Naval Information Warfare Center PACIFIC

2023 Virtual Summer Intern Presentation

Team Camarao

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SEAP

8/04/2023

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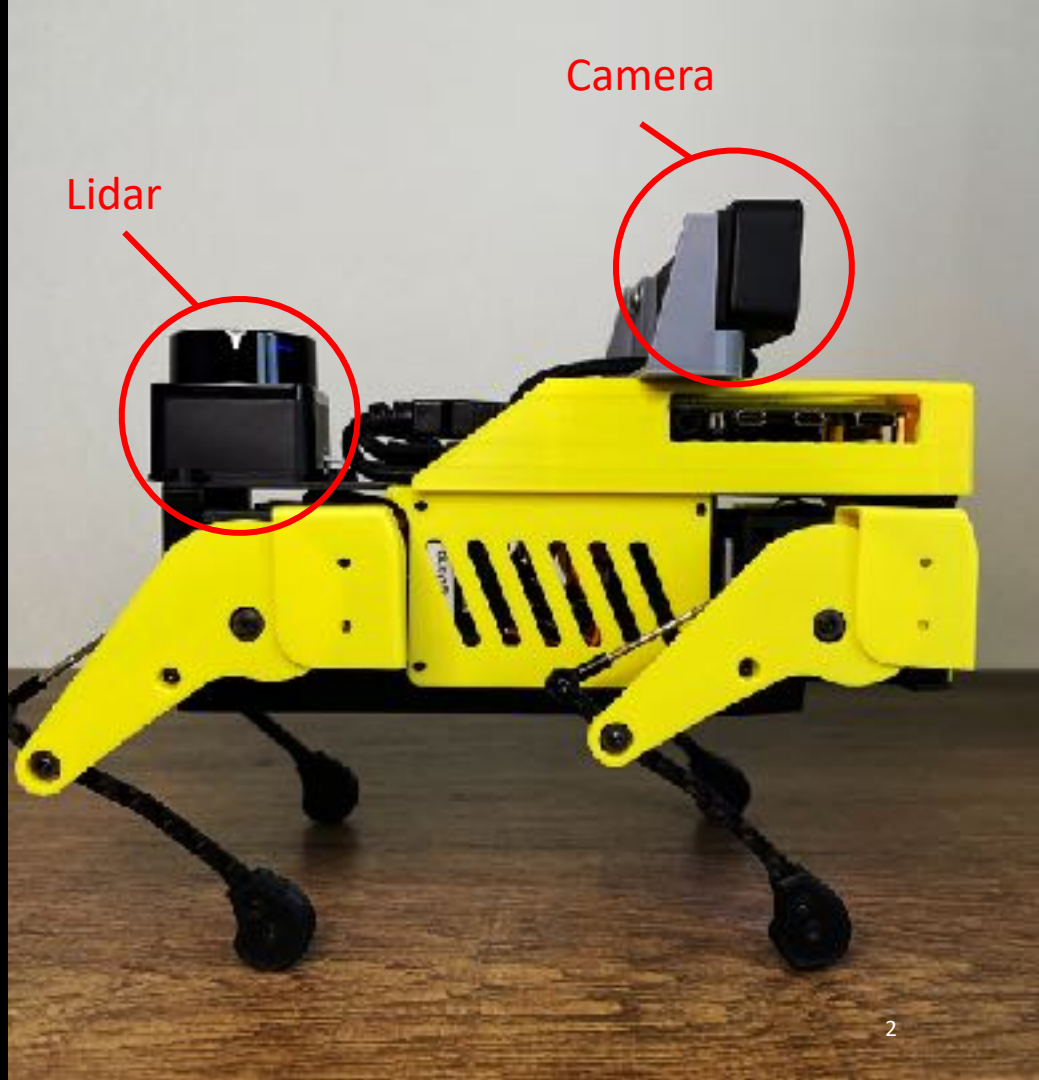
What I Worked On (Old):

Pupper Components

- Walking
  - Simulated in virtual environment
- Computer Vision (camera)
  - Face Detection
  - Object Detection
- 2D Spatial Mapping
  - LIDAR



