Ahmed Hassan Abdelhalim

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Education

Cairo University Cairo, Egypt

Bachelor of Engineering, Electronics and Electrical Communication Engineering Department *Oct. 2023 – Present*

- Junior Engineer.
- CGPA: 3.79.
- Expected Graduation: January 2028.

Experience

Undergraduate Researcher Jul. 2024 – Dec. 2024

Undergraduate Researchers Initiative (URI Program) *Remote*

- Conducted scientific research training with focus on problem-solving methodologies.
- Developed academic writing skills through research documentation.
- Contributed to initial phases of engineering research projects.

ALX AICE Cohort 7 Graduate Sep. 2024 – Nov. 2024

ALX Africa *Remote*

- Conducted many useful AI Models and generated Content using AI Tools.
- Learned how to build strong workplace relationships and manage my well-being.
- Developed my Leadership Skills such as strategic thinking, decision-making and inspiring others.

Projects

Programmable LDO Regulator & OTA | *Analog IC Design (Cadence Virtuoso, 65nm CMOS)* Dec. 2025

- Designed a programmable LDO voltage regulator (0.75V–1.05V) with 50mV step resolution using g_m/I_D sizing methodology.
- Engineered a 5-transistor OTA achieving **35.8 dB DC gain**, **6.2 MHz GBW**, and **58 dB PSRR**, ensuring high noise rejection.
- Optimized for low power (34μA quiescent current) and validated stability across PVT corners (-40°C to 125°C) with $< 0.31\%$ error.
- **Skills**: Cadence Virtuoso, ADE L/XL, Analog Circuit Design, CMOS Technology, LDO, OTA.

High-Speed CMOS Frequency Divider | *VLSI Circuit Design (Cadence Virtuoso, 65nm)* Dec. 2025

- Designed a Divide-by-2 frequency divider using **TSPC (True Single-Phase Clock)** logic in 65nm CMOS.
- Achieved a maximum operating frequency of **2.5 GHz** with a power consumption of 45μW (optimized PDP).
- Performed transistor sizing and corner simulation to ensure robust operation across Process-Voltage-Temperature (PVT).
- **Skills**: Cadence Virtuoso, Analog/Mixed-Signal Simulation, Transistor Sizing, CMOS Technology.

Automotive FMCW Radar Simulation | *Signal Processing & Radar Systems (MATLAB)* Dec. 2025

- Developed a full signal processing chain for a 76.5 GHz automotive radar with 1 GHz bandwidth, achieving **15cm range resolution**.
- Implemented 2D-FFT architecture to generate Range-Doppler maps, successfully detecting moving targets in low-SNR (5dB) environments.
- Designed adaptive CFAR peak detection and non-maximum suppression algorithms, achieving $<$ 3cm range estimation error.
- **Skills**: MATLAB, Digital Signal Processing (DSP), FFT, Radar Systems, Target Detection.

16-Bit Arithmetic Logic Unit (ALU) | *Digital Logic Design (Verilog HDL)* Nov. 2025

- Designed a fully combinational 16-bit ALU executing **20 distinct operations** including arithmetic, bitwise logic, and barrel shifting/rotation.

- Implemented a real-time 6-bit Status Register to calculate flags for Carry, Zero, Negative, Signed Overflow, Parity, and Auxiliary Carry.
- Validated design integrity through comprehensive testbenches covering corner cases like signed overflow and carry propagation.
- **Skills**: Verilog HDL, ModelSim, Digital Logic, RTL Design, Computer Architecture, FPGA.

RISC-V Single-Cycle Processor | *32-bit Harvard Architecture Implementation in Verilog HDL* Jun. 2025

- Designed complete 7-stage datapath (fetch to writeback) executing RV32I instruction set.
- Developed core components: ALU (7 operations), 32-register file, and dynamic control unit.
- Prototyped on Cyclone® IV FPGA with successful Fibonacci sequence verification.
- Achieved 1.8x speed improvement over baseline design through pipeline optimization Skills: Digital Electronics, Verilog, Computer Architecture, FPGA Prototyping, RISC-V ISA, SystemVerilog, Quartus Prime.

Physics-Informed Neural Networks for Vehicle Control | *Python, Matlab, Kaggle* Apr. 2025 – May. 2025

- Participated in the 13th Undergraduate Mathematics Research Forum with a project titled "Physics-Informed Neural Networks: A Quantum Leap in Robust Control."
- Investigated the use of PINNs to enhance the performance of Model Predictive Control (MPC) in autonomous vehicle systems.
- Demonstrated improved control stability and reduced tracking error using hybrid PINN-MPC architecture.
- Achieved 4th place overall in the EECE28 research cohort, Developed a deep understanding of neural networks, control theory, and system modeling.

