Hirthik Gopal Shanmugam

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Education

Purdue University West Lafayette, IN
Bachelor of Science in Computer Engineering
Relevant Coursework: Embedded Systems, Digital System Design, Data Structures

Research Experience

Digital Design Engineer June 2026 – Aug 2026
Purdue System-on-Chip Extension Technologies (SoCET) West Lafayette, IN

- Contributed to the tapeout of an image-processing ASIC on a 4-person team, integrating UART communication with an RGB image-processing pipeline
- Implemented a SystemVerilog UART transmitter and receiver operating at 115200 baud on a 66 MHz FPGA prototype
- Built a Python and PySerial automation pipeline to stream RGB pixels over UART and reconstruct processed output as PNG images for end-to-end testing
- Incorporated Purdue ECE faculty design-review feedback into the UART protocol before tapeout

Projects

CAN Vehicle Telemetry Monitor ESP32, FreeRTOS, C, Python

- Developed an MCP2515 CAN driver in C with SPI register access, mode control, and 500 kbps CAN TX/RX
- Built a dual-ESP32 hardware-in-the-loop test bench to validate CAN communication, firmware behavior, and injected fault response against ESP32 TWAI
- Implemented a FreeRTOS TWAI receive path using an ISR-safe queue and mutex-protected shared state for concurrent firmware tasks
- Built a 23-case pytest regression suite covering 3 injected telemetry faults, automating firmware diagnostics and timeout validation

Embedded Alarm System ESP32, C, GPIO, Interrupts

- Developed interrupt-driven ESP32 firmware for an alarm system using GPIO ISRs and a finite-state machine for armed, disarmed, and alarm-triggered behavior
- Implemented an 8-bit passcode interface using GPIO, bitwise operations, and software debouncing for reliable button input
- Prototyped and debugged breadboard hardware with pushbuttons, LEDs, and pull-up resistors during firmware bring-up

SimBoard: VATSIM Flight Tracker Python, Flask, Pandas, JavaScript

- Created a Flask-based departures and arrivals website for VATSIM, a flight simulation multiplayer network, reaching ∼350 users in 2025
- Polled aircraft and airport data every 10 seconds, processing telemetry for ∼2,000 live aircraft per update
- Combined live aircraft and airport datasets with Pandas and implemented Haversine distance, ETA, and flight-status calculations

Skills

Languages: C, C++, Python, SystemVerilog, JavaScript, MATLAB
Embedded Systems: FreeRTOS, ESP32, GPIO, CAN, UART, SPI, I2C, HIL Testing
Software and Tools: Git, Linux, ESP-IDF, pytest, PySerial, Flask, Pandas