Ahmed Mohamed Amin

PhD Applicant – Signal Processing, Embedded Systems, SDR & AI/ML/DL

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Multidisciplinary researcher bridging electronics, embedded systems, signal processing, and AI/ML/DL. Experienced in PCB and RF hardware design, bare-metal ARM development, and SDR-based radar and communication systems. Focused on sensor fusion, lightweight deep-learning deployment on Edge hardware, and adaptive hardware–software architectures for smart systems.

PROFESSIONAL EXPERIENCE

SOUTHERN UTAH UNIVERSITY **Cedar City, UT**

AI/ML Research Assistant **May 2025 – Current**

- Leading development of a decentralized visual-localization framework for TurboPi swarm robots, enabling GPS-free relative positioning through multi-robot feature sharing and geometric triangulation.
- Designing adaptive feature-selection and lightweight CNN/ViT pipelines to optimize visual perception and inter-robot communication under compute and bandwidth constraints.
- Integrating modified ORB-SLAM2 with embedded inference on Edge hardware, achieving real-time multi-robot mapping and coordination without centralized control.
- Redesigned legacy control boards and fabricated a new 4-layer PCB (SmartBot Core V1.1) with enhanced power management, EMI performance, and signal integrity for autonomous platforms.
- Integrated modular power and communication subsystems with diagnostic feedback to enhance system scalability, maintainability, and field robustness.

Teaching Assistant (**Multiple Classes**) **Aug 2024 – Current**

- Updated the *Applications of Microprocessors (EE-3780)* curriculum to emphasize reproducible experimentation, measurable learning outcomes, and system-level understanding of ARM-based microcontrollers.
- Delivered weekly lab and discussion lectures on ARMv7-M assembly programming, instruction cycles, and Cortex-M architecture, integrating theory with hands-on experiments using CPUlator, Keil µVision, and STM32 Nucleo boards.
- Developed eight bare-metal laboratories with STM32 drivers written entirely in ARM assembly (no HAL drivers), including RCC, GPIO, SysTick, EXTI/NVIC, TIM-PWM, UART, SPI, and ADC. Each laboratory featured modular APIs, startup and linker integration, and hardware-verified timing validation to ensure reproducible embedded-systems instruction.
- Modernized *Communication Circuits (EET-3720)* laboratory projects, including LM386 audio amplifiers, LC/RC/ceramic band-pass and switched-capacitor filters, and full-wave rectifiers. Implemented calibrated Bode-plot and FFT characterization workflows in Analog Discovery Studio and LabVIEW, and standardized –3 dB bandwidth, Q-factor, and phase-margin analysis for repeatable cross-section measurements.
- Graded and provided conceptual assistance for *Programming for Engineers (ENGR 2170)* and *Robotics and Automation (EET 1600),* supporting students in algorithm design, embedded control logic, and system integration.

Electronics Laboratory Assistant **Aug 2024 – May 2025**

- Established a comprehensive PCB prototyping lab using the Voltera Nova printer and PCB laser-cutting system to support rapid PCB prototyping and research.
- Developed an end-to-end PCB fabrication workflow covering schematic design, UV exposure, chemical etching, laser cutting, solder-paste application, thermal/UV curing, and final assembly.

- Enabled fabrication of rigid and flexible PCBs, including RF and wearable antennas printed on polyimide (PI) and PET substrates.
- Calibrated and maintained oscilloscopes, multimeters, and programmable power supplies, ensuring accurate measurement and reliable laboratory operation.

GAF **Cedar City, UT**

Research Assistant – **Industry Challenge Lab** **Mar 2025 – May 2025**

Collaborated with GAF engineers through SUU's Industry Challenge Lab to develop a smart, small-scale Waste-to-Energy (WTE) system that repurposes Polyiso insulation waste. Focused on the electrical control, energy conversion, and sensing aspects of the modular prototype.

- Modeled thermal energy conversion and system response using Cantera and OpenFOAM, integrating results into control-oriented system analysis.
- Designed embedded control architecture for combustion and emission monitoring using ESP32 microcontrollers with feedback from temperature and gas sensors.
- Supported signal acquisition and calibration for combustion diagnostics (CO, NOx, and temperature profiles).
- Evaluated power and energy efficiency of the system (target 5–6 kWh/kg) and contributed to documentation for control-loop optimization and scalability.

