ECE

ELECTRICAL AND COMPUTER ENGINEERING

AT MICHIGAN TECH

Cultural Experiences

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Michigan Technological University

1885

2023 ANNUAL REPORT

GREETINGS FROM MICHIGAN TECH

I hope everyone is doing great with the Husky spirit and strength. My first year has been quite busy as I have worked to get to know our department, students, faculty, and staff, all while transitioning from the Deep South to the Upper Peninsula.

The good news is that I have nearly settled down in Houghton, which is an incredibly beautiful place, with such warm-hearted people and outstanding students. I am delighted to share that our department has experienced decent growth over the past year.

We have welcomed new faculty members who bring diverse expertise and perspectives, which is gradually enriching the academic experience for our students. Additionally, we have introduced several new courses and learning opportunities to better prepare our students for success in their chosen career paths in the future.

Our alumni are the foundation for the continued success of our department, and we are exceedingly proud of the achievements of our graduates. Your accomplishments certainly inspire current students and help the department recruit the next generation engineers into our three undergraduate programs.

The department is always dedicated to fostering strong connections through mentorship, guest lectures, networking events, philanthropic support, and campus visits. There are numerous ways for you to stay connected and contribute to the education and development of current and future students.

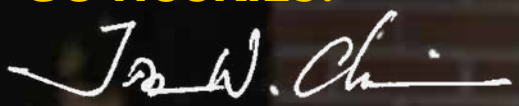
I invite you to remain connected with us by attending alumni events, following us on social media, sharing your experiences and stories with us, or simply dropping a line. Your insights and contributions are invaluable, and we are grateful for your continued care and support.

By the way, my first winter in 2022 in the UP was not bad at all, even though everyone said it was a very mild winter, not to mention the one that just passed. Indeed, I thoroughly enjoyed the first winter season in Houghton thanks to a lot of kind tips from you. With the right clothing and equipment, I did not feel that cold. Fresh new snow everyday created a clean and white scenery and made me feel like everyday was a fresh start.

Due to shorter daylight hours, it was always dark when I left the office and the building. Of course, there was almost always new snow making the outside so quiet and peaceful. Walking on fresh new snow was healing and relieving to me, until I saw my car covered with a thick layer of snow…

I look forward to the opportunity to get connected with all our alumni and share my experiences at Michigan Tech.

GO HUSKIES!



JIN W. CHOI, PH.D.
DEPARTMENT CHAIR AND PROFESSOR

ON THE COVER
Zoey Mishler works in the glove box using spin-coating to apply a chemical solution to the glass substrates for IGOST fabrication.

Story on page 4 →

STUDENT HIGHLIGHT

Zoey Mishler (bottom left) and international lab members discussing the differences between their home countries and Korea.

CULTURAL Experiences

Hoping to gain cultural experiences while broadening her research portfolio, computer engineering student **Zoey Mishler** applied for an eight-week paid research position in Korea. The project is funded through the National Science Foundation and was set up specifically for students enrolled at Michigan Tech, Louisiana State University, and the University of Florida.

MISHLER NOTES:

"I decided to apply because I could see the value in learning about different perspectives. I enjoy being in a setting where I can discover more about cultures, people, and their experiences."

"I am grateful for the work Jin Choi and his colleagues put in to establish the grant that made this travel possible."

Through the program, a total of six students from the three partner institutions were selected to conduct research at prominent universities and research institutes in South Korea, including Seoul National University, Korea Advanced Institute of Science and Technology, Korea Electrotechnology Research Institute (KERI), and CJ Group.

While there is no requirement for the major a student is seeking, the work was all broadly focused on applied smart systems. Along with Mishler, two additional Michigan Tech students were selected, including Chethan Magnan, an electrical engineering major, and Lizzy Mueller, a chemical engineering major.

Taking place over the summer of 2023, students worked on neural recording and simulation using electronics, machine learning for disease detection in medical images, and ulcer prevention systems using ion gels.

"WE WERE GIVEN AN ENGINEERING TASK TO EXECUTE ON OUR OWN."

"In the courses at Michigan Tech, my work had mostly been in team projects, so it was a new challenge for eight weeks of being given a task with guidance from my mentor and then figuring it out on my own."

Michigan Tech undergraduate students, Lizzy Mueller, chemical engineering (second from left); Chethan Magnan (third from left); Zoey Mishler (second from right); and Jin Choi, ECE Chair enjoying Korean BBQ with University of Florida students and faculty.

Mishler's work was completed in a lab on the Seoul National University campus, where she learned to work with substrates inside a glove box.

