

Gazi M. Ehsan ur Rahman

Senior Embedded System Engineer

Low-Level Firmware & Real-Time Systems | Full Product Lifecycle Leadership

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EXECUTIVE SUMMARY

Embedded Systems Engineer with over 25 years of combined industrial (communication and embedded system) and academic (teaching, consultancy, research) experience.

PhD in IoT/WSN research with commercialization scope.

CORE COMPETENCIES (Hands-on & Working knowledge)

FW/SW language: Embedded C/C++, Python, PyQT, [HTML/CSS](#), [JS](#)

FW/SW platform: VS-Code, PyCharm, Cube-IDE, Zephyr Studio, Linux, Windows, MAC-OS

FW Architecture: bare-metal, Zephyr RTOS, [FreeRTOS](#), [Embedded Linux/Yocto](#)

Algorithm: HAL, Driver, real-time (parallel processing), multi-thread, [multi-core](#), 8-bit crypto, matrix/optimization.

Application: Sensor fusion, Desktop GUI, [LVGL](#)

Automation: python test HIL/SIL automation, git, [Dev-Ops \(Jenkins, Ansible\)](#) [docker](#)

Cloud connectivity: HTTP, MQTT, TCP, AWS

Security: TLS, embedded LWC algorithm

Embedded HW Platform: ARM-32 (STM, nRF, ESP, SAMD), 8-bit (PIC, AVR, i51), [RISC-V](#)

Interfacing module: IMU, GPS, LTE, TOF, BLE/LoRa, Hall, Mag-encoder, Camera, etc.

Communication/Networking: UART, I2C, SPI, CAN,

Debugging: DSO, Protocol/Logic analyzer, SDR, JTAG/SWD, Segger System View

HW design: Datasheet reading, Schematic capture, PCB design ([6 layer](#), [impedance and power density management](#)) Altium, KiCad, SMD assembling, digital/mixed, [power electronics](#), [RF](#), analog

Electronics: Component sourcing/updating, manufacturing

R&D: Board bring-up, Team lead, [3d-design & printing](#), [electro-mechanical system design](#)

Other: Production software (with OTA), product commercialization, IS certification

Industries: IoT & WSN (agriculture, mining, communication), [bio-medical](#), [renewable energy](#), [textile](#)

[Some/little knowledge](#): [FPGA](#), [DSP](#), [SERDES](#), [AUTOSAR](#)

PROFESSIONAL EXPERIENCE

Sr. Embedded Programmer (R&D) | Biktrix Enterprises Inc, Saskatoon, Canada | Dec 2023 – Nov 2025

Lead independent research and development of embedded systems with focus on sensor integration and cloud connectivity.

- Designed and delivered real-time embedded firmware using C/C++ for ARM-based automotive telematics and IoT platforms, integrating GPS, LTE, IMU, and power-management subsystems with secure MQTT/TLS cloud services, Python microservices, MySQL databases, and web applications, enabling end-to-end connected vehicle solutions from edge devices to the cloud.
- Led the recovery of a high-risk telematics platform experiencing critical TCP/IP, MQTT, and TLS communication failures; performed deep protocol analysis using Wireshark to identify root causes, restore system stability, and design a secure OTA firmware update framework, enabling **readiness for commercial launch** within **2 months**.
- Managed the full lifecycle of embedded software in an RTOS environment- from requirements definition and system architecture to implementation, verification, validation, production support, and deployment- establishing a reusable software framework that improved maintainability and accelerated future product development.
- Designed and optimized low-power telemetry, tracking, and event-driven communication architectures for battery-powered embedded devices, extending battery operational lifetimes to **100+ days** while maintaining reliable connectivity and real-time system performance.
- Developed a highly reliable electro-mechanical control system architecture for multi-processor embedded platforms, providing deterministic communication via CAN, SPI, I2C, UART, and GPIO interfaces for mission-critical applications, as well as low-level drivers, HAL framework, interrupt-driven software, closed-loop PID control, and sensor-fusion algorithms.

