Surya Balaji

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Education

The University of Texas at Austin May 2028
B.S., Electrical and Computer Engineering Honors, B.B.A., Canfield Business Honors **GPA: 3.96**

Relevant Coursework: Real-Time Operating Systems, Embedded Systems, Linear Systems & Signals, Computer Architecture, Linear Algebra, Multivariable Calculus, Differential Equations, Digital Logic Design, Circuit Theory

Relevant Skills

Languages/Libraries: Python, C, C++, ARM M0+ Assembly, TensorFlow, scikit-learn, NumPy, Pandas, OpenCV
Systems/Platforms: ROS2, Isaac Sim, cuRobo, Docker, Linux, FreeRTOS, Distributed Systems, Real-Time Systems
Tools: Git, GitHub, VSCode, ESP-IDF, Code Composer Studio, Vivado, KiCad, SPICE, IdeaMaker, Autodesk Fusion

Experience

Autonomous Mobile Robotics Laboratory May 2026 – Present
Undergraduate Researcher *Austin, TX*
- Developing perception-driven ROS 2 motion planning pipeline for 7-DOF Kinova mobile manipulator in Isaac Sim, integrating cuRobo with spherically abstracted 3D LiDAR point cloud for GPU-accelerated collision avoidance
- Designing safety override combining depth camera and visual discriminator to predict workspace collisions 3s in advance
- Preparing deployment of autonomous system on cobot hardware, benchmarking performance against target control loop frequency, trajectory generation latency, and collision avoidance accuracy KPIs

The University of Texas at Austin Aug 2025 – Present
Teaching Assistant, ECE 319K/H: Intro to Embedded Systems *Austin, TX*
- Evaluate lab competency across 3 lab sections covering GPIO, FSM design, interrupts, and SPI/ADC/UART drivers
- Hold 3 hrs/week office hours for 320 students to reinforce embedded systems concepts and debug lab implementations
- Collaborate with faculty weekly to diagnose knowledge gaps, write/proctor exams, and align instruction with curriculum

Longhorn Neurotech Aug 2024 – Jan 2025
EMG Director & VR HSI Subsystem Lead *Austin, TX*
- Engineered EMG signal acquisition pipeline utilizing hardware bandpass filtering, rectification, and enveloping to isolate muscle activity via voltage thresholding on Arduino Uno R4
- Established Direct Access Point on Uno R4 to facilitate low-latency UDP communication with robotic hardware, bypassing network router overhead for wireless control
- Integrated asynchronous FastAPI backend to stream EMG triggers to VR environment, leveraging non-blocking I/O to maintain estimated <30 ms latency and zero visible jitter

Projects

Autonomous Racecar & Real-Time Operating System · *RTOS, CAN, Sensor Fusion* Jan 2026 – May 2026
- Won 1st place against 12 teams, raced custom autonomous differential drive racecar featuring PD motor control, dual-board CAN communication, and Wi-Fi server data logging and start/stop status acquisition
- Navigated racecar using multi-rate sensor fusion of LiDAR, IR, and IMU as concurrent RTOS threads with <1us jitter
- Ran racecar on custom preemptive RTOS kernel with 8-level priority scheduling, PendSV context switching, blocking semaphores, SVC process loader, and FAT file system to enable low-latency multitasking and diagnostic data logging

EMG Winter Soldier Robotic Arm · *FreeRTOS, ESP-IDF, TensorFlow, Scikit-Learn* Dec 2025 – Present
- Engineered muscle sensor data collection pipeline, using DMA for nonblocking ADC sampling at 1kHz and asynchronous task for USB data transfer, then labeled signals via onset detection and stored datasets in HDF5 for training
- Trained LDA and MLP models on muscle sensor signal features through sklearn and TensorFlow, achieving 82% accuracy across 5 hand gestures and deployed models on ESP32 for fast, offline TinyML inference/robotic arm control
- Built 9 DOF robotic arm with custom 3D printed CAD shims to reduce servo stress, then modified bicep servo motor for continuous rotation by repurposing internal potentiometer for elbow angle feedback, enabling screw-driven actuation

The M0+rix: Segfaulted – Real-Time Game Engine · *Bare Metal, KiCAD* March 2025 – May 2025
- Designed custom PCB and enclosure, integrating peripherals for graphics, audio, communication, and user input
- Developed 20 FPS 3D graphics engine in C utilizing interrupts, SPI, and UART-based inter-board communication
- Built asset processing pipeline to convert image and audio data to fit under 128KB flash and 32KB RAM constraints