

Corey Knutson

Woodbury, MN

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Education

MS | University of Minnesota - Twin Cities

Master of Science in Computer Science

Minneapolis, MN

Aug. 2021 - Dec.

2023

Research Projects:

1. Autonomous Underwater Vehicle (AUV) surface docking station
 - Created the ROS-based software stack, power systems, and controllers for an AUV docking station. Formulated and validated vision-based AUV docking station detection method and PID control in simulation, pool, wave flume, and a lake.
2. MeCO: the Medium-Cost Open AUV
 - Co-led a team of 10 students to design and build a new AUV robotic platform
 - Designed and created the compute architecture (hard and soft real-time constraints), networking, ROS 2 and microROS based software stack, Dockerized system modules, PID attitude controller, and power systems.
 - Researched stereo camera configuration, tactical grade IMU, and HRI devices.

Participated in and led over 50 field experiments in pools, lakes, rivers, and oceans.

Honors: Gauge Fellowship

BS | University of Minnesota - Duluth

Bachelor of Science in Computer Science

Duluth, MN

Aug. 2017 - May

2021

Minor: Electrical Engineering | **GPA:** 3.89/4.0

Senior design project: AFRL wall-climbing sensor deployment rover

- Researched and designed the Ardupilot-based flight software stack for rover control during wall ascent. Added thrust-vectoring closed loop control and streamed rover telemetry data to the US military's ATAK situational awareness app.

Honors: Cum Laude, Dean's List [7/8 Semesters], UMD Academic Scholarship, CS Department Scholarship, CS Department Outstanding Senior Award

Professional Experience

Perception Engineer Intern, Astrobotic Technologies

Pittsburgh, PA

Supported LiDAR hazard detection C++ flight code development for the Griffin

May - Aug 2024

Mission 1 lunar lander. At the end of the 12 week internship, deliverables included:

- Enhanced robustness of LiDAR data processing C++ flight code through test-driven development practices. 3 existing bugs discovered and resolved. Increased code test coverage of various LiDAR flight software components by 75%.
- Improved frame transformation and spatial outlier rejection methods of the LiDAR data processing module. 10 pull requests merged in 12 weeks.
- Decoupled algorithmic components from data streaming logic using standard design patterns. Added support for temporally varying data packets, standardized exceptions and guarantees for functions manipulating the scan data, and improved time and space complexities of existing data operations.
- A new high fidelity physics-based LiDAR scan simulator written in Python. Functionality based on vendor ICD and in-house testing of the LiDAR. This tool is now used for Monte Carlo simulations for 3 projects within the company.

Teaching Assistant, University of Minnesota - Twin Cities

Minneapolis, MN

Developed and taught lessons for CS undergraduate capstone class Software Design and Development. Specific duties included

Aug. 2021 - Dec

2023

- Ran technical lab sessions, taught students about Git/GitHub, Docker, Agile/Scrum,

design patterns, and added functionality to a simulation written in C++.

- Created and graded assignments covering software design specifications, polymorphism, path planning, UML class diagrams, code quality, and design patterns.

Software Research Intern, Smart Information Flow Technologies (SIFT) Minneapolis, MN

- Implemented object recognition and control for a robotic platform in first 2 weeks May 2020 - Aug. 2021
- Integrated an AI agent into domain novelty simulations ScienceBirds and DoomViz for testing and validation. Utilized rabbitmq and Docker compose to orchestrate simulation episodes and inter-agent communication.
- Identified and patched a non-deterministic bug in the open source fuzzing tool afl.
- Hard Worker award recipient

Undergraduate Research Assistant, University of Minnesota - Twin Cities Minneapolis, MN
Interactive Robotics and Vision Lab June - Aug. 2019

- Designed and fabricated underwater robot power and communication harnesses
- Created robot control software stack on a Jetson TX2 using ROS and ArduPilot

Technical Skills

C/C++ | Eigen, OpenCV, happily, GTest, ROS1/2
Python | numpy, scipy, OpenCV, ROS1/2
Embedded | NVIDIA Jetson, Raspberry Pi, Arduino, I2C, CAN/CAN-FD, microROS
Virtualization | Docker, Docker Compose, qemu, VMware

Publications

1. C. Ohnsted, **C. Knutson** et al., "Design and Development of MeCO: the Medium Cost Open-Source Autonomous Underwater Vehicle." Accepted for publication at the 2024 IEEE OES AUV Symposium.
2. **Corey Knutson**, Zhipeng Cao, and Junaed Sattar, "Adaptive Landmark Color for AUV Docking in Visually Dynamic Environments." Accepted for publication at the 2024 International Conference on Robotics and Automation (ICRA 2024).
3. D. J. Musliner, M. J. S. Pelican, M. McLure, S. Johnston, R. G. Freedman, and **C. Knutson**, "OpenMIND: Planning and Adapting in Domains with Novelty." Proceedings of the Ninth Annual Conference on Advances in Cognitive Systems, November 2021.
4. P. Goldman, **C. R. Knutson**, R. Mahtab, J. Maloney, J. B. Mueller, and R. G. Freedman, "Evaluating Gin Rummy Hands Using Opponent Modeling and Myopic Meld Distance," Proceedings of the AAAI Conference on Artificial Intelligence, vol. 35, no. 17, pp. 15510–15517, May 2021.
5. C. Edge et al., "Design and Experiments with LoCO AUV: A Low Cost Open-Source Autonomous Underwater Vehicle," in 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Oct. 2020, pp. 1761–1768. doi: 10.1109/IROS45743.2020.9341007.

Volunteering

Assistant Coach, Farmington High School FIRST Robotics Team Sept. 2020 - Current

Main responsibilities as the assistant coach include teaching students to:

- Understand C++ programming, software design patterns, Agile/Scrum, and more.
- Design and implement cascading PID control loops and trapezoidal motion profiling for trajectory following and other high level autonomous robot behaviors.
- Fuse inertial and encoder sensors for high performance state estimation.
- Communicate with dozens of sensors through CAN/CAN-FD, Serial, and I2C.

STEM Camp Instructor, University of Minnesota - Twin Cities July 2018 - Current

STEM Camp Founder, Instructor, Farmington High School July 2022 - Current