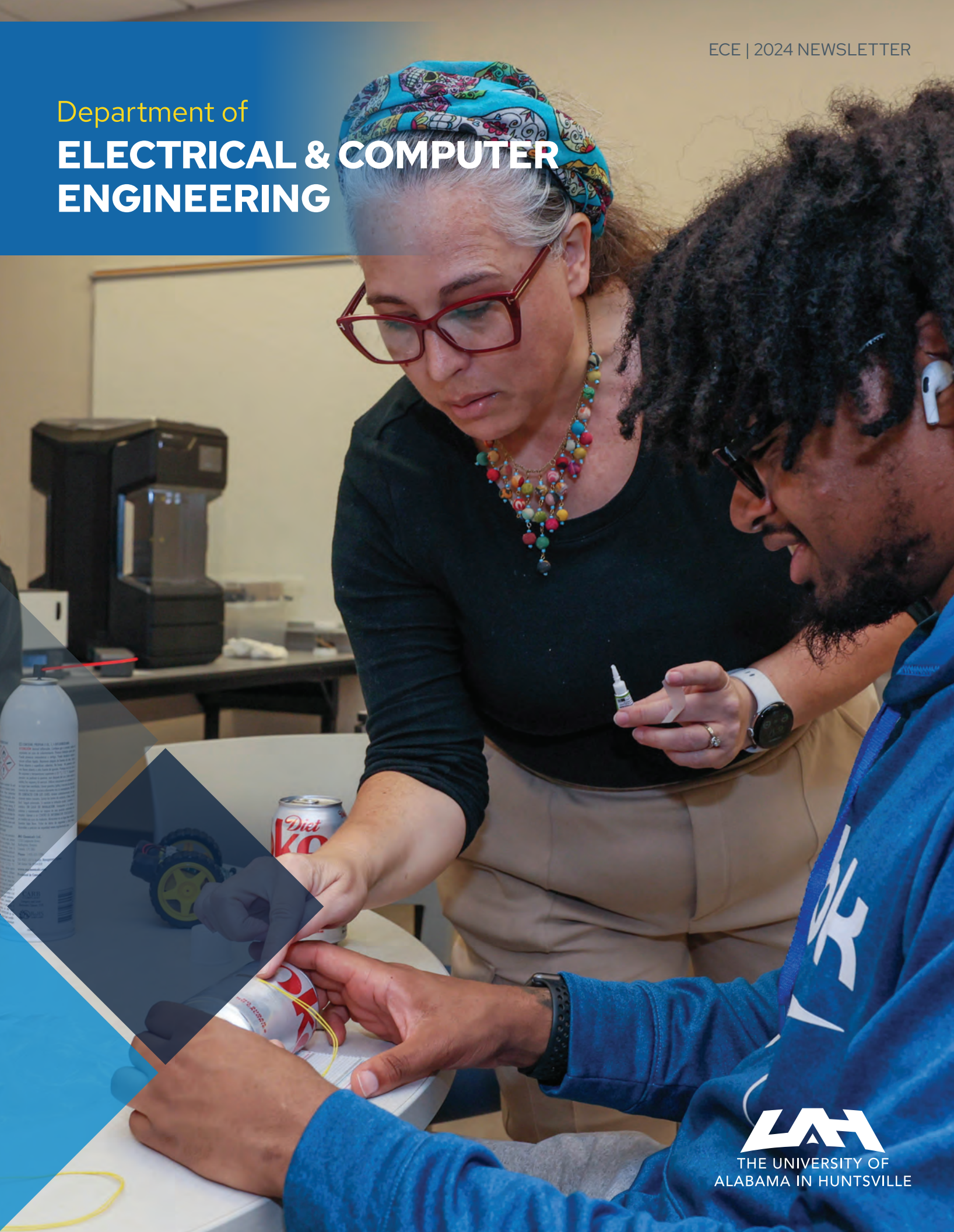
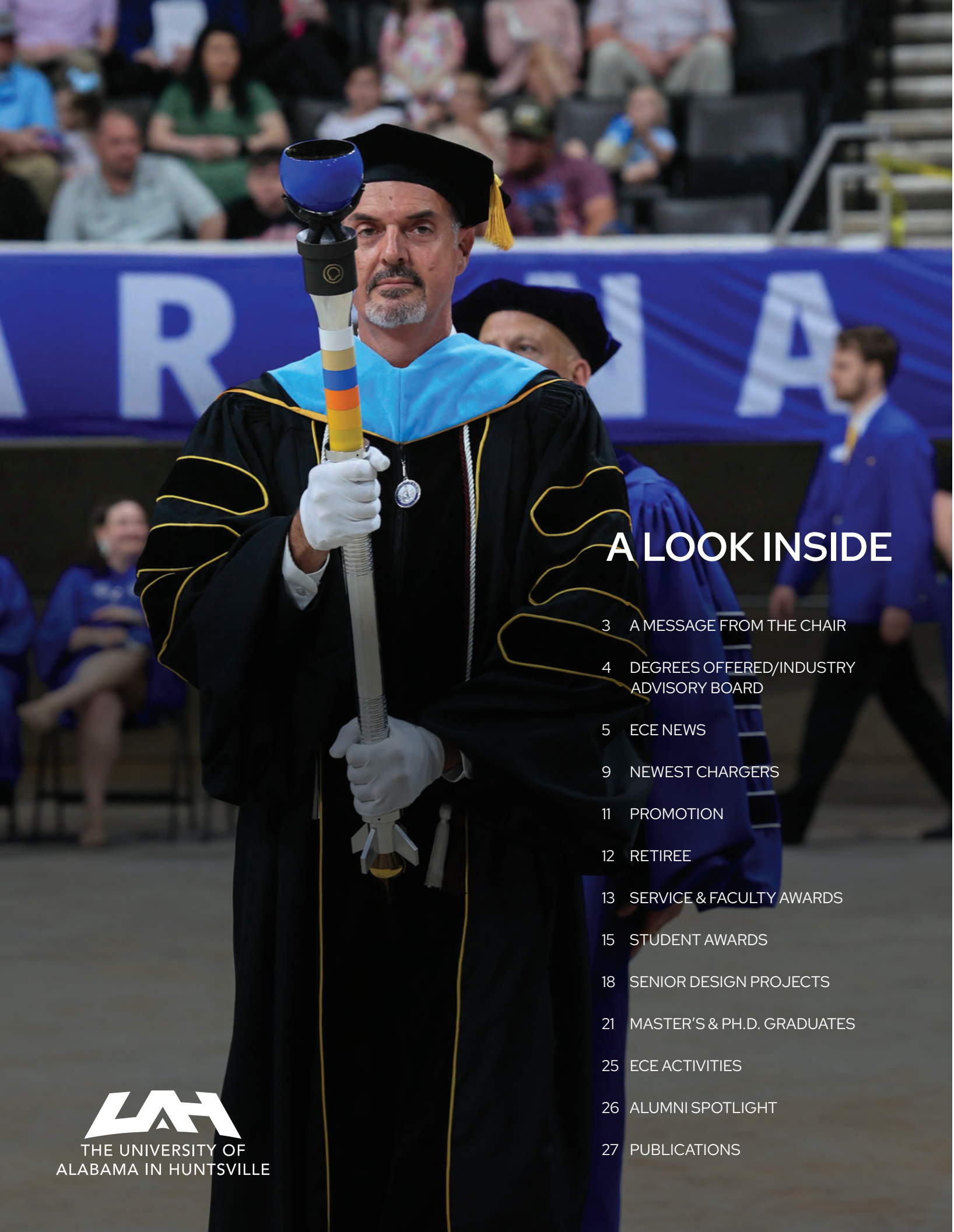
Department of

ELECTRICAL & COMPUTER ENGINEERING



THE UNIVERSITY OF ALABAMA IN HUNTSVILLE



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THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

CHAIR'S MESSAGE

Welcome to the 2024 edition of the Electrical and Computer Engineering Department Newsletter at the University of Alabama in Huntsville. We are thrilled to update you on the new initiatives and events that marked the past academic year.