"I was working on creating an ulcer prevention circuit using ion-gel gated organic synaptic transistors (IGOSTs)," says Mishler. "The work I was doing was focused on neuromorphic areas having to do with multi-modal sensing for biomedical applications to mimic the way our neurological system works."

Throughout the summer, she had an opportunity to work with transistors and circuits in applications outside of what was learned in class.

"I HAD NEVER SEEN THE POWER OF MEDICAL APPLICATIONS FIRSTHAND."

"I was able to utilize the circuit-making skills I developed on campus at Michigan Tech and expand my abilities to include IGOST fabrication—creating and applying a solution to substrates using the glove box and spin-coating, as well as IGOST measurement."

While in Korea, Magnan was involved with a different research group in Seoul working on smart system design for packaging automation.

"The focus was on embedded systems within the Doosan Robotic arm with algorithm development to minimize wasted crate space and computer visioning for package recognition," says Magnan.

"I FEEL INCREDIBLY LUCKY TO HAVE GOTTEN INTO THE PROGRAM," SAYS MISHLER.

"I had no issues with working in Korea or communicating with others—the language barrier led me to ask more questions and increase my curiosity."

The project provided Michigan Tech students with international collaborative research experiences and training, while building a professional network on which to build future collaboration.

"We hope to continue applying for funding from the National Science Foundation to offer this as a continuous experience for our students at Michigan Tech," says Choi.

Each student's research project and laboratory were different, but through the eight-week program, they were given the opportunity to expand their research experiences.

MISHLER ADDS, "I WAS ENRICHED BOTH ACADEMICALLY AND CULTURALLY."

"I feel like I'm a better person and engineer having gotten to explore Korea, collaborate with others, and build a network of peers in research."

STUDENT HIGHLIGHT

DRIVEN by Passion

"I knew I was home when I toured the department and saw the various Enterprises and labs," says **Ian Mattson**, who graduated with his bachelor's in electrical engineering in fall 2023. From the first tour, Mattson knew he wanted to be involved in the Robotic Systems Enterprise to build on the practical and hands-on courses and labs that are part of the curriculum.

MATTSON NOTES:

"I joined the Robotic Systems Enterprise in the spring of my first year because I like to stay busy and was hoping for a project to work on."

"From there, I joined the leader-follower convoy team tasked with turning a fleet of five unmanned ground vehicles autonomous so they could follow each other intelligently, while avoiding obstacles," says Mattson.

Through the Enterprise, an opportunity arose for Mattson to stay for the summer to assist with AutoDrive and Jeremy Bos' research team. He had only a few weeks to learn all he could before he jumped in with both feet to prepare a concept design presentation with a team that ultimately received second place. During that summer, Mattson assisted with running simulations for the graduate students conducting research and helped maintain the robots. It was that experience that led Mattson to stay on as an undergraduate researcher.

"I've been part of the AutoDrive team since that summer and am currently serving as one of the team captains," says Mattson, who also served as the Robotic Systems Enterprise outreach coordinator, assistant director, and director before graduation.

"I HAVE ENJOYED WATCHING THE MEMBERS I HELPED ONBOARD NOW HELPING TO SOLVE OUR TOUGHEST CHALLENGES."

This passion for sparking interest led Mattson to teach the department's Summer Youth Program (SYP) courses for two summers. "I love sharing my passion for engineering and problem solving to encourage people to find what excites them," he says.

