

JOSEPH MA

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EDUCATION

Purdue University, College of Engineering – West Lafayette, IN

Master of Science in Electrical and Computer Engineering

August 2023 - December 2025

- Graduate Teaching Assistant for Microprocessor Systems and Interfacing

Bachelor of Science in Computer Engineering | GPA: 3.83 / 4.00

August 2020 - May 2023

- Undergraduate Teaching Assistant for Electrical Engineering Fundamentals, Advanced C Programming, Data Structures

WORK EXPERIENCE

Amazon Robotics

January 2025 - July 2025

Embedded Firmware SDE Co-Op

North Reading, MA

- Emulated a camera by streaming simulated frames from an **R5F** core (**RTOS**) to an **A72** core (**Linux**) on a multi-core **SoC**, enabling fault injection and stress testing to validate system limits. Eliminated reliance on live hardware or variable environments by enabling deterministic reproduction of false positives for debugging.
- Resolved cross-core memory conflicts by resizing and relocating the memory region allocated to the RTOS core running the camera transmission firmware, updating the **device tree overlay** and **linker script** accordingly.
- Configured **U-Boot** to disable auto-loading of secondary core firmware, enabling manual initialization via Linux user space. Used **JTAG** to debug firmware execution and isolate interrupt handling failures.
- Separated the **I2C** control plane from the **MIPI CSI** data path by remapping the bus via device tree overlay, spoofing I2C communication to satisfy **V4L2**'s device detection while injecting custom frames from an alternate source.
- Implemented synchronized communication from the Linux to the RTOS core using **IPC rpmsg** and a shared **ring buffer** to supply custom camera frames to the transmission firmware; handled **virtual-to-physical memory translation** and **CRC**-based validation to enable parallel transfer with reliable cross-core control signaling.
- Developed a **Python gRPC** client and **CLI** with mock-driven unit tests to query system health and diagnostics across an autonomous robot via an **NGINX reverse proxy**, achieving **20x faster** queries during on-call response. Added socket routing fallback to mitigate single points of failure and **SSH tunneling** to enable remote access.

The Walt Disney Company

May 2024 - August 2024

Attractions Engineering Intern - IoT and Embedded Systems

Hong Kong

- Engineered and led the development of a monitoring and data acquisition system for a Disneyland boat ride using an **ESP32**, capturing over **16 critical measurements**, including location, speed, engine RPM, water temperature, oil pressure, and fuel levels. Utilized **I2C** and **SPI** for peripheral communication and applied signal conditioning techniques to enhance data accuracy.
- Prototyped the circuit system on a breadboard, iterated and tested through multiple versions, and finalized the design on a PCB for mass production. Successfully deployed the system on **22%** of the ride, enabling 24/7 monitoring and real-time data transmission via **LoRa** to a central gateway whenever a boat is active.
- Configured LoRa protocols on the ESP32, programmed and optimized gateway settings for efficient data reception using **UDP**. Developed **Python** scripts utilizing **TCP** protocols and API keys for reliable data transfer from the gateway to a NAS (InfluxDB), enabling continuous data logging and remote monitoring - even from offsite - providing real-time data and precise boat location—insights previously inaccessible unless observed directly.
- Prepared data for potential use in Machine Learning, including **Recurrent Neural Networks (RNNs)** to predict and prevent engine failures. The system is estimated to **reduce engine downtime by 50%** and is projected to **increase ride capacity by 23,000 guests annually**. Framework set for mass deployment across the entire ride.

Purdue University School of Electrical and Computer Engineering

January 2024 - December 2024

Graduate Teaching Assistant - Microprocessor Systems and Interfacing

West Lafayette, IN

- Instructed lab sessions involving **STM32 ARM Cortex-M** microcontrollers, focusing on Embedded C/Assembly programming, DMA, ADC/DAC, and timer-driven interrupt service routines (**ISRs**). Introduced **RISC-V** assembly and instruction set architecture (ISA) usage.

PROJECTS See joseph-ma.com for a full range of projects with interactive demos and details.

SKILLS

Languages: Expert: C/C++ | Python | Proficient: Assembly | Java | HTML/CSS/JS | MATLAB | Basic: SystemVerilog

Software: Unix/Linux | TCP/IP | HTTP/HTTPS | CI/CD | Git | GDB | Valgrind | Embedded Linux | RTOS | LTspice

Hardware: STM32 (ARM cortex) | RISC-V | I2C/SPI/UART | DMA | ADC/DAC | JTAG | Oscilloscope | Multimeter