

CHANGWE MUSONDA

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EDUCATION

California State Polytechnic University, Pomona

M.S. Electrical Engineering (Aug 2026 – May 2028, Expected); B.S. Computer Engineering (May 2026)

Pomona, CA

GPA: 3.56

Crafton Hills College

A.S. in Mathematics

Yucaipa, CA

May 2023, GPA: 3.67

WORK EXPERIENCE

iCode

Robotics Instructor (Part-Time)

Costa Mesa, CA

Aug 2026 – Present

- Teaching K-12 students robotics and coding fundamentals through iCode's hands-on, belt-system STEM curriculum, covering robotics kits, drones, and introductory programming concepts
- Translating real-world robotics and embedded systems concepts from my own coursework and research into age-appropriate, hands-on lessons that build students' technical and problem-solving skills

Northrop Grumman Collaboration Project

Embedded Systems Engineer, Integration Team

Pomona, CA

Aug 2026 – Present

- Serving as an embedded systems engineer on the integration team for the campus **Northrop Grumman** Collaboration Project, tasked with unifying independently developed autonomy, ground control station (GCS), and RF subsystems into a shared **ROS** architecture
- Coordinating interface and data-format standards across sub-teams to enable cross-team subsystem integration within ROS

Autonomous Vehicle Laboratory

Student Research Assistant – LiDAR Systems & Sensor Integration Lead

Pomona, CA

May 2025 – Present

- Leading **LiDAR** sensor integration for the lab's autonomy stack, designing an **STM32**-based hardware time-synchronization module that timestamps IMU and LiDAR data against a shared **GPS/PPS** reference for deterministic sensor fusion
- Architecting an **RTOS** task pipeline (interrupt-driven PPS capture → sensor read → buffered output) feeding a custom **ROS 2** node that time-aligns IMU and **Velodyne VLP-16** point cloud data for downstream perception and SLAM
- Coordinating with the broader autonomy team to identify and scope real-time sensor-sync gaps in the existing perception pipeline, translating them into firmware-level solutions

Team Pegasus (Lockheed Martin Sponsored)

Autonomy Engineer → Autonomy Lead (Senior Capstone)

Pomona, CA

Jan 2025 – May 2026

- Led a team of 7 engineers to design and integrate an end-to-end UAV autonomy system in **C++** and **Python** on ARM-based embedded Linux (Jetson AGX), progressing from Gazebo SITL simulation through hardware-in-the-loop testing to outdoor field deployment
- Bridged **PX4** flight controller firmware to **ROS 2** via uXRCE-DDS; integrated LiDAR and ZED X stereo cameras (GMSL bring-up) into a unified perception pipeline supporting SLAM-based localization and closed-loop control
- Diagnosed hardware and software integration failures using telemetry logs and root-cause analysis, tracing faults across firmware, OS-level timing, and application software to improve reliability from lab through outdoor flight test
- Collaborated with cross-functional teams on system integration, test readiness reviews, and iterative validation; produced wiring diagrams, calibration procedures, and integration documentation

PROJECTS

STM32 Diff-Drive Motor Controller Bridge (Teensy-to-STM32 Port)

Sept 2026 – Present

- Ported a real-time CAN motor-controller bridge for an IGVC-style autonomous ground robot's differential drivetrain from a Teensy 4.1/Arduino sketch to a bare-metal **STM32F767ZI** (NUCLEO-F767ZI), rewriting the firmware in **C** against the STM32 HAL while preserving the host-facing UART protocol byte-for-byte
- Reimplemented the REV SparkMAX CAN protocol layer from scratch (extended-ID frame construction, heartbeats, velocity/duty commands, encoder decode, PID parameter writes) over a hand-configured 1 Mbit/s bxCAN bus, running a 50 Hz control loop with a 300 ms host watchdog and a non-blocking, safety-critical timing state machine
- Replaced a bit-banged NeoPixel driver with a DMA-driven WS2812 implementation (TIM1 PWM + DMA), eliminating a ~480 microsecond interrupt blackout present in the original firmware, with zero changes required to the existing **ROS 2** host software

Low-Cost Manually Controlled Surgical Manipulator with Impedance-Sensing End Effector

CPP Project Hatchery, advised by Dr. Dan Gonzalez (25+ yrs Design/Quality Engineering, J&J)

July 2026 – Present

- Electrical/embedded lead on a sub-\$5K manually controlled surgical robot, secured through competitive Project Hatchery funding
- Designing impedance-sensing tip electronics, front-end signal conditioning, and firmware for real-time tissue contact detection
- Building **ROS 2** data handoff and hardware fail-safes aligned with **IEC 60601/62304** medical device standards
- Collaborating with ME counterpart to integrate sensor electronics with end-effector design from the ground up

CaseBridge — AI-Powered Case Management (Hackathon Finalist)

April 2026

- Built an AI-powered case management tool at the Cal Poly Pomona AI Hackathon 2026, reaching the finals as part of a team, targeting the administrative overhead that consumes 60–70% of a social worker's day
- Developed an AI scribe converting session transcripts into structured case notes, a resource-matching tool connecting clients to community services, and a form-filler auto-populating referral documents from existing case data
- Built with **React**, **Vite**, **Tailwind CSS**, and the **Anthropic Claude API**

Deep Differentiable Neural Planner for Egocentric Navigation

Jan 2026 – May 2026

- Trained and benchmarked four differentiable planning architectures (VIN, GPPN, CALVINConv2d, CALVINConv3d) on custom egocentric and allocentric datasets, extending a **CVPR 2022** paper to evaluate cross-dataset generalization

- Modernized a legacy **PyTorch** research codebase, resolving GPU/CPU tensor handling and CUDA dependency issues to establish a reproducible ML experiment pipeline

Broncos Gambit Chess Engine

Jan 2026 – May 2026

- Developed a fully functional chess engine in **C** as part of a 5-person team managed with Jira and Git, communicating over the **UCI** protocol for plug-in compatibility with any standard chess GUI
- Implemented alpha-beta search with negamax, quiescence search, and a 1M-entry Zobrist-hashed transposition table (~32 MB); applied iterative deepening and move ordering heuristics to improve pruning efficiency

Unmanned Ground Vehicle SLAM System

Dec 2025 – Present

- Developed a **ROS 2**-based SLAM pipeline integrating mapping and localization for autonomous navigation in unstructured outdoor environments
- Improved localization robustness by analyzing failure cases under sensor noise and environmental variation, refining pipeline parameters through iterative field testing

Medical Image Segmentation (PyTorch)

Aug 2025 – Dec 2025

- Built a **PyTorch**-based segmentation pipeline for cardiac MRI data, establishing a reproducible training workflow from preprocessing through evaluation
- Improved segmentation consistency through preprocessing decisions and metric-driven evaluation, deepening understanding of how model architecture choices interact with data quality

A* Path Planning on FPGA (Verilog + Python)

Aug 2025 – Dec 2025

- Implemented a hardware-accelerated A* path planning algorithm in **Verilog** on an **FPGA**, enabling parallel execution and exposing hardware/software co-design tradeoffs between FPGA execution and software-side orchestration
- Validated hardware output against **Python** reference models across structured test scenarios, performing performance analysis to measure execution time improvements and resource utilization

TECHNICAL SKILLS

Languages: C/C++ (C++17), Python, Verilog

Tools: ROS 2 (Humble), PX4, uXRCE-DDS, MAVSDK, Pixhawk, PyTorch, Git, Linux

Systems: ARM Embedded Linux, SLAM, Sensor Fusion, Real-Time/RTOS Systems, Fault Handling, Field Deployment & Validation