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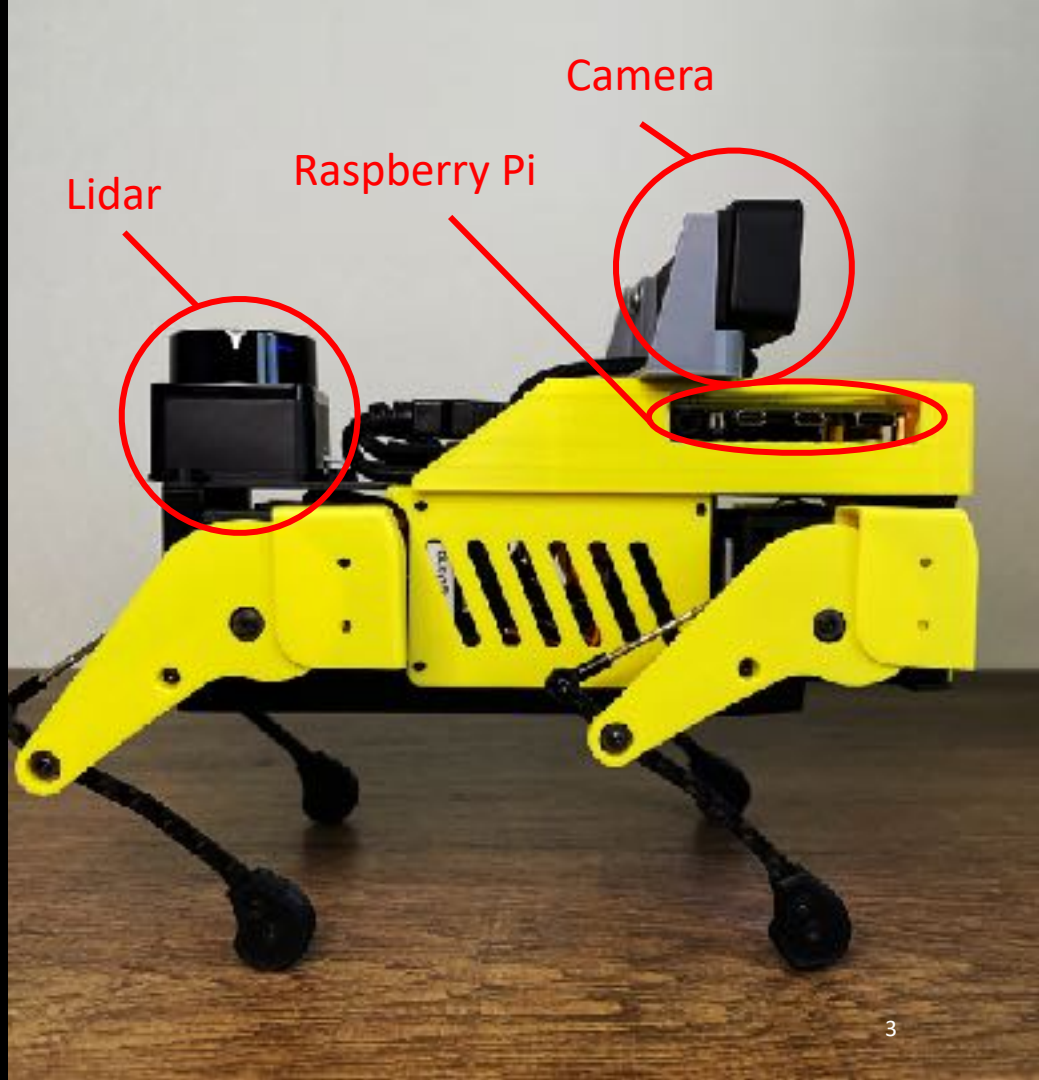
What I Worked On (New):

Pupper Components:

- Computer Vision (camera)
  - Depth Detection
  - Edge Detection
- 2D Navigation
  - Lidar
- 3D Mapping