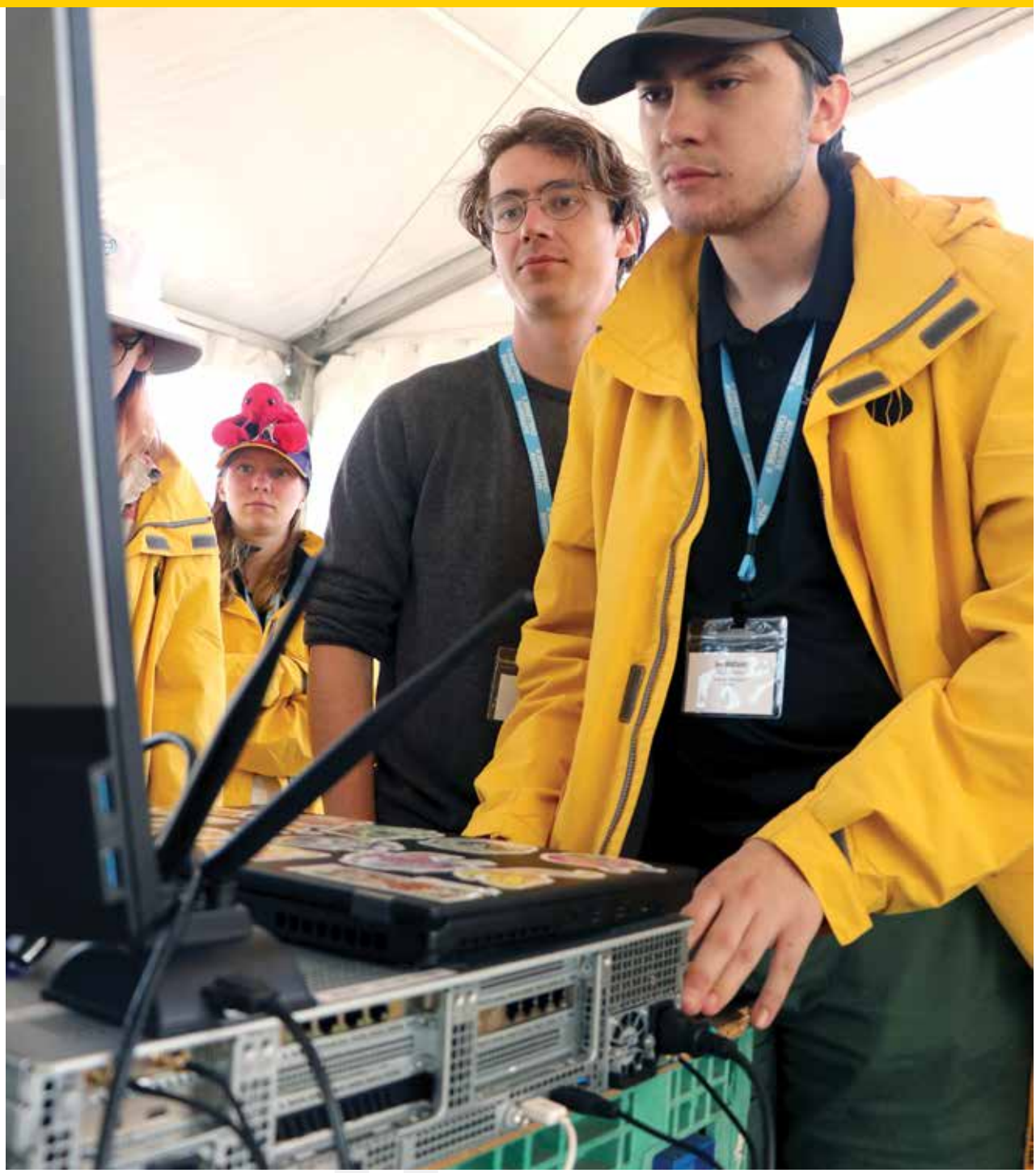
Struck by the problems AutoDrive is solving, Mattson decided to apply for the PhD program at Michigan Tech to further the research on autonomous systems.

"I ENJOY SEEING HOW MY WORK HELPS THE GREATER SCIENTIFIC AND ENGINEERING COMMUNITY."

"I've been privileged to work as a mentee alongside Zach Jeffries and Akhil Kurup in the Robust Autonomous Systems Lab (RASL), as well as my advisor and research mentor, Jeremy Bos, who has helped me discover a passion for research in autonomous vehicles and sensing."

With a broad range of skills from hands-on course work, enterprise involvement and leadership in the Summer Youth Program, Mattson hopes to see his contributions on commercial LiDAR sensors and ultimately improve vehicle safety and performance.

IAN MATTSON



R-L: Ian Mattson; Erik Nunne, Computer Engineering; Ingrid Halverson, Robotics Engineering; and Tabitha Halicki, Mechanical Engineering (behind the monitor)

"I LOVE SHARING MY PASSION FOR ENGINEERING AND PROBLEM SOLVING TO ENCOURAGE PEOPLE TO FIND WHAT EXCITES THEM."

–IAN MATTSON

STUDENT HIGHLIGHT

Engineering Day! event hosted by South Range Elementary School. L-R: Future Husky Jenna Beaudoin; Skyler Brawley; Andrew Crocker, a volunteer from Blue Marble Security (BMS) Enterprise; and Nolan Datema in the foreground, also from BMS. **Background right:** Lauren Huested, ECE and Allison Hein, Materials Science and Engineering, SWE Advisor.

CODING Opportunities

When it comes to encouraging women and minorities to consider careers in engineering, **Skyler Brawley** has poured her heart and soul into igniting their passions through outreach events with barrier-free opportunities.