Our tireless efforts to improve our curriculum and in-class and out-of-class experiences for our students have paid off. We have increased both our student and faculty numbers, grown our research expenditures, and further engaged our local, national, and global communities.

In the Fall of 2023, the ECE Department had 845 registered students, making us the largest ECE Department in Alabama by enrollment. Based on the numbers from commencements in December 2023 and May 2024, 127 undergraduates earned their B.Sc. degrees, 40 students earned Master's degrees, and 7 earned Ph.D. degrees from our department.

Our world-class faculty currently includes 20 tenured and tenure-track members and 3 lecturers, with plans for continued growth. In Fall 2023, we welcomed three new faculty members: Dr. Rahul Bhadani, Dr. Dinh Nguyen, and Dr. Mengfei Ren. We are excited about their contributions to our academic programs and research endeavors in computer engineering, cybersecurity, and software engineering. Additionally, we welcomed new staff members Ms. Arron DePorter and Mr. Cliff Bell.

I am pleased to announce that our undergraduate program in Cybersecurity Engineering received ABET accreditation in October 2023, joining our accredited programs in Electrical and Computer Engineering. At that time, there were only four ABET-accredited Cybersecurity Engineering programs in the nation. Many thanks to our dedicated students, faculty, and staff who contributed to the successful launch of this program. We are also expanding our course offerings with new courses in Machine Learning and Quantum Computing.

To invigorate our connections with alumni, we have started the ECE Alumni Spotlight webpage (uah.edu/eng/departments/ece/ece-alumni-spotlight). Our alumni, coming from diverse backgrounds and cultures, have embarked on remarkable journeys, transforming challenges into opportunities and making significant contributions across a wide spectrum of industries and research areas. Through these interviews, our former students share their paths to success, the obstacles they've overcome, and the milestones of their careers since graduation. They also reflect on how the ECE department prepared them for the complexities of the modern world and the dynamic landscape of engineering and technology. Please take a moment to read stories about Dr. Matthew Nicely, a Deep Learning Compiler Product Manager at NVIDIA, and Elizabet Sawyer, a computer engineer at Ethicon, a subsidiary of Johnson and Johnson.

Our new ECE research seminars have been a success, bringing researchers from the department, the university, and our community together. We look forward to continued growth and engagement with the local and national communities. If you are in North Alabama, please stay tuned and attend our seminars.

Please explore the other pages in this newsletter. You will find information about our new faculty members and staff, exciting research projects conducted by our faculty and students, and the achievements of our exceptional students and faculty who were recognized during Engineer's Week, Honors Day, and the ECE awards ceremony. We also highlight the successes of our seniors and their mentors.

If you are interested in learning more about the exciting opportunities available in our department, please visit our website or contact us directly. To our prospective undergraduate and graduate students, come and join us – you will receive a world-class education while building lasting friendships with your peers, faculty, and staff. To our alumni, the ECE Department is your academic home, and we look forward to hearing from you and continuing to build a vibrant and engaged ECE community.

Go Chargers!

Sincerely,

Aleksandar Milenkovic,
Department Chair and Professor

ABOUT ECE

The ECE Department at UAH offers a comprehensive set of courses that span the Electrical and Computer Engineering disciplines. Our programs are designed to not simply train students to be users of current technology but to educate them in a manner so that they understand the underlying principles through which this technology is based. This allows them to be innovators throughout their lives and become active contributors to the ever-changing technological landscape. Our graduates can be found throughout the world actively impacting industry, government, and academia.

For more information about our department or to learn more about our degree programs, please visit **uah.edu/eng/departments/ece/about**.

Degrees Offered

Bachelor of Science in Computer Engineering (BSCPE)

Bachelor of Science in Electrical Engineering (MSEE)

Bachelor of Science in Cybersecurity Engineering (BSCBSY)

Master of Science in Cybersecurity Engineering (MSCBSY)

Master of Science in Cybersecurity Engineering (MSCBSE)
(Jointly with Computer Science and the College of Business)

Master of Science in Software Engineering (MSSE)
(jointly with Computer Science)

Master of Science in Electrical Engineering (MSEE)

Doctor of Philosophy in Computer Engineering
(jointly with UAB)

Doctor of Philosophy in Electrical Engineering

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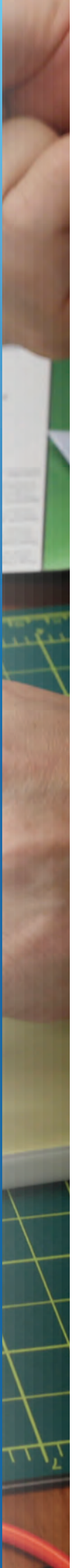
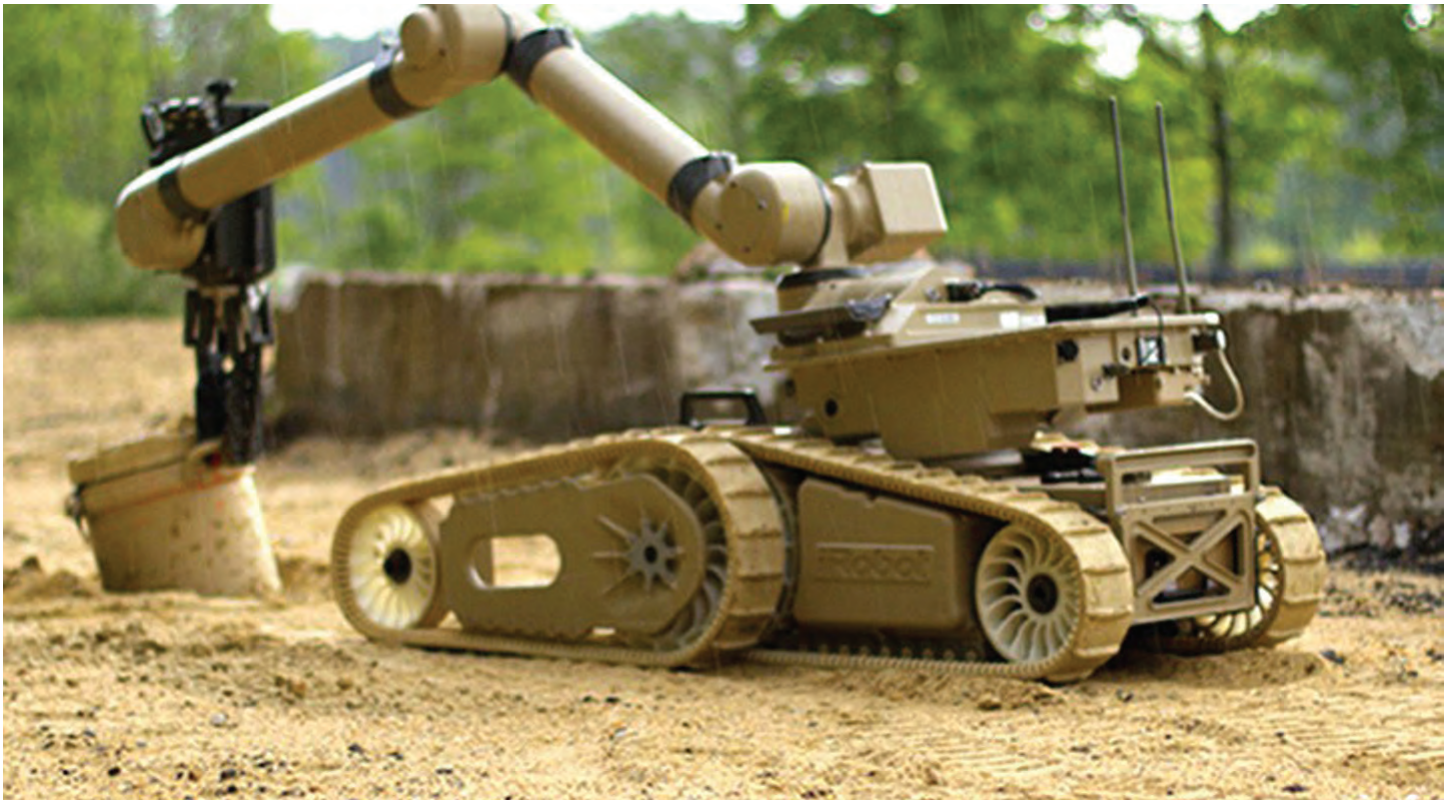


UAH Researcher Wins Three Grants Totaling $650k to Tap Learning-Based Controls

October 19, 2023 // Russ Nelson



▶ Research advances autonomous agents to integrate artificial intelligence, robotics and human teaming elements in challenging environments. *Courtesy U.S. Army*

Dr. Avimanyu Sahoo, an assistant professor at The University of Alabama in Huntsville (UAH), has secured three federal grants totaling nearly $650,000 for his research projects focused on learning-based control and its application in machinery lifecycle management.

