Joshua Ramos

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EDUCATION

Carnegie Mellon University, Pittsburgh, PA — May 2025
B.S. in Electrical & Computer Engineering — GPA 3.43
M.S. in Electrical & Computer Engineering — GPA 4.00

RELEVANT COURSES

Planning Techniques for Robotics	Strategy for High-Tech Products and Services	Embedded Real-Time Systems
Introduction to Machine Learning	Embedded Systems Software Engineering	Distributed Embedded Systems
Modern Control Theory for Robotics	Optimal Control & Reinforcement Learning	Autonomous Robotics

WORK EXPERIENCE

Teaching Assistant | Carnegie Mellon University | Introduction to Embedded Systems | Gregory Kesden — Fall 2024 – Spring 2025

- Administered recitations and office hours to enhance student learning, and assisted in the development of course lab projects.
- Guided 42 teams of students to construct customized RTOS kernels with multi-threading and dynamic scheduling, design, order and populate PCBs, implement bootloaders, UART, I2C, and motor encoder drivers (via EXTIs), and implement a PID controller to drive a car system using an STM32 Nucleo board.
- Reinforced students' understanding of safety critical systems (SIL, HAZOP, PHA, etc.), power-management, control systems, ARM architecture/assembly, serial communication, real-time kernel, real-time scheduling, concurrency control, and more.

Software Development Engineering Intern | Amazon Web Services | Arlington, VA — Summer 2024

- Prototyped an internal service that enhances the building experience for all Amazon software engineers.
- Deployed a cluster of containerized, embedded Apache Mina SSHD servers to proxy service requests and stream critical data.
- Worked with security teams to obtain system security clearance to securely route high critical data across VPC networks.
- Maintained discussions with primary stakeholders to iterate and deliver the product prototype in a timely manner.
- Designed unit/integration tests in Java, validating program functionality/performance to ensure high-quality solutions.

Software Development Engineering Intern | Amazon Web Services | Arlington, VA — Summer 2023

- Implemented a transformative feature for a customer facing front-end, leveraging a range of AWS technologies including Lambda, DynamoDB, S3, Cloud Development Kit, and Elastic Container Registry/Service.
- Constructed a robust REST API in Kotlin, enabling the seamless communication of customer data.
- Developed the foundation of a sophisticated back-end system, harnessing the capabilities of AWS DynamoDB, Lambda, and S3 storage to efficiently retrieve and analyze customer-requested data, store results, and subsequently provide actionable insights and analytics to customers.
- Implemented an intuitive and immersive user interface to showcase critical data metrics, optimizing customer experience and facilitating informed decision-making.
- Designed comprehensive unit tests in both Go and Kotlin, validating program functionality and performance to ensure high-quality solutions.

Undergraduate Research Assistant | Carnegie Mellon University Robomechanics Lab | Aaron M. Johnson — Since 2022

Microtaur: A Low-Cost, Easily Implementable Quadrupedal Research Platform

- Implemented kinematic simulations to model the motion of quadruped legs using MATLAB
- Performed trade-off analysis on the system features such as the MCU (Teensy 4.1) and body composition (PLA/acrylic)
- Implemented dynamic behaviors such as walking, trotting, hopping, and bounding gaits (C++).
- Built a testbed and conducted trials on various surfaces to analyze the differences in behaviors with respect to surface.

Path Planning for Wheeled Platforms Under Unstable Conditions

- Designed a proposal to investigate the integration of novel methods of stability analysis for hybrid systems in planning for AVs
- Programmed simulations in MATLAB to observe the performance of SOTA dynamically constrained planning algorithms such as the kinodynamic RRT on a 6D vehicle model with integrated hybrid system analysis techniques.

