Sean O'Connor

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Research Interests

I'm passionate about human-robot interaction and developing technologies that make robots better collaborators with humans. My work focuses on creating reproducible research methodologies, particularly through Wizard-of-Oz experiments, and building platforms that lower barriers for HRI researchers. I'm especially interested in how we can make robot behaviors more trustworthy and explainable, and how to design effective frameworks for studying human-robot collaboration across different contexts and applications.

Education

Bucknell University **Lewisburg, PA**
Bachelor of Science in Computer Science and Engineering **Expected May 2026**
Engineering GPA: 3.86/4.0 • Dean's List: Fall 2022, Fall 2023, Spring 2024, Fall 2024, Spring 2025

Publications

[1] Sean O'Connor and L. Felipe Perrone. HRIStudio: A Framework for Wizard-of-Oz Experiments in Human-Robot Interaction Studies (Late Breaking Report). In *2024 33rd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2024.

[2] Sean O'Connor and L. Felipe Perrone. A Web-Based Wizard-of-Oz Platform for Collaborative and Reproducible Human-Robot Interaction Research. In *2025 34th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, Eindhoven, The Netherlands, 2025.

Research Experience

Human-Robot Interaction Research **Bucknell University**
Lead Researcher - HRIStudio Platform Development **Jan 2023 – Present**
Advisor: Dr. L. Felipe Perrone, Computer Science Department

- Developing HRIStudio, a novel web-based platform addressing reproducibility challenges in Wizard-of-Oz HRI studies, with two first-author publications at IEEE RO-MAN 2024 and 2025
- Designed modular architecture enabling cross-platform robot control without specialized programming knowledge, lowering technical barriers for HRI researchers across disciplines
- Implemented comprehensive data logging and playback capabilities for experimental analysis, supporting rigorous scientific methodology in human-robot interaction studies
- Currently developing honors thesis evaluating platform effectiveness and impact on interdisciplinary HRI research accessibility
- Conducted literature review identifying key challenges in WoZ methodology reproducibility, informing platform design decisions and feature prioritization

Interdisciplinary Research Collaboration **Bucknell University**
Computer Science Research Assistant - Chemical Engineering Department **Aug 2023 – May 2025**
Collaborating with Chemical Engineering Department on Environmental Monitoring

- Developed automated data collection and analysis tools for environmental research, processing real-time sensor data streams for atmospheric and water quality monitoring
- Built custom Python pipelines integrating multiple data sources, enabling researchers to identify patterns in environmental data that informed conference presentations
- Bridged computer science expertise with domain-specific research needs, demonstrating ability to collaborate across disciplines

RoboLab@Bucknell **Bucknell University**
Founding Member and Research Participant **Sep 2023 - Present**
Interdisciplinary lab bridging Computer Science and Psychology perspectives on HRI

- Participate in weekly research seminars exploring human-robot trust, automation bias, and ethical implications of autonomous systems
- Contribute to discussions on experimental design for HRI studies, bringing technical perspective to psychological research questions

Teaching Experience

Computer Science Department — **Bucknell University**

Teaching Assistant - Software Engineering & Design — **Jan 2024 - Present**

- Mentor 150+ students in software engineering principles, design patterns, and collaborative development practices
- Developed automated testing frameworks with personalized feedback, improving learning outcomes while streamlining assessment processes
- Created supplementary materials connecting theoretical concepts to real-world applications, drawing from industry experience
- Hold regular office hours and code review sessions, fostering deep understanding of software architecture principles

Computer Science Tutor - Engineering Study Spot — **Aug 2024 - Dec 2024**

- Provided one-on-one tutoring across the entire computer science curriculum, from introductory programming to advanced algorithms
- Developed personalized learning strategies for students with diverse backgrounds and learning styles

Engineering Department — **Bucknell University**

Teaching Assistant - Engineering Design Experience — **Aug 2023 - Dec 2023**

- Guided 40+ engineering students through Arduino programming and breadboard circuit design
- Supervised hands-on laboratory sessions involving microcontroller programming and sensor integration
- Facilitated discussions on engineering ethics and the societal implications of embedded system design

Physics Department — **Bucknell University**

Teaching Assistant - Experimental Physics Laboratory — **Aug 2023 - May 2024**

- Instructed 100+ students in experimental design, data analysis, and scientific writing
- Emphasized connection between theoretical physics principles and experimental validation
- Guided students through error analysis and uncertainty quantification in experimental measurements

Selected Projects

HRIStudio - Web-Based Wizard-of-Oz Platform — **TypeScript/React/WebRTC**

- Architected full-stack web application for managing HRI experiments with real-time robot control interfaces
- Implemented WebSocket-based bidirectional communication protocols for low-latency robot teleoperation
- Designed RESTful API leveraging Robot Operating System with JSON-defined plugins for extensibility across multiple robot platforms
- Created comprehensive logging system capturing interaction data, timestamps, and experimental conditions for reproducibility
- Technologies: Next.js, React, TypeScript, Node.js, WebSockets, PostgreSQL, Docker

Autonomous Vehicle Control System - Chem-E-Car Competition — **C++/Arduino**

- Designed embedded control system for autonomous hydrogen fuel cell-powered vehicle using finite state machine architecture
- Implemented real-time sensor fusion combining spectrometer readings and power monitoring with calculated stopping algorithms
- Developed PlatformIO-based build system with hardware abstraction layer for testing and simulation
- Achieved precise distance control (±10cm) through chemical reaction timing at AIChE National Competition
- Technologies: C++, Arduino, PlatformIO, I2C/SPI protocols, finite state machines

