

Brian Goodluck Mmari

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EDUCATION

Princeton University (Princeton, NJ)

Expected May 2025

B.S.E Candidate: Electrical and Computer Engineering

Relevant Coursework: Research Projects in Data Science; Introduction to Programming Systems; Optimal Learning; Intelligent Robotic Systems; Automatic Control Systems; Robotic and Autonomous Systems Lab; Machine Learning for Predictive Data Analytics; Algorithms and Data Structures.

EXPERIENCE

Purdue University, RISE Lab, (West Lafayette, Indiana)

May 2024 – July 2024

Summer Undergraduate Research Fellow, "Enabling Robots to Mimic Natural Behaviours: Exploration in robot control with LLMs and RL"

PI: Upinder Kaur

- Integrated an aerodynamic tail on the Mini Pupper 2 robot, utilizing Linux and bash scripting for data collection, system operations and automation of experimental setups.
- Conducted complex model training sessions on Nvidia GPUs, applied machine learning frameworks to analyse the stabilization capabilities of robotic tails, drawing parallels with biological quadrupeds.

Polygone Systems, Inc., (Princeton, New Jersey)

Jan 2024 – May 2024

R & D Engineering Fellow (Link: <https://polygonesystems.com/about-us>), "Exploring portable applications for the Plastic Hunter"

Research supervisor: Nathaniel Banks

- Innovated an electrical system using Raspberry Pi for a new Unmanned Surface Vehicle (USV) aimed at environmental monitoring and water filtration.
- Wired and C++ coded a Buffer Pad system that was integrated in another water filtration system.
- Played key role in R&D developments by attending general meetings and contributing to the team's knowledge base.

Princeton University, Self-Organizing Systems Research Group, (Princeton, NJ)

Jan 2023 – Present

Undergraduate Researcher, "BlueGuppy"

PI: Nagpal Lab

- Designed 5cm-scale single-fin fish-like flapping robots used to investigate hydrodynamic interactions & formations.
- Implemented substantial hardware design enhancements through Fusion360, achieving a notable 20% reduction in density enhancing underwater robot buoyancy. Fine-tuned the minimal angle of the bent shaft, leading to a 15% performance increase.
- Improved the propulsion system using magnetic coils, synchronization of flapping fish-robots, and making the fish fully autonomous.

Clear Blue Sea Organization, San Diego, California (Remote)

June 2023 – Sep 2023

Electrical Engineer Intern

- Investigated ROS-compatible GPS, IMU, and network communication hardware for integration into a wireless-controlled semi-autonomous water vehicle designed for waste collection.
- Created wiring schematics for the Floating Robot for Eliminating Debris (FRED) design choices on SPICE.

PROJECTS

Predicting forest fires along trail routes in the Table Mountain, South Africa

Feb 2024 – May 2024

Statistics and Machine Learning (SML312) – Research Projects in Data Science (Link: https://github.com/BRIANMMARI10/SML312_Final-Project)

- Aggregated and created a dataset from three different sources: AllTrails, NOAA website, and NASA Firms using geospatial clustering algorithm.
- Chose minimizing false negatives as my metric and picked Histogram-Based Gradient Boosting Classifiers as the best model from Logistic Regression and Random Forests.

Autonomous Truck Driving & Obstacles Avoidance Class Project

Feb 2024 – May 2024

Developer, Class Project

- Implemented an iLQR policy as well as a receding horizon planner by pre-defining a set of waypoints and using the truck's onboard perception to traverse and avoid obstacles, earning 3rd place overall in lap time.
- Implemented a safety filter that enabled monitoring of a driver's proposed control action for safety, and if unsafe intervening to prevent failures.

Car Lab Project

Sep – Dec 2023

2-team member, Class Project

- Implemented a PI control system to guide an autonomous vehicle up and down a ramp within a predefined timeframe.
- Contributed to the design and customization of the power board, video board, motor board, and PSOC. Introduced a hall-effect sensor-based approach to accurately measure the speed of the autonomous vehicle.
- For the final project, I implemented a wireless control hand gloves equipped with flex sensors that could control the front, back and sideways movement of the vehicle by bending fingers.

Princeton Racing Electric, Princeton University (Princeton, NJ)

Jan 2023 – Aug 2023

Team Member, Differential Action Team (Link: <https://princetonracingelectric.com/diff-action>)

- Researched & developed control algorithms for limiting both slip ratio and improving static and dynamic cornering crucial for overall safety and performance of our vehicle.
- Combined readings over CAN and RS-485, including temperatures and speeds of motors & position of the steering wheel, to produce the desired torque and speed control on all our wheels.

Tanzania Weather SMS App

May 2022

Developer (Link: <https://youtu.be/YCik9BPwjW4>)

- Developed a real-time SMS server using the Twilio library by extracting relevant rainfall CSV. data from the Tanzania Meteorological Authority, TMA website.
- Improved server query code, increasing accessibility by nearly 10% with each active region's major symbol table data.

Harvard PacBot Competition, Harvard Undergraduate Robotics Club (Cambridge, MA)

April 2022

Low-level Code Contributor

- Improved reliability on the server communication between the pi, Harvard server, and our local PC using C++.
- Self-administered an easier solution to a higher baud rate without losing the ability to debug our robot, managing us a 5th place in the Harvard Robotics Competition.

AWARDS

Recipient of Charlotte Mangum Student Support Program, Departmental Excellence in Engineering Funding, and Undergraduate Fund for Academic Conferences

- As the co-author for the project "Designing a miniature fish robot – an aquatic analog for hex bugs", I was awarded \$1200 to defray costs for housing, trip airfare, and conference registration at the annual Society for Integrative and Comparative Biology conference, SICB in January 2024.