- Developed Python/Qt-based diagnostic, monitoring, and validation tools that automated troubleshooting workflows, accelerated root cause analysis, and reduced system integration and testing efforts by nearly **50%**, significantly improving engineering productivity and release time.
- Led hardware-software co-design activities, which included schematic review, PCB validation, board bring-up, component selection, manufacturing support, and system integration; used oscilloscopes, logic analyzers, and protocol analyzers to troubleshoot complex hardware and communications issues, increasing product reliability and reducing development risk.
- Provided technical leadership to a cross-functional team of **12+** engineers from software, hardware, systems, mechanical, and manufacturing departments, ensuring architectural decisions, system integration, and successful deployment of automotive and military-grade embedded platforms.
- Resolved a critical parallel battery-management issue that had remained unresolved for **over a year** on e-bike platform and delivered a verified solution within **2 weeks**, ensuring readiness for production as well as improving charging performance, battery balancing, and overall system reliability.
- Led the integration of advanced torque-sensing pedal-assist technology on a military-grade e-bike platform, which improved power-delivery efficiency, ride quality, and vehicle responsiveness, as well as increased overall system performance under adverse operating conditions.

Embedded Systems R&D Lead | I3S (Personal Venture), Canada | Jan 2023 – Present

Lead independent research and development of advanced embedded systems, focusing on modern RTOS, wireless protocols, and edge intelligence (ML/AI) to explore commercial applications and maintain cutting-edge technical proficiency.

- Architect and develop a next-generation intelligent sensing platform using Zephyr RTOS, which delivers real-time distributed embedded software integrating multi-sensor data acquisition, edge AI/ML inference, and federated learning across hybrid BLE Mesh and LoRa networks, enabling scalable and low-power user remote monitoring and analytics.
- Lead the software architecture design for a modular embedded platform, defining a device abstraction layer, multi-threaded application framework, and hardware-neutral interfaces, accelerating portability and enabling rapid integration of new sensors, communication technologies, and AI workloads across multiple embedded hardware platforms.
- Design and develop an LTE-connected imaging and telemetry system for precision agriculture applications, integrating camera sensors, wireless communications, edge analytics, and cloud connectivity to automate remote field-data collection and reduce the need for manual monitoring.
- Deploy and deploy CI/CD infrastructure using Jenkins, Docker, GitHub, and AWS, which improves software quality by automating build, test, and deployment workflows, reducing integration efforts, and accelerating development across multidisciplinary engineering teams.
- Lead the development of a subsurface wireless imaging platform combining embedded electronics, electromechanical systems, optical design, and 3D mechanical design to enable remote imaging and reliable wireless data transfer in hostile subsurface environments.
- Provide technical leadership and oversight for the development of a cross-platform desktop application built with **React.js** and **Electron.js** to support electronics product development and manufacturing operations, integrating inventory management, procurement tracking, and order management workflows to improve operational efficiency and manufacturing visibility.
- Leading the architecture, design, and validation of mixed-signal, RF, power-management, and embedded hardware platforms, overseeing schematic capture, PCB design and review (KiCad, Altium Designer), component selection, procurement, assembly, and system verification.
- Collaborate with cross-functional teams across embedded software, AI/ML, cloud, hardware, mechanical, and manufacturing to define system architecture, make technical decisions, and deliver integrated end-to-end sensing and analytics solutions.

R&D Lead | HazTrack Inc. (Formerly WIoT Inc. and Doppl Inc.), Saskatoon, Canada | May 2021 – Dec 2022

(Promoted from R&D Intern within 6 months) Led full lifecycle development of industrial IoT sensor devices.