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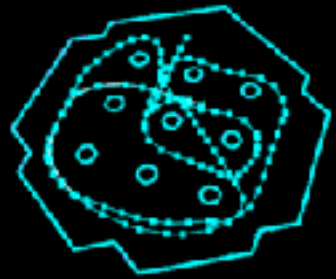
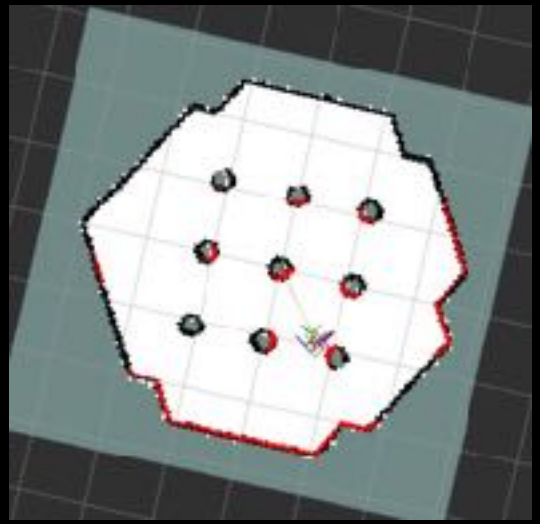
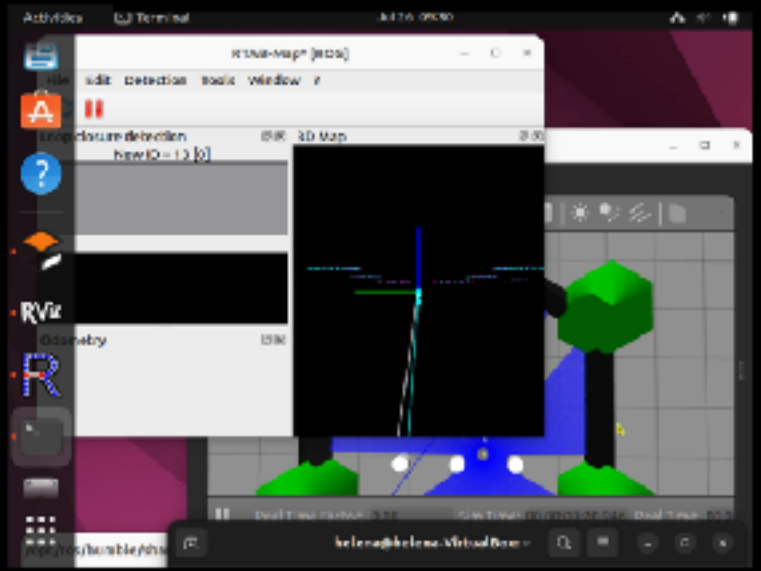
2D Navigation using Virtual LIDAR

