Call for Internship (ISIR - Sorbonne University)
Social Robot Navigation with Pepper Robot

December 28, 2023

1 Abstract

Human Robot Interaction is one of the main pillars of robotics that has a long way to go to adapt robots in our daily life environments. Robots working in human populated environments should be able to understand the human behavior and adapt their motions to be more socially compliant. This means, they should not only guarantee the safety of the people around them, but also should be able to show legible motions to be more understandable by humans. In fact, by generating approach trajectories that are both legible and informative, we can optimize service efficiency and customer experience in dynamic, shared spaces. As part of euROBIN project , we are working on a social navigation stack to deliver a small object to a person in a cafe / restaurant while being gentle and legible. This requires designing a good architecture for the perception system that captures the necessary information from the environment and the people in it. And to develop motion planning algorithms that can generate legible motions for the robot while adapting to the environment changes.

2 Internship Objectives

The main objective of this internship is to develop a social navigation stack for Pepper robot. This stack should perceive the human behavior plus any other relevant information from the scene, predict the motions and finally generate legible motion plans for the robot. But since Pepper, is not equipped with the necessary sensors to perceive the environment, we need to equip it with extra sensors and processing units. We want to leverage Intel RealSense stereo cameras and Nvidia Jetson GPUs to enhance the

perception and processing capabilities of the robot. The algorithms should be implemented in ROS (preferably ROS2) and be tested on Pepper robot. But this might also require to simulate the robot before testing on the real robot, for which we can use Gazebo or Unity. This internship is a great opportunity to dive into the ROS ecosystem, learn about social navigation and also learn about the latest technologies in computer vision for robotics.

3 Required Profile

Motivated Master's students with a robust academic foundation in Computer Vision and Robot Navigation, eager to contribute to a dynamic and collaborative robotics team.

4 Skills

Skills needed include expertise in:

- programming (Python / C++)
- implement nodes and algorithms in ROS/ROS2
- debugging multi-threaded applications
- motion planning, and obstacle avoidance algorithms
- stereo vision and depth cameras
- simulation (Gazebo, Unity, Isaac Sim, ...)
- basic experience with a 3D CAD design software (Solidworks, FreeCAD, ...)
- and demonstrate strong problem-solving skills.

5 Internship Details

- Supervised by: Javad Amirian, Mouad Abrini
- Start date: February or March 2024
- Duration of internship: 6 months

- Level of studies required: Currently enrolled in Master 2, or final year of engineering school.
- Host laboratory: ISIR (Institut des Systèmes Intelligents et de Robotique), Campus Pierre et Marie Curie, 4 place Jussieu, 75005 Paris.
- Email: [firstname].[lastname]@isir.upmc.fr

Send your application by e-mail, with [Internship euROBIN] in the subject line, including a CV and a cover letter. It is strongly recommended that you also attach one or more personal projects (github, etc. . .).

6 References

1. euROBIN project https://www.eurobin-project.eu
2. Taylor, Ada V., Ellie Mamantov, and Henny Admoni. "Observer-aware legibility for social navigation." 2022 31st IEEE International Conference on Robot and Human Interactive Communication (RO-MAN). IEEE, 2022.
3. Caniot, Maxime, Vincent Bonnet, Maxime Busy, Thierry Labaye, Michel Besombes, Sebastien Courtois, and Edouard Lagrue. "Adapted pepper." arXiv preprint arXiv:2009.03648 (2020).
4. Wallkotter, Sebastian, Mohamed Chetouani, and Ginevra Castellano. "A new approach to evaluating legibility: Comparing legibility frameworks using framework-independent robot motion trajectories." arXiv preprint arXiv:2201.05765 (2022).