Obed K. Allotey Babington

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Summary

Dedicated to advancing AI for edge systems, with a focus on leveraging reconfigurable computing to accelerate machine learning inference. Actively seeking PhD opportunities for Fall 2026 and beyond to contribute to cutting-edge research in these areas.

Education

B.Sc. (Hons) Computer Engineering, Ashesi University 2021 – 2025
Cumulative GPA: 3.84/4.0

Relevant Courses: Embedded Systems, Digital System Design, Internet of Things (IoT), Deep Learning, Circuits and Electronics, Data Structures and Algorithms, Object-Oriented Programming.

Honors & Awards

IEEE Memberships: Student Member, Young Professionals, Computer Society 2024 – Present
Magna Cum Laude, Ashesi University Jun 2025
Technical Excellence Award in Computer Engineering, Ashesi University May 2025
Dean's List (All semesters), Ashesi University Sep 2021 – Jun 2025
Selected for Study Abroad, University of Toronto Exchange Program May 2024
1st Place, Ashesi D:Lab Hackathon Nov 2022
TEDx Speaker, TEDxAshesiUniversity Apr 2022

Work Experience

Research Assistant Smart Technologies Lab, Ashesi University
Aug 2025 – Present

- Conducting research on **embedded machine learning (TinyML)** solutions for deploying AI models on resource-constrained microcontrollers and SoC for local applications.
- Designing and implementing **hardware acceleration strategies** for neural network inference using **FPGAs (Xilinx Artix-7, ZYNQ-7000)** with custom accelerators and **co-design methodologies** involving softcore processors (**MicroBlaze**).
- Benchmarking performance across microcontrollers and FPGA-based accelerators, analyzing **latency and energy efficiency trade-offs**.

Research Consultant (Intern) Schneider Electric Sustainability Business
May 2025 – Jul 2025 Wooster, Ohio

- Through the AMRE Program at the College of Wooster, collaborated with a research team to design and prototype an **Energy Management Co-Pilot** using large language models (LLMs) and autonomous agent architectures.
- Developed an **evaluation pipeline** leveraging LlamaIndex's `CorrectnessEvaluator` to assess agent responses against ground-truth datasets across multiple query categories.
- Delivered a **35-minute final presentation** to Schneider Electric's Sustainability Business team and co-authored a **66-page technical report** documenting research findings, methodologies, and recommendations.

Undergraduate Research Assistant Smart Technologies Lab, Ashesi University
May 2024 – Sep 2024

- Investigated hardware acceleration of **neural network inference** using a Xilinx Basys 3 Artix-7 FPGA in parallel communication with microcontroller units (MCUs).
- Interfaced the FPGA with both an 8-bit Arduino Uno and a 32-bit Freedom KL25Z MCU, analyzing the effect of MCU **bit-width architecture** on inference latency.
- Demonstrated up to **86% performance improvement** in inference execution time across both MCU platforms through FPGA-based acceleration.

Telematics Engineer (Intern) Swoove360, Accra, Ghana
Jun 2023 – Dec 2023

- Contributed to the launch of **Fleet360**, a fleet management platform designed to optimize vehicle operations in Ghana.
- Configured and synchronized telematics devices with company servers and APIs, ensuring reliable **real-time data streaming**.
- Maintained and managed a ledger of SIM cards for device connectivity, supporting data integration with Swoove360's API endpoints.
- Authored and updated comprehensive telematics documentation, enhancing troubleshooting workflows and system optimization across engineering operations.

Selected Projects

Hardware-Accelerated Embedded ML on a Softcore Processor Sep 2024 – May 2025
Designed and deployed a hardware–software co-designed embedded ML system by integrating a **MicroBlaze softcore processor** with a custom neural network accelerator on an FPGA. Achieved a **420× inference speedup** over the softcore baseline, eliminating off-chip latency and enabling real-time inference for edge AI and IoT applications.

On-Chip vs. Off-Chip FPGA Acceleration for Embedded ML Sep 2024 – May 2025
Conducted a comparative study evaluating communication latency in hardware-accelerated embedded ML systems by benchmarking **4 distinct hardware configurations** across softcore and silicon microcontrollers in on- and off-chip acceleration scenarios. Demonstrated a **9369% improvement** in the on-chip accelerated configuration, validating and quantifying communication overhead impact on inference latency.