- 2D MAP of surrounding environment
- Creates a trace mapping the path taken



- Cartographer
- Turtlebot3 Simulator
- Rviz
- RTab



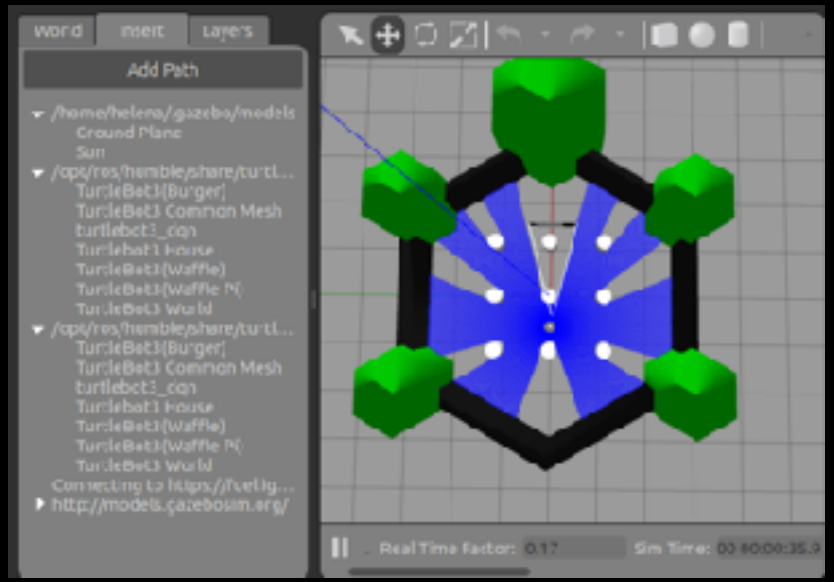


3D Mapping using LIDAR

- 3D MAP of surrounding environment

Set of data points in a 3D coordinate system

- Point Cloud Library
- Turtlebot3 Simulator



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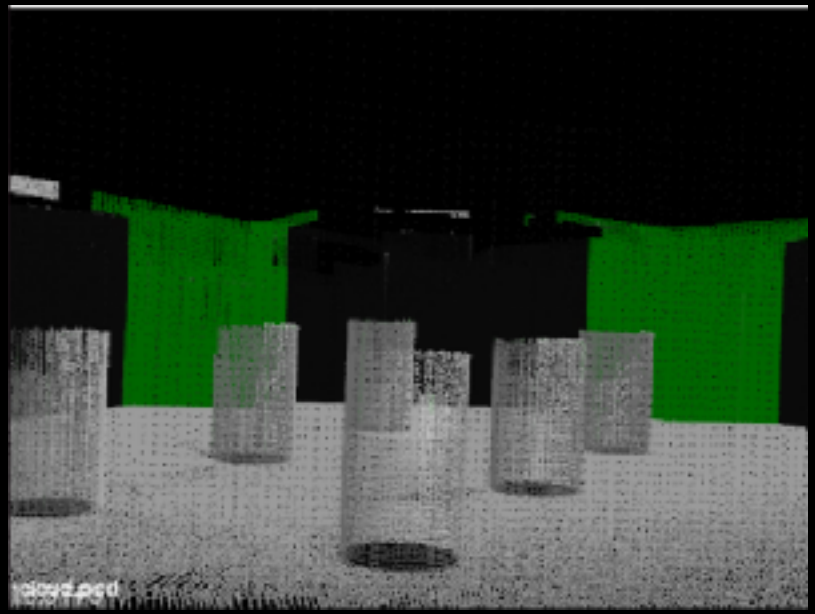
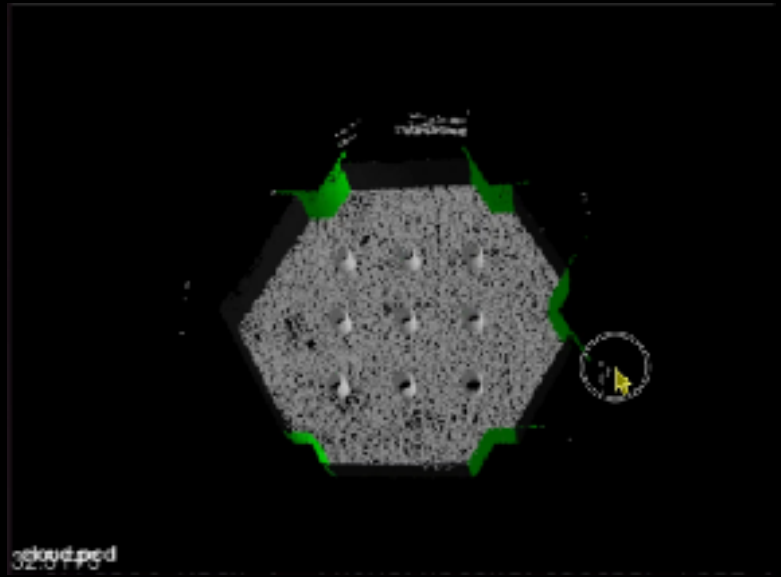
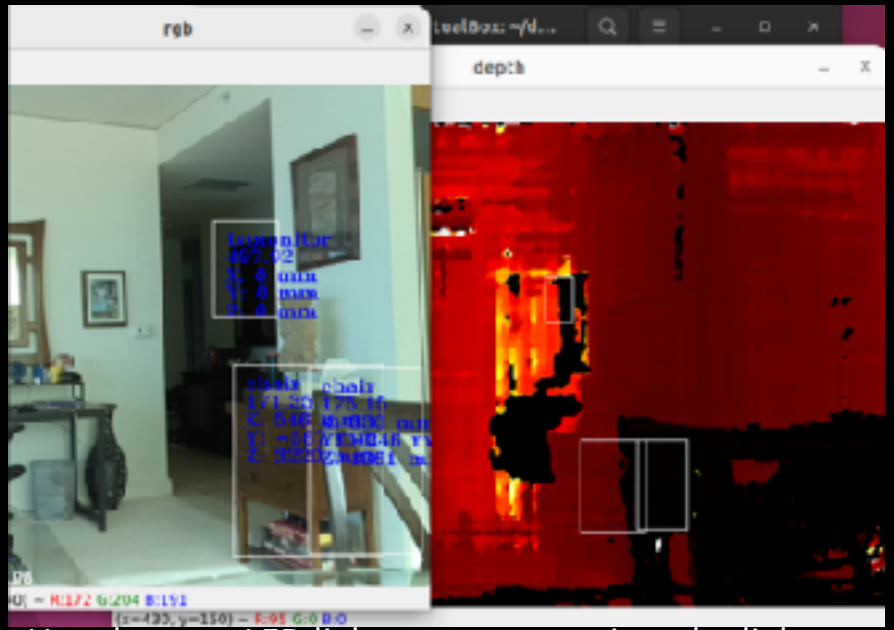
3D Mapping Example

