LEWIS FORREST BATES

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PROFESSIONAL SUMMARY

Results-driven Electrical and Computer Engineering graduate (B.S., Tennessee Tech, May 2026) with hands-on expertise in embedded systems, hardware security, and real-time Hardware-in-the-Loop (HIL) simulation. Team Lead for MITRE eCTF 2026 and founder of HCIG (Hardware Cyber Interest Group). Extensive experience integrating RTAC-like control logic and ML models on industrial Raspberry Pi for microgrid applications using Typhoon HIL. Recognized with Highest Technical Rigor Award for capstone power subsystem work. Strong communicator and mentor with proven ability to lead cross-functional teams, coordinate multi-stakeholder training, and present complex technical concepts to industry advisors. Seeking entry-level Embedded Systems / Hardware Security Engineer roles.

EDUCATION

Tennessee Technological University — Cookeville, TN

B.S. Electrical and Computer Engineering | Combined GPA: 3.06 | May 2026

Relevant Coursework: Embedded Systems, Digital Design (VHDL/FPGA), Power Systems, Computer Architecture, DSP, Cybersecurity, Real-time Control

PROFESSIONAL EXPERIENCE

Joint R&D; Staff Engineer (CESR & CEROC) | TN Tech

June 2026 – Present

- Lead integration of CESR RTAC-like functionality and ML-enabled control on industrial Raspberry Pi, demonstrating strong technical leadership and systems thinking: implemented on-device structured text for deterministic sequencing, Modbus gateways, time synchronization, alarms/events, local historian, and secure remote engineering access.
- Implement and validate neural network models for islanding detection and energy forecasting; test in standalone and RTAC-coupled Typhoon HIL environments and scale to multi-microgrid systems. Findings disseminated via technical reports and publications, showcasing critical thinking and attention to rigorous validation.
- Develop hands-on instructional materials for hardware security and OT security using CEROC testbeds. Mentored hardware security interest groups, student clubs, and eCTF teams while coordinating training and outreach to students, educators, and industry partners. Applied strong organizational, communication, and mentoring skills to build sustainable talent pipelines.

Undergraduate Assistant Engineer (Part-Time) | CESR, TN Tech

Oct 2024 – May 2026

- Supported MS/PhD teams on power/microgrid solutions; coordinated with Typhoon engineers on HIL simulation enhancements and lab IT maintenance. Engineered 4G Raspberry Pi data interfaces while demonstrating teamwork, adaptability, and clear technical communication across research groups.

Student Worker (GenCyber Hack-a-Thon) | CEROC, TN Tech

Summer 2024

- Collaborated on an 8-week student team to design interactive educational puzzles teaching K-8 students cybersecurity concepts, applying creativity, teamwork, and age-appropriate communication skills.

SENIOR CAPSTONE DESIGN

Automated Chessboard ("Chess 2 Impress") | TN Tech ECE

Fall 2025 – Spring 2026

- Developed a low-cost (<$660), voice-controlled automated chessboard with CoreXY gantry, under-board electromagnet, Stockfish AI, and LCD feedback for accessibility (mobility/visual impairment). Achieved 97% first-try voice accuracy (exceeded 80% spec), 3 μs electromagnet switching (3,300× faster than spec), >2 hours battery runtime, and 100% legal move validation.
- Power Subsystem Lead: Designed and validated complete power architecture using DFRobot UPS HAT + 4×18650 cells, including MT3608 boost converters, fuse protection, and seamless wall-to-battery switchover. Conducted and documented experiments on UPS switchover, sleep-mode current draw, battery runtime, voltage regulation, and safety compliance. Demonstrated strong analytical and organizational skills in data-driven decision making.
- Led data analysis and reporting for all power-related experiments (Experiments 11, 13, 16, 17). Presented subsystem design, methodology, and results to the ECE Industrial Advisory Board, earning the Highest Technical Rigor Award through clear communication of complex engineering trade-offs and rigorous validation processes.
- Ensured reliable power delivery for CoreXY motion, electromagnet actuation, and embedded control systems, enabling full project functionality during voice-activated gameplay, AI integration, and public demonstrations.

