Guiding Task through Route Description in the MuMMER Project

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ABSTRACT

The EU-funded MuMMER [1] project (http://mummer-project.eu/) has developed a socially intelligent robot to interact with the general public in open spaces. One of the core tasks for the robot is to guide the visitors to specific locations in the mall. The primary MuMMER deployment location is Ideapark, a large shopping mall in Lempäälä, Finland. The MuMMER robot system has been taken to the shopping mall several times for short-term co-design activities with the mall customers and retailers [2]; the full robot system has been deployed for short periods in the mall in September 2018, May 2019, and June 2019, and has been installed for a long-term, three-month deployment as of September 2019.

Description

Different components allowing the execution of the robot guidance task are explained below. ***Route computing and route verbalization***: The entire description of the route, from the search for the best route to get to the final destination to the verbalization of this route, is based on the Semantic Spatial Representation [6]. ***Geometric reasoning***: It uses Underworlds [5], a lightweight framework for *cascading spatio-temporal situation assessment* in robotics. It represents the environment as real-time distributed data structures, containing scene graph (for representation of 3D geometries). Based on a 3D model of the mall, it maintains what the robot knows about the scene as well as the estimation of the human’s beliefs about the scene. ***Motion planning***: The navigation of the robot is implemented using the ROS navigation stack, with *navfn* global planner and a modified local planner that accommodates humans into planning, inspired from [3], called Social TEB. ***SVP planner***: The purpose of the SVP (Shared Visual Perspective) planner [7] is to try to find a position where the human will have to go to observe an element of the environment such as a passage, a staircase or a store. To do this, a visibility grid is computed for each possible landmark. Having determined a good position for the human, the planer also allows determining the good position for the robot so as to have a human-robot-landmark conformation allowing both to point the landmark and to look at the human. ***Supervision and Evaluation of the Quality of Interaction***: A supervision system handles the execution. Throughout the task, the robot supervises the execution and, depending on what goes wrong, the robot has multiple possible responses. It is able to handle nominal scenarios of route guidance while being able to take into account contingencies such as the human lack of visibility of the direction. While interacting with people, it evaluates in real-time the quality of the interaction at three different levels which are the interaction session, the task and the action levels as described in [4].

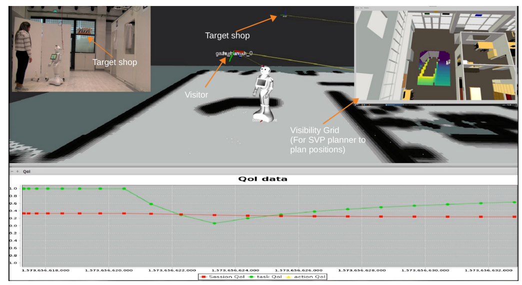

Figure 1: Pepper interacting with a customer

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