"I CULTIVATED A DEEP FASCINATION FOR TECHNOLOGY, but faced limitations in exploring and channeling this interest—encountering obstacles on my journey to satisfy my technological curiosity," says Brawley, who chose to pursue a degree in computer engineering with a minor in cybersecurity at Michigan Tech.

"As an adult, my enthusiasm for comprehending the intricacies of the technology remains undiminished and I am driven to provide youth with the opportunities and resources I once lacked, empowering them to explore and expand their interest in technology."

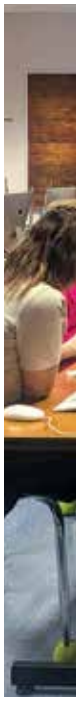
Once on campus, Brawley hosted an event with a Girl Scout troop, where she shared her field programmable gate array (FPGA) board from the EE 2174 Digital Logic course.

"They loved programming the board and seeing it change the display, which inspired me to develop an ardunio outreach activity that would allow them to program a microcontroller."

"The basis of the activity is they will learn to use a breadboard to create a simple DC motor circuit and then program the board," says Brawley.

She partnered with a SWENext member working on a high school senior project to create a user interface to teach the students where each wire goes in the circuit in a step-by-step process.

"With the support of the ECE Department and Lauren Huested helping broaden the scope, we obtained $4,500 in funding for the activity," says Brawley.



SKYLER BRAWLEY

"THIS HAS ALLOWED US TO PURCHASE 150 ARDUNIO KITS AND EXPAND THE PROJECT TO LOCAL AND REGIONAL HIGH SCHOOLS, FIRST ROBOTICS TEAMS, AND GIRL SCOUT TROOPS."

In 2022, Brawley, along with members of the Society of Women in Engineering (SWE) on campus developed Engineering Day!, which is a K-5 half-day event introducing youth to engineering. The event has been hosted at 6 elementary schools—impacting more than 1,000 students with hands-on activities to inspire.

Staying active on campus and continuously expanding her skillset, Brawley joined the Blue Marble Security (BMS) Enterprise, where she is part of the cost effective vision pick point system funded by General Motors.

Two of the projects she's been involved with have been used to illustrate manufacturing and the use of robots to K-12 students, where one robot picks and places LEGO blocks and a second removes and places the pieces in the game, Operation.

Through Brawley's leadership as project manager, the team has grown from three to eight members and is one of the largest teams within BMS.

Skyler Brawley, far right, teaching at the Engineering Day! event.

Through extensive internship experiences and knowledge of programming languages, Brawley saw opportunity to improve the EE 2174 Digital Logic course by closing the gap in real-life applications and the lab work. She became a teaching assistant as an undergraduate and has made substantial improvements to the course. "I introduce how students learn about the variable types in Verilog and ensure the codes developed in the class align with industry standards with real-world application of FPGA," says Brawley.

She remains committed to improving the educational experiences of the next generation through outreach, learning opportunities, and hands-on experiences on campus in coursework, laboratories, and Enterprises.

BRAWLEY NOTES:

"My passion is in service and outreach, in inspiring and encouraging others to reach their full potential."

UNDERGRADUATE STUDENT AWARDS

IAN MATTSON

2023 DEPARTMENTAL SCHOLAR

MADISON AUGUSTYNIAK

2023 WOMAN OF PROMISE

MATTHEW KOUBA

2023 CARL S. SCHJONBERG OUTSTANDING UNDERGRADUATE

GRADUATE STUDENT AWARDS

MIKE MAURER

2022 BARA AWARD FOR OUTSTANDING GRADUATE TEACHING ASSISTANT

AKHIL KURUP

2022 WOLFE AWARD FOR OUTSTANDING GRADUATE RESEARCH ASSISTANT

ECE DOCTORAL DEGREES

Summer 2022 - Spring 2023

STUDENT NAME	PROGRAM	ADVISOR(S)	DISSERTATION TITLE
Zachary Jeffries	Electrical Engineering	Jeremy P. Bos	Evaluation of Lidar Uncertainty and Applications Towards SLAM in Off-Road Environments
Ranit Karmakar	Computer Engineering	Sean J. Kirkpatrick	Artificial Intelligence Algorithms for Eye Banking
Li Wei	Electrical Engineering	Zhaohui Wang	Adapting Deep Learning for Underwater Acoustic Communication Channel Modeling
Steven Whitaker	Electrical Engineering	Timothy C. Havens and Andrew R. Barnard	On-Ice Detection, Classification, Localization, and Tracking of Anthropogenic Acoustic Sources with Machine Learning
Zhouquan Wu	Electrical Engineering	Bo Chen	Study of Electric Vehicle Smart Charging and Energy Management for Vehicle-Grid Integration Systems

ENTERPRISE HIGHLIGHT

OUTFITTED for the Future

Transformation is happening across the automotive and mobility sectors, triggering a demand for engineers who can work across disciplines. Through the Robotic Systems Enterprise (RSE), advisors **Jeremy Bos** and **Darrell Robinette** have remained committed to ensuring tomorrow's engineers are ready to deliver product design, safety, and solution management.

