

Muhammad Saad

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EDUCATION

University of Waterloo

B.A.Sc in Honours Electrical Engineering

Sep 2025 – Apr 2030

TECHNICAL SKILLS

Languages: C, C++, Python, MATLAB, Verilog

Embedded & RTOS: STM32F4 (bare-metal C / CMSIS), ESP32, ARM Cortex-M4 microcontrollers, FreeRTOS (real-time), embedded Linux (Raspberry Pi 5), device drivers

Protocols & Peripherals: UART, I2C, SPI, CAN, ADC, GPIO, DMA, EXTI/NVIC, USB-UART

PCB & Hardware: KiCad (4-layer schematic capture, layout, JLCPCB PCBA), DFM, AutoCAD Electrical, oscilloscope, JTAG/SWD

Tools: VS Code, STM32CubeIDE, Vivado, Git, ST-Link, OpenCV, SciPy

PROJECTS

Custom STM32 Sensor PCB 🛠️ | KiCad (4-Layer PCB), STM32F411, Bare-Metal C / CMSIS, FreeRTOS, Python

- Designed a custom 4-layer PCB in KiCad around an STM32F411RET6 (LQFP-64): a USB-C powered system with an AMS1117 3.3V LDO power tree, USBLC6 ESD protection on the USB data lines, a CP2102N USB-to-UART bridge, and an 8 MHz crystal driving a 100 MHz PLL, with per-pin decoupling across dedicated power and ground planes.
- Prepared the board for JLCPCB PCBA, generating Gerber, BOM, and CPL outputs and specifying mixed SMT and wave-soldered through-hole assembly; resolved a via-in-pad solder-wicking DFM flag by specifying epoxy-filled, copper-capped vias (POFV) across all 94 vias.
- Wrote bare-metal register-level device drivers for a BME280 sensor and an SSD1306 OLED on a shared 400 kHz I2C bus (3.3 k Ω pull-ups), arbitrating sensor and display access with a priority-inheriting FreeRTOS mutex and cycling OLED pages via a debounced PA0/EXTI interrupt button.
- Developed no-HAL firmware in C via direct CMSIS register access (RCC clock tree at 100 MHz PLL, GPIO, EXTI, USART) with a CRC-checked binary sensor-data protocol at 921600 baud, structured as a multi-task FreeRTOS application with queue-linked producer/consumer tasks and a Python visualizer for live plotting and CSV logging.

Multi-Modal Patient Distress Detection System 🛠️ | Raspberry Pi 5, Embedded Linux, SciPy FFT, DeepFace

- Architected an audio-triggered patient monitoring system on Raspberry Pi 5 (5-person team), combining FFT spectral analysis of voice bands (85–2000 Hz) with DeepFace facial-emotion classification via a multi-frame voting state machine.
- Drove hardware integration of USB microphone, webcam, and speaker subsystems and conducted end-to-end validation, achieving ~1 second trigger-to-alert latency and 90% detection accuracy across testing scenarios with multi-frame voting reducing false positives.
- Implemented defensive USB device handling with priority-based microphone fallback and camera retry logic with buffer flush sequences, keeping the system reliable across hardware configuration changes during demo testing.

EXPERIENCE

Embedded Systems Developer | Embedded C, STM32 (HAL), FreeRTOS, CAN

Waterloo, ON

UW Baja SAE

Sep 2025 – Present

- Developed powertrain and suspension firmware in Embedded C on an STM32, using hardware timer input-capture to convert wheel and CVT square-wave pulses into live RPM and configuring multi-channel ADC sampling of analog suspension-travel sensors.
- Contributed to bring-up of the team's STM32 data-acquisition board, porting bare-metal driver patterns from my own board into the team's HAL-based codebase and developing SPI/I2C drivers for a 6-axis IMU and engine-temperature sensors.
- Integrated the sensor firmware into a FreeRTOS task structure for synchronized 100 Hz data logging and transmission over the vehicle CAN bus.

Electrical Engineering Intern | AutoCAD Electrical, Instrumentation I/O

Calgary, AB

WSP Canada Inc

Jan 2026 – May 2026

- Mapped instrumentation signal flow from field sensors (pressure / temperature / flow transmitters) to PLC I/O across control-panel schematics, cross-referencing instrument tags, signal types, and DI/DO/AI/AO assignments in AutoCAD Electrical.
- Completed 350+ as-built revisions across multiple markup cycles for Shell Montney Electrification, applying field redlines in AutoCAD Electrical and tracking statuses in a 380-row control spreadsheet.