NIKHIL GANGARAM

Roboticist ~ Computer Scientist ~ Researcher

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SUMMARY

Hey there, I'm Nikhil! I'm currently deep into researching decentralized learning and complexity theory. Beyond that, I'm exploring how generative AI can be applied in robotics education. In my downtime, you'll catch me binging math youtube videos, diving into esoteric topics like Quantum Information, or trying to learn Japanese!

SKILLS

Languages: C++, C, Python, Java, MATLAB, Javascript, Wolfram Mathematica, Markdown, RST.

Softwares: ROS, Gazebo, Drake, Solidworks, Onshape, Git, Github, Jira, Agile, Trello.

Adobe: Animate, After Effects, Photoshop, Illustrator, Premiere Pro.

EDUCATION

8/22 - 5/26 **Worcester Polytechnic Institute (GPA: 4.0 / 4.0)** **(BS) Robotics Engineering & Computer Science Minor**
Relevant Coursework: Robotic SLAM, Robotic Manipulation, Algorithms, Quantum Information.
Activities / Societies: Tau Beta Pi, Upsilon Pi Epsilon, WPI High Powered Rocketry Club (HPRC)

8/18 - 5/22 **Bellarmine College Preparatory** **High School Diploma**
Led both the Team 254 (Cheesy Poofs) FRC and VEX teams to a dual World Championship win in 2022

EXPERIENCE

10/24 – 12/24 **Visiting Researcher** **Kyoto University of Advanced Science (KUAS)**
Worked with Prof. Ryosuke Matsumoto to develop Equivariant Graph Neural Network based interatomic potentials which predict the effects of hydrogen vacancies to mitigate embrittlement in magnesium alloys.

6/24 – 10/24 **Research Intern** **MIT Lincoln Laboratory**
Worked with Luis Alvarez to deploy multi-aircraft systems which utilize the Soft Actor-Critic architecture to protect civilians in the case of failure and provide humanitarian assistance in response to natural disasters.

9/23 – Present **Swarm Robotics Researcher** **Novel Swarm Technologies (NEST) Lab**
Working with Prof. Carlo Pinciroli to research novel methods for decentralized machine learning in multi-agent robotic systems, specifically using Graph Pointer Networks, in the sub-field of task allocation.

10/23 – 8/24 **Theoretical Computer Science Researcher** **Worcester Polytechnic Institute**
Worked with Prof. Daniel Reichman to study an intersection between Generative AI and Complexity Theory. Specifically, fine-tuning LLMs on NP-Hardness reductions to increase logical reasoning capability.

8/23 – Present **R&D Software Lead** **WPI HPRC**
Led the development of an Extended Kalman Filter and a Model Predictive Controller for onboard, real-time control of a model rocket. Currently building a simulator in Unreal Engine to extend with an LSTM.

PROJECTS

Python
Markdown
RST

Experiental Robotics Project (XRP)
Currently developing a Retrieval Augmented Generation (RAG) agent to provide 24/7 educational support.
Also, developing robotics curriculum to teach middle school students how to integrate OOP and Robotics.

Python
MATLAB
ROS
Drake

HURON
Developed inverse kinematic scripts in python for a bipedal robot to achieve desired locomotion
Startd the implementation of a Nonlinear Model Predictive Control (NPMC) algorithm in python and MATLAB to realize dynamically stable locomotion. The bipedal robot was simulated using ROS and Drake.

Python
ROS

SLAM Maze-Exploring Robot
Developed and implemented a simultaneous localization and mapping (SLAM) algorithm on the TurtleBot3. This necessitated the use of A* for search, a particle filter for localization, and pure pursuit for navigation. All of this code was developed in Python to interface with ROS and simulated using Gazebo.

Lua
C++ / C
Solidworks

Project Capricornus - 2022 WPI High Powered Rocketry Club (HPRC)
Implemented scripts for an autonomous drone using Lua and ArduPilot.
Developed sensor libraries for weather-station cubes in embedded C.
Designed and fabricated an arm-folding mechanism for a cube-sat form factor drone in Solidworks.

MATLAB

Vision-Based Color Sorting Robot Arm
Calculated inverse, forward, and velocity kinematics for a pick-and-place, 4-DOF robot arm. Implemented vision-based object detection, real-time trajectory planning, and a simulator for the arm in MATLAB.