1. Smart Personal Protective Equipment (SmaPP): Funded by the NSF for $178,937, this project aims to enhance personal protective equipment (PPE) through smart technologies. The initiative will establish a collaborative Research Experiences for Undergraduates (REU) site to provide students with research experiences in developing SmaPP. The project will focus on developing new smart materials, incident heat flux measurement on the surface of SmaPP, intelligent wireless sensing technology for human vital signs and radiation monitoring, and human perception of SmaPP.

2. Networked Autonomous Heterogeneous Agents (NAHA): Supported by the Naval Surface Warfare Center with a grant of $229,837, this project seeks to improve collaborative control tasks in uncertain environments such as marine exploration and disaster management. The research focuses on developing intelligent control systems for networked autonomous agents to perform collaborative tasks efficiently, even with communication constraints.

3. AI-Enabled Robotic Inspection Platforms: Dr. Sahoo has been awarded $240,920 from the Department of Energy to enhance the autonomy of AI-enabled robotic inspection platforms for inspecting critical energy infrastructure. The project aims to develop integrated AI-driven platforms for autonomous dynamic path planning, safe navigation, and real-time defect identification, contributing to the sustainability of energy sectors.

These projects demonstrate Dr. Sahoo's expertise in learning-based control and its diverse applications in enhancing safety, efficiency, and sustainability across various domains.

UAH Leads National Vivid Coalition to Advance Cybersecurity Education With $3.2M DOD Grant

April 4, 2024 // Anne Marie Martin

The University of Alabama in Huntsville (UAH) is spearheading a coalition of four universities in a three-year program called Virtual Internship and Varied Innovative Demonstrations (VIVID), funded by a $3.2 million grant from the Department of Defense (DOD). UAH, part of The University of Alabama System, leads the coalition, which comprises of Augusta University in Georgia, Florida International University, and The University of Arizona.

Directed by Dr. Tommy Morris of the UAH Center for Cybersecurity Research and Education (CCRE), VIVID aims to recruit diverse students by offering virtual paid internships. Each year, it plans to conduct four eight-week virtual cohorts with 20 students per cohort. Co-principal investigators are Sharon Johnson, UAH; Dr. Josh Pauli, Arizona; Dr. Michael Nowatkowski, Augusta, and Randy Pestana, Florida.

Dr. Tommy Morris

"The VIVID program hires interns from Centers of Academic Excellence in Cybersecurity Education and Research to work side by side with experts from Redstone Arsenal, the associate's Defense Industrial Base," Morris said. "In doing so, this program provides a new vector for workforce development for North Alabama. The VIVID program also provides enhanced visibility for UAH and our three partners."

The support of Alabama Lt. Gov. Will Ainsworth was instrumental in the development of the UAH CCRE.

"Huntsville is nationally recognized as a hub of cutting-edge technology and ground-breaking research, and much of that spotlight is focused on the UAH Center for Cybersecurity Research and Education, which I was proud to help create," Ainsworth said. "In addition to developing the next generation of cybersecurity experts and innovating new techniques and technologies, this grant demonstrates that the center is also helping attract additional federal dollars, jobs and opportunities to our state."

VIVID's objectives include providing hands-on cybersecurity experience through internships, conducting Red versus Blue hackathons, and hosting an annual colloquium in fall 2024 to showcase DOD cyber programs' successes.

The coalition, consisting of R1 or R2 universities, collaborates closely with DOD agencies and military bases in their respective regions. UAH partners with Redstone Arsenal, while Augusta University serves Fort Eisenhower in Georgia, Florida International University supports U.S. Army Garrison in Miami, and The University of Arizona collaborates with Fort Huachuca in Arizona.

UAH Researcher Wins $279K

NSF EPSCoR Fellowship to explore preventing catastrophic failures in lithium-ion battery packs in electric vehicles (Dr. Sahoo)

April 25, 2024 // Russ Nelson

Dr. Avimanyu Sahoo, a researcher at The University of Alabama in Huntsville (UAH), has been awarded a U.S. National Science Foundation's Established Program to Stimulate Competitive Research (EPSCoR) Fellowship totaling $279,105 to study ways to enhance the safety, efficiency and longevity of lithium-ion battery packs in electric vehicles (EV). Lithium-ion batteries are subject to overheating and catching fire, highlighting the limitations of onboard electronic battery management systems (BMS) in detecting abnormal behavior and raising concerns about safety and the broader acceptance of EVs. With the number of EVs on U.S. roads projected to reach 26.4 million by 2030, this research is especially timely and is slated to run through December 2025.

An assistant professor in electrical and computer engineering at UAH, a part of the University of Alabama System, Sahoo will act as principal investigator on the project, working in collaboration with the Sandia National Laboratories in Albuquerque, NM. The researcher's prime area of expertise is in intelligent control systems, a discipline that focuses on developing control methods capable of emulating important characteristics of human intelligence, such as adaptation and learning, as well as operation of systems within uncertain environments. Intelligent systems can gather, analyze and respond to the data they collect, making them particularly applicable to improving BMS behavior.

"This research was sparked by my initial work with lithium-ion batteries during my doctoral studies, a curiosity further fueled by reports of fire incidents in electric vehicles," Sahoo explains. "Given my background in intelligent control, I recognized the potential to improve battery management systems by incorporating advanced algorithms, enhancing the accuracy of operational decisions, ensuring the safety of the battery pack, the vehicle and its users."

Sahoo reports that developing a "smart BMS" capable of monitoring the smallest part of a battery pack in real-time and learning abnormal behavior for future prediction could be the key to addressing safety concerns.

(L-R) Saima Alam, Arian Yousefian, Dr. Avimanyu Sahoo, Sazzad Hossen (front) in the lab with the battery test equipment.

"Our project is centered on crafting an AI-driven model aimed at achieving a more precise monitoring of individual cells within a battery pack," the researcher notes. "Imagine having a highly intuitive system within electric vehicles that can keep a constant and detailed check on each battery cell's health and performance. This system would not only foresee potential internal issues and regulate temperature to prevent overheating, but also ensure each cell operates optimally. The ultimate goal is to create a safer, more reliable electric vehicle, significantly reducing the risks of fires and enhancing overall battery efficiency."

The project hopes to chart a new frontier in power and energy management and minimize the risk of pack overheating, while also addressing efficiency concerns and "range anxiety" drivers may experience due to insufficient charging stations.

"The fellowship at Sandia National Laboratories represents a pivotal opportunity to conduct tests on lithium-ion battery modules to refine and validate the AI-driven model we intend to develop," Sahoo says. "This initiative aims to bridge the gap between theoretical models and their practical application, ensuring our intelligent BMS can effectively adapt to and manage the complexities of real-world battery operation."

EPSCoR is part of NSF's Broadening Participation portfolio which seeks to strengthen the nation's science, technology, engineering and mathematics (STEM) capacity and capabilities.

UAH Electrical Engineering Design Students Craft Projects Aimed at STEM Outreach and Advanced Tracking Technology

June 3, 2024 // Russ Nelson

Senior engineering design students at The University of Alabama in Huntsville (UAH), a part of the University of Alabama System, have created projects intended to encourage STEM outreach for middle and high school students, as well as advancing tracking technology aimed to enhance the traceability of assets such as autonomous rovers and satellites. Two recent projects include crafting Doppler Radar Guns (DRGs) simple enough to be produced by middle and high school students, along with demonstrating a novel way to track an object using a special signal that doesn't require computers.

