Hamza Abdinassir Hassan

hamza.a.hassan@outlook.com | LinkedIn.com/in/Hamza-A-Hassan | GitHub.com/Hamza-Robotics

Education

Aalborg University – Master of Science in Robotics June 2024
Aalborg University – Bachelor of Science in Robotics June 2022

Experience

Student Worker, DESMI – Aalborg, Denmark Mar 2024 – July 2024

- Developed a predictive maintenance algorithm to forecast centrifugal pump failures, using data and machine learning to minimize downtime, reduce maintenance costs, and save significant repair expenses
- Created a directive outlining sensor and implementation requirements, based on insights from the project
- Engineered features using a public dataset and applied PCA to reduce the feature dimensions
- Built a random forest classifier with scikit-learn to predict failures 12 hours in advance with 96% accuracy

Robotics Engineering Intern, Capra Robotics – Aarhus, Denmark Sep 2023 – Jan 2024

- Implemented a Non-Linear Model Predictive Controller (NMPC) using Acados for a robot-trailer system, enabling the trailer to carry payloads and enhancing the robot's capabilities by increasing task versatility
- Designed the controller to consider physical and input constraints while avoiding obstacles.
- Built a simulation of the robot trailer system inside ROS2 and integrated SLAM and NAV2 into the simulation
- Contributed to research & development equipping the company with the architecture to implement the NMPC
- Implemented the NMPC in the simulation to demonstrate forward & backward movement in constrained spaces

Projects

Tube-based NMPC for Non-Holonomic Multi-agent Systems Grade: 12/A | Master Thesis Publication | GitHub

- Developed an NMPC for controlling three non-holonomic robots in the presence of disturbances, addressing the challenge of coordinating multiple robots in a decentralized manner while ensuring robustness to disturbances
- Formulated constraints for obstacle and collision avoidance, and maintaining inter-agent connectivity
- Designed a hierarchical leader-follower scheme to avoid issues related to coupled constraints
- Developed a feedback control strategy using a scaled feedback gain between the nominal and actual errors
- Proved stability using a Lyapunov function to show conditions where the gain kept the error within a hyper-tube
- Implemented a simulation in ROS2 and used Acados to formulate the control problem, showcasing functionality
- Demonstrated successful trajectory tracking and constraint adherence by the Multi-Agent NMPC

Collaborative Eye Tracking with Robot Interaction GitHub

- Developed a system to facilitate human-robot collaboration in Industry 4.0 environments by integrating pose detection and intention inference from eye gaze, enabling intuitive interaction in smart manufacturing
- Implemented a Gated Recurrent Neural Network (GRU) from PyTorch for intention inference from eye gaze
- Developed a robust YOLOv7 object detector to identify objects currently being looked at by the gaze detector
- Created a pose detector using an SVM from scikit-learn and used pose estimation data from MediaPipe
- Integrated the pose detector to detect if the human operator has extended their hands to signal interaction
- Demonstrated control achieving 92% accuracy in intention detection and 99% accuracy in pose detection

Skills

Software: ROS2, OpenCV, Acados, Git, Simulink, Gazebo, scikit-learn, Open3D, Arduino, PyTorch, SolidWorks
Language Skills: Fluent in Danish and English. Limited Working Proficiency in German.