Weekly Report 1

Lukas Evers

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1 Research question

How can we improve the behaviour planning for a robot in order to achieve better safety and reliability?

2 Collection of Scenarios for Autonomy and Safety Tests

2.1 Scenarios Derived From Intel RSS Guidelines

Table 1: RSS Guideline Scenarios

Number of Scenario	**RSS Rule**	**Description**
1	Safe linear and lateral distance	An obstacle gets too close to the robot. Obstacle gets spawned near the current location of the robot
2	Right of way is given	Another robot drives into the path of the robot.
3	Limited Visibility	The robot drives through a densely occupied area with many occlusions in the lidar data ahead.
4	Avoid collisions	Robot performs a dodge maneuver if anything gets too close in the zone what is considered to be a safe distance.

2.2 Scenarios Derived Fom Sense - Plan - Act - Principle

Table 2: Sense-Plan-Act Scenarios

Number of Scenario	**Activity**	**Description**
5	Sense	Crash of the Lidar node.
6	Sense	Crash of the Odometry/Localization node.
7	Plan	No valid path to goal is found.
8	Plan	Path Planning Node crashed.
9	Act	A collision with an obstacle is forced.

3 Current Behaviour vs. Planned Behaviour during Scenarios

Contrasting the difference between reactive behaviour and active behaviour for the robot. With a basic vanilla nav2 stack setup you could probably achieve the Intel RSS Guidelines, as the replanning takes place almost instantly. The difference between the current and expected behaviour will not be that great except from the occlusions scenario which is not taken into account in normal nav2 navigation due to the lower speeds of the vehicles.

Table 3: Current Behaviour vs. Behaviour Planning Extension

Scenario	**Current Behaviour**	**With Behaviour Planning**
1	Robot replans to avoid the obstacles.	Robot replans to avoid the obstacles.
2	The robot would replan the path around the around but not predict where things will be moving.	The robot would replan the path around the around but not predict where things will be moving.
3	Robot is unaware of occlusions and sudden appearances of dynamic obstacles	The robot slows down in areas with occlusions.
4	The robot would replan the path around the around but not predict where things will be moving.	The robot would replan the path around the around but not predict where things will be moving.
5	The robot would continue to drive blind.	The robot would continue to drive with lowered speed and try to restart the Lidar. Taking into consideration the motion prediction of obstacles.
6	Robot would drive indefinitely and never reach the goal	The robot tries to change the method of localization and meanwhile to restart or reset the odometry.
7	The robot would never move.	The robot tries to restart the planner and replan. Else, it tries to change the path planning algorithm. If planning is still not possible the robot tries to move to a different starting position.
8	The robot would never move.	The robot will restart the path planning node.
9	The robot would not be able to move away from the crash.	The robot slowly reverses out of the crash and resets navigation and odometry at the last known safe location.

4 Next Week

- Setup Gazebo and ROS Environment on a good laptop/pc
- Create a Code Behaviour Tree
- Architectural Decisions on how to work with ROS2 (inside/outside, interfaces to ROS)
- How can testing be done effectively and how to get meaningful data?