ACADEMIC PROJECTS

FPGA-Based Pong Game Implementation | ECE 3140 Digital System Design

Spring 2024

- Collaborated with a lab partner to design and implement a real-time Pong game in VHDL on the Terasic DE10-Lite FPGA board.
- Developed modular VHDL entities for ball/paddle physics, collision detection, score tracking (up to 11), and game-over logic with center-lock behavior.
- Integrated peripherals including rotary encoder for paddle control, ADXL345 accelerometer (in enhanced variants), 7-segment displays for scores/volleys/miscounts, and buzzer feedback.
- Implemented progressive enhancements across variants: English spin based on hit location, dynamic ball speed/size/color during long volleys, score-threshold background and border color changes, dual-paddle support, and player labeling.

Embedded Systems Labs | ECE 4140 Embedded Systems

Fall 2024

- Implemented sensor, timing, and peripheral interfaces primarily in embedded C on the Raspberry Pi Pico (RP2040).
- Built I2C drivers for DS3231 RTC (watchdog-triggered time readout over UART with heartbeat and status LEDs) and MCP4725 DAC.
- Developed ADC-based monitoring for LM45 temperature sensor (polling and interrupt-driven FIFO variants with configurable threshold buzzer), onboard potentiometer, and VEMT2520 light sensor, streaming results over UART.
- Configured watchdog timers, UART, and GPIO for system health monitoring and reliable operation.

LEADERSHIP & HARDWARE SECURITY COMPETITIONS

MITRE Embedded Capture The Flag (eCTF) — Hardware Engineer / Team Lead

2024 – 2026

- 2026 Season (Team Lead): Led an international competition team to 19th place out of 114 teams. Founded HCIG (Hardware Cyber Interest Group) by collaborating across academic departments with faculty and staff. Utilized leadership, cross-functional coordination, and organizational skills to establish a sustainable hardware security talent pipeline supporting team development, training, and recruitment.
- 2025 Season: 33rd place (113 teams); implemented satellite TV stream encoding/decoding with access-control security on embedded platforms, demonstrating creative problem-solving and attention to secure design principles.
- 2024 Season: 13th place (76 teams); performed security bug fixes for medical-device microcontroller and analyzed I²C vulnerabilities and offensive/defensive hardware techniques on Analog Devices MAX7800FTHR, applying critical thinking and methodical debugging skills.

TECHNICAL SKILLS

Languages & Embedded: C/C++, Python, VHDL (synthesizable RTL, entity/architecture, concurrent/sequential statements), ARM Assembly, Structured Text (IEC 61131-3), Real-time Deterministic Control

Hardware & Platforms: Raspberry Pi (industrial), Typhoon HIL + RTAC + PYTAC, Modbus, DE10-Lite FPGA, STM32, MAX7800FTHR, ChipWhisperer, Raspberry Pi Pico/RP2040

Tools & Domains: Quartus Prime, ModelSim, Git/GitHub/LFS, Docker, Power Systems & Microgrids, Hardware Security (eCTF), DSP, Real-time HIL Simulation, Neural Net Edge Deployment

VOLUNTEER EXPERIENCE

Sycamore Church of Christ, Cookeville, TN — Audio/Visual & Livestream Assistant, Volunteer

Aug 2022 – Present

- Rotated A/V/livestream duties via iPads/OBS; tuned speakers/inputs; managed projectors and PowerPoints for services and recordings. Demonstrated reliability, attention to detail, and service-oriented communication in a team environment supporting weekly worship services.

LICENSES & CREDENTIALS

- Amateur Radio License, Technician Class (KQ4SNV) — Operate and maintain radio equipment; apply EE principles to real-world communication and problem-solving.
- **ABI Electronics 5-Day Certification – RevEng & BoardMaster:** Hands-on training in PCB reverse engineering (RevEng netlist generation and schematic reconstruction) and component/board-level diagnostics (BoardMaster Power-OFF signature analysis and Power-ON in-circuit testing). Covers TestFlow creation, V/I analysis, short location, and repair workflows for unsupported electronics.