- Designed and developed an STM32L15-based industrial IoT sensing platform integrating NB-IoT, BLE, NFC, IMU, and Time-of-Flight (ToF) sensors via I2C, SPI, and UART interfaces. Provided secure cloud connectivity using TCP/IP, HTTP, and MQTT protocols, enabling reliable remote monitoring and data collection in hazardous mining environments.
- Led a cross-functional team of **6 engineers (3 HW, 3 SW)** across the entire product lifecycle, including system architecture, development, verification, certification, and deployment, and successfully completed project milestones despite post-pandemic resource and supply-chain constraints.

- Led system verification, validation, and regulatory compliance activities and implemented HIL automation, functional testing, regression testing, and qualification workflows. Successfully supported **IEC Class I Division 1 (C1D1)** and Intertek certification efforts, which reduced deployment risk and accelerated commercial readiness.
- Led embedded hardware development from concept to MVP using Altium Designer, which included architecture definition, component selection, schematic capture, PCB design, and environmental qualification testing (-40°C to +85°C). Reduced development time by approximately **30%** through rapid design iterations and early risk mitigation.
- Established in-house prototyping and low-volume manufacturing capabilities by implementing pick-and-place assembly and streamlined validation workflows, which reduced MVP development cycles by nearly **50%** and accelerated product iterations.
- Led hardware-software integration and system bring-up activities across embedded, RF, and cloud-connected platforms. Solved complex multi-dimensional problems using oscilloscopes, spectrum analyzers, logic analyzers, and wireless protocol analysis tools to improve reliability and shorten troubleshooting cycles.
- Conducted research and development (R&D) for RF signal measurement and wireless data-acquisition systems and developed automated signal-generating and measurement methods. These methods improved test repeatability, reduced human intervention, and enhanced data quality for sensitive RF applications.
- Designed and conducted field trials at multiple locations to evaluate cellular network performance, optimize communication strategies, and reduce power consumption of battery-powered IoT devices, which increased deployment efficiency in remote environments and extended battery life.

Research Assistant | University of Saskatchewan, Canada | Apr 2018 – Jun 2022

Conducted academic research on wireless networks and embedded system security.

- Ported and optimized embedded Linux (Yocto) on ARM-based SoCs and advanced Python-powered HIL automation framework for performance and power-consumption evaluation of 32 lightweight cryptographic algorithms, significantly reducing manual testing effort and accelerating benchmarking and validation activities.
- Architected and developed an autonomous underground electro-mechanical imaging and sensing platform that integrates embedded controllers, sensors, actuators, multi-spectral cameras and environmental monitoring systems. Enables automated root phenotyping and soil carbon sequestration research, eliminates labor-intensive data collection, and provides a platform for multiple ongoing research experiments.
- Designed and implemented a UAV-to-ground multimodal sensing and communication platform for wide-area data collection, developed synchronized multi-channel wireless communication in LoRa networks that achieved approximately **50% higher throughput** than conventional LoRa implementations while enabling reliable long-range data acquisition.
- Collaborating with multidisciplinary teams across the agricultural, biomedical, imaging, and environmental research domains, delivering custom embedded hardware (including schematic capture and PCB design using Altium), firmware, sensing, communication, and electro-mechanical solutions that accelerate experimental validation and expand research capabilities in **more than 10 projects**, contributing to high-profile publications.
- Acquired expertise in mathematical modeling and optimization algorithms, later using this knowledge to develop **multi-variable optimization solutions** in cloud and standalone computing projects, resulting in a **high-impact peer-reviewed journal publication**.

