

Hang Yin

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PROFESSIONAL EXPERIENCE

Robotics and Controls Software Intern - Johnson & Johnson MedTech

Jun. 2023 – Sep. 2023

- Contributed to software development for instruments on a novel robotic surgical system using kinematics and control theory
- Redesigned and implemented the existing Kalman filter torque estimation model, achieving comparable performance while significantly reducing the calibration time required for diverse instruments
- Optimized configuration and URDF file formats, reducing memory requirements to roughly 20% of the original size, to enable efficient storage on embedded devices with memory limitations
- Undertook the refactoring of C++ controls and kinematics libraries, increasing code efficiency, readability, and maintainability
- Tested control algorithms, collected data during testing, and conducted offline analysis to compare multiple approaches

EDUCATION

Northwestern University

Evanston, IL

M.S. in Robotics

Sep. 2022 - Dec. 2023

B.S. with honors in Computer Science, *summa cum laude*

Sep. 2019 - Jun. 2022

PROJECTS

Robot Jenga Assistant

ME 495 Embedded Systems in Robotics

- Programmed a 7 DoF Franka Emika Panda robot arm to interactively play Jenga, leveraging ROS2, MoveIt 2, OpenCV, and Tensorflow, with calibration facilitated through AprilTag alignment
- Constructed a custom MoveIt library to guide the end effector along Cartesian paths via inverse kinematics, calculate feasible joint positions, and simulate an environment for collision avoidance in RViz
- Augmented gameplay intelligence by applying transfer learning on a MobileNet-based convolutional neural network, trained specifically to discern the presence of hands in the game scene

Mobile Manipulation with KUKA youBot Simulation

ME 449 Robotic Manipulation

- Simulated mecanum-wheeled robot motion with a 5 DoF robot arm to manipulate the position of a block in CoppeliaSim
- Generated end-effector trajectory and implemented feed-forward + PI controller to follow that trajectory

EKF Simultaneous Localization and Mapping from Scratch

ME 495 Sensing, Navigation, and ML for Robotics

- Implemented Extended Kalman Filter SLAM pipeline in ROS2, using C++ for a Turtlebot3 differential drive robot
- Developed a robust cylindrical landmark detection method from LiDAR data, integrating unsupervised point clustering and supervised circular regression methodologies
- Built a comprehensive simulated environment in RViz from scratch and wrote custom C++ libraries for differential drive kinematics, collision detection, 2D transformations, and odometry

Quadrotor Design and Control

ME 410 Mechatronics - Quadrotor-based Project

- Designed and built a WiFi-enabled quadrotor drone with a Raspberry Pico and onboard IMU, incorporating PID closed-loop control, rigorous safety measures, and joystick interfacing for both autonomous and manual flight control
- Integrated Vive Lighthouse with four IR sensors to capture and leverage 3D spatial data, enabling real-time autonomous flight adjustments based on quadrotor positioning

ChatGPT-powered Robot Chef

Independent Project

- Engineered a voice-controlled, robot-assisted cooking system leveraging a custom Alexa skill for intuitive interaction, a Flask app with ChatGPT for context-sensitive recipe generation, and a RealSense camera with CLIP model for robust object detection and spatial awareness in the kitchen environment
- Developed a hand-action recognition module using MediaPipe and an LSTM neural network to facilitate cooperative human-robot tasks, with feedback mechanisms enabling dynamic task progression based on user actions

ROI-bounded Visual Odometry

MSAI 495 Computer Vision

- Developed an efficient monocular visual odometry algorithm that balances accuracy and run-time by extracting high-quality features from key image regions, minimizing the computational overhead associated with whole image processing
- Implemented and tested the algorithm in real-world scenarios via a custom ROS2 package, integrating with RealSense D435i for image sourcing and enabling path visualization in RViz

Line-following Mario Kart Motorcycle

ME 433 Advanced Mechatronics

- Designed and built a line-following motorcycle utilizing Raspberry Pi Pico W for image processing, a servo for steering control managed by a PIC microcontroller, additional drive motors for propulsion, and 3 custom PCBs

IMU & EMG Controlled Robot Arm

CE 346 Microprocessor System Design

- Designed and built a 2-jointed robotic arm with a mechanical gripper as the end-effector and a Microbit v2 microprocessor
- Controlled the servos on the arm and the gripper with pitch and roll from an IMU and signal from an EMG muscle sensor respectively

Path-planning Algorithm Implementation

Independent Project

- Implemented path-planning algorithms including Rapidly-Exploring Random Tree (RRT) and A* Search
- Tested RRT algorithm with randomly generated circular obstacles and arbitrary obstacles imported from images

Skills: C++, C, Python, MATLAB; ROS2, Gazebo; Git, Linux, Docker, GDB; CI/CD, Unit Testing; CAD; Numpy, Scipy; Jira, BitBucket