Autonomous Searching Vehicle

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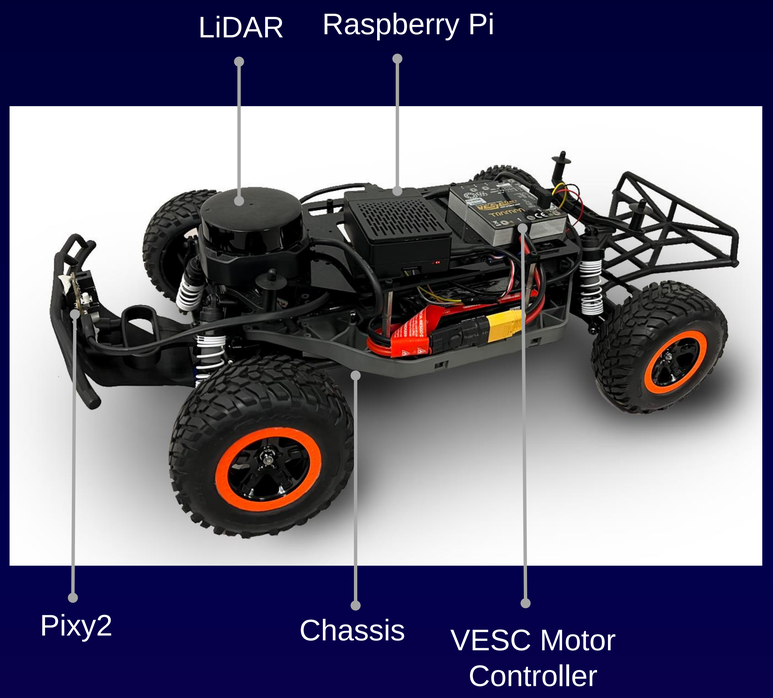
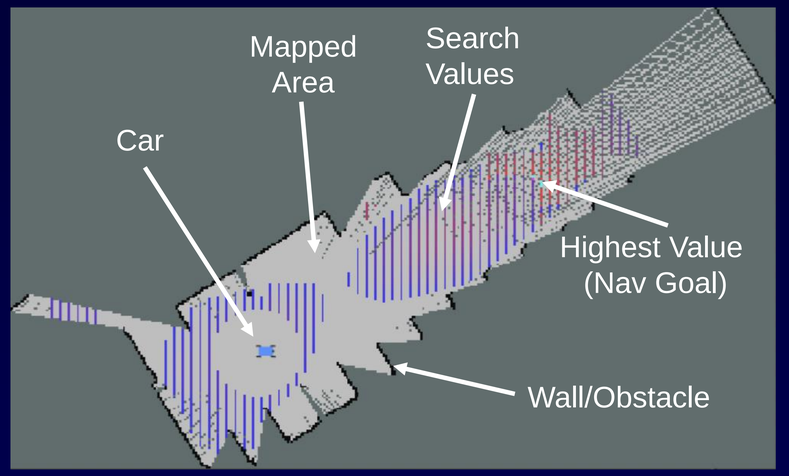
Velma
Finding Today
Creating Tomorrow

Design Overview

Robotic autonomy is the direction of the future. Our Velma robot can efficiently search an unknown environment and successfully find a target object, in our case an orange bucket. With a Raspberry Pi as the computing unit, and Robot Operating System (ROS) serving as the framework, our software creates a map of the vehicle's surroundings in real-time and avoids obstacles by leveraging simultaneous localization and mapping (SLAM) software combined with LiDAR data. Additionally, we fuse LiDAR scans with odometry data from the speed controller for improved localization. Using the generated map, an occupancy grid is populated with values based on multiple variables such as ease of accessibility, obstacles detected, potential targets detected, and more. The vehicle optimizes path trajectories based on these variables, and continuously updates the route until the target is detected using a Pixy2 color recognition camera. With this project, we enhance the utility of autonomous vehicles for search and identification.