DOPPLER PROJECT PROVIDES TWO SOLUTIONS

For the first project, the goal was to design a task that involved an engineering build process that would be accessible to grade school students. The UAH Fieldable Radar Outreach Group, or Team FROG, decided to craft a device that would appeal to future engineers who have grown up with video game controllers in their hands. DRGs turned out to be the perfect fit for such a task, though the biggest challenge the team faced was fitting a single implementation to the various skill levels of younger students.

"This led to an elegant solution," says Dennis Hite, a senior lecturer in electrical and computer engineering at UAH and team advisor. "Design two separate radar guns, one to be constructed around a radar module that would be simpler to build for a middle school kid, and the other would use the more advanced HB100 radar module, a version of DRG with a more involved implementation process, requiring an external amplifier circuit."

The UAH Systems Management and Production (SMAP) Center dedicated funding to support the initiative. Team FROG, led by Elijah Gay from the SMAP, included senior design class students Riley Carroll, Garrett Conner, Chad Lowe and Ethan Thoenes, all working toward undergraduate degrees in electrical engineering.

To make switching from one version of the DRG to the other more feasible, both designs emphasized shared design features and production steps. The team was able to create and successfully test both versions of the DRGs, and hopes to one day soon take the project on the road, leading outreach builds at area schools.

BUILDING AN UNTRACEABLE ASSET

In scenarios where an asset must be tracked remotely, it is often difficult to acquire the position of the asset without also revealing the asset to adversaries, as is often the case with objects such as spy satellites, where having a beacon on the satellite risks revealing its position. Team Beal-istic Missiles, consisting of electrical engineering design students Aiden St. Hilaire, Sidney Lovelady, William Current, Ethan Hoben and Patrick Natividad, advised by UAH Assistant Professor Aubrey Beal, tackled this problem by designing a system intended to demonstrate a new way to track an object by emitting a special signal.

Rather than a satellite, the team utilized an autonomous rover for the effort. "Our system is made of two main parts, a rover and a beacon," explains team project manager Ethan Hoben. "The beacon can be thought of as a speaker, and it emits a signal in the form of sound. The rover can be thought of as a person listening to the speaker, as the rover has two microphones similar to a person's ears. The rover's microphones listen for this specific sound that only the beacon can emit, which allows the rover to always follow the beacon, even if you move the beacon around."

This method allows for the locating signal to be indistinguishable from atmospheric noise to adversaries, but still allows for quick acquisition for any receiver systems that have the matching filter. The system is entirely passive, meaning no computers are required to make it work.

"The real trick here is that the beacon emits a signal that can be thought of as a password, because only the beacon can produce this sound, and the rover is designed to only respond to that password sound," Hoben points out. "It can be likened to a GPS in that sense, as it allows our sensors to determine where the source of a signal is, thereby tracking it. This tracking is completed without any form of digital computation, resulting in quick beacon acquisition without dedicating computational resources. This technology would allow for a number of interesting applications, such as clandestine tracking of friendly assets, the aforementioned satellite applications, as well as hidden communications."

NEW ECE FACULTY

The ECE Department welcomed 3 new faculty members in Fall 2023

Dr. Rahul Bhadani

ASSISTANT PROFESSOR

Areas: Cyber-physical Systems, Connected & Autonomous Vehicles

Dr. Bhadani is an assistant professor of Electrical & Computer Engineering at the University of Alabama in Huntsville. He was a post-doctoral research fellow at Vanderbilt University from July 2022 - August 2023. His research expertise includes connected and autonomous vehicles, cyber-physical systems, smart cities, microgrids, and quantum information science.

WE WELCOME

OUR NEWEST CHARGERS!

Dr. Dinh Nguyen

ASSISTANT PROFESSOR

Areas: Networking, Intelligence, Security

Dr. Nguyen is an assistant professor at the Department of Electrical and Computer Engineering, The University of Alabama in Huntsville. Previously, he worked as a postdoctoral research associate at Purdue University. His research interests include wireless networking, distributed learning, and network security. He has published over 30 papers on top-tier IEEE/ACM conferences and journals. He is an Associate Editor of the IEEE Open Journal of the Communications Society.

NEW ECE FACULTY

Dr. Mengfei Ren
ASSISTANT PROFESSOR

Areas: Software Engineering, Testing

Dr. Ren worked as an assistant professor of Electrical and Computer Engineering Department. Her expertise and research interests span software engineering and cybersecurity. She has focused so far on security analysis of IoT wireless protocols with advanced software testing techniques, like fuzzing, data flow analysis and combinatorial testing. Her work has detected several 0-day vulnerabilities in a mainstream Zigbee protocol implementation.

WE WELCOME
OUR NEWEST CHARGERS!

NEW ECE STAFF

Mr. Cliff Bell
LAB MANAGER

A native of the Huntsville area, Cliff has joined the ECE department as the new lab manager to round out his fifth year collectively in the university system. He is a technophile and a tinkerer, which blends well with the rest of the cast here in Engineering. He's a firm believer in the mindset that getting old is mandatory, but growing up is not.

NEW ECE STAFF

Ms. Arron DePorter

SENIOR STAFF ASSISTANT

Originally from Tuscaloosa, AL, Arron moved to Huntsville in January of 2024, serving as one of the ECE department's newest staff members. After five years of teaching at both the university and secondary levels, Arron realized that she loves helping students navigate their way through college. Arron enjoys being outside in any way that she can—long walks, hiking, biking or relaxing at the beach—as well as spending time with the people that she loves.

THANK YOU AND CONGRATULATIONS ON YOUR PROMOTION

Mr. Chris Hardy

Congratulations on his promotion to **System Engineer III**

RETIREES

Ms. Annette Archer

A bittersweet farewell
and Happy Retirement!

THANK YOU AND CONGRATULATIONS TO

OUR NEWEST RETIREES!

Ms. Mary Nutial

A bittersweet farewell
and Happy Retirement!

ECE Department Awards 2023-2024

April 26 2024

"The Annual ECE Awards Ceremony is not just an occasion to recognize remarkable achievements of our peers, but also a celebration of the collective spirit, hard work, and dedication that define our Department.

This year, we are delighted to honor several members of our community whose contributions have significantly advanced our mission and upheld our commitment to excellence. Attached to this email, you will find a document detailing the awards and the recipients. We are recognizing multiple individuals in several categories, as we have not had similar events since the Covid19 pandemic.

I also want to take this opportunity to express my gratitude to each and every one of you. Whether through teaching, research, service, or support, your efforts are the cornerstone of our success."

- Dr. Aleksandar Milenkovic

Dr. Joseph C. Dowdle Outstanding ECE Faculty Award

This endowment fund was established by the ECE department in 2005 in honor of Dr. Joseph C. Dowdle, the first ECE Department Chair.

"The Dr. Joseph C. Dowdle Outstanding ECE Faculty Award shall be conferred on a full-time member of the ECE faculty whose record of activities demonstrates a dedication to the following institutional ideals espoused by Dr. Joseph C. Dowdle throughout his career: quality programs, academic excellence, scholarly environment, and high standards in promotions and professional ethics."

Dr. Avimanyu Sahoo

Dr. Avimanyu Sahoo is awarded the Joseph C. Dowdle Outstanding ECE Faculty Award for his significant achievements in extramural research funding, supporting numerous graduate students, and for revitalizing our controls area curriculum.

Mr. Dennis Hite

Mr. Dennis Hite is awarded the Joseph C. Dowdle Outstanding ECE Faculty Award in recognition of his exceptional service as a senior design instructor in Electrical Engineering, his coordination of the ECE graduate teaching assistant program, and his commitment to the outreach and community engagement mission of the ECE Department.

Linda Mauldin Hooper ECE Outstanding Service Award

Endowment fund was established in honor of Linda Mauldin Hooper, who served the University for more than 30 years as a devoted and loyal employee.

"The award(s) shall be given annually to one or more full-time staff members, faculty members, and/or undergraduate or graduate students either employed by or enrolled in the ECE Department and shall be based on a record of outstanding service to the Department."

