Online verification of mobile robots in intralogistics

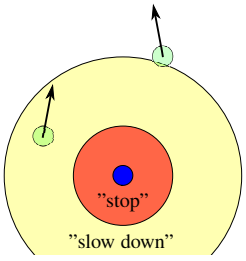
Background

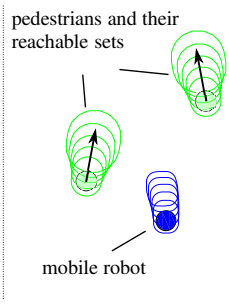
Mobile robots operating in a shared environment with pedestrians are required to move provably safe to avoid harming pedestrians. Current approaches like safety fields use conservative obstacle models for guaranteeing safety [1], which leads to degraded performance in populated environments. In order to overcome this problem, an online verification approach that uses information about the current pedestrian velocities to compute possible occupancies based on a kinematic model of pedestrian motion was introduced [2]. Simulation has shown using this method goals are reached between 1.4 and 3.5 times faster than current standard methods.

Description

This thesis/IDP is a collaboration between the Chair of robotics and Chair of Logistics (MW) and has the goal to evaluate the new safety method on a real robot system. For this purpose the area of logistics was chosen, as efficiency plays a key role in material flow use cases. As these systems share their working environment with humans, safety plays an important role. Only if the vehicle has undergone a safety certification it is allowed to be used in a warehouse.

- The thesis begins accordingly with an analysis of the requirements for the safety certification under consideration of the online safety verification.
- The online safety verification requires information about the person to be avoided. This information must be extracted from the environment by the robot using its sensors (Lidar, Camera). In order to online verify safety, a safe people detection method needs to be developed.
- The system shall be implemented and tested on the robot. The implementation shall be based on the Robot Operating System (ROS) preferably in C++ (or Python).
- After implementation and commissioning, the online safety verification shall be evaluated on the basis of logistics-specific application cases (commissioning, goods transport). For this purpose, a test plan is conceptualized and experiments are carried out.
- The data captured enables a verification of the human and robot model as well as a comparison to known standards and the simulation mentioned in the introduction.





(SICK)

References

[1] DIN EN ISO 13849-1:2016-06. Safety of machinery - safety-related parts of control systems - part 1: General principles for design (iso 13849-1:2015), 2016.

[2] Stefan B. Liu, Hendrik Roehm, Christian Heinzemann, Ingo Lutkebohle, Jens Oehlerking, and Matthias Althoff. Provably safe motion of mobile robots in human environments. In *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 1351–1357. IEEE, sep 2017.

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Research project:
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Research area:
People detection, Safety, Logistics

Programming language:
C++/Python, ROS

Required skills:
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Language:
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