Natural Mobility

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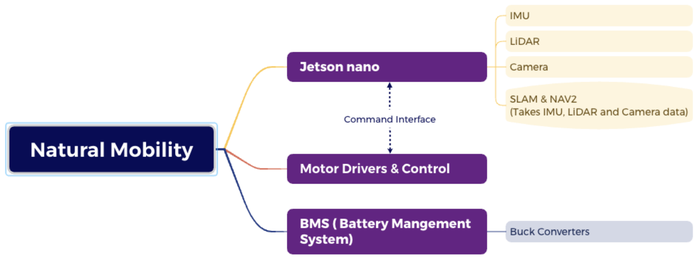
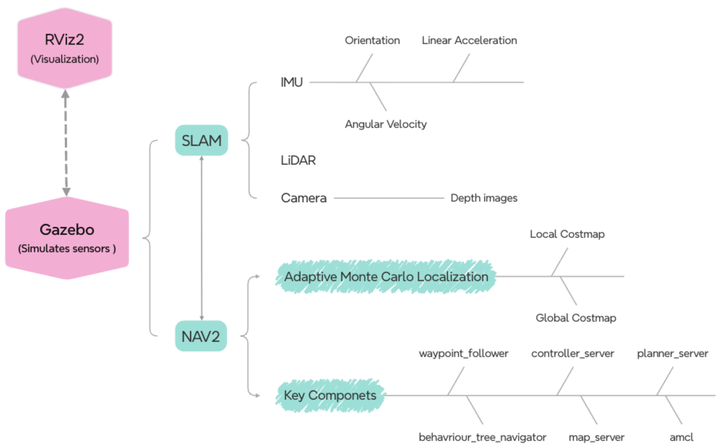
Background & Concept

- The Natural Mobility Robot is a project hosted by the DXARTS department in collaboration with the ECE ARC Lab.
- The final product is an autonomous robot that navigates urban spaces, juxtaposing it with displays of small, carefully designed representations of the Pacific Northwest
- As climate change and industrial development reshape our landscapes, we aim to ask whether a robot can make the natural environment easier to notice and remember.
- A concept design is shown on the right.

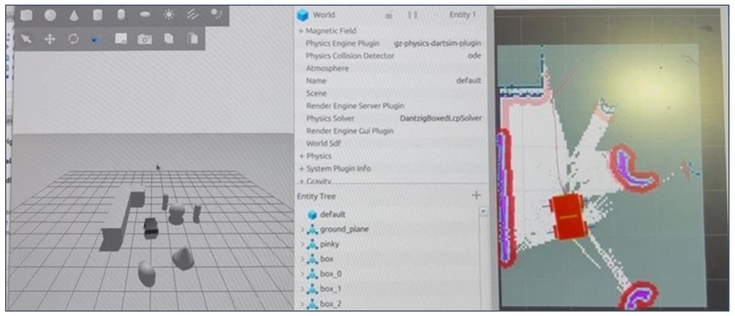
System Architecture





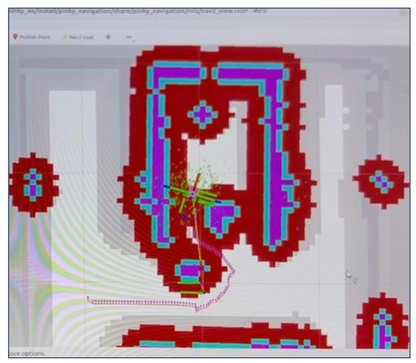
ROS2 Simulation - Gazebo & RViz2

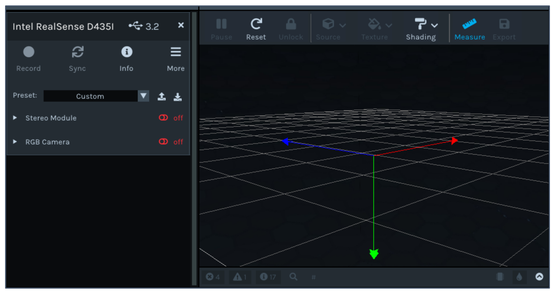
- **Gazebo** is used to create a simulated environment before construction of the physical robot.
- **RViz2** is a visualization tool used to display sensor data, visualize map, and monitor robot's real-time perception in the environment.



Navigation & Perception

- The robot uses several sensors to understand its position and surroundings in real time: Depth camera, LiDAR, Motor encoders, and IMU
- Two main software systems coordinate mapping and navigation:
- **SLAM** (Simultaneous Localization and Mapping): Estimates the robot's position while building a map of the environment.
- **NAV2**: Uses this map to plan safe paths for the robot to follow.
- The interface shows a costmap, which represents how close obstacles are in the robot's internal map. NAV2 continuously uses this costmap to plan and update the robot's path as it moves.





- The robot uses an Intel RealSense D435i as its depth camera
- The camera collects RGB channels along with depth
- We plan to fuse camera+LiDAR data for localization and navigation
- In addition, it will use OpenCV for visual images used for video streaming

Physical Design

- The cart is where the artwork sits, and the bottom base made of aluminum extrusions is used to store most of the electronics
- Two Roboclaw 2-channel brushed DC driver are used to drive motors which move the wheels; this form a skid-steer system
- The solar system on the robot helps offset power consumption and increases total runtime

Future Work & References

- Integrate LiDAR, depth camera, and motor driver control on the NVIDIA Jetson Orin Nano to enable fully autonomous robot navigation.
- Install a streaming camera to upload videos to project website

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[2] PinkWink, "GitHub - PinkWink/pinky_for_edu," GitHub, 2025. Available: https://github.com/PinkWink/pinky_for_edu.

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