Heart Disease Prediction ML Project | *Sprints x Microsoft Summer Camp – AI & Machine Learning* Jul – Aug. 2025

- Built an end-to-end ML pipeline to predict heart disease using the UCI dataset.
- Performed data preprocessing, exploratory data analysis, PCA, and feature selection.
- Trained and evaluated multiple models (Logistic Regression, Decision Tree, Random Forest, SVM) achieving highest accuracy with Random Forest.
- Deployed a Streamlit web app with Ngrok for public access.
- Tech Stack: Python, Pandas, NumPy, Scikit-learn, Matplotlib, Seaborn, Streamlit, Joblib, Ngrok.

Autonomous Eco-Racing Car | *STM32 Microcontroller-Based System, C* Mar. 2025

- Designed an STM32-based autonomous vehicle for eco-racing competitions.
- Integrated ultrasonic, IR, and LiDAR sensors for obstacle detection and path planning.
- Implemented motor control algorithms and communication protocols (UART, I2C, SPI).
- Tuned system for minimal energy consumption and optimized autonomous performance. Strengthened skills in embedded systems, microcontrollers, and sustainable design.

H-Bridge Motor Driver Circuit | *Proteus* Feb. 2025 – May. 2025

- Designed and implemented an H-Bridge circuit to control the direction and speed of a DC motor.
- Used transistors and diodes to enable forward and reverse motion through pulse-width modulation (PWM).
- Simulated the circuit using Proteus and tested on a breadboard before physical implementation.
- Gained hands-on experience in power electronics, motor control, and safety precautions in hardware design.

Digital Multimeter Design | *Arduino, Altium* Sep. 2024 – Dec. 2024

- Designed multilayer PCB in Altium Designer with optimized trace routing for noise-sensitive analog signals ($\leq$10mV ripple).
- Built multimeter measuring voltage (0-20V), current (0-200mA), and resistance (10Ω–1MΩ) with high accuracy.
- Designed signal conditioning circuits using op-amps (LM358) for precision measurements.
- Calibrated ADC (ADS1115) and implemented auto-ranging functionality.

Compare Stellar Spectra | *MATLAB* Jul. 2024

- Used MATLAB to compare stellar spectral data and analyze differences in star temperatures and compositions.
- Applied matrix manipulation and data visualization techniques.
- Gained experience in scientific computing and astrophysics.

Stellar Motion Analysis | *MATLAB* Jul. 2024

- Analyzed star movement using observational data.
- Calculated velocity/displacement and visualized results in MATLAB.
- Enhanced data analysis and astrophysics modeling skills.

Skills

Programming Languages: C, C++, Python, Java, Arduino C, MATLAB
Microcontrollers and Embedded Systems: STM32, Arduino
Hardware Design: PCB Design, Circuit Debugging, Sensors & Actuators Integration
Hands-on skills: Circuit analysis, Motherboard troubleshooting, Soldering techniques
Tools: Visual Studio, Matlab, Notion, Proteus, Altium, ModelSim, Vivado
Soft Skills: Strong Problem Solving & Critical Thinking, Scientific Writing & Research Methodology, Time Management & Task Prioritization

Languages

Arabic: Native
English: Proficient
French: Intermediate

Activities

Scientific Research trainee Jul. 2024
URI/URS *Cairo, Egypt*

- Participated in academic research training on methodology and problem-solving.
- Collaborated with peers on research topics, literature review, and data analysis.
- Strengthened scientific writing and research presentation capabilities.

Digital Electronics Design Workshop Feb. 2025
IEEE CUSB - Cairo University *Cairo, Egypt*

- Participated in an intensive workshop covering the fundamentals of digital logic design.
- Gained hands-on experience with combinational and sequential circuits using simulation tools.
- Worked on small-scale projects involving logic gates, multiplexers, counters, and flip-flops.
- Strengthened understanding of digital systems and Verilog basics.

Competitions & Awards

13th Undergraduate Mathematics Research Forum Feb. 2025 – May 2025
Cairo University

4th Place – Awarded top honors for research on robust vehicle control systems using Physics-Informed Neural Networks (PINNs). Developed a hybrid control framework integrating PINNs with Model Predictive Control (MPC) to optimize tracking performance and enhance stability in autonomous driving applications.

Best PR Member Award May. 2025
IEEE CUSB - Cairo University

Recognized as the top-performing member in the Public Relations team for outstanding commitment, creativity, and impact.