

# ABHIK KUMAR

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## Education

### University of Pennsylvania

Master's of Science in Electrical Engineering – 3.88 / 4 CGPA

August 2024

Philadelphia, U.S.

Courses: Embedded Systems, Digital Integrated Circuits AND VLSI, Linear System Theory

### Delhi Technological University

Bachelor of Technology in Electrical Engineering – 8.73 / 10 CGPA

August 2019

Delhi, India

Minor in Computer Science Engineering

Courses: Deep Learning, AI, Microprocessors & Microcontrollers, Digital Circuits System, Power Electronics, Operating Systems

## Skills

Programming Languages: Embedded C, C++, Python, CLI, Bash, Matlab, FreeRTOS, Cmake, NodeJs, Docker

Protocols Technologies: XBee, SPI, I2C, RS485, UART, Bluetooth Low Energy, MQTT, Robot Operating System

Hardware: WINC1500, ATMega, Digital Multimeter, Oscilloscope, Logic Analyzer, ULtra96

Software/Tools: Altium, Microchip Studio, MPLabX, Linux, Visual Studio Code, GitHub, JIRA, Confluence

## Professional Experience

### MUNCH Industries, Inc.

June 2025

#### Lead Embedded & Electrical Systems Engineer Intern

Philadelphia, PA, USA

- Led the design and development of the electrical and embedded control systems, managing firmware architecture, PCB integration, power distribution, and CAN-based communication between microcontrollers and Backend support.
- Developed modular Zephyr firmware using devicetrees, interrupts, and work queues for real-time control.
- Built comprehensive test infrastructure including **hardware-in-the-loop** validation, **end-to-end RTOS testing**, and unit tests using **Zephyr's ztest** framework with mocked drivers to verify subsystem behavior pre-deployment.
- Automated CI builds/tests with Docker git, cut bugs by **30%**, speed up iterations by **40%**; ensured HW integration.

### Cogoport

January 2023

#### Software Development Engineer (Full Stack Developer)

Gurgaon / Mumbai, India

- Developed a platform to streamline onboarding, cutting time by **50%** and user errors by **30%** with checkpoint features.
- Automated data population, reducing manual effort by **70%** and tripling platform engagement. Ensured data consistency across **Indonesia, Vietnam, Thailand, Singapore, and China**.
- Built a real-time cargo tracking map using Leaflet and a **partner growth visualization** CRM tool with an org tree, 2X user interaction, accelerating data updates by **20%**, and improving reporting accuracy by **40%** for 2,000+ daily users.
- Automated agent allocation, increasing retention by **60%** and revenue by **30%** through improved shipment forecasting.

## Research & Project work

### Smart Plant Survival System

May 2025

- Designed and developed a 4-layer PCB using **Altium** with **SAMD21** microcontroller and **WINC1500** Wi-Fi module, fabricated by **PCBWAY** for automated plant monitoring and irrigation.
- Integrated soil, air, and NPK sensors with motor, pump, and buzzer over I2C; used **FreeRTOS** for real-time control and WiFi alerts, boosting water efficiency by **40%**.
- Built a **Node-RED** dashboard for remote control and alerts, optimizing irrigation and cutting water use by **25%**.

### DJ Gloves: Interactive Music Control System

December 2024

- Built a wearable that mapped hand gestures and motion to MIDI control using IMU, LCDs, and sensor fusion.
- Utilized ADXL335 accelerometers, Neopixel LED rings, Zigbee (XBee S2C) radios, ATMega32PB MCUs, and custom Python-based MIDI bridge for wireless data transmission and gesture mapping.
- Enabled real-time gesture recognition, visual feedback, and low-latency audio control through interrupt-driven sampling and SPI/LCD integration, enhancing responsiveness and user interaction.

Enrolled in **ESE 5320: System-on-Chip Architecture**, learning SoC-FPGA design, HLS-based hardware acceleration, HW/SW partitioning, and performance-power-area tradeoffs for low-latency compute systems.

## Publication & Achievements

### Reinforcement Learning in Simultaneous Localization and Mapping

Springer Nature, April 2025

- Book chapter in *Recent Developments in Control, Automation and Power Engineering* (ISBN: 978-981-96-0047-2).
- Developed model-free path planning strategies using reinforcement learning for reconfigurable robotic systems.
- Implemented and compared value iteration, policy iteration, and modified A\* algorithm within SLAM frameworks.

### Leadership & Sportsmanship

- Deputy Director of Compliance at **GAPSA** Finance Team, managing fiscal funds for university clubs and events.
- Featured **RAKT** project in the **top 100 out of 10,000+** entries at the United Nations Academic Impact.
- Won silver in 5km and 4x400m relay; led organization of Arena sports festival.