

ROBERT J. HAYEK

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EDUCATION

Northwestern University

Master of Science in Electrical Engineering (*ABET Accredited*)

Relevant Coursework: Communication Systems, Quantum Electronics, Quantum Optics, Advanced Electronic Devices

June 2025

Evanston, IL

Ohio Northern University

Bachelor of Science in Computer Engineering (*ABET Accredited*)

Minors in Applied Mathematics and Physics

May 2023

Ada, OH

PUBLICATIONS

1. **R. J. Hayek**, J. Chung, K. Comer, C. R. Murthy, R. Kettimuthu, I. Kadota, "Federated Learning over NextG O-RAN Cellular: Experimentation and Optimization"
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.

RESEARCH EXPERIENCE

Federated Learning over NextG Cellular

Affiliation: Northwestern University (COMMNET); Argonne National Laboratory

Thesis Advisor: Dr. Igor Kadota

March 2024 – Present

Evanston, IL

- 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)

Affiliation: Argonne National Laboratory

Supervisor: Dr. Rajkumar Kettimuthu

March 2024 – Present

Lemont, IL

- 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

Affiliation: Ohio Northern University

Supervisor: Dr. Ahmed Ammar

August 2023 – April 2024

Ada, OH

- 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.

WORK EXPERIENCE

Argonne National Laboratory

March 2024 – Present

Graduate Research Assistant – Data Science and Learning

Lemont, IL

- Performed a comparative analysis of federated learning application over a private 5G network.
- 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.

Northwestern University

October 2024 – January 2025

Honors Engineering Analysis Grader

Evanston, IL

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

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 “*An O-RAN Advanced Wireless Testbed for Science (SUDO-AW)*” as a **lightning talk** at the annual Confab conference hosted by ESNet in April 2025.
2. 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).
3. 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.
4. 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.
5. 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](#).
6. 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