Objective

Mobile robots must generate and keep a representation of the environment. For indoor environments, most of the time it is in the form of a top-down map that encodes whether spaces are occupied with obstacles or not. Semantic maps, however, include much richer information: objects, tables, rooms, etc. Whenever a robot generates a semantic map, it should communicate this information to the users. The objective of this project is to visualise the semantic maps generated by a robot with an Augmented Reality (AR) headset. This information then can be used for tasking, for example, the user can select a virtual object using natural gestures, and command the robot to fetch it.

Project Details

The hardware that will be used for this project is a mobile robot platform (Fetch Mobile Manipulator) and an AR Headset (Microsoft Hololens 2). We will not focus on the development of the semantic mapping approach in this project. Instead, the focus will be on the visualisation of this information. The system would have 3 functions:

1) Building a semantic map that includes tables, rooms and objects (3rd party library will be used)
2) Connecting the semantic map output in Robot Operating System (ROS) with Unity (Hololens) and visualising relevant elements
3) Enabling the user to edit the semantic map with natural gestures and speech. The user should be able to modify/delete entities generated by the robot, and label them with speech.
4) Conducting user studies to measure the effectiveness of the proposed system

Prerequisites

- Strong programming skills in Python, C++, or C#
- Interest in publishing the results of research in a scientific journal