Mr. Chris Hardy

Mr. Chris Hardy is awarded the Linda Mauldin Hooper ECE Outstanding Service Award for his exceptional service to the Department, filling dual roles with extraordinary dedication and versatility, and providing continuous support for summer camps.

Ms. Mary Nutial

Ms. Mary Nutial is awarded the Linda Mauldin Hooper ECE Outstanding Service Award for her instrumental role in the revitalization of student areas and laboratories, demonstrating exemplary leadership and service to the ECE Department.

Iliana Martin Chittur Outstanding Graduate Student Award

Endowment fund is established by the ECE Department in 2005 in memory of Iliana Martin Chittur.

"The award(s) shall be conferred upon one or more full-time graduate students, with preference given (without consideration of financial need) to students who demonstrate scholarly research in the areas of Electrical, Computer, or Optical Engineering."

Mr. Umeshwarnath Surendranathan

Mr. Umeshwarnath Surendranathan is awarded the Iliana Martin Chittur Student Award in recognition of his exemplary research accomplishments.

Adjunct Faculty Excellence Award

- **Dr. Buddy Bishop** is recognized for his long-term service to the ECE Department in various capacities, including the Industrial Advisory Board, as an adjunct instructor, and an advocate, enriching the Department with his experience and commitment.

ECE Outstanding Adjunct Instructors Awards

- **Dr. Mervin Budge** is recognized for his commitment to excellence in teaching multiple graduate courses in radars, Kalman filters, and others, enhancing the curriculum and student learning experience, and participating in graduate student research.
- **Dr. Casey Cain** is recognized for his outstanding teaching in undergraduate Electrical Engineering courses, significantly contributing to the educational mission of the department.
- **Dr. Adam Panagos** is recognized for his exceptional teaching in both undergraduate and graduate Electrical Engineering courses, positively impacting students' academic journeys, and participating in graduate student research.

Outstanding Student Service Award

- **Mr. Ethan Hoben** is recognized for his exceptional service to the ECE Department. He has revitalized Eta Kappa Nu and Tau Beta Pi honor societies and has participated in a number of outreach activities.

The ECE Department at The University of Alabama in Huntsville is thrilled to announce the outstanding achievement of our Circuit Design team, clinching 3rd place at the IEEE SoutheastCon 2024 Circuit Design competition, held in Atlanta, Georgia.

Congratulations are in order for our exceptional students, Aidan Barton and Elijah Moore, whose dedication and talent have brought this accomplishment to fruition.

STUDENT HIGHLIGHTS

- Virtual Institutes for Cyber and Electromagnetic Spectrum Research and Employ (VICEROY) National Cyber Competition

The ECE Department celebrates the success of a UAH team that won a national cybersecurity competition. Congratulations to team members:

- Allan Benjume, Computer Science
- Jason Hatfield, Cybersecurity Engineering
- Seth Bredbenner, Cybersecurity Engineering
- Trey Graham, Computer Science.

Thanks to Dr. Morris for creating opportunities for our students to compete (story below).

A student team from UAH has been crowned national champion in the first Virtual Institutes for Cyber and Electromagnetic Spectrum Research and Employ (VICEROY) National Cyber Competition. The VICEROY Institute is a program of the Air Force Research Laboratory managed by the Griffiss Institute to provide support for a virtual institute at UAH to develop expertise in critical cyber and electromagnetic spectrum operational skills for future military and civilian leaders of the Armed Forces and the Department of Defense.

"The cybersecurity programs at UAH attract very talented students," says Dr. Tommy Morris, the director of the UAH Center for Cybersecurity Research and Education (CCRE). "Two members of this national championship team are freshmen. In the UAH Cybersecurity Club, UAH students are training each other how to win cybersecurity competitions. Their dedication and the outcome is very impressive."

In 2023, the UAH CCRE was awarded a grant from the Griffiss Institute for the VICEROY program which will run through 2025. UAH is the lead institution and is partnering with Alabama A&M University and the Alabama School of Cyber Technology and Engineering (ASCTE). UAH team members include Allan Benjume and Trey Graham, both majoring in computer science, as well as cybersecurity engineering students Jason Hatfield and Seth Bredbenner.

The UAH squad topped 19 other teams and completed all seven progressive levels of difficulty as part of the competition's "Dr. Boom" challenge. Each level of the competition had students working in a unique scenario to use cyber techniques to defuse a bomb and stop "Dr. Boom." UAH President Charles "Chuck" Karr and Provost David Puleo presented the winners with their National Championship banner.

HONOR'S DAY RECOGNITIONS

Congratulations to the 2024 ECE Outstanding Students recognized at the UAH Engineering Convocation dinner (Honors day)

LILY COMPHER
2024 Outstanding Electrical Engineering Undergraduate

JONATHAN PARKER VANDINE
2024 Outstanding Computer Engineering Undergraduate

JAMESON GARNER
2024 Outstanding Cybersecurity Engineering Undergraduate

Thanks to our outstanding faculty for their mentorship and commitment to fostering an environment of excellence and growth for our students.

FEATURED SENIOR DESIGN PROJECTS

unFOG: unFreezing Of Gait System (CPE)

Team Members: Mary Claire Correl, Nathan Dinh, Nathan Pendergrast
Faculty Members: Dr. Emil Jovanov (UAH), Dr. Steven Pucket (UNA)
Abstract: Freezing of Gait (FoG) is a serious condition that can lead to falls and injuries of Parkinson's patients. However, it has been shown that a simple auditory or visual cue might unfreeze the patients and prevent injuries. There is nothing on the market that people who suffer from the FoG can use to detect and resolve FoG when it occurs. This project designs a body area network, with a custom watch as the central node, and inertial sensor and a buzzer as peripherals. The watch will use inertial signals and biometric signals (heart rate) to detect FoG in real time and generate audio cue on the buzzer to resolve freezing of gait. If a FoG event is detected, the watch will send an alert to the cloud server with the accompanying event data. A mobile app will receive an alert allowing the user to flag whether it was a false alarm or what triggered the event. The project implemented a custom PCB design for the central node, inertial sensor, and a wearable photoplethysmography (PPG) sensor.

The Guardians of the Grid (CBSY)

Team Members: Alli Reno, Serena Simpson, Hunter Smith, G. Piddington
UAH ECE Department Faculty Mentor: Dr. Thomas Morris
Abstract: The main objective of the Guardians of the Grid Project (GoG) is to produce an application that performs a Large Language Model (LLM) based time network analysis in real-time. The application would allow network monitoring for ordinary users as well as seasoned cybersecurity professionals. A raw network traffic data will be transformed into Natural Language format and used as input into an LLM such as ChatGPT or Google's Bard to perform network analysis and generate a report for the user. This project will utilize the CCREs Smart Installation Model (SCADA System) as a testing asset with the premise that if the LLM can successfully interpret and identify an intrusion or attempted intrusion in a congested network that it could also do the same for a home network with a more generic traffic flowing through it. Additionally, there will be cyberattacks conducted on this model which will be used as input into the GoG tool to test detection of the attempted infiltration.

Blockchain Enabled Network Security (CBSY)

Team Members: Timothy Alhorn, Caleb Cope, Virginia Folse, Savannah Graham, Megan Salmons
UAH ECE Department Faculty Member: Dr. Dinh Nguyen
Abstract: This project is focused on the use of blockchain for secure communication and the secure transfer of files on a network. This is a needed project as blockchain technology is still very new in its application, and while some work has been done in creating IoT networks using blockchain, additional work should be pursued to take advantage of the security of blockchain. The project will integrate lightweight devices, taking into consideration their processing limitations. The main objective set for this project includes creating an implementation of automated security to facilitate secure file transfer within the network using blockchain technology. The project implemented a test network of VMs, lab machines, and a prototype interface for Android devices that will include the same features as the full node devices.

