FAZLAY RABBY

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STATEMENT OF RESEARCH INTEREST

Aspiring Ph.D. candidate with a strong foundation in Embedded Machine Learning (TinyML) and Biomedical Signal Processing. My research focus lies in designing resource-constrained microsystems for healthcare monitoring, optimizing Edge AI algorithms for Cortex-M architectures, and developing energy-efficient AI-IoT sensing networks.

EDUCATION

University of Liberal Arts Bangladesh (ULAB)   *Dhaka, Bangladesh*
Bachelor of Science in Electrical and Electronic Engineering   *Jan 2020 - Feb 2024*
CGPA: 3.59 / 4.00

- **Thesis:** "Detecting Preeclampsia with ML Algorithms" (Machine Learning in Healthcare).
- **Relevant Coursework:** Digital Signal Processing, Analog Integrated Circuits, Microprocessor & Embedded Systems, Control Systems, Artificial Intelligence, VLSI Design.

PUBLICATIONS & PREPRINTS

Submitted Journal Paper

F. Rabby, M. A. Azim, A. B. M. S. U. Doulah, "A Pilot Feasibility Study of a Secure, Low-Latency LoRaWAN Wearable for Elderly Care in Resource-Constrained Environments," *Submitted to Wiley Engineering Reports (Under Review)*, 2025.

Peer-Reviewed Conference Proceedings (IEEE)

F. Rabby, et al., "Preeclampsia Prediction Using Machine Learning with Electronic Medical Records in Low-Resource Settings," *2025 2nd International Conference on Next-Generation Computing, IoT and Machine Learning (NCIM)*, 2025. [DOI].

F. Rabby, et al., "A Parameter-Efficient Deep Learning Model for Preeclampsia Prediction Using Diverse Datasets," *2025 International Conference on Quantum Photonics, Artificial Intelligence, and Networking (QPAIN)*, 2025. [DOI].

F. Rabby, et al., "Scalable Hand Gesture Recognition from Surface Electromyography (sEMG) Signals Using a Hybrid Deep Learning Model," *2025 9th International Conference On Electrical, Electronics And Information Engineering (ICEEIE)*, 2025. [DOI].

KEY RESEARCH PROJECTS

Secure, Low-Latency LoRaWAN Wearable for Elderly Care   *Submitted to Wiley*
Role: Lead Researcher — **Tech:** LoRaWAN, ESP32, AES-128, MPU6050, Power Optimization

- Developed a cost-effective emergency wearable architecture achieving sub-3-second alert delivery and 100% packet delivery ratio in indoor environments (up to 30m).
- Validated long-range performance with 70%+ reliability in non-line-of-sight conditions up to 6km, ensuring coverage in rural settings.
- Integrated AES-128 encryption with minimal overhead (12ms processing time) to secure patient data.
- Achieved aggressive power optimization for multi-year battery life, with infrastructure costs amortizable to less than $1 per user.

Adaptive TinyML-Based sEMG Wheelchair Control System   *Ongoing*
Role: Hardware Lead — **Tech:** TinyML, Edge Impulse, EMG Sensors

- Designing an Adaptive TinyML framework to control a robotic wheelchair using Surface Electromyography (sEMG) signals.
- Implementing a lightweight Convolutional Neural Network (CNN) on an Esp32 edge device, utilizing int8 quantization to reduce model footprint by 65%.
- Optimized the system for real-time inference with latency ¡100ms, enabling fluid motor control for disabled users.
- Addressing "concept drift" in bio-signals by experimenting with on-device transfer learning techniques.

Adverse Glycemic Event Forecasting on Edge Devices *Ongoing*

Role: Sole Researcher — **Tech:** TensorFlow Lite Micro, Time-Series Forecasting, SHAP

- Developing a resource-efficient forecasting model for hypoglycemia using Continuous Glucose Monitoring (CGM) data.
- Applied batch ensembling and FP16 post-training quantization to deploy on constrained wearable platforms (Cortex-M).
- Incorporating SHAP-based analysis to ensure clinical interpretability of the black-box AI predictions.

PROFESSIONAL & RESEARCH EXPERIENCE

Founder & Lead Researcher, Tiny Neurons Research Group *Dhaka, Bangladesh*
(Independent Research Initiative) *March 2025 – Present*

- Leading a research group focused on model compression and hardware-aware Neural Architecture Search (NAS).
- Mentoring undergraduate students in deploying Deep Learning models on embedded targets (STM32, Arduino).
- Delivering technical workshops on "From Notebook to Cortex-M," bridging the gap between AI theory and silicon.

Application Engineer, ANTT Robotics Ltd *Dhaka, Bangladesh*
(Industrial Automation R&D) *May 2023 – September 2024*

- Led firmware development for industrial AMRs (Autonomous Mobile Robots), integrating motor control with IoT dashboards.
- Resolved critical hardware-software synchronization latency, ensuring reliable operation in noise-heavy factory environments.

TEACHING EXPERIENCE

University of Liberal Arts Bangladesh (ULAB), Dept. of EEE
Graduate Teaching Assistant, EEE 308: Microcontroller Programming

Spring 2024, Dhaka, Bangladesh

University of Liberal Arts Bangladesh (ULAB), Dept. of EEE
Undergraduate Teaching Assistant, EEE 203: Digital Electronics

Fall 2022 – Fall 2023, Dhaka, Bangladesh

TECHNICAL COMPETENCIES

Edge AI & ML: TinyML, TensorFlow Lite for Microcontrollers, Edge Impulse, PyTorch, Model Quantization (PTQ/QAT).
Hardware Platforms: STM32 (ARM Cortex-M4/M7), ESP32, LoRaWAN (SX1278), Biomedical Sensors (EMG/ECG).
Software & Tools: Python, C/C++ (Embedded), MATLAB, VS Code, Git, Proteus, KiCAD.
Lab Equipment: Digital Oscilloscopes, Function Generators, Soldering (SMD).

HONORS & AWARDS

- **IEEE R10 Ethics Champion (2024):** Awarded by IEEE Region 10 EAAC for ethical leadership (Score: ¿70%).
- **Richard E. Merwin Scholar (2023):** Prestigious grant from IEEE Computer Society for academic excellence.
- **Champion, ULAB EEE Olympiad (2022):** First place in Hardware Project Showcase (IoT Robotic Arm).
- **2nd Runner-up, Capstone Project Award (2024):** For excellence in the Preeclampsia Prediction thesis.

REFERENCES

Dr. Nafees Mansoor
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