Kwasi Debrah-Pinamang

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Education

Kennesaw State University **Graduating Aug 2025**
Master of Science in Intelligent Robotic Systems GPA: 4.0/4.0

University of Wisconsin-Madison **Graduated May 2024**
Bachelors of Science in Electrical Engineering, Computer Science, Applied Mathematics GPA: 2.75/4.0

Research Experience

Advanced Mechatronics and Intelligent Robotics Lab **August 2024-Present**
Graduate Research Assistant Marietta, GA

- Developing a 6DOF soft actuator for minimally invasive heart surgeries that integrates a hybrid sensing approach with a soft electromagnetic sensor and force sensor
- Implementing model-based control strategies, such as inverse kinematics and dynamic control algorithms, for real-time manipulation of the soft robot in MATLAB
- Constructed a ROS2-based software architecture to facilitate communication between sensors and actuators, using DDS (Data Distribution Service) for real-time data streaming

University of Wisconsin CATS Lab **February 2024-August 2024**
Undergraduate Research Assistant Madison, WI

- Developed a simulation environment for a mower using Webots and Python to test and validate planning and mapping algorithms
- Implemented the Boustrophedon Cellular Decomposition (BCD) algorithm to optimize the mower's path planning for complete area coverage while minimizing overlap and ensuring efficiency
- Integrated LiDAR-based SLAM (Simultaneous Localization and Mapping) to enable real-time environment mapping and localization for dynamic obstacle avoidance

University of Wisconsin WiNGS Lab **September 2023-June 2024**
Undergraduate Research Assistant Madison, WI

- Researched the prospects of using SLAM on a HoloLens in a computational and power efficient manner in order to assist firefighters in mapping out their surroundings
- Investigated the possibilities of using edge computing in order to offset some of the computational complexity of SLAM from the computer interfacing with the VR headset
- In addition, also worked on a project involving the use of multiple cameras in conjunction to build one centralized map using a modified version of OrbSLAM known as AdaptSLAM

University of Wisconsin Visual Computing Lab **February 2023 - September 2023**
Undergraduate Research Assistant Madison, WI

- Conducted a comprehensive evaluation of various sensor technologies, including depth cameras and time-of-flight sensors, to determine their suitability for detecting and mapping hazardous substances under low-visibility conditions on a robotic dog

- Programmed robotic algorithms for perception and control using ROS2 for mobile robots; examples include a PID controller for a wheeled robot and depth camera image processing and measurement using OpenCV
- Performed extensive testing of these sensors to determine their performance in varying environments and ranges

Madison Experimental Mathematics Lab **February 2023 - May 2023**
Undergraduate Research Assistant Madison, WI

- Focused on exploring a variety of square-tiled surfaces, such as square tori and regular octagons, to identify unique geometric structures with statistical distributions that differ from Hall's Distribution
- Programmed an algorithm using Python and FlatSurf from SageMath software to graph the distributions of selected various square-tiled surfaces
- Statistical analysis revealed that all examined surfaces conformed to Hall's Distribution, suggesting potential underlying geometric invariants

University of Wisconsin CAVH Research Group **February 2022 - December 2022**
Undergraduate Research Assistant Madison, WI

- Conducted a comprehensive study of various deep learning-based object detection algorithms, including Region-based Convolutional Neural Networks (RCNN), CenterNet, and YOLOv4, to evaluate their effectiveness in perceiving and interpreting complex driving environments
- Deployed each algorithm within the CARLA simulator to perform real-time object detection and classification tasks, simulating real-world driving scenarios with diverse road users and obstacles
- Identified the trade-offs between accuracy and processing speed, noting that YOLOv4 offered high-speed inference suitable for low-latency applications, while RCNN variants provided superior accuracy at the cost of increased computational demands

Professional Experience

Thomson Reuters **June 2022 - December 2022**
Software Engineering Intern Eagan, MN

- Developed applications using Python for scanning financial accounts in order to ensure blacklisted accounts were omitted
- Monitored the status of active applications using AWS and the CI/CD pipeline in order to ensure successful performance
- Maintained applications by practicing version control and repository management with Git and Github

Publications

Space Exploration with Deep Reinforcement Learning **August 17, 2022**
Available at: https://www.kdd.org/kdd2022/papers/14_Kwasi%20Debrah-Pinamang.pdf

Organizations

Wisconsin Robotics **September 2021 - June 2024**
Electrical Team Lead Madison, WI

- Led the optimization of the electrical system for the rover, enhancing performance for the URC 2024 competition
- Spearheaded the redesign of the rover's electrical enclosure to improve heat dissipation and accessibility, resulting in reduced maintenance time and enhanced reliability

- Integrated a Time-of-Flight sensor at the front of the rover for real-time cliff avoidance, leveraging precise distance measurements to improve navigation safety
- Developed a robust hardware health monitoring interface for real-time diagnostics from the base station, allowing for proactive troubleshooting and increased mission uptime

Wisconsin Autonomous **September 2020 - June 2024**

Controls Team Researcher Madison, WI

- Investigated and implemented control algorithms for autonomous vehicle navigation using sensor data and mapping information provided by the perception and infrastructure subteams
- Designed and tested path planning algorithms, including A* and Dijkstra's, to optimize route efficiency and obstacle avoidance
- Developed simulations in MATLAB, Simulink, and Roadrunner to validate and refine control strategies, improving the robustness and accuracy of the vehicle's autonomous navigation capabilities

BadgerFly **December 2021 - May 2024**

President, Software Lead Madison, WI

- Led the end-to-end design and construction of a tilt-rotor VTOL aircraft from scratch for participation in VFS's annual Design-Fly-Build competition
- Managed all project aspects, including CAD drafting, circuit and PCB design, CFD and FEA analysis, and control system development and tuning
- Coordinated the manufacturing process, ensuring integration across software and hardware components to achieve a fully functional and competitive VTOL

AIAA - UW Madison Chapter **October 2021 - May 2024**

Avionics Lead Madison, WI

- Engineered electronic systems for flight, including sensors for key flight parameters (altitude, velocity) and actuators for airbrake deployment, enhancing control and stability during rocket flights
- Designed and built custom enclosures for electrical components, optimizing for weight, size, and structural integrity within the rocket's physical constraints
- Led testing and validation efforts to ensure electronic systems met performance and safety standards under dynamic flight condition

Aerial Robotics Competition Team **August 2024 - Present**

Guidance, Navigation and Control Engineer Marietta, GA

- Designing the electrical system for two UAVs, integrating hardware and software components for both manual and autonomous flight modes
- Developing a ground station using Mission Planner for real-time UAV monitoring and control, incorporating RTK GPS for enhanced localization accuracy
- Assembling and configuring critical components, including microprocessors, GPS systems, telemetry modules, and a programmable flight controller, to support autonomous flight missions

Skills

- **Mechanical & Electrical**: 3D Modeling (AutoCAD, SolidWorks), CFD/FEA (ANSYS), Circuit/PCB Design (Altium), Dynamic Control Systems, RF/Power Electronics, Spacecraft and Astrodynamics
- **Programming & AI**: Python, C, C++, Java, MATLAB, ROS, Verilog, AI/ML/DL (TensorFlow, PyTorch), Computer Vision (OpenCV), Reinforcement Learning (OpenAI Gym, wandb)
- **Tools & Libraries**: Docker, AWS, Git, NumPy, Pandas, Matplotlib, Simulink, Gazebo
- **Embedded Systems**: Embedded C, FreeRTOS, Embedded Linux, Communication Protocols (I2C, SPI, UART, CAN), Hardware Testing