Entropic Signals with Hardware Fingerprints (FA23, EE)

Team Members: Aidan Barton, Joey Beard, Ryan Carman, Seth Howard, Isaiah Mason
Faculty Advisor: Dr. Aubrey Beal
Abstract: We present signals generated by electronic hardware that result in distinct, digital fingerprints that are provably unique between any device. Previous efforts have attempted to use fabrication variations to achieve these fingerprints. However, few have considered the effects of these variations in chaotic systems that generate true entropic signals. Interestingly, types of chaotic systems have been shown to be solvable and consist of first order basis functions. With the combination of time-series analysis techniques and simple, closed-form solutions, we will analyze fingerprints embedded in signals made by these first order chaotic oscillators. By using electronics with fingerprints as demonstrated by these systems, the electronics supply chain can be verified, resulting in less counterfeit components.

Real-Time Kinematic Rover Upgrade (SP24)

Team Members: Jacob Knowles, Brendan Mitchell, Seth Schmidt, Haylee Winters
Abstract: Our task for our senior design project was to create an upgrade to the Global Positioning System (GPS) currently being used on Dr. Piccirillo's QuadRover. The GPS is a system of American satellites that transmits position and time information back to earth, allowing receivers to determine location within a few meters.

The previous system on the QuadRover used a plain unsophisticated GPS with an accuracy error of a few meters, while the new system uses Real-Time Kinematics (RTK) to have an increased accuracy, down to an RMS error value of 1 cm (our goal was below 3 cm).

This system involves a base station with a known location and a rover module. The base station computes the phase between the data of its known location and its own GPS. This correction data is sent to the rover module, where it is used along with the rover's own GPS data to create extremely accurate location data of the QuadRover.

Paul Michael Salmon Engineering Design Award

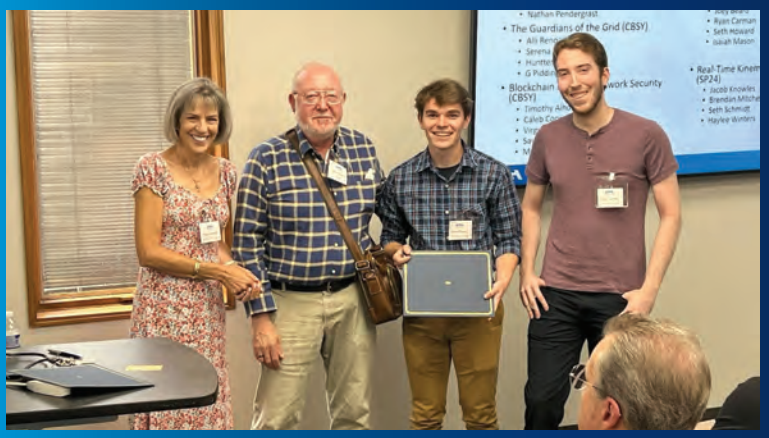
Endowment fund is established in 2007 in memory of Paul Michael Salmon, our beloved student of Computer Engineering.

"The Paul Michael Salmon Engineering Design Award shall be conferred on the individual ECE student or the team of ECE students judged to have devised, completed, and submitted the best design project, in terms of meeting economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability requirements."

Congratulations to the 2024 Paul Michael Salmon Engineering Design Award Winners

1st place: unFOG: unFreezing Of Gait System
- Mary Claire Correll
- Nathan Pendergrast
- Nathan Dinh

2nd place: Real-Time Kinematic Rover Upgrade
- Jacob Knowles
- Brendan Mitchell
- Seth Schmidt
- Haylee Winters



3rd place: Entropic Signals with Hardware
- Fingerprints
- Aidan Barton
- Joey Beard
- Ryan Carman
- Seth Howard
- Isaiah Mason

2024 Huntsville Engineer's Week Awards Winners

BRENDAN MITCHELL
- Outstanding EE Student

EMILY COWART
- Outstanding CPE Student

PAUL CHOE
- Outstanding CBSY Student

UMESHWARNATH SURENDRANATHAN
- Outstanding ECE Graduate Student

DR. AUBREY BEAL
- Outstanding College of Engineering Junior Faculty Award
- Outstanding IEEE Educator

Faculty Highlights

Project/Grants of Dr. Avimanyu Sahoo
- Collaborative REU site: Multi-disciplinary Research Experiences in Smart Personal Protective Equipment (SmaPP); NSF; 3 years; ~$179K for UAH
- Towards Autonomy in Uncertain Environments: Exploring Vistas Beyond Consensus, Naval Surface Warfare, IHD; ~$230K for UAH
- AI-Enabled Autonomy of Robotic Inspection Platforms for Sustainability of Energy Infrastructure, DOE, 3 years, ~$241K for UAH
- Meta and Multimodal Learning for Smart Visual Borescope Inspection, Baker Hughes, 01/23-12/24, ~120K for UAH

ECE Faculty & Students Publications in 2023
- 18 journal articles
- 7 conference papers
- 1 book co-authored
- 6 U.S. patents

CONGRATULATIONS
TO ALL OF OUR 2023 AND 2024
ECE GRADUATES!

CONGRATULATIONS TO ALL!

ECE DEPARTMENT SPRING 2023 PH.D. & MASTER'S GRADUATES ▸

DOCTOR OF PHILOSOPHY (PH.D.) GRADUATES

YUHANG DONG, Electrical Engineering
Dissertation: "Joint Pattern Classification and Data Compression Using Deep Learning on Large Image Datasets"
Advisor: Dr. David Pan

REETU HOODA, Electrical Engineering
Dissertation: "Contributions to Data Compression Research for Various Media Formats Using Particle Swarm Optimization and Neural Networks"
Advisor: Dr. David Pan

SIJAY HUANG, Electrical Engineering
Dissertation: "Exploring Reliability Issues in Non-volatile Memories Using Numerical Simulation"
Advisor: Dr. Biswajit Ray

MASTER'S GRADUATES

MAKENZIE LEONETTEE FOGLE, Electrical Engineering
Thesis: "Software Defined Radio (SDR) with Applications in Radar Systems"
Advisor: Dr. Laurie Joiner

JOSEPH R. ADAMS, Electrical Engineering
RHETT ARMAND BATES, Cybersecurity
JEREMY SANFORD BOYD, Cybersecurity
THOMAS NELSON ELLIS BENSON, Electrical Engineering
JERAMY R. GILLIS, Electrical Engineering
BRANDON KING, Electrical Engineering
ZACHARY ANTHONY LAMEAR, Electrical Engineering
NATHANAEL S. MCCAFFERTY, Electrical Engineering
LOGAN P. MCCARTHY, Electrical Engineering
LAUREN MCDANIEL, Computer Engineering
COLIN J. OBERTHUR, Electrical Engineering
ROOSEVELT J. PIERRE NOEL, Electrical Engineering
JACOB ROSS ELMORE, Computer Software Engineering
JASON RUZICKA, Computer Software Engineering
ALYSA MARIE SAN FILIPPO, Computer Engineering
TYLER A. SMITH, Electrical Engineering

DOCTOR OF PHILOSOPHY (PH.D.) GRADUATES

SAININAD CHANDRAKANT NAIK, Electrical Engineering
Dissertation: "Self-Powered Sensor Systems for Space Applications"
Advisor: Dr. Maria Pour

