

SHIVASHANKER SWAMINATHAN

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EDUCATION

MS Computer Engineering

North Carolina State University, Raleigh, USA

May 2027

Coursework: Embedded Systems Architectures, Microprocessor Architecture, ASIC & FPGA design with Verilog

BTech Electrical and Electronics Engineering

Amrita Vishwa Vidyapeetham, Coimbatore, India

Dec 2023

CGPA: 7.67/10.00

TECHNICAL SKILLS

Embedded Platforms & Tools: STM32, ESP32, nRF52, Raspberry Pi, NXP; STM32CubeIDE, Keil uVision, MPLAB X, ST-Link

Embedded Systems: UART, I²C, SPI, BLE, LoRa, Wi-Fi, RS-232/485; Timers, ISR, DMA, ADC/DAC, PWM, RTOS

Software & Programming: C/C++, Embedded C, Python, Verilog; Linux, Git, MATLAB, Simulink, LabVIEW

Computer Architecture: Multilevel Cache, Pipelining, Branch Prediction, Instruction level parallelism, Superscalar Pipeline

PROFESSIONAL EXPERIENCE

Embedded Research Assistant - Biointerface Lab, NC State University, Raleigh, USA

Sep 2025 – Present

- Developing firmware for miniaturized potentiostat, enabling real-time physiological signal acquisition and processing; in a multidisciplinary research environment, under **Dr. Michael Daniele**
- Established toolchain for ultra-small sized nRF52 based custom controller to measure data through I²C from AFE
- Used BLE, RTOS, ADC

Embedded Engineer - RadioStudio, Chennai, India

Mar 2024 - Jun 2025

- Developed embedded solutions on **STM32, ESP32, and R-Pi**, integrating sensors across multiple **protocols**
- Enabled real-time IoT with **<1s** latency through optimized embedded firmware and system-level integration
- Designed a **60 GHz** radar sensor with mm level accuracy, extending measurement range from 7 m to 20 m
- Built a **GNSS** handheld device with offline mapping, reducing power consumption by **60%** and enhancing security

Embedded Engineer Intern - COS AI, Madurai, India

Oct 2021 - Dec 2021

- Built a weather monitoring system with **IoT** integration on R-Pi, using multiple **sensors** for real-time data collection
- Visualised the data over cloud and implemented local data contingency storage, improving system **reliability by 80%**

ACADEMIC PROJECTS

Resilient Real-Time Embedded Controller: Synchronization & Fault Recovery

- Enforced **mutex-based** thread safety and RTOS scheduling on NXP FRDM-KL25Z to eliminate race conditions
- Coordinated **shared buffer access** between interrupts and threads using a custom **FSM**, ensuring data integrity
- Engineered system resilience using **Watchdog Timers** and **runtime data validation** to correct critical memory faults
- Optimized **interrupt** priorities and PID control loops using **Analog Discovery 3** for low-latency signal acquisition

Dynamic Instruction Scheduler – C++

- Implemented out-of-order superscalar processor with **9-stage pipeline**, ROB-based renaming, and broadcast wakeup
- Analysed Instructions Per Cycle performance across configurations with varying ROB size, width, and queue depth

Multi-level Cache Simulator – C++

- Designed a flexible simulator for **multi-level cache** hierarchies with configurable size, associativity, and block size
- Integrated stream buffer **prefetching** to reduce miss penalties and evaluated memory hierarchy configurations
- Experimented using SPEC 2006/2017 traces, analysing miss rates, area, and energy trade-offs with CACTI modelling

Convolutional Neural Network Hardware Accelerator Pipeline – Verilog

- Designed RTL for **multi-stage processing** (convolution-ReLU-pooling) on 1024x1024 images using DRAM burst interface
- Optimized memory architecture with sliding-window buffering, reducing memory accesses and hardware complexity

Hybrid State of Charge Estimation (using Deep Learning and Kalman Filters)

- Developed a hybrid estimation model that improved accuracy by **~15–20%** compared to standalone methods
- Validated the model on Li-ion battery datasets, achieving **<1%** error, demonstrating robustness for electric vehicles

ACTIVITIES AND LEADERSHIP

Lead Research Member, Amrita Live-in-Labs (UNESCO-recognized program)

Jul 2021 - Jun 2022

- Selected as **1 of 60 students** (from ~600 applicants); led a **multi-disciplinary** research group in a rural village, interviewing 100+ residents and designing a humane bio-control system for pest deterrence

Captain, Sapthaguru Ultimate Frisbee Club

Jan 2022 - Jun 2023

- Led team in state and national tournaments, securing **1st place** (sectionals) and **3rd place** (nationals)