

Aaron Omadutt

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Education

Swarthmore College - Swarthmore, Pennsylvania

May 2024

Bachelor of Science in Engineering & Bachelor of Arts in Mathematics

GPA: 3.30 / 4.00

Skills

Programming & Simulation: MATLAB, Python, Java, C/C++, Control Systems, Kinematic & Dynamic Modeling, Numerical Methods, Stochastic Modeling, Data Analysis, PID Control

Engineering & Robotics Tools: Fusion360 (CAD), CNC Machining, 3D Printing, PCB Design, Laser Cutting, Arduino, ESP32, Mechanical Design, Prototyping

Experience

AI Data Labeler – Pareto.AI

October 2024 – Present

- Created and solved math problems across calculus, trigonometry, geometry, linear algebra, and differential equations to train AI large language models.
- Used LaTeX to format problems and solutions, producing clear, high-quality materials for model training.

Robotics Technician – FRC Team 6593

September 2024 – Present

- Mentored FRC robotics team in designing and building mechanical components using Fusion360, with CNC milling and 3D printing for precise fabrication.
- Integrated and managed electrical systems, ensuring seamless connectivity between mechanical and electronic components for fluid electromechanical operation.
- Developed Java and Python code for vision processing, autonomous navigation, and control of electromechanical systems, while coordinating subteams for efficient project workflow.

Undergraduate R&D Engineer – Swarthmore College

June 2023 – January 2024

- Developed a biomimetic robotic system for NSF-IOS 2136018, replicating barnacle nauplii swimming techniques for hydrodynamic studies.
- Designed and simulated nitinol spring housing using Fusion360 and MATLAB, ensuring biologically accurate limb movement and component compatibility.
- Created a custom PCB and control circuit with an ESP32 microcontroller, achieving multi-limb actuation with C-based algorithms for synchronized, sinusoidal motion.
- Analyzed actuation patterns in MATLAB, achieving a $90\% \pm 5\%$ match with nauplii swimming, validated through motion tracking alignment.

Projects

Omnidirectional Sorting Robot

github.com/Swarthmore-Robotics/Swerve-Drive

- Led a team of three in designing, assembling, and programming an omnidirectional robot equipped with a web camera for intelligent sorting and transfer of colored boxes, simulating industrial workplace scenarios.
- Using Fusion360 for CAD modeling and CNC milling, optimized the gripper mechanism to reduce backlash, increase torque, and minimize weight, enhancing robot performance.
- Assisted in Java-based control systems programming, including implementing swerve drive kinematics, PID control tuning, and development of tele-operational and autonomous object detection movement.
- Achieved autonomous detection and navigation precision with a 2-inch margin of error and 90% sorting accuracy in a controlled environment.

Modeling Path Trajectories and Object Avoidance for a Differential Drivetrain Robot

- Developed a mathematical model for a differential drivetrain robot, integrating guidance, control systems, and trajectory planning to optimize navigation in dynamic environments.
- Applied kinematic equations and differential equations to model robot motion, dynamics, and external force responses, ensuring accurate behavior simulations.
- Designed algorithms using potential field methods, creating attractive and repulsive fields for effective guidance and collision avoidance.
- Implemented kinematic models and trajectory planning in MATLAB, integrating real-time and pre-planned path functions for enhanced navigation and obstacle avoidance.