Operating in real-world scenarios, RSE is participating in the AutoDrive Challenge II, sponsored by General Motors and the Society of Automotive Engineers (SAE). Enterprise members are tasked with creating an SAE level-four autonomous vehicle over the course of a four-year competition.

The ambitious scope of the project is such that the Enterprise can involve over 60 undergraduate students plus graduate students as mentors to succeed in all five focus areas, including perception, simulation, software, innovation, and project management.

"EACH GROUP IS STUDENT LED, MANAGED, AND OPERATED. OUR STUDENTS GET TO TAKE THE MECHANICAL SYSTEM OF A CAR AND AUTOMATE AND ROBOTIZE IT."

"They are not as focused on the hardware of the mobility system, but rather the hardware-software integration and achieving the safety objectives. We dig deep into system-level integration with multi-function teams all focused on separate tasks that merge at the seams for a final product," says Robinette.

Throughout the process, student leaders are intensively collaborating to understand the boundaries of each sub-team.

"THE STUDENT LEADERS BECOME SUBJECT MATTER EXPERTS ON THEIR OWN AREA, but also build a deep understanding through collaboration of how their area interfaces and influences the performance of the other sub-systems."

The yearly competition takes place at the University of Michigan in Mcity, where students face a full week of activities from static presentations to on-road practices and the final dynamic scored events.

During the first year of competition, the goal was to outfit a simple cart—a toolchest—with autonomous vehicle sensors to simulate real-world perception challenges.

"In year two, the goal was to migrate the developed systems from an autonomous vehicle test bench to the sponsored Chevy Bolt EUV that will be used for the remainder of the competition," says Robinette.

After finishing third overall in last year's dynamic events, the team looks forward to kicking off year three of the competition early in the summer.

"NOW IN YEAR THREE, WE FACE MORE DYNAMIC CHALLENGES—each year the evolution increases the level of difficulty in autonomy and connectivity," says Robinette.

In the final year, the RSE team will need to focus on connectivity and autonomy even further to pick up passengers and payload and go to the next dynamic reroute point in an urban environment with changing traffic signals and moving targets.

"The purpose of the AutoDrive program is for educational development of students in the next generation of the automotive industry," says Robinette.

With Bos planning a sabbatical in 2023-2024, RSE needed to focus solely on the AutoDrive Challenge II but expects to ramp back into other robotics activities the following year that contribute to manufacturing, recreation, and medical research.

"THERE IS A HIGH VALUE PLACED ON THE RECRUITING, PROMOTION, AND CULTIVATION OF THE STUDENTS THAT COME OUT OF THIS PROGRAM– not only here, but across the ten universities involved in the competition. The program with AutoDrive through RSE enhances autonomous education, while maturing top talent to recruit directly into industry," says Robinette.

L - R: Erik Nunne, Wei Weng, Logan Schexnaydre, and Chaz Cornwall working at the AutoDrive competition.

Kevin Fogg assembles a custom board to be used in the OSHE Water Maintenance System project.

OPEN SOURCE HARDWARE ENTERPRISE (OSHE)

OSHE is a student enterprise that specializes in leveraging open source technology to rapidly iterate and create new electronic devices that solve a multitude of problems. OSHE typically employs distributed manufacturing methods to keep products low cost and replicable by the broadest audience. Projects range from scientific instrumentation, robotics, and consumer products.