Real-Time Morse Code Decoder as Embedded Neural Network Sep 2024 – Dec 2024
Developed a **multilayer perceptron (MLP) decoder** for Morse code sequences, trained on STM32-collected button-press timing data with preprocessing and early stopping. Deployed inference on both STM32 (**bare-metal C**) and MicroBlaze/FPGA (**C/C++ in Vitis**). Achieved **85.58% accuracy** on evaluation data, and the project served as a benchmarking workload for subsequent embedded ML acceleration research.

Automation of a Robotic Vehicle Nov – Dec 2024
Designed a remotely operated vehicle in register-level, bare-metal C using **dual microcontrollers** (M0 and M7) with **UART-based communication**. Integrated advanced embedded systems capabilities on the **STM32 M7**, including **RTOS-based task scheduling**, variable speed control, keypad-driven motion, and built-in self-test features.

Automatic Speech Recognition System for Asante Twi Language Nov – Dec 2024
Developed an **Encoder–Decoder LSTM model** for automatic speech recognition of Asante Twi. Despite limited linguistic resources, achieved an average **Word Error Rate (WER) of 20%** on test data, demonstrating the feasibility of deep learning for low-resource African languages.

Tennis Scoreboard Digital System Design Jun – Jul 2024
Engineered a digital tennis scoring system on a Xilinx Basys 3 Artix-7 FPGA using dual **VHDL architectures** (structural with JK flip-flops and behavioral with FSM). Verified functionality through testbenches and validated outputs on 7-segment displays.

32-bit Single-Cycle MIPS Processor Components in VHDL Mar – Apr 2024
Designed and simulated components of a 32-bit single-cycle **MIPS processor**, implementing arithmetic, logical, control-flow, and memory instructions. Verified correctness with comprehensive **ModelSim testbenches**.

Low-Cost Optical Heartbeat Monitoring System Mar – Apr 2024
Constructed an optical heartbeat monitoring device using an **infrared LED and phototransistor**. Designed a multi-stage **active filter and amplifier chain** for signal conditioning, validated outputs via oscilloscopes, and converted frequency measurements to beats per minute for real-time monitoring.

Estimating the Impact of Soiling on Solar Panels Jan – May 2023
Collaborated on developing **IoT-based embedded models** to quantify the soiling effect on solar panels. Engaged with industry partners to evaluate products and align system specifications with project requirements.

Research Leadership & Engagement

President, Ashesi Research Club Ashesi University
June 2023 – June 2024

- Served as the first active president of the Ashesi Research Club, expanding students' understanding of the research landscape and fostering a culture of scholarship and innovation.
- Co-organized the **first-ever campus-wide research festival**, themed *"Exploring New Horizons"*, under the auspices of the Provost's Office, to celebrate student research and inspire future inquiry.
- Directed the development of research workshops, championed student-led research projects, and supported proposal writing, leading to increased engagement and measurable growth in undergraduate research output.

Research and Innovation Lead, Arm(E^3)NGAGE Student Club Ashesi University
May 2023 – May 2024

- Led engineering projects within a collaboration between ARM and Ashesi University to advance student knowledge in **IoT and embedded systems** using ARM technologies.
- Directed development of an **automated parking system**, conducting Arduino C workshops, introducing GitHub for collaborative development, and mentoring peers in algorithmic problem-solving.
- Authored project documentation and design outlines to ensure clarity, reproducibility, and knowledge transfer.
- Built a network of student researchers in engineering and computer science, resulting in the production of **five research articles** and pioneering a research-driven culture within the club.

Publications

- O. Babington and N. Amanquah, *"On-Chip vs. Off-Chip FPGA Acceleration for Embedded Neural Networks,"* accepted for presentation at the 2025 13th International Conference on Intelligent Embedded, MicroElectronics, Communication and Optical Networks (IEMECON), Jaipur, India, 2025.

Skills & Languages

Hardware: ARM Cortex-M (STM32), FPGA (Xilinx Artix-7, ZYNQ-7000), Arduino, ESP32, Raspberry Pi, Oscilloscopes, Signal Generators
Programming: Embedded C, VHDL, Python, Java, MATLAB, C++, Assembly
Tools: Vivado, Vitis IDE, ModelSim, Logisim Evolution, Git/GitHub, Linux/UNIX, VS Code, Microsoft Office Suite, Notion

Licenses & Certifications

- **Embedded Systems Essentials with Arm: Getting Started**, edX — Issued Jan 2025
- **Operating Systems Basics**, Cisco — Issued Dec 2024
- **Python & Data Science Foundations**, DataCamp — Issued Jun 2023
  (Courses: Introduction to Python, Intermediate Python, Data Manipulation with Pandas, Joining Data with Pandas, Introduction to Statistics in Python)