ROBERT J. HAYEK

Chicago, IL | [redacted] | [redacted] | Personal Website

EDUCATION

Northwestern University **June 2025**
Master of Science in Electrical Engineering *(ABET Accredited)*, GPA: 3.7 *Evanston, IL*
Relevant Coursework: Communication Systems, Quantum Electronics, Quantum Optics, Advanced Electronic Devices

Ohio Northern University **May 2023**
Bachelor of Science in Computer Engineering *(ABET Accredited)* *Ada, OH*
Minors in Applied Mathematics and Physics

RESEARCH EXPERIENCE

Federated Learning over NextG Cellular **March 2024 – Present**
Affiliation*:* Northwestern University (COMMNET); Argonne National Laboratory *Evanston, IL*
Thesis Advisor: Dr. Igor Kadota

- Led creation of the NextG wireless testbed at Northwestern University and Argonne National Laboratory utilizing off-the-shelf components.
- Developed federated learning system and integrated to the wireless testbed.
- Explored enhancements for federated learning systems when integrated with a NextG testbed.
- Evaluated the impact of NextG technology on federated learning systems, considering model size and constraints.

Science Uses Deployment Operations – Advanced Wireless (SUDO-AW) **March 2024 – Present**
Affiliation*:* Argonne National Laboratory *Lemont, IL*
Supervisor: Dr. Rajkumar Kettimuthu

- Implemented ORAN 5G testbed using OpenAirInterface (OAI), software defined radios (SDR), and commercial off-the-shelf (COTS) components.
- Evaluated performance benchmarks of O-RAN 5G cores and gNB's.
- Integration of open source 5G core with neutral host solution.
- Research funded by U.S. Department of Energy.

Dual-Hop Energy Harvesting TDMA Algorithm **August 2023 – April 2024**
Affiliation*:* Ohio Northern University *Ada, OH*
Supervisor: Dr. Ahmed Ammar

- Assisting in advising development of an energy harvesting TDMA algorithm for a dual-hop scenario.
- Published the research findings in the *International Conference on Mobile Intelligence (ICMI)*, where it received the Best Paper Award.
- Research funded by Ohio Northern University.

Single-Hop Energy Harvesting TDMA Algorithm – Ohio Northern University **August 2022 – October 2023**
Affiliation: Ohio Northern University *Ada, OH*
Supervisor: Dr. Ahmed Ammar

- Development of an energy-efficient TDMA algorithm for energy harvesting wireless sensor networks.
- Setup experiments and performed analysis on results using custom Python scripts.
- Published findings in the *Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*.
- Resulted in a conference paper, invited talk (ONU), and two poster presentations (ONU and Fermilab).
- Research funded by Ohio Northern University.

PUBLICATIONS

1. **R. J. Hayek**, J. Chung, I. Kadota, R. Kettimuthu, C. R. Murthy, "Federated Learning over NextG O-RAN: Experimentation and Optimization" (**In-preparation)**
2. T. D. Patterson, **R. J. Hayek** and A. Ammar, "A TDMA Algorithm for Dual-Hop Energy Harvesting Wireless Sensor Networks," *2024 IEEE 3rd International Conference on Computing and Machine Intelligence (ICMI)*, Mt Pleasant, MI, USA, 2024, pp. 1-7, doi: 10.1109/ICMI60790.2024.10585820. **(1st Best Paper Award)**
3. **R. J. Hayek** and A. Ammar, "An Energy-Efficient TDMA Algorithm for Energy Harvesting Wireless Sensor Networks," *2023 IEEE 14th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*, New York, NY, USA, 2023, pp. 0333-0338, doi: 10.1109/UEMCON59035.2023.10316152.

WORK EXPERIENCE

Northwestern University **October 2024 – Present**
Honors Engineering Analysis Grader *Evanston, IL*

- Graded assignments for the Honors Engineering Analysis course, covering Linear Algebra and MATLAB.

Argonne National Laboratory **March 2024 – Present**
DSL Research Aide *Lemont, IL*

- Collaborated with the SAGE Waggle device team to integrate 5G into their federated learning network.
- Developed/deployed a 5G testbed utilizing O-RAN NextG cellular technologies.
- Supported various research activities within the DSL department.

