

# Abdelrahman Elewah

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in [abdelrahman-elewah](#)    🌐 [elewah](#)

## Summary

AI & Machine Learning Researcher with 7+ years of experience architecting scalable, real-time AI and IoT systems. Specialized in Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), and intelligent frameworks for real-time IoT data processing and search. Passionate about undergraduate education and advancing inclusive, impactful research in AI and Generative Systems.

## Experience

### Ontario Tech University, Graduate Research Assistant (full-time)

Oshawa, ON  
Jan 2020 – Apr 2025

- Designed **SensorsConnect** framework: **World-Wide Web for Internet of Things**, enabling seamless **device communication**.
- Introduced **Agentic Search Engine for real-time IoT data (ASE-IoT)**, leveraging **large language models (LLM)**, **retrieval-augmented generation (RAG)**, and **Agentic AI systems**.
- Designed the **ThingsDriver** messaging protocol for **IoT cloud-node management**.
- Contributed to a project funded by **OVIN**, focusing on developing **curriculums for autonomous vehicles** and researching **software-defined vehicles (SDV)** and **digital twins**.
- Collaborated with **Eagle Aerospace** on an **Aircraft Deceleration Early Warning System**.
- Introduced a **data visualization method, RadViz-Plotly**, to visualize **high-dimensional data** and published it as a **research paper**.

### 2U, Instructional Specialist (part-time)

Toronto, ON  
Jan 2023 – Apr 2025

- Contributed to the success of the **University of Toronto** 's online **Data Analytics Boot Camp** specializing in training data professionals.
- Assisted learners in acquiring essential **practical and technical skills** for modern data analysis:
  - **Excel**: Pivot tables, Forecasting, VBA scripting, Statistical modeling.
  - **Python Data Analytics**: APIs, NumPy, SciPy, Pandas, Matplotlib, TensorFlow, Keras, PyTorch.
  - **Databases**: SQL, PostgreSQL/pgAdmin, MongoDB, **Extract, Transform, Load (ETL)** process.
  - **Web Visualizations**: HTML, CSS, Bootstrap framework, JavaScript charting, Geomapping with Leaflet.js.
  - **Advanced Data Analysis Topics**: Tableau, Data ethics, Hadoop, Machine Learning/Deep Learning.
- Guided learners through **real-world projects** tailored to industry sectors like **Finance, Human Resources, Healthcare, and Government**.

### Tamra-IoT, Co-Founder(part-time)

Toronto, ON  
May 2019 – present

- Architected **IoT platforms** integrating **MQTT TLS**, **cloud services**, and **mobile control**.
- Collaborating on **business management** and strategic decision-making.
- Designed **OTA firmware updates** and implemented **robust IoT management solutions**.

## Education

### PhD Ontario Tech University, Electrical and Computer Engineering

Jan 2020 – Mar 2025

- GPA: 4.22/4.3 [Link to Transcript issued by Ontario Tech University](#)
- **Coursework**: Real-Time Data For IoT, Communication Networks, Knowledge Discovery & Data Mining, Data Visualizations
- **Thesis**: SensorsConnect: World Wide Web for Internet of Things.

### MSc Benha University, Electrical Engineering

Jan 2020 – Mar 2025

- **Thesis**: Multi-modulation Low Earth Orbit Satellite Based on Software Defined Radio

- **GPA:** 85% (3.3/4)
- **Capstone:** *EagleEyes* – **Mine Detection System** using a **Quadcopter (Drone)**

## Selected Publications

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**Agentic Search Engine for Real-Time IoT Data** [arXiv](#) 

Mar 2025

*Abdelrahman Elewah*, Khalid Elgazzar

**SensorsConnect Framework: World-Wide Web for Internet of Things** [IEEE Access](#) 

Nov 2024

*Abdelrahman Elewah*, Khalid Elgazzar

## Projects

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**Apply Lightweight Fine Tuning to a Foundation Model**

[github.com/repo](#) 

- Leveraged the **GPT-2 language model** and the **Hugging Face Transformers** to fine-tune GPT-2 on **news classification tasks** using the **AG News dataset**.
- Implemented a **parameter-efficient fine-tuning (PEFT)** approach.
- Achieved improvements in the **evaluation metrics**, including **reduced loss** and **increased classification accuracy**.

**IoT Agentic Search Engine**

[github.com/repo](#) 

- **Developed** a real-time IoT search engine powered by **LLMs and RAG**, supporting natural language queries across heterogeneous IoT systems.
- **Implemented** a semantic search pipeline using **Sentence-BERT and Hierarchical Navigable Small World (HNSW)** indexing.
- **Managed** over 37,000 real-time IoT documents across 500 service types stored in **MongoDB** with geographic indexing.
- **Achieved** 92% top-1 accuracy in complex intent detection and retrieval, outperforming state-of-the-art systems like Gemini.
- **Applied** in real-time urban scenarios: finding least-crowded clinics, available parking, and lowest gas prices based on live sensor data. [Live Demo](#) 
- **Technologies:** LangGraph, Tavily API, OpenRouteService, VectorDB, Sentence-BERT.

**RadViz-Plotly**

[github.com/repo](#) 

- Developed **RadViz-Plotly**, an **open-source Python package** for creating **2D and 3D Radial Visualization (RadViz)** plots for **high-dimensional datasets**.
- Enabled **data scientists** to visualize **complex data distributions** interactively using **Plotly** for enhanced **insight discovery**.
- Facilitated better understanding of **high-dimensional data** and detection of **hidden patterns** through **intuitive visual analytics**.

## Technologies

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**Programming Languages:** Python, C/C++, JavaScript.

**Web Technologies:** REST APIs, React, HTML, CSS, Bootstrap.

**Automation Tools:** Jenkins, GitLab CI/CD.

**IoT Frameworks:** MQTT, IoT platforms.

**Database Systems:** PostgreSQL, MongoDB.

**DevOps Tools:** Docker, Kubernetes, Helm, Dev container.

**Scripting:** Bash, Perl.

**Development Environments:** GitHub, GitHub Actions Workflow, VScode, Anaconda, PlatformIO.

**LLM and Prompt Engineering:** langChain, langGraph, langSmith, RAG.