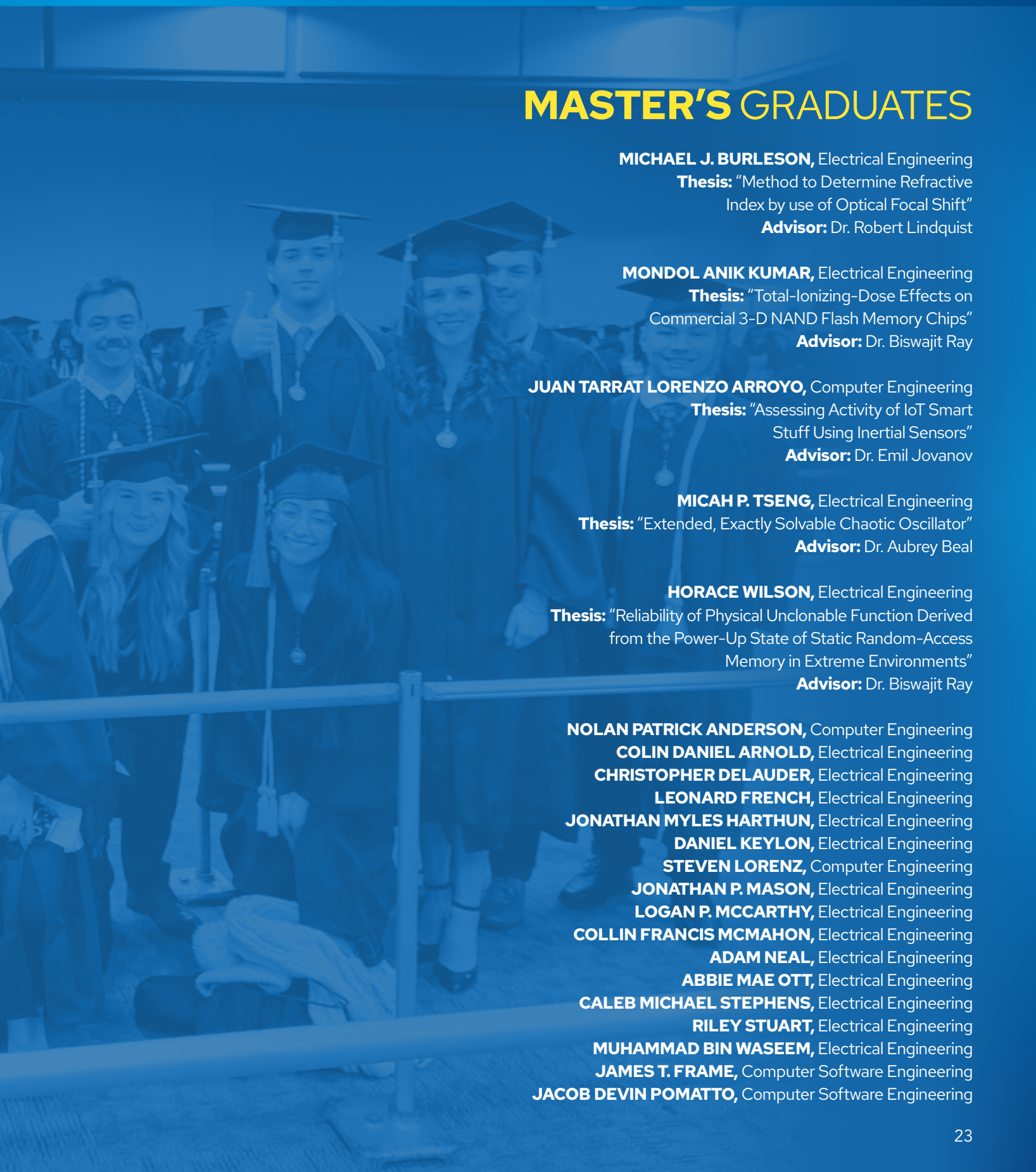
ROBERT JOSEPH MATHEWS, Electrical Engineering
Dissertation: "Bioimpedance-Based Real-Time Wearable Physiological Monitoring"
Advisor: Dr. Emil Jovanov

STEVEN CHARLES PUCKETT, Computer Engineering
Dissertation: "Design of Secure, Low-Power Internet of Medical Things with Precise Time Synchronization"
Advisor: Dr. Emil Jovanov

M D RAQUIBUZZAMAN, Electrical Engineering
Dissertation: "Reliable and Energy Efficient 3D NAND Flash Storage System Design Using Run-Time Device and System Interaction"
Advisor: Dr. Biswajit Ray

TAMSEEL MAHMOOD SYED, Electrical Engineering
Dissertation: "Joint Sonar and Communication (SONCOMM) System Using Solvable Chaos"
Advisor: Dr. Aubrey Beal

SHELTON RAY WRIGHT, Computer Engineering
Dissertation: "A High Speed Simulation and Cybersecurity Regression Testing Platform for Industrial Control Systems"
Advisor: Dr. Tommy Morris



MASTER'S GRADUATES

MICHAEL J. BURLESON, Electrical Engineering
Thesis: "Method to Determine Refractive Index by use of Optical Focal Shift"
Advisor: Dr. Robert Lindquist

MONDOL ANIK KUMAR, Electrical Engineering
Thesis: "Total-Ionizing-Dose Effects on Commercial 3-D NAND Flash Memory Chips"
Advisor: Dr. Biswajit Ray

JUAN TARRAT LORENZO ARROYO, Computer Engineering
Thesis: "Assessing Activity of IoT Smart Stuff Using Inertial Sensors"
Advisor: Dr. Emil Jovanov

MICAH P. TSENG, Electrical Engineering
Thesis: "Extended, Exactly Solvable Chaotic Oscillator"
Advisor: Dr. Aubrey Beal

HORACE WILSON, Electrical Engineering
Thesis: "Reliability of Physical Unclonable Function Derived from the Power-Up State of Static Random-Access Memory in Extreme Environments"
Advisor: Dr. Biswajit Ray

NOLAN PATRICK ANDERSON, Computer Engineering
COLIN DANIEL ARNOLD, Electrical Engineering
CHRISTOPHER DELAUDER, Electrical Engineering
LEONARD FRENCH, Electrical Engineering
JONATHAN MYLES HARTHUN, Electrical Engineering
DANIEL KEYLON, Electrical Engineering
STEVEN LORENZ, Computer Engineering
JONATHAN P. MASON, Electrical Engineering
LOGAN P. MCCARTHY, Electrical Engineering
COLLIN FRANCIS MCMAHON, Electrical Engineering
ADAM NEAL, Electrical Engineering
ABBIE MAE OTT, Electrical Engineering
CALEB MICHAEL STEPHENS, Electrical Engineering
RILEY STUART, Electrical Engineering
MUHAMMAD BIN WASEEM, Electrical Engineering
JAMES T. FRAME, Computer Software Engineering
JACOB DEVIN POMATTO, Computer Software Engineering

DOCTOR OF PHILOSOPHY (PH.D.) GRADUATES

BRIAN GRANTHAM, Electrical Engineering
Dissertation: "Benefits of Quadratically Tapered Flexures For MEMS Resonators and Gyroscopes"
Advisor: Dr. Jennifer English

MASTER'S GRADUATES

SURESH AVULA, Computer Engineering
Thesis: "SMS: A Smartwatch Application Suite for Mobility Assessment"
Advisor: Dr. Emil Jovanov

JASCHA PRITCHETT, Cybersecurity
JOEL SANCHEZ, Cybersecurity
BRENNAN C. SWEENEY, Cybersecurity
CALEB KING YAN WONG, Cybersecurity
MORUFU BABATUNDE ADEOYE, Electrical Engineering
WESLEY DONISON, Electrical Engineering
DIPENDRA GAUDEL, Electrical Engineering
JONATHAN TIMOTHY KONUCH, Computer Engineering
TIMOTHY CORCORAN KRITZLER, Electrical Engineering
EMILY MERCEDES LEPORE, Electrical Engineering
GARRETT RIDGE MANLEY, Electrical Engineering
KEVIN MILLER, Computer Engineering
JUDSON OWEN SMITH, Electrical Engineering
NICHOLAS JAMES TESTIN, Electrical Engineering
ANNE E. WOLF, Electrical Engineering
JAMES ANTHONY GOODLOE, Computer Software Engineering
HARSIMRAN SINGH, Computer Software Engineering
WILLIAM ANDREW WILK, Computer Software Engineering

ECE Mardi Gras Social

February 13, 2024

On Tuesday February 13th the ECE Department let the good times roll in true Mardi Gras fashion. With King Cake in hand, students and faculty from the department gathered in between classes to celebrate the holiday. Aside from delicious treats, students entered for a chance to win some ECE swag to commemorate their time with the department. Dr. Aleksandar Milenkovic, Department Chair, thanked his fellow students and faculty for setting time aside in their busy schedules to celebrate and foster a sense of community. Community and a sense of belonging is what makes UAH stand out, and the ECE department will continue to host these events to cultivate a positive, tight-knit culture for both current and future students and faculty alike. Below are some photos from the celebration.

