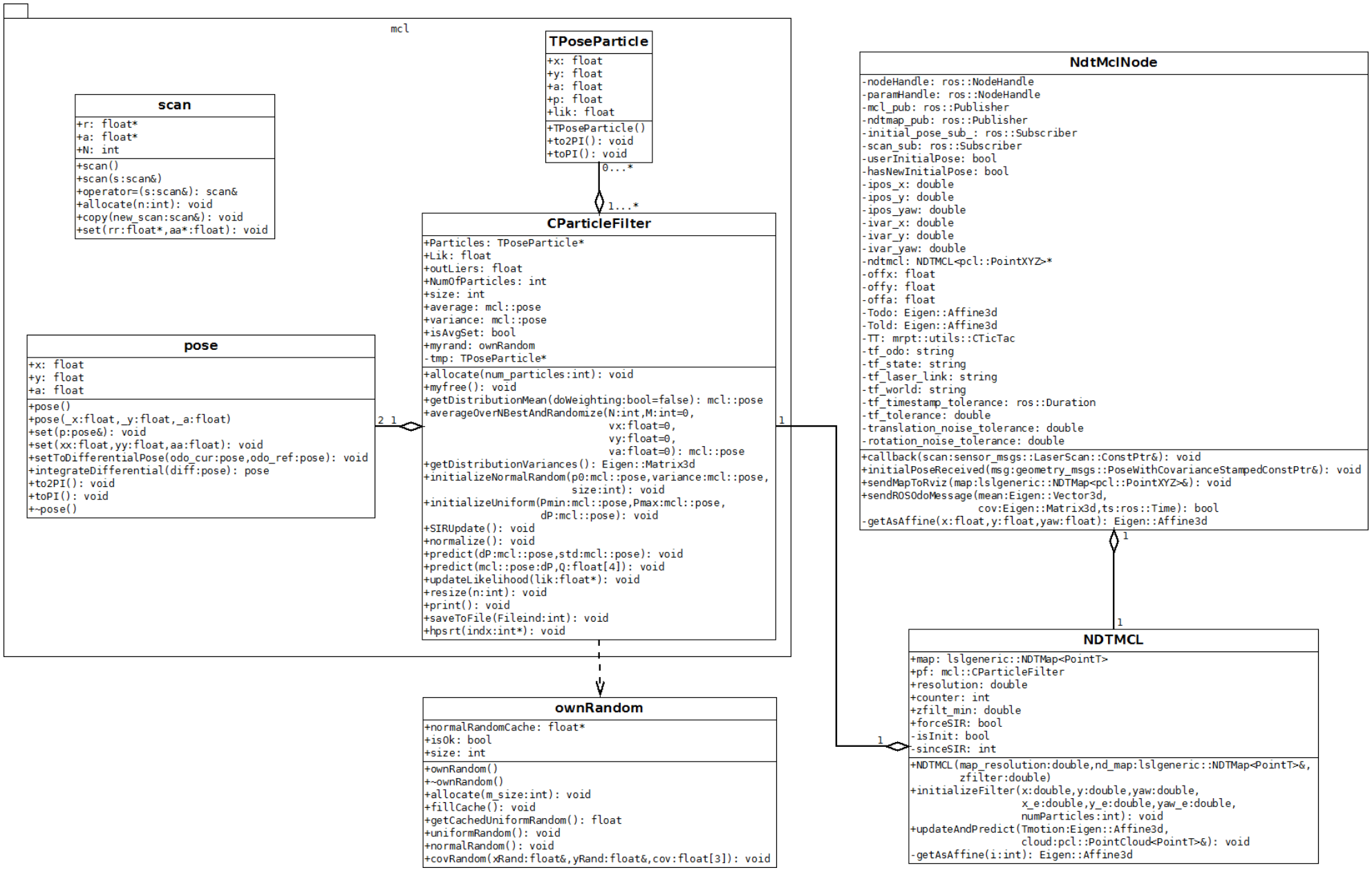
Normal Distribution Transform - Monte Carlo Localisation

- Normal distribution transform Monte Carlo localisation (NDT-MCL) [1] is a localisation algorithm whose goal is providing an estimate of the true position of a robot in a given environment
- NDT-MCL parametrizes grid cells by Gaussian distributions, employing a so-called NDT representation as suggested by [2]
- Localisation involves calculating a pose likelihood, updating particle weights, and resampling particles.
- The only difference in NDT-MCL is the likelihood calculation, such that $L2$-likelihood is used to express the discrepancy between the estimated and the actual robot pose.

Node Description



Implemented Modifications

- Re-factored node as a class
- Removed use of ground truth
- Pose estimate published as transform between map and odom frame
- Added parameters to the launch file - such as tf frames, translational and rotational tolerances, etc.

Remaining Issues

Tested localisation both in simulation and in a real environment

- Poor localisation during mapping using the NDT Fuser node (for mapping)
- Map is not very accurate
- Incorrect pose estimation while robot is stationary
- Pose estimate "jumps"

Improvements and Future Work

- More parameters should be exposed in the launch file so the node can be tuned to different platforms and environments if necessary
- Resolution of map should be stored in the map file
- Investigate compatibility with navigation planners
- Port visualization to Rviz

References

[1] J. Saarinen, H. Andreasson, T. Stoyanov, and A. J. Lilienthal, "Normal Distributions Transform Monte-Carlo Localization (NDT-MCL)," in *Intelligent Robots and Systems (IROS), 2013 IEEE/RSJ International Conference on*, Tokyo, Japan, 2013, pp. 382-389.

[2] P. Biber, "The Normal Distributions Transform: A New Approach to Laser Scan Matching," in *Intelligent Robots and Systems, 2003. (IROS 2003). Proceedings. 2003 IEEE/RSJ International Conference on*, Las Vegas, NV, 2003, pp. 2743-2748.