ADVISOR:
SHANE OBERLOIER, ASSISTANT TEACHING PROFESSOR

2022-23 PROJECTS	DESCRIPTION	SPONSOR
Localized Lyme Disease Control	Develop deployable devices for administering tick repellent to mice in Lyme disease hotspots	ECE Department
Chocolate Production Line for Outreach	Design an engaging and functional chocolate assembly line for educational purposes	ECE Department
Open Source ATX Power Supply	Develop a cost-effective and efficient ATX power supply	Plexus Corp.
Laser Tag Blaster System	Create affordable, robust, and adaptable laser tag accessories, in collaboration with Respawn Laser Tag	ECE Department
Human-Machine Interface for Robotics	Develop an affordable touchscreen interface for Fanuc Robots	Flex Automation
Hibernacula Climate Control	Engineer systems to regulate temperature in Mead Mine to combat white-nosed bat syndrome	MiDNR
Bird Attractant & Deterrent System	Create solar-powered audible devices to deter birds from high-risk areas	CFRES
Restruder	Innovate a 3D printer extruder that adjusts feed rate based on input filament diameter	ECE Department
Kewee Meters	Develop low-cost, IoT-enabled power metering solutions	ECE Department
Reconfigurable Automation Device	Create a broadly adaptable and expandable Open Source Data Acquisition Suite	ECE Department
Recyclebot	Design a system for converting recycled plastics into 3D printer filament	ECE Department
Growbot	Develop a versatile robot for automating small-scale home gardens	GM
Lasersaur	Build an open-source laser cutter	GM
Open Source Water Treatment System	A system made for automatically treating and balancing chemical levels in a pool or hot tub.	ECE Department

GM Digital Twin team's trip to GM's Brownstown plant in March 2023.

BLUE MARBLE SECURITY (BMS) ENTERPRISE

This student-led enterprise focuses on securing the future through the thoughtful use of technology. The team specializes in engineering design and product development. BMS has developed a culture that fosters high professional standards, creativity, and productivity. BMS defines the word "national security" through the provision of technological support to the defense, corporate economy, and personal well-being of the nation and all its people.

ADVISOR:
GLEN ARCHER, TEACHING PROFESSOR

2022-23 PROJECTS	DESCRIPTION	SPONSOR
SERC PowerSimulator	The project is to produce a training simulator for the vehicle power system on the dry combat submersible system.	Naval Special Warfare Group
SERC Everything Tablet	The project is to deliver a tablet computer that provides operator access to all operating systems and procedures for the dry combat submersible system.	Naval Special Warfare Group
Oshkosh Defense Extreme Actuator	This project is proprietary and covered by an NDA.	Oshkosh Defense
GM EMI Digital Twin	Create a digital simulation of a current production cell as a proof of concept for future manufacturing efforts.	General Motors Manufacturing Initiative
GM EMI Low Cost Pick Point	Demonstrate the capability of low cost COTS components in manufacturing settings.	General Motors Manufacturing Initiative
Wild Card Power Pack	This project designed a light-weight pack frame with integrated power storage for outdoor recreational activity. It was inspired by a battery project for Special Operations Command to provide light-weight, high energy density battery replacements for ground forces.	ECE Department

Whether controlled by a smartphone or tablet, a microcontroller with wireless connectivity allows the user to manually control the window or program intelligent behavior, like closing automatically after detecting rain.

Below: Ben Stier, electrical and computer engineering, holding a mobile device for testing.

L - R: Stephen Gillman, Emma Korhonen, Jacob Smith, Ryan Peckham, Professor Kit Cischke, Ben Stier, Dominika Bobik, and Alex Stockman.

WIRELESS COMMUNICATION ENTERPRISE (WCE)

The WCE focuses on wireless, optical, renewable energy, user interface, and biomedical technologies. WCE functions much like an engineering company with a variety of different project teams. These small project teams allow team members to be very involved in project work and provide ample opportunity for them to gain technical skills, business presentation skills, and leadership experience.

ADVISOR:
KIT CISCHKE, TEACHING PROFESSOR

2022-23 PROJECTS	DESCRIPTION	SPONSOR
Stellantis Wireless Battery Monitoring System	Creating a wireless battery monitoring system for electric and hybrid-electric vehicles	Stellantis
Crazy Smart Window	Creating a smart window that reacts to the weather, temperature, and can be controlled through a smartphone app	ECE Department
5G Tower	Building a 5G cell network from scratch using a software-defined radio	ECE Department
VPN	Building a small device to provide internet privacy and security on open Wi-Fi networks	ECE Department
PharmAlarm	A smart pill dispenser with programmable schedule and audio alarm	ECE Department
Whirlpool Peace of Mind	Automatic leak detection and predictive modeling of component failures on Whirlpool washing machines	Whirlpool

The Waterfowl Retrieving System Team was the recipient of the 2023 Larry Kennedy Innovation Award presented by External Advisory Committee Chair Rob Cooke. **L - R:** Will Stier, Luke Dulac, Seth Wood, Andrew Freel, Trent Johnson, Kurtis Shiverski, Matthew Borgen, Erin Wiser, and Rob Cooke.

