KOJO WELBECK

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EDUCATION

Northwestern University –- Evanston, IL
Master of Science in Robotics Candidate *Dec 2022 (Expected Graduation)*
Relevant Coursework: Robotic Manipulation, Mechatronics, Machine Learning, Deep Learning, Deep Reinforcement Learning from Scratch, Active Learning, Simultaneous Localization and Mapping, Dynamic Systems and Control

Massachusetts Institute Technology (MIT) — Cambridge, MA
Bachelor of Science, Mechanical Engineering *Sept 2010 - June 2014*

WORK EXPERIENCE

Argonne National Lab, Lemont, IL — *Research Intern* *Jun 2022 - Sept 2022*
- Co-designed end-to-end communication template for automating and monitoring biological lab experiments over a distributed network of robots
- Prototyped template as series of ROS2 Python nodes containerized with Docker for load-balanced deployment and automatic startup and deployed on multiple Opentrons OT2s
- Furnished Docker images with bash scripts to check for required dependencies and to alert errors

ClearSpace Labs, Accra, Ghana — *Home Automation Engineer* *Feb 2018 - Sept 2019*
- Architected, executed and tested smart home automation solutions leveraging HomeAssistant's open-source framework
- Augmented electrical schematics with electrical and networking provisions for mixes of IoT sensors and actuators
- Co-developed a web-based user interface in PolymerJS for wall-mounted tablets across a development of townhomes

Compass Automation, Elgin, IL — *Machine Design Engineer* *May 2015 - Aug 2017*
- Designed and detailed mechanical subsystems of 10 custom automation and/or robotic cells for inspection, assembly, and machine tending applications. Served as lead or sole design engineer on 7 projects.
- Coordinated with customers, vendors, and in-house electrical and control engineers from idea-generation through to factory acceptance; managed teams of up to 3 in-house builders during mechanical build and integration.
- Structured, adapted, executed, and communicated plans and schedules to deliver systems priced from $250,000 to upwards of $1,000,000 within budget and on time, typically 28-32 weeks.

SELECT PROJECTS

Wafer Positioning by Phased-Array Near-Field Acoustic Levitation *(ongoing)*
- Designed a modular configuration of 4 synchronized PIC32 microcontrollers bit-banging at 400Khz through an amplifier intermediary to drive an array of 120 individually addressable acoustic transducers at different phases.
- Detailing the serial port communication API to control the phase shifts and wrapping in a ROS2 C++ interface.

Extended Kalman Filter SLAM on Turtlebot3 | *C++, ROS, Unit Tests, Git*
- Developed a robot navigation library in C++ to implement the Odometry of a differential drive; to parse LiDAR data for detecting, classifying and matching to map landmarks; and to process sensor measurements through an Extended Kalman Filter for localization updates.
- Leveraged Catch.hpp for unit tests on library components and Armadillo for matrix operations.
- Deployed the navigation library as part of a collective of ROS C++ packages to drive, to simulate and to effect SLAM on a real Turtlebot3.

Two Wheeled Self-Balancing Platform Robot | *C*
- Designed and implemented the mechanical, electrical and software subsystems of a two-wheeled inverted pendulum robot
- Fused gyroscope and accelerometer data together to inform a microcontroller-based Proportional-Integral-Derivative (PID) controller, programmed in C
- Interfaced microcontroller, by serial communication, with a Raspberry Pi central command for ROS integration.

Quadcopter Assembly and Control | *C*
- Pair-programmed an embedded flight controller in C on a Raspberry Pi to position and stabilize the quadrotor in flight.
- Implemented, layered and tuned variations of PID control loops for autonomous and semi-autonomous flight.
- Integrated an inertial measurement unit (IMU) with filtering and calibration schemes for stabilizing orientation, an optical beacon sensor array for local positioning under a Vive Lighthouse base station, and a game controller and joystick for user control through shared memory.

RELEVANT TECHNICAL SKILLS

Languages: Python, C++, C, JavaScript **Developer Tools:** ROS/ROS2, OpenCV, TensorFlow, Scikit-Learn, Docker, Linux/Bash Scripting, git **Hardware:** Microcontrollers (PIC, Arduino/AVR, Raspberry Pi Pico), Microprocessors (Raspberry Pi, Jetson Nano) **CAD:** Solidworks, Onshape, Eagle (PCB Design) **Fabrication:** Rapid Prototyping, Manual Machining, GD&T