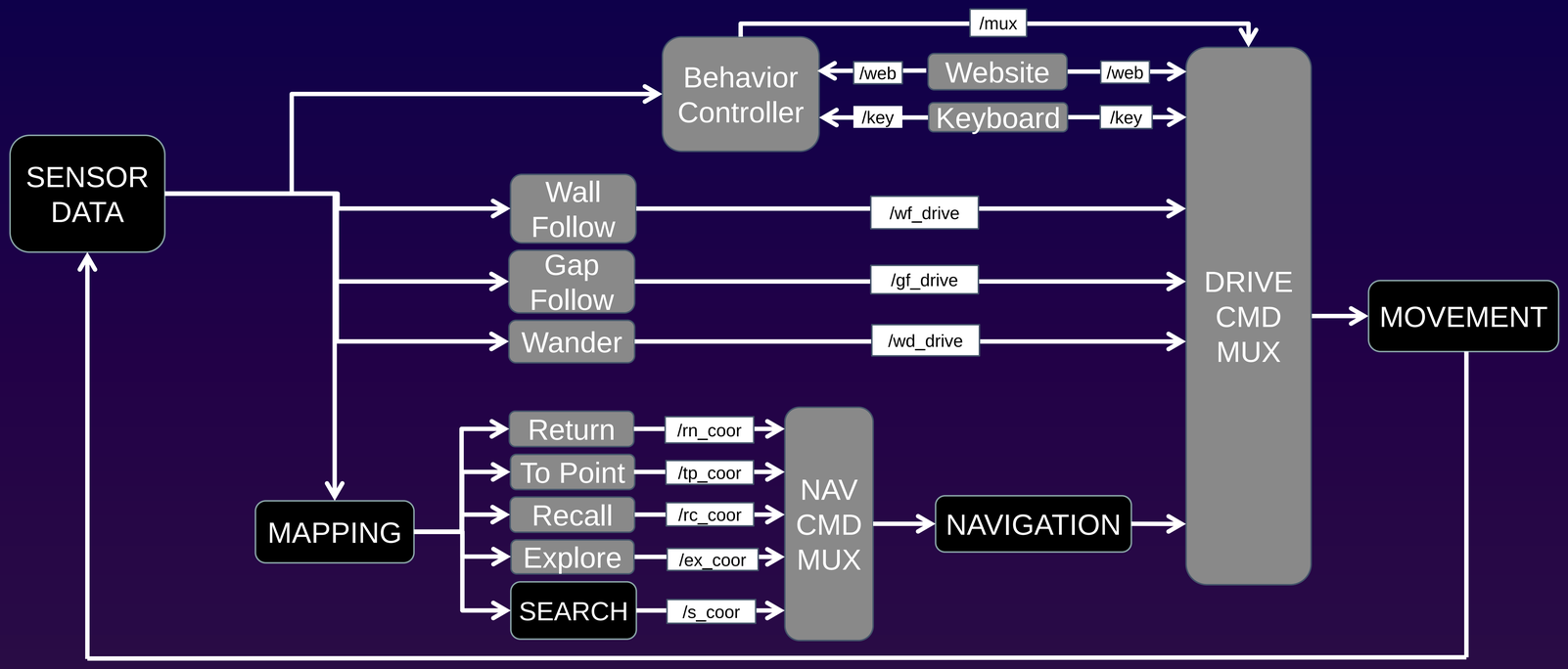


Searching Algorithm

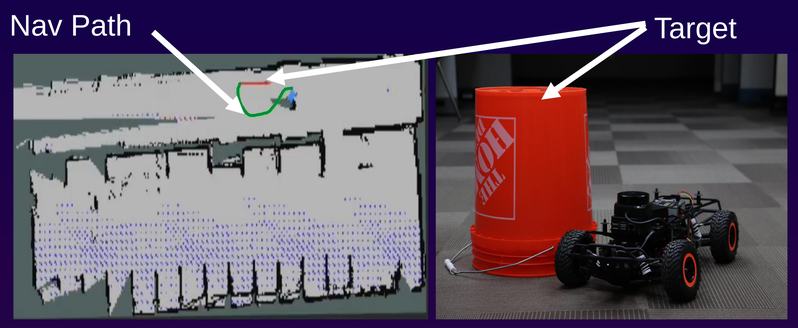


The Searching Algorithm uses the SLAM map and assigns values to points based on aspects such as unsearched areas, obstacle locations, ease of travel, unmapped areas, and time since a point was last seen. These values are shown as the colored stripes with red being a higher value. Velma then constantly navigates to the high value points until the target bucket is found and reached by the vehicle.

ROS System Block Diagram



Results



Velma was able to find the target bucket in multiple configurations of various difficulties in under three minutes. Potential improvements include faster map updates, improved path planning algorithm, and add LEDs for headlights, brake lights, and status indication.

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