2022-23 SENIOR DESIGN TEAMS

TEAM NAME	PROJECT DESCRIPTION	SPONSOR	ADVISOR
Waterfowl Retrieving System	Research, evaluate, design, and build a mobile device that can be used to locate and retrieve downed waterfowl in a real-world hunting environment.	Restricted	Tony Pinar
Camper Security and Ambient Light Device	Design a product that can easily be installed (retrofitted) into the existing trailer cable connection, allowing the user to modulate the trailer's running lights via a cell phone app.	ECE Department	Trever Hassell
Drone Video to Cell Tower	Develop a transmitter that can be carried on a small drone and exfiltrate drone video to a commercial cell phone network directly through a cell phone tower.	Restricted	Tony Pinar
Vacuum Control for Thin Film Deposition	Design and implement a vacuum control system that can be deployed on one or more of the MFF thin film depositions.	MTU Microfabrication Facility	John Lukowski
Moveable Shelf Networking and Control	Network the various moveable, motorized shelving units such that a central controller can coordinate and control all the various shelving units.	MTU Van Pelt Library	Kit Cischke
Enhancement for Smoke and Carbon Monoxide Detectors	Create a means of easily and accurately locating a smoke or CO detector with a low battery in a multi-detector environment by incorporating a programmable audible signal that is unique to each detector.	Restricted	Trever Hassell
Equipment Checkout Station	Create a "checkout station" for ECE equipment where a technician can scan the equipment's serial number (barcode) and swipe an MTU ID card, and the information is saved in a database.	ECE Department	Hongyu An
Low Cost Power Electronic Control and Drive System	Reduce the cost of the current power electronics controller used in the Power Electronics and Motor Drives Lab by replacing the dSpace system that requires a large computer, with a custom system centered on (TBD) processor technology and programmable by Matlab/Simulink.	ECE Department	Trever Hassell
Wireless Tail Lights	Design temporary, retrofitted, battery-powered, wireless tail lights that could be placed on any trailer, with no physical connections (wires) between the lights and the towing vehicle.	ECE Department	John Lukowski
Renewable Energy Powered Portable Plastic Waste Breakdown Machine	Design and fabricate a portable plastic waste breakdown machine for use within a substation during construction projects.	ITC Holdings	John Lukowski

ALUMNI HIGHLIGHT

Mike's hobbies include dog mushing and everything outdoors. He and his wife, Jenny, met through mushing and recently went backcountry camping with the dogs in Denali National Park.

MAKING Magic

It was an innate desire to build things that drew **Michael Roddewig '09** to Michigan Tech, where he found his home in the electrical and computer engineering department—pursing first a degree in computer engineering before changing his major to electrical engineering.

RODDEWIG NOTES:

"I never had an end goal for a career. I went into electrical engineering because I wanted to build things and get them to run. My father was an electrical engineer and I built circuits as a kid, as well as some programming, so my interests span both disciplines."

Driven to explore beyond the theory of circuits, he took the controls class, which led to an independent study with Jeff Burl. He further enjoyed working with the department technicians to build experience.

"The reality behind circuits is more complicated than the fundamentals learned in class," he says. "You can draw out a schematic, but when you want to organize it on the circuit board, there are infinite ways to put it together and I wanted to understand the best methods."

Shaped by experiences like his Senior Design project, Roddewig decided to continue his education with a master's degree in electrical engineering from the Colorado School of Mines and followed that with a PhD in engineering with a focus on optical engineering from Montana State University.

"I WASN'T PLANNING ON GETTING A PHD, BUT I CONNECTED WITH JOE SHAW AT MSU WHO WAS DOING RESEARCH IN UTQIAGVIK, ALASKA, AT THE TIME AND THE OPPORTUNITY SPARKED MY INTEREST."

"When I started the program, I switched gears to focus on building an airborne fisheries lidar to hunt for invasive lake trout in Yellowstone National Park."

After his PhD, his lidar focus continued, now geared toward helping a salmon hatchery outside Ketchikan map zooplankton density to help determine where to place the juvenile salmon pens.

"FISH LIDAR IS UNDERUTILIZED BUT HAS TREMENDOUS POTENTIAL."

"The market exists but there is no commercial product that does what we do today. The capabilities exist in research labs, but it is expensive to operate by aircraft, and the fishery community often has limited funding."

Because of the expense in airtime, he is working on adapting the lidar to work with a fixed-wing drone to lower the field cost and open new research opportunities mapping rivers to serve the fishery community.