ALUMNI SPOTLIGHT

At the heart of programs in the ECE department at the University of Alabama in Huntsville is a vibrant community of innovators, problem solvers, and leaders who are shaping the future of technology and engineering. Our alumni, hailing from diverse backgrounds and cultures, have embarked on remarkable journeys, transforming challenges into opportunities and making significant contributions across a wide spectrum of industries and research areas. The ECE Alumni Spotlight is more than just a celebration of individual success stories; it's a testament to the enduring impact of a solid foundation in engineering education. More stories can be found at **uah.edu/eng/departments/ece/ece-alumni-spotlight**.

MATTHEW NICELY, MSE-EE & PhD CPE

Matthew Nicely graduated from the UAH ECE department with his Master's in Electrical Engineering in 2014 and later with his PhD in Computer Engineering in 2019. He studied part-time while working full-time at Redstone arsenal. Throughout his coursework and research, Matthew primarily focused on GPU algorithms and optimizations. Upon graduation, he joined NVIDIA, a company renowned for their work in AI, graphics and industrial digitization. Matthew currently works as a Deep Learning Compiler Product Manager and is responsible for the strategic planning, development, feature roadmaps, and life cycles of various NVIDIA products. He specifically works with CUTLASS and cuDNN, both of which are used for matrix multiplication in deep learning neural networks.

ELIZABETH SAWYER (STALEY), BS CPE

Elizabeth Sawyer graduated from the UAH ECE department with her Bachelor's in Computer Engineering in 2020. Elizabeth was named the 2020 Outstanding Computer Engineering Undergraduate. Upon graduation, Elizabeth moved to Cincinnati, Ohio, where she launched her career at Ethicon, Inc. A subsidiary of Johnson and Johnson, Ethicon specializes in manufacturing medical devices, including surgical sutures and wound closure devices. At Ethicon, innovation is key, and their employees look beyond traditional surgery methods to develop new ways of healing for patients around the world. Elizabeth's various roles at Ethicon have involved writing software and bringing up hardware for upcoming operating room equipment.

Publications

June 26, 2024

Umeshwarnath Surendanathan, Horace Wilson, Maryla Wasiolek, Khalid Hattar, Aleksandar Milenkovic, Biswajit Ray, "Total Ionizing Dose Effects on the Power-up State of Static Random-Access Memory," IEEE Transactions on Nuclear Science, vol. 70, no. 4, January, 2023, pp. 641-647. doi: 10.1109/TNS.2023.3236625.

Md Raquibuzzaman, Aleksandar Milenkovic, Biswajit Ray, "Intrablock Wear Leveling to Counter Layer-to-Layer Endurance Variation of 3-D NAND Flash Memory," IEEE Transactions on Electron Devices, vol. 70, no. 1, January, 2023, pp. 70-75. doi: 10.1109/TED.2022.3224420.

Maria Pour, Tanzeela Mitha, and Eli Brothers, "A Combined Electronic Position- and Partial Amplitude-Control Synthesis Technique for Sidelobe Reductions in Linear Array Antennas," IEEE Transactions on Microwave Theory and Techniques, vol. 71, no. 12, pp. 5074-5081, Dec. 2023, doi: 10.1109/TMTT.2023.3288634.

Matthew Adams and Maria Pour, "A TE-mode Rectangular Microstrip Patch Antenna Excited by a Coplanar L-strip Feed," Progress In Electromagnetics Research C, vol. 134, pp. 171-180, July 2023, doi: 10.2528/PIERC23030103.

Tanzeela Mitha and Maria Pour, "Null Steering in Linear Array Antennas with Electronically Displaced Phase Center Dual-Mode Antenna Elements," IEEE Transactions on Antennas and Propagation, vol. 71, no. 3, pp. 2843-2848, March 2023, doi: 10.1109/TAP.2023.3240311.

Sai Radavaram and Maria Pour, "A Novel Decoupling Technique for Single-Layered CloselySpaced Patch Antenna Arrays," Progress In Electromagnetics Research M, vol. 115, pp. 35-44, Jan. 2023, doi: 10.2528/PIERM22120220.

Nguyen, Van-Dinh and Vu, Thang X. and Nguyen, Nhan Thanh and Nguyen, Dinh C. and Juntti, Markku and Luong, Nguyen Cong and Hoang, Dinh Thai and Nguyen, Diep N. and Chatzinotas, Symeon, "Network-Aided Intelligent Traffic Steering in 6G O-RAN: A Multi-Layer Optimization Framework," IEEE Journal on Selected Areas in Communications, Vol. 1, No. 1, November 2023, pp. 1-16. doi: 10.1109/JSAC.2023.3336183.

Zhang, Shiying and Li, Jun and Shi, Long and Ding, Ming and Nguyen, Dinh C. and Tan, Wuzheng and Weng, Jian and Han, Zhu, "Federated Learning in Intelligent Transportation Systems: Recent Applications and Open Problems," IEEE Transactions on Intelligent Transportation Systems, Vol. 2, No. 12, November 2023, pp. 1-16. doi: 10.1109/TITS.2023.3324962.

Pubudu. L. Indrasiri, Dinh C. Nguyen, B. Kashyap, Pathirana . N. Pathirana and Yonina. C. Eldar, "FedXPro: Bayesian Inference for Mitigating Poisoning Attacks in IoT Federated Learning," IEEE Internet of Things Journal, Vol. 3, No. 5, November 2023, pp. 1-16. doi: 10.1109/JIOT.2023.3334298.

Quy, Vu Khanh, Nguyen Tien Ban, Dang Van Anh, Nguyen Minh Quy, and Dinh C. Nguyen, "An Adaptive Gateway Selection Mechanism for MANET-IoT Applications in 5G Networks," IEEE Sensors Journal, Vol. 23, No. 19, November 2023, pp. 23704-23712. doi: 10.1109/JSEN.2023.3307617

Aubrey Beal, "Extracting Communication, Ranging and Test Waveforms with Regularized Timing from the Chaotic Lorenz System," Signals, Vol. 4, No. 3, July 2023, pp. 507-523. doi: 10.3390/signals4030027

XiaoFu Li, Md Shougat, Tushar Mollik, Robert Dean, Aubrey Beal, Edmon Perkins, "Field-programmable analog array (FPAA) based four-state adaptive oscillator for analog frequency analysis," Review of Scientific Instruments, Vol. 94, No.3, March 2023, 035103. doi:10.1063/5.0129365

Seth Cohen, Casey Fendley, Aubrey Beal, Ned Corron, "Long-Range Pulse Interactions in Unclocked FPGAs," IEEE Access, Vol. 11, pp. 41158-41166, 2023, doi: 10.1109/ACCESS.2023.3269433.

XiaoFu Li, Aubrey Beal, Robert Dean, Edmon Perkins, "Chaos in a Pendulum Adaptive Frequency Oscillator Circuit Experiment," Chaos Theory and Applications, Vol.5, No. 1, March 2023, pp 11-19. doi:10.51537/chaos.1204481

Steven Puckett, Emil Jovanov, "ecoSync: An Energy-Efficient Clock Discipline Data Synchronization in Wi-Fi IoMT Systems," Electronics, 2023, 12, 4226. https://doi.org/10.3390/electronics12204226

Robert Joseph Mathews, Emil Jovanov, "Enabling Complex Impedance Spectroscopy for Cardio-Respiratory Monitoring with Wearable Biosensors: A Case Study," Electrochem, 4(3), pp. 389-410; https://doi.org/10.3390/electrochem4030025, August 2023.

Yuan Zhang, Deng Fuxiang, Emil Jovanov, Houbing Song, Weisong Shi, Yuan Zhang, Wenyao Xu, "WiLDAR: WiFi Signal-Based Lightweight Deep Learning Model for Human Activity Recognition," IEEE Internet of Things Journal, https://doi.org/10.1109/JIOT.2023.3294004, July 2023.

Rahul Bhadani, Ivan B. Djordjevic, "Optimized receiver design for entanglement-assisted communication using BPSK", Optics Express, 2023, Vol. 31, Issue 24, pp. 39765-39783. https://doi.org/10.1364/OE.496792

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