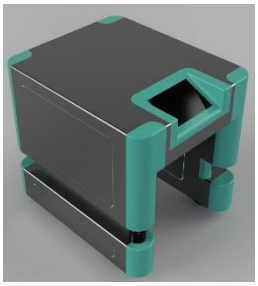
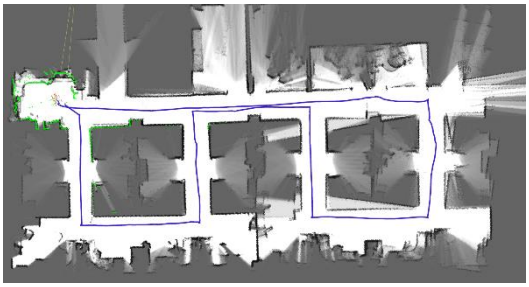
GRADUATION ASSIGNEMENT - DEVELOPING AN INTEGRATED SOFTWARE SOLUTION FOR MAPPING AND ROUTING FOR USE IN NEXT GENERATION NAVIGATION OF ROBOTS





The goal of the project Next Generation Navigation (NeNa) is to develop safe, robust, precise and trustworthy navigation for robots (autonomous guided vehicles - AGVs) using open-source software. Small and medium-sized enterprises (SMEs) that develop AGVs currently need to fall back to costly black-box commercial software solutions.

The goal of this project is to develop an open-source software solution for creating and annotating maps and routes for robots to achieve the level of functionality of commercial software.

The top left figure shows the AGV that is currently in development by the Mechatronics lectorate. Using open-source software (ROS - Robot Operating System), the AVG should, in the end, be able to demonstrate driving to a crate, picking it up, driving with the crate to a designated location, and putting it down again. For an AGV to achieve that, a number of steps need to be performed:

1. During manual steering the AGV "Simultaneously Localizes And Maps" (SLAMs) its surroundings, trying to position itself in a map that it is creating.
2. The result of SLAM is a 2D (potentially 3D) map of the environment, essentially a 2D image where pixels indicate locations without (light px.) or with (dark px.) obstacles (top right figure).
3. Once the map is created, the AGV can use the map to locate itself and also to plan a route from A to B without hitting obstacles. The operator needs to indicate where the robot may or may not drive, e.g. unoccupied areas vs. areas reserved for people.

This navigation behavior would be different from traditional ROS navigation where the robot is allowed to use all unoccupied areas and we need to have a more deterministic and controllable behavior.

DESCRIPTION OF POSSIBLE TASKS:

- Developing new software solution tools for making and annotating maps for AGVs.
- Critically assessing whether and why ROS or ROS2 is better for building the demo in view of the usability/maturity of available packages (e.g. Gmapping, Cartographer).
- Exporting annotated maps to fleet manager software (e.g. OpenTCS) and to the ROS navigation stack, adjusting the ROS global planner to be able to use the information from annotated maps.
- Validating these solutions in an AGV testing environment and make it open source.

PRACTICAL INFORMATION:

- **Student profile:** HBO-ICT SE, graduate student, knowledge of ROS and Linux is a plus.
- **Duration:** February 2020 – July 2020.
- **Compensation:** 230 euro per month (before taxes) when carrying out this assignment at Ambient Intelligence / Mechatronics.
- **Contact person:** For more information, contact Miha Lavric (**m.lavric@saxion.nl**) and Wilco Bonestroo (**w.j.bonestroo@saxion.nl**).