Founder director of technology (Parttime) | eTechnologic, Bangladesh | Feb 2012 – Feb 2018

- **Led a cross-functional team of 10 engineers and 30 technicians** to develop, commercialize, and build industrial embedded IoT systems for the telecom, renewable energy, battery, and textile industries in local and North American markets, meeting quality standards from Telenor, Ericsson, and Huawei.
- **Delivered 10+ commercial embedded products** from prototype through full-scale production, with multiple products still in production, demonstrating **end-to-end ownership of the product lifecycle**.
- Installed a semi-automated in-house PCB and SMD assembly line, reducing development and production time and cost by ~50%, enabling rapid product iteration and time-to-market.
- **Engineered specialized embedded solutions** including ultra-low voltage (1.2V) GPS asset tracker for industrial batteries with cloud-based Google Map integration, automated DC-PLC-enabled rural solar home monitoring with encrypted payments, and solar nano-grid systems with integrated power converters and charging management.
- **Managed end-to-end product support**, including R&D, **24/7 customer support**, OEM coordination, component sourcing, overseas procurement, local manufacturing and mechanical enclosure mounting (including 3D design), **field maintenance and rapid product replacement**.
- **Mentored and trained local university graduates**, providing internships and technical skills development programs, fostering the next generation of embedded systems engineers and promoting knowledge transfer within the team.

Assistant Professor | United International University, Bangladesh | Jul 2008 – Feb 2018

- **Designed and delivered advanced courses in embedded systems** and real-time systems, including concurrency, scheduling, hardware interfacing, and system testing, preparing students for practical engineering challenges.
- **Supervised 20+ capstone projects** across embedded, IoT, biomedical, and robotics domains including swarm robots for 3D ultrasonic mapping, GPS-guided drones, ZigBee navigation networks, resulting in multiple University Best Project Awards, National Innovation Awards, and URC Competitions.
- **Led ABET accreditation and quality assurance** initiatives, creating documentation and establishing standards that strengthen program credibility and ensure compliance with rigorous academic requirements.
- **Developed and delivered professional** short courses and industry training programs, developed industry-ready skills, supported internships, and promoted **university-industry collaboration**.

Communication Engineer | Bangla Link & City Cell, Bangladesh | Nov 1999 – Jun 2008

- Gained foundational experience in GSM/CDMA/3G networks, protocol analysis, and network optimization to support telecom-related product development. Contribute to dynamic network restructuring strategies that support changing traffic demands, improve network performance and increase annual revenue.
- Led by an automated system data acquisition and reporting platform, eliminating manual reporting processes and reducing reliance on 5 engineers, resulting in cost savings of approximately **\$500K in CAPEX** while accelerating operational decision making.
- Led post-disaster recovery efforts following a severe fire, restoring telecom system operations without vendor assistance and minimizing service downtime, preventing nearly **one week of revenue loss**.

EDUCATION & CREDENTIALS

Ph.D., Electrical & Computer Engineering - University of Saskatchewan, Canada

M.Sc., Electrical & Electronic Engineering - Bangladesh University of Engineering and Technology

B.Sc., Electrical & Electronic Engineering - Bangladesh University of Engineering and Technology

Post-secondary projects : i85 SBC, i51 industrial motor controller, PCM interface and protocol analyzer, communication protocol for distributed PBX system including schematic capture, PCB design, assembling and board bring up.

Certifications & Professional Development

DevOps, Cloud & Software Engineering:

- DevOps (ComIT), and Software Test Automation
- Linux Administration and Cloud Management
- Node.js, React, and Web Application Development
- Concurrent and Parallel Programming in Python
- CMake for Cross-Platform C++ Development
- AWS Cloud Fundamentals and Azure Cloud Services
- MySQL with Python
- Data Analytics and Data Science (Python)
- Bash and Shell Scripting

Embedded Systems & Firmware Development

- Embedded Linux using Yocto Project
- STM32 Firmware with DMA, Bootloader, and LVGL GUI
- ESP32 Advanced Embedded Programming
- Embedded System Design using UML State Machines
- ARM Low-Level Driver Development
- FreeRTOS on STM32
- USB HID Firmware Development
- Rust Programming for Embedded Systems

Industrial & Communication Systems

- AUTOSAR Architecture Fundamentals
- RF Communication and Signal Analysis using SDR
- Wireless Communication Systems including LoRaWAN and IoT Networks