Autonomus Robotics

2D Barbie Localization Semestral Project report

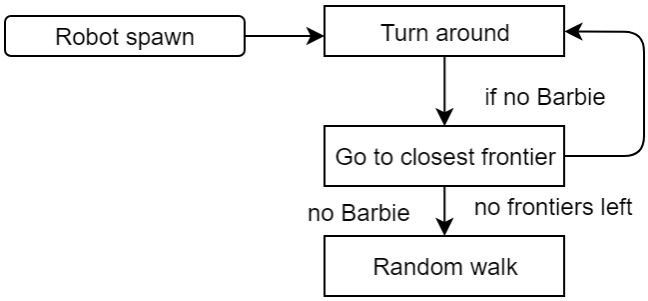
Mikhail Ivanov, Timur Uzakov, Denys Chereda

Cybernetics and Robotics department
Czech Technical University, Prague, Czech Republic

Localization of robot in the environment, motion planning, and object recognition are most common but still difficult challenges in robotics. The task of the semestral work suggests combining several techniques for the realization of all those challenges.

I. PROJECT APPROACH

For achieving a goal of localization a Barbie doll in an unknown environment we established algorithm with the following steps:



Fig,1 Basic algorithm

By combining turns around with consistent exploration of all reachable frontiers the whole playground is explored not only by lidar but also with a camera. In case if during those step we didn't achieve any doll detection robot starts to randomly generate angle and move till obstacle in angle direction.

II. ALGORYTHMS SPECIFICS

The "Turn around" block is realized by rotating robot in discrete steps for overlapping frames and each turn is done only after the detector algorithm process received the image.

To avoid unnecessary movement of robot frontier search includes a few stages of filtering to return only good quality point. Firstly, in frontier point area we compare a number of known, unknown and obstacle points, secondly, we store all visited frontiers and if a new one is close enough to already visited we eliminate it.

For the same reason path-planning also includes filtering stages: avoid very short (less than 35 cm) and very long (more than 3.5m) paths.

Few tweaks also were done to ICP launch parameters like inlier_ratio and inlier_dist_mult what made our map very robust regarding any type of movement.

It turned out that detector is very sensitive to noise or environment objects, such as chair or fire distinguisher. The problem there is that it could detect a wrong object and send the wrong coordinates of the Barbie doll. In order to tackle the issue, a solution was found in the Barbie detection script, where there is one detection criteria — detection threshold. The optimal parameter was found and set to a value around 4.0.

III. RESULTS AND CONCLUSION

After many hours of adjusting different parameters, we achieved a working build that is able to detect Barbie with high precision (on the final run we derivation was 6 cm). Was found that all robots don't behave in the same way and even battery level can drastically change the robot behavior. Also, when the lab was full of our colleagues the load on Wi-Fi net sometimes caused troubles with robot communication there for it is better to run all scripts on the robot itself but on the other hand, it is too computationally costly for embedded NUC computer.