Joshua Cox

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Education

University of Illinois Urbana-Champaign

Master of Science, Mechanical Engineering — *GPA: 3.83 / 4.00* — *Expected: December 2025*

Bachelor of Science, Mechanical Engineering | Minor, Computer Science — *GPA: 3.61 / 4.00* — *December 2022*

Skills

Programming Languages: Python, C/C++, MATLAB, Java, C#, Microsoft VBA, Bash Scripting
Software & Tools: Simulink, PyTorch, Docker, Git, ROS, Godot, PyGame, Unity, CARLA Simulation, LaTeX, OpenCV
Hardware & Microcontrollers: STM32 (Nucleo), TI C2000, Stretch3, UR3, Raspberry Pi, ESP32, IMUs, Stereo Cameras
CAD Software: Solidworks, Creo Parametric, Fusion
Other: 3D Printing, CAD, Design, Rapid Prototyping, Oscilloscope Use, Technical Writing, Signal Filtering

Research Experience

Lunar Autonomy Challenge | Human-Centered Autonomy Lab *November 2024 - Present*

- Founded and led a student robotics team to compete in NASA simulation challenge, managing a full autonomy stack for virtual lunar navigation and mapping with a digital twin of the IPEx rover
- Engineered the perception to mapping pipeline through utilizing ROS, visual inertial odometry solutions, and a custom computer vision algorithm to convert stereo pairs to accurate point clouds
- Implemented navigation strategy employing both a high and low-level planner, creating local object avoidance methods, querying rover's battery usage, and determining heuristics on when to recalculate path
- Developed 2D exploration simulation from scratch with Python and PyGame in order to test team's navigation algorithm

Wayfinding with Handle Haptics | Human-Centered Autonomy Lab *February 2024 - Present*

- Designed, created CAD for, and 3D-printed parts for a novel haptic handle that is attached onto a wayfinding robot in order to communicate signals and provide feedback to guided users
- Rapidly prototyped designs in order to test mounting strategies, vibration magnitude, and user comfort

Reinforcement Learning for Autonomous Agent in CARLA | Human-Centered Autonomy Lab *August 2023 - Present*

- Utilized CARLA simulator for testing autonomous control and gathering data on a mobile robot (self-driving car)
- Implemented reinforcement learning-based controller for an autonomous agent to successfully navigate a circular track
- Programmed a modular codebase to enable future deployment of an anomaly detection module for failure prediction
- Collaborated with lab members to build upon prior work in robot failure detection using machine learning

Work Experience

Control Systems Teaching Assistant | University of Illinois Urbana-Champaign | Urbana, IL *January 2023 – Present*

- Directly TA'd the lab section of numerous engineering classes related to controls, signals, and embedded systems
- Took on a managerial role at times to teach other TAs material and their responsibilities, develop course work, redesign documentation, prepare class resources, and fix equipment as needed

Embedded Systems Engineer Intern | Engineering System Design Lab | Urbana, IL *May 2024 – August 2024*

- Completed hardware and software tasks to develop a new testing setup for a hinge-integrated multifunctional structures for attitude control (MSAC) scheme for satellites utilizing piezoelectric strain actuators
- Programmed software in C++ for STM32 microcontroller Nucleo-H755ZI-Q for the purpose of enabling advanced PWM signals, logging SD card data, and communicating with multiple accelerometers
- Tested types of signal filters to produce sin signals from period-changing PWM signals as inputs for the actuators
- Created various MATLAB scripts that analyzed signal frequency response and ensured proper signal generation

Systems Engineer Intern | Quartus Engineering | San Diego, CA *January 2022 – May 2022*

- Tested flamethrower robot to find its most efficient parameters by discussing an in-house experimental setup with customer to ensure monetary, timeline, and tangible goals were met
- Built and calibrated camera assemblies in a cleanroom by preparing future materials, adhering to a strict construction schedule, troubleshooting software issues as needed, and observing customer requests
- Costed and designed a customer's heavy lifter assembly and corresponding lift test tooling. Documented, assembled, organized, and cleanroom-tested the physical end product using an overhead crane

Project Experience

Robotic Arm Obstacle Course *January 2023 – May 2023*

- Programmed a robot arm to complete a variety of tasks for the final project of a robot dynamics and controls class, including pushing on an egg with specified force, following a maze, and avoiding obstacles