

# Muhammad Uzair

raouzair890@gmail.com | github.com/raouzair10 | linkedin.com/in/raouzair10 | uzairm.com

+92332 6609658 | Islamabad, Pakistan

## Education

**National University of Sciences and Technology, Islamabad**

November 2021 – June 2025

*Bachelor of Engineering – Software Engineering*

- **CGPA:** 3.61/4.0
- **Relevant Coursework:** Machine Learning, Reinforcement Learning, Large Language Models, Probability and Statistics

## Publications

**Multiagent Reinforcement Learning for Joint Spectrum and Energy Optimization in CR-NOMA Enabled Internet of Unmanned Agents**

IEEE IoT Journal 2025

Saleha Ahmed, *Muhammad Uzair*, Syed Asad Ullah, et al.

**Energy Efficient Uplink Communications for Wireless Powered Networks with EH Diversity: A DRL-driven Strategy**

IEEE ICC 2025

Saleha Ahmed, *Muhammad Uzair*, Syed Asad Ullah, et al.

## Experience

**Artificial Intelligence Engineer**

November 2025 – Ongoing

Adept Tech Solutions – Islamabad, Pakistan

- Built end-to-end voice AI pipelines using VAPI and Deepgram STT, handling inbound and outbound call flows with real-time transcription latency under 400ms.
- Engineered a multi-agent LLM orchestration system using FastAPI microservices and PostgreSQL, reducing manual task handling time for enterprise clients.
- Developed a RAG-powered knowledge retrieval layer using sentence-transformers (MPNet, 768-dim) and pgvector.
- Implemented automated email intelligence agents with intent detection and context-aware reply generation via OpenAI APIs, processing 500+ emails per day.

**Research Intern**

June 2025 – August 2025

McMaster University – Hamilton, Ontario, Canada

- Completed a fully funded Mitacs Globalink Research Internship focusing on guided policy optimization in sequential decision-making environments.
- Implemented and benchmarked REINFORCE and PPO algorithms in the Gymnasium Pac-Man environment, tuning reward shaping and entropy regularization to improve exploration-exploitation balance.
- Integrated human advisory signals into the RL training loop via subjective logic-based belief modeling, enabling uncertainty-aware guidance that accelerated policy convergence over standard PPO.

**Research Collaborator**

June 2024 – September 2025

Information Processing & Transmission Lab – Islamabad, Pakistan

- Trained and benchmarked DDPG, TD3, and PPO for continuous-action transmit power optimization in wireless-powered networks under stochastic fading channels.
- Developed a multi-agent DRL framework for joint spectrum access and power control in CR-NOMA IoT networks, with distributed agents learning cooperative policies under partial observability.
- Evaluated MRC, SC, and EGC diversity-combining schemes, analyzing trade-offs in SNR and energy harvesting efficiency under Rayleigh fading models.

## Scholarships & Awards

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- Fully funded MITACS Globalink Research Internship, 2025
- 4x FBISE HSSC merit scholarship recipient (2021 – 2025)

## Technical Skills

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**Programming:** Python, C++, JavaScript, SQL

**AI / ML:** PyTorch, TensorFlow, Scikit-Learn, Stable Baselines3, Gymnasium, Sentence Transformers, PEFT, LoRA, OpenAI API

**Voice & Agentic AI:** VAPI, Deepgram, Multi-Agent Orchestration, RAG Pipelines, Tool Use, Prompt Engineering

**Backend & Data:** FastAPI, PostgreSQL, pgvector, NumPy, Pandas, Matplotlib

**Infrastructure & Tools:** Docker, Git, Google Cloud Platform, Azure IoT Hub, OAuth 2.0, REST APIs

## Selected Projects

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### PPO for Gymnasium Inverted Pendulum Environment

- Developed a PPO agent to solve the Inverted Pendulum problem in MuJoCo, achieving optimal performance through a meticulously designed shaped reward function and extensive hyperparameter optimization using Optuna.

### RAG-Based Banking Assistant

- Developed a domain-specific AI assistant for banking using LLaMA-3.2-3B-Instruct, FAISS, and FastAPI.
- Implemented semantic search with Sentence Transformers and real-time document ingestion via Streamlit.
- Applied LoRA-based fine-tuning (PEFT) for efficient adaptation of LLMs to banking data.

### Distributed Learning-to-Rank on ANTIQUE

- Built a DNN scorer on the ANTIQUE QA benchmark with TensorFlow Ranking, training on ELWC-formatted data and the `approx_ndcg_loss` objective.
- Benchmarked single-device training against `tf.distribute.MirroredStrategy` multi-GPU data parallelism, reaching  $NDCG@10 \approx 0.83$  on the held-out ANTIQUE test split under both configurations.

### AI-Driven Air Quality Monitoring System

- Implemented an end-to-end IoT solution for air quality monitoring, integrating ESP32 with Azure IoT Hub and PowerBI for real-time data acquisition and visualization.
- Trained and validated a machine learning model for AQI prediction, achieving 75% accuracy, leveraging a custom dataset derived from data stored within Azure Blob Storage.

## Extra-Curricular Activities

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- Member, NUST Cricket Team, PCB HEC Intervarsity Cricket Championship (2023, 2024)
- Deputy Director, SGA Sports Council (2022–2023); led organization of SEECS Sports Gala 2023

## Volunteering & Community Engagement

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- Participated in university-led plantation and environmental sustainability drives, contributing to the maintenance of campus green spaces.
- Led a student-driven fundraising and coordination initiative to support the installation of a solar energy system at an underprivileged school.
- Delivered introductory computer science lectures at underprivileged schools, promoting digital literacy and access to education.