Roddewig accepted an assistant professor position with the University of Alaska-Fairbanks in 2022, where he is focused half-time on teaching and half-time on research at the Geophysical Institute with his work on lidar.

In the classroom, Roddewig's enthusiasm is infectious. He strives to help students connect with what they are learning through hands-on activities. His students work through the strain of lectures full of challenging equations because they've seen how the math enables a special magic—the magic of making things work.

Mike and Jenny compete in local races and he enjoys having incredibly "nerdy" conversations about lidar at the Geophysical Institute and hanging out with Iditarod mushers and talking dogs—all in the same day.

DYNAMIC Engineering

In the spring of 2023, the department celebrated the first graduates of our newly-created robotics engineering program. The program was launched after state approval in 2020 to teach students topics in electrical engineering, computing, and mechanical engineering to ensure they are prepared to develop the robust autonomous systems of the future. Our first four program graduates are Andrew Freel, Emily Ladensack, Emma Korhonen, and Erin Wiser.

ANDREW FREEL

After coming to Michigan Tech on a tennis scholarship and enrolling in mechanical engineering and changing to mechatronics, **Andrew Freel '23** heard about the robotics engineering degree and knew it was the right fit.

"The blend of disciplines within the degree was exactly what I was looking for," he says. "I found a passion for software and computer vision in particular, and two months after graduation I landed a job as an AI engineer at XRAM Analytix, where I am developing a visual AI safety system for dangerous worksites."

Through the robotics engineering program, Freel was able to build an understanding of electrical hardware and the efficient computational limits to hardware requirements.

"My job requires intensive problem solving in the image processing and object detection spaces, and the program at Michigan Tech gave me the framework to solve engineering problems of varying degrees," says Freel, who appreciates the skillset gained through multi-disciplined engineering.

EMILY LADENSACK

The robotics engineering program helped frame **Emily Ladensack's '23** ability to think analytically and problem-solve like an engineer. Combined with her experiences in the Multiplanetary INnovation Enterprise (MINE), she learned to work a problem from beginning to end with a functioning robot. After graduation, Ladensack secured a position as an electrical engineer at Morbark.

"At Morbark, I update electrical schematics, build wire harnesses for machines, test and collect performance data for our new line of wood chippers, analyze collected data and report the information, as well as update and develop software across platforms," she says.

"I enjoy crunching the numbers and finding what they can tell me about the performance of our machines, which has opened doors into programming the software on the machines, which is what I love most from the degree—programming."

Her involvement in robotics in the MINE Enterprise sparked a passion for helping the next generation.

"I've started volunteering with the local FIRST Robotics team, where much of my assistance is telling them, as someone who has been there before, that reading the documentation is super useful in building a complete understanding," says Ladensack.

When deciding on degrees at Michigan Tech, **Emma Korhonen '23** was debating between electrical and mechanical engineering. She chose electrical but switched to robotics in her sophomore year, based on her summer internship experience.

"Throughout the robotics engineering program, I was exposed to many different programming and engineering methods, including image processing, programming, and mechatronics, which help me to problem solve challenges in any project," says Korhonen. "My experiences at Michigan Tech taught me to be versatile and to thrive amidst adversity. When I encounter an issue at work, I am not scared, but rather excited to design a solution for the problem at hand."

Korhonen started her job at Pieper Automation as an automation engineer in 2023 following graduation, where she puts the knowledge gained from classes, labs, and her Wireless Communications Enterprise experience to work.

"I work on a range of projects in my role. On a given day, I can split my time between working on an inspection or vision system, PLC/HMI programming, or robot programming," she says. "What I love about my job is that I am constantly learning new things and expanding on topics and theories that I learned in school."

EMMA KORHONEN

With initial enrollment totals of six students, the program has grown from its humble beginnings to an enrollment of 87 students in fall 2023.

"The robotics engineering curriculum intersects with electrical engineering, mechatronics, and computer engineering—not just robotics. It forces students to understand compute platforms, perception, dynamics, build sensor suites, and tie in the simulation tools," says Darrell Robinette, advisor of the Robotic Systems Enterprise. "Students gain background in various disciplines to be prepared for the Fourth Industrial Revolution. Robotics engineering students are given the toolset to do anything from hardware to the programming to make a system function."

ALUMNI HIGHLIGHT: ROB COOKE

COLLABORATIVE Circuit

Falling in love with the Upper Peninsula during his studies at Michigan Tech, **Rob Cooke** knew he wanted to come back. After graduating with a BS in Electrical Engineering in 2002, Cooke took a job in analog electronic design for military systems on the F-22, F-35, and P-8A