Formula One Performance Prediction Using Machine Learning — **Python/ML**

- Developed ensemble machine learning models (LightGBM, XGBoost, Random Forest) to predict F1 lap times with high accuracy
- Engineered features from weather data, track characteristics, and historical performance using domain knowledge
- Implemented cross-validation and hyperparameter optimization for model evaluation across multiple racing circuits
- Analyzed feature importance to understand factors influencing racing performance
- Technologies: Python, LightGBM, XGBoost, Random Forest, pandas, scikit-learn, FastF1 API

Real-time Racing Statistics Platform — **TypeScript/Next.js**

- Built production system serving 1500+ concurrent users and 250k+ monthly visitors
- Implemented WebSocket-based real-time data streaming with automatic reconnection and state synchronization
- Designed responsive UI with accessibility features meeting WCAG 2.1 AA standards
- Optimized database queries reducing page load times by 60% through intelligent caching and indexing
- Technologies: Next.js, TypeScript, PostgreSQL, Docker, DigitalOcean

Professional Experience

Riverhead Raceway — **Riverhead, NY**

Software Developer — **Oct 2020 – Present**

- Architected and deployed production systems handling 250k+ monthly users and $100,000+ in payment processing
- Led digital transformation initiative, replacing legacy paper-based systems with modern web applications
- Implemented CI/CD pipelines, containerization, and infrastructure as code using Docker and GitHub Actions
- Developed RESTful APIs and microservices architecture for scalable, maintainable systems

IT Administrator **Oct 2020 - Apr 2024**

- Modernized IT infrastructure from consumer to enterprise-grade systems, improving uptime to 99.9%
- Implemented comprehensive backup and disaster recovery protocols protecting critical business data
- Automated system administration tasks using PowerShell and Bash scripting

Miller Place School District **Miller Place, NY**
Information Technology Intern **Sep 2020 - May 2022**

- Supported 1000+ students and faculty during COVID-19 transition to remote learning
- Deployed and maintained educational technology platforms and troubleshooted hardware/software issues

Leadership & Activities

AIChE Chem-E-Car Competition Team **Bucknell University**
Former President, Current Electrical/Mechanical Team Lead **Jan 2023 – Present**

- Led 15-member interdisciplinary team in designing autonomous chemical-powered vehicles for national competition
- Introduced agile development methodologies and version control practices to hardware development process
- Mentored junior members in embedded systems programming and control theory

Bucknell Coffee Society **Bucknell University**
Co-Founder and Treasurer **Oct 2023 – Present**

- Co-established campus organization promoting coffee education and community building
- Manage $5,000+ annual budget, coordinate events, and maintain vendor relationships
- Organized educational workshops on coffee science, brewing techniques, and sustainability

Conferences & Presentations

IEEE RO-MAN 2025 **Eindhoven, The Netherlands**
34th International Conference on Robot and Human Interactive Communication **Aug 2025**

- Presented: "A Web-Based Wizard-of-Oz Platform for Collaborative and Reproducible Human-Robot Interaction Research"

IEEE RO-MAN 2024 **Pasadena, CA**
33rd International Conference on Robot and Human Interactive Communication **Aug 2024**

- Presented: "HRIStudio: A Framework for Wizard-of-Oz Experiments in HRI Studies" (Late Breaking Report)

AIChE Annual Student Conference **San Diego, CA**
Chem-E-Car Performance Competition **Oct 2024**

- Competed in National Chem-E-Car Performance Competition with autonomous hydrogen fuel cell vehicle
- Presented poster on safety-critical embedded systems design

AIChE Mid-Atlantic Regional Conference **UMBC, Baltimore, MD**
Chem-E-Car Performance Competition **Apr 2024**

- Placed 2nd overall in regional Chem-E-Car Competition

Relevant Coursework

Artificial Intelligence & Data Science: Data Mining, Algorithm Design & Analysis
Systems & Software Engineering: Software Engineering & Design, Computer Systems, Operating Systems Design, Programming Language Design
Research & Analysis: Research Methods in Computer Science, Probability & Statistics, Experimental Design
Mathematics & Theory: Linear Algebra, Discrete Mathematics
Networks & Security: Computer Networks & Security

Technical Skills

Programming Languages: Python, C/C++, JavaScript/TypeScript, Java, MATLAB, SQL, Bash, LaTeX
Robotics & HRI: ROS/ROS2, Gazebo, NAO/Pepper SDK, WebSockets, Robot Operating System (ROS)
Machine Learning & AI: PyTorch, TensorFlow, scikit-learn, LightGBM, XGBoost, OpenCV, pandas, numpy, Jupyter
Research Tools: Git/GitHub, Docker, Statistical Analysis (R), Experimental Design, Data Visualization
Web & Systems: React, Node.js, Next.js, REST APIs, PostgreSQL, Linux, Cloud Computing, Distributed Systems
Hardware/Embedded: Arduino, Raspberry Pi, I2C/SPI, Sensor Integration, Real-time Systems

Honors & Awards

- Dean's List (5 semesters): Fall 2022, Fall 2023, Spring 2024, Fall 2024, Spring 2025
- Engineering GPA: 3.86/4.0
- AIChE Mid-Atlantic Chem-E-Car Competition - 2nd Place (2024)