SOUTHERN UTAH UNIVERSITY – Tutoring Center **Cedar City, UT**

Student Tutor **Aug 2024 – Mar 2025**

Provided one-to-one and drop-in tutoring sessions across Computer Science, Cybersecurity, Electrical Engineering, and Mathematics courses, emphasizing conceptual understanding and analytical reasoning.

- **Computer Science & Cybersecurity:** CS 1410 (*Object Oriented Programming*), CSCY 1000 (*Introduction to Computer Applications and the Internet*), CSCY 1350 (*Security Scripting with Python*), and CYBR 2500 (*Data Communications and Networking*).
- **Mathematics:** Tutored MATH 1010 (*Intermediate Algebra*), MATH 1031 (*Statistical Reasoning*), MATH 1040 (*Statistical Inference*), MATH 1050 (*College Algebra*), MATH 1210 (*Calculus I*), MATH 1220 (*Calculus II*), and MATH 2210 (*Calculus III*).
- **Electrical Engineering:** Assisted with ENGR 2170 (*Programming for Engineers*), EE 2250 (*Electric Circuits I*), EE 3100 (*Introduction to Signal Processing*), EET 1700 (*Circuit Analysis I*), and EET 1730 (*Electronic Devices I*).

VIVINT **Dallas, TX**

Embedded Systems Intern **Apr 2024 – Aug 2024**

- Gained hands-on experience in embedded IoT systems design and debugging, working with custom PCBs, microcontrollers, and signal-integrity optimization techniques.
- Learned to implement and test low-level firmware drivers for analog and mixed-signal components, applying industry-standard protocols such as I^2C, UART, and SPI.

EDUCATION

SOUTHERN UTAH UNIVERSITY **Cedar City, UT**

Bachelor of Science, Major in Electrical Engineering; Minor in Mathematics **2023-2025**

(SUU GPA: 3.80, Cumulative GPA: 3.33)

HIGHER TECHNOLOGICAL INSTITUTE **10th of Ramadan, Egypt**

Uncompleted Degree, Electrical Eng. Electronics and Communications Diploma **2017-2022**

(HTI GPA & Cumulative GPA: 2.33)

PROJECTS & RESEARCH

Capstone Project: Low-Cost Dual-Band Radar System for Drone Detection and Tracking

- Designed, implemented, and experimentally validated a bistatic 5.8 GHz SDR-based FMCW radar and a 24 GHz Doppler radar within a $1,000 budget, demonstrating the feasibility of 3D localization through dual-receiver TDoA/AoA processing.
- Conducted controlled measurements on a 24 GHz K-LC7 front-end, mitigating LO leakage and DAC artifacts (DC-block and Sallen–Key filter), and empirically showed that it is reliable for Doppler motion sensing but SNR-limited for FMCW ranging on small-RCS drones. These results motivated subsequent non-coherent fusion research.

Research Achievements

Journal Publications

- Ahmed M. Amin, Gandhiraj R., and Rajagopalan Thiruvengadathan, "Coherent Estimator and Non-Coherent Signal-Level Fusion in Dual-Band FMCW Radar under Single-Sweep IF Constraints: A Statistical Evaluation across SNR and Range Regimes," *manuscript under mentor review, to be submitted.*

Conferences Presentations

- **Utah Conference on Undergraduate Research** (**UCUR**)**, 2025**: Presented *"Radar System for Drone Detection",* introducing the system concept, research motivation, and design architecture integrating 5.8 GHz SDR-based FMCW radar and 24 GHz radar modules.
- **Utah Academy of Sciences, Arts & Letters** (**UASAL**)**, 2025**: Presented *"Low-Cost Dual-Band Radar System for Drone Detection and Tracking"*, demonstrating experimental validation of bistatic 5.8 GHz FMCW radar using log-periodic antennas and showing the feasibility of TDoA/AoA-based localization.
- **Festival of Excellence** (**FOE**)**, 2025:** Presented final capstone poster *"Low-Cost Dual-Band Radar System for Drone Detection and Tracking"*, summarizing the integrated dual-band architecture and outlining AI-driven prioritization and non-coherent fusion as the next research phase.

Workshops Attended

Responsible & Ethical Conduct of Research (**RECR**) **Workshop** (**Mar 2025**)**:** Participated in NSF-funded training on responsible research practices and ethical data management during UCUR 2025.

Honors & Awards

- CONNECT Grant — Undergraduate Research Funding Award ($1,000). Link
- Dean's List — Recognition of Academic Excellence (4 semesters). Link