Crown Equipment Corporation **May 2022 – December 2024**
DevOps Engineer Part Time *New Bremen, OH*

- Extensive experience working with an enterprise scale SaaS application.
- Developed audits for various sections of the application using Python and CloudFormation.
- Developed Python script to automate the creation/deletion of users in a production SaaS platform via its REST API; utilized AWS S3 for managing users current state with Boto3.
- Implemented unit tests for the above automation script using Pytest, including mocking all AWS resources with Moto.
- Migrated build environment from manually configured Mac hardware using Bamboo to Infrastructure as Code (IAC) using GitHub Actions pipeline.
- Implemented Bamboo plan and associated developer tooling to enable the creation of OAuth2 CloudFormation stacks; created documentation, including process workflow diagrams.
- Modified AWS CloudFormation stack parameters for a microservice cloud infrastructure.
- Completed development of user automation project utilizing Azure Graph API.
- Created audits to assist in maintaining ISO 27001 certification.

Ohio Northern University **January 2023 – May 2023**
Teaching Assistantship, Digital Logic *Ada, OH*

- Assisted students in a laboratory setting by providing guidance and troubleshooting.
- Graded laboratory assignments and provided feedback to students on their performance.
- Demonstrated effective communication skills to facilitate student learning.

Ohio Northern University **January 2020 – March 2023**
Help Desk Technician *Ada, OH*

- Communicate with faculty, students, and staff helping with computer related issues.
- Troubleshoot computer concerns including password resets, software installs, and general hardware issues.
- Collaborate with peers to brainstorm solutions to computer issues.
- Managed overdue tickets and asset loans.
- Developed and executed onboarding practices for new employees of the organization.

PRESENTATIONS

1. Presented research efforts involving 5G testbeds at Argonne National Laboratory for scientific use cases to the U.S. Department of Energy, Office of the Chief Information Officer (DOE OCIO).
2. Presented *"An Energy-Efficient TDMA Algorithm for Energy Harvesting Wireless Sensor Networks"* at the 2023 IEEE Annual Ubiquitous Computing, Electronics & Mobile Communications Conference, held at Columbia University, NYC, in October 2023.
3. Presented a poster on "An Energy-Efficient TDMA Algorithm for Energy Harvesting Wireless Sensor Networks" at the Fermilab SQMS USQIS in August 2023, highlighting its application to quantum networks.
4. Presented "Efficient TDMA Algorithm for a Single-Hop Energy Harvesting Sensor Networks" at the ONU Student Research Colloquium in 2023. Co-authored with A. Ammar. Available at: ONU Student Research Colloquium.
5. Delivered an invited talk on "Low Power Consumption TDMA Algorithm for Energy Harvesting Wireless Sensor Networks" to the Engineering Orientation Course at Ohio Northern University in December 2022.

HONORS AND AWARDS

1. IEEE ICMI Best Paper Award for *"A TDMA Algorithm for Dual-Hop Energy Harvesting Wireless Sensor Networks". (2024)*
2. Ohio Northern University Dean's List *(Fall 2021, Spring 2022, Fall 2023).*
3. Elected to ONU chapter of Sigma Pi Sigma, The National Physics Honor Society. (*2023)*
4. Elected to ONU chapter of The National Society of Leadership and Success. *(2023)*
5. Polar Pitch Entrepreneurial Competition Finalist: PillSmart Box. (*2022)*

PROFESSIONAL MEMBERSHIPS

- Sigma Pi Sigma (National Physics Honor Society), American Institute of Physics, Member Since 2023.
- IEEE Member, IEEE Communications Society, IEEE Computer Society Member, IEEE Quantum Community Member.
- National Society of Leadership and Success.

PROGRAMMING LANGUAGES / SKILLS

- Python
- C++
- MATLAB
- Arduino
- Verilog/SystemVerilog
- Networking Protocols (TCP/IP, UDP)
- AWS CloudFormation
- Linux Server