SKILLS

Programming Languages: Java, Python, C, C++, Go, Typescript, Kotlin, JavaScript, HTML, CSS, SystemVerilog
Software & Frameworks: AWS, Quartus, CAD (Autodesk, Fusion, SOLIDWORKS), MATLAB, Apache Mina, React, Docker
Hardware: PCB, FPGA, Microcontrollers (Arduino, ESP32, Teensy, STM32), Manufacturing (3D Printing, Soldering, Power tools)

PROJECTS

Climber's Ligament Injury Mitigation Band (Product Design, Embedded Systems / Biomedical Engineering) Fall 2024

- Invented CLIMB, a system capable of monitoring, analyzing, and visualizing forces applied by the hand over time.
- CLIMB improves the state of training/rehabilitation in rock-climbing by providing climbers with an unobtrusive, injury-prevention training device paired with the immersive CLIMB app to help users track, analyze, and share their workouts.
- Designed and created the CLIMB device (hardware) which comprises a PCB, a 3D-printed capsule, haptic DC motors, piezo-resistive sensors, and programmed an Olimex ESP32 to utilize on-board peripherals ADC, PWM, and Bluetooth Classic.
- Proposed the CLIMB solution to Carnegie Mellon faculty, derived design-requirements from use-cases and value-drivers, performed trade-off analyses per device subsystem, executed rapid design iteration, realized a risk-mitigation plan, and orchestrated a series of verification and validation trials which included durability, ergonomic, and safety testing.
- CLIMB can accurately measure up to 60lbs per pulley with 3% error, can be used at any distance from the paired device, and can visualize data from a workout within 5 seconds for a 10 minute workout.
- Won 1st place among 23 contending teams in the Carnegie Mellon 18-500 ECE Design Experience competition.

Autonomous Systems (Robotics, Optimal Control, SLAM, State Estimation, Python) Fall 2024

- Implemented a Linear-Quadratic Gaussian (LQG) controller using an Extended Kalman Filter (EKF SLAM) and an IH-LQR to track an optimized motion trajectory (A*) for a 6D vehicle model, simulated in Webots.
- Designed a Model Reference Adaptive Controller (MRAC) and Linear-Quadratic Regulator (LQR) to fly and stabilize a quadrotor experiencing a stochastic 69% and 50% loss of thrust in one motor, respectively, simulated in Webots.

Real-Time Systems (Embedded Systems Engineering, Bare-metal Programming, C, ARM Assembly) Spring 2024

- Designed, ordered, and populated a printed circuit board using Fusion to support an STM32 with an ARM Cortex M4 processor.
- Programmed numerous driver files to configure communication protocols like I2C and UART among other peripherals, drove a motor using PWM and implemented an encoder using EXTIs and controlled it with a PID controller, flashed NeoPixels using DMA, implemented a RTOS kernel with multi-threading, and processed sensor readings using ADC on an STM32 Nucleo.

Network-On-Chip Design (Hardware Design, FPGA, SystemVerilog) Spring 2024

- Designed and implemented multiple, coordinated hardware threads in SystemVerilog to simulate a network-on-chip.
- Utilized fundamental design principles such as handshaking, pipelining, buffering, and fairness arbitration.

RPN Calculator Verification and Validation (Hardware Design, FPGA, SystemVerilog Assertions) Spring 2024

- Designed a robust testbench to exhaustively probe an RPN calculator based on a fault model I devised.
- Utilized constrained random testing, class-based vectorization, concurrent and immediate assertions, and task modularization.

Multi-Agent Planning Under Dynamic, Adversarial Conditions (Robotics, Path Planning, Simulation, Python) Spring 2023

- Designed a simulation to analyze the Learning Real-Time A* Search algorithm in a dynamic, adversarial environment.
- Simulated both centralized and decentralized planners utilizing multiprocessing techniques.

High-DoF Arm Motion Planning (Robotics, Motion Planning, C++) Spring 2023

- Wrote multiple planners for a planar arm with 6 joints to move from a starting state to goal state utilizing different sampling-based search methods: Probabilistic Road Maps (PRM), Rapidly-exploring Random Trees (RRT), RRT-Connect.

Game Development (Storyboarding, Game Design, Python) Fall 2021

- Designed an immersive top-down strategy game in Python (Tkinter) with graphics.
- Implemented randomized maze creation and intelligent agents to enhance the user experience.
- Optimized game performance by utilizing multiprocessing techniques.