Stephen Ferro

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EDUCATION

Northwestern University, Evanston, IL   Expected Graduation: December 2024
Master of Science in Robotics   GPA: 3.6/4.0
Purdue University, West Lafayette, IN   Graduated: May 2018
Bachelor of Science in Mechanical Engineering; Minor in Economics, Certificate in Entrepreneurship and Innovation

WORK EXPERIENCE

SmoothAg
Lead Robotics Software Engineer   **September 2024 – Present; Chicago, IL**
- Engineered algorithms to merge point cloud and odometry from four Zed cameras for use in navigation and obstacle avoidance
- Led development of firmware for robot power distribution module using C++ to control feeder, lights, and more over CAN bus
- Developed Mask R-CNN training pipeline for precise bunk feeding and cattle counting through computer vision

Robotics Software Engineering Intern   **June 2024 – August 2024; Chicago, IL**
- Architected navigation stack for the RanchRover using ROS 2 Navigation 2, incorporating custom path planning and behavior trees
- Created solution for fusing local odometry data from Zed camera with GNSS RTK feedback using an EKF for precise robot navigation
- Developed efficient ROS 2 drivers for communicating between Jetson Orin AGX, engine ECU, and other hardware over CAN bus

SKF USA
Product Design Engineer for Slewing Rings   **July 2022 – August 2023; Chicago, IL**
- Designed custom slewing bearings with PTC Creo for demanding applications in the wind energy and rail industries
- Served as subject matter expert for design and application of wind turbine pitch and yaw bearings
- Conducted thorough raceway and bolting analyses to optimize bearing designs, ensuring compliance with customer specifications

Application Engineer for Industrial Market   **June 2018 – July 2022; Elgin, IL and Lansdale, PA**
- Provided comprehensive support to agriculture, robotics, and other industrial customers in all aspects of bearing system design
- Selected optimal thin section bearings for high-precision robotics applications, focusing on size, type, and preload considerations

PROJECT WORK

Human-Robot Interaction with ECG Sensors and Vision Language Model (C++, ROS 2, Python)   **Sept 2024 – Present**
- Developed system for teaching a Franka Panda to execute unseen multistep manipulation tasks using the Octo vision-language-action model, guided by demonstration images and language prompts
- Integrated live data from ECG sensor, allowing the robot to take over completing a task when it detects the user getting fatigued

Real-Time Stereo Visual Odometry from Scratch (Python)   **April 2024 – June 2024**
- Engineered a sophisticated real-time visual odometry algorithm for accurate 3D stereo camera position tracking
- Performed in-depth comparison of different feature detection methods including SIFT, ORB, and SuperPoint
- Conducted rigorous performance evaluation using the KITTI dataset and in real-time using a RealSense stereo camera

Robot Arm Block Sorting with Active Human Feedback (C++, ROS 2, Python, PyTorch)   **March 2024 – June 2024**
- Created ROS 2 packages to control a Franka Emika robot arm for adaptive block sorting using any sorting method (color, shape, etc.)
- Created and implemented a dynamic PyTorch neural network capable of real-time learning from user feedback
- Utilized MoveIt for advanced robot control, incorporating a depth camera near the gripper for accurate block manipulation

Autonomous Race Car Robot Build (C++, ROS 2)   **January 2024 – March 2024**
- Built an autonomous race car robot from scratch capable of drag racing and executing point-to-point navigation
- Created ROS 2 packages using C++ to map and plan racetracks through hallways using SLAM Toolbox with 2D lidar technology
- Developed a high-fidelity robot simulation in Isaac Sim to facilitate rapid testing and iteration of new functionalities

Simultaneous Localization and Mapping Algorithm (SLAM) from Scratch (C++, ROS 2)   **January 2024 – March 2024**
- Engineered an EKF SLAM algorithm from the ground up using C++ and ROS 2 for both a real and simulated Turtlebot3 robot
- Implemented a landmark detection algorithm using supervised learning and data association

Purdue FSAE Electric – Member and 2018 Vehicle Dynamics Team Lead   **January 2016 - June 2018**
- Directed a team of 8 students to design, manufacture, test, and tune the suspension system for an electric racecar
- Achieved team's best-ever performance: 1st in Skidpad and 2nd in AutoX at Formula North and FSAE Lincoln 2018

RELEVANT SKILLS

Programming/Software: Python, C++, C, Git, Linux, Unit Testing, PyTorch, TensorFlow, Docker, CMake, OpenCV
Robotics: Robot Operating System (ROS/ROS 2), Kalman Filter, Particle Filter, RRT, A-Star, Reinforcement Learning, SLAM, SLAM Toolbox, Navigation 2, Isaac ROS, Nvidia Jetson, MoveIt, Visual Odometry, Isaac Sim, Vision-Language Action Models
Design: CAD (SolidWorks/Creo/ProE/Fusion360/Inventor), CAM (Fusion360), FEA (SolidWorks, Creo), PCB Design (KiCAD)
Manufacturing: Manual and CNC Machining, Injection Molding, Waterjet, Laser Cutting, 3D Printing (FDM, SLA), Soldering