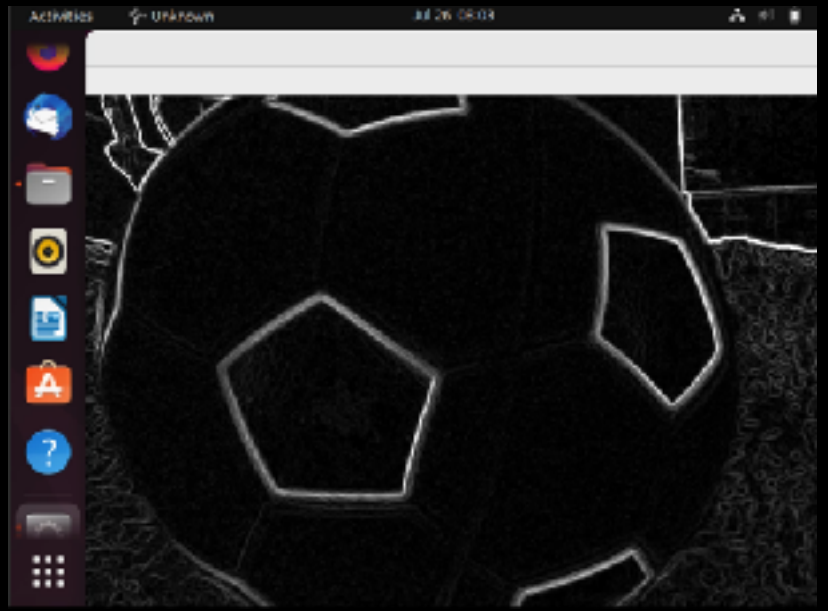




Camera Examples: Depth & Edge Detection



Uses laser or LED light source to project the light to the objects. (like LIDAR)



Detecting discontinuities in brightness

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Raspberry Pi

- Used to integrate the camera and LIDAR together

MangDang Pupper Programming

Student Name/School: Helena Sieh ('Iolani School)
Mentor Name: Jake Camarao
Lab Coordinator/Assignment Name: MangDangPupper Programming

SEAP
SCIENCE AND ENGINEERING APPRENTICE PROGRAM

Project Objective and Intern Contribution:

Our aim was…
- To explore the possibilities for expanding the Pupper motion and navigation capabilities via programming.

The methods we used to accomplish this aim were…
- Read the documentation for the Pupper
- Researched how to use the camera and LIDAR
- Programmed applications

I was tasked with the development and implementation of various devices, such as a camera and LIDAR. These devices were designed to detect faces, objects, and map the surrounding environment. Additionally, I worked on kinematics, specifically focusing on the movement of the Pupper.

My contributions were…
- Programmed advanced, open-sourced robotic dog using Python: OpenCV/AI for object detection, LIDAR and ROS SLAM (Simultaneous Localization and Mapping) for 2D and 3D mapping.

1. What are you most proud of this summer [with respect to your experience/project]?
   - Successfully troubleshooting integration issues
   - Successfully working with cutting-edge technology

2. Why was the internship valuable?
   - A real work experience, working with diverse group
   - Networking and learning about what different people are working on

3. Answer: Advice for future cohorts?
   - Ask questions
   - Provide regular updates
   - Stay on task with project
   - Go beyond project assignments to learn more

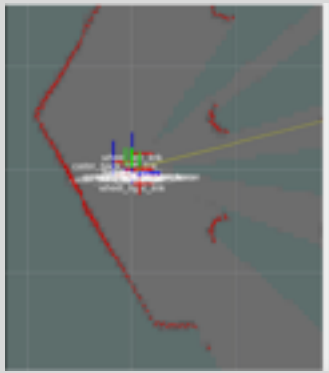
Results / Accomplishments / Next Steps:

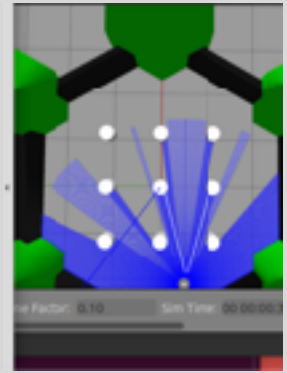
1. Successfully showcased the capability to remain focused on the assigned tasks, while adeptly utilizing the camera for face and object detection, as well as harnessing LIDAR technology to create a detailed 2D map and effectively navigate the surroundings.

2. The impact for the Navy: Demos led to initiation of new ideas for projects at NIWC.

3. What's most important is understanding how to use these advanced technologies and applying them to other projects and working well with your team.

4. In the future this work will be able to provide the NIWC with new ideas for new applications.





Mahalo!

Any Questions?

Thank You:

Mentor: Jake Camarao

Dawei & his team

Tekali Arnold

Henry Au

Appendix

- Documentation: https://docs.google.com/document/d/1wZuyLLjP36ZXgC9e7A8_GUP-4j1NOYRRu_Pi8HuTk6k/edit?usp=sharing

- Time Sheet: https://docs.google.com/spreadsheets/d/1PBz6ZnvXwQPp8UNE60BiMPgWIN2CAJ-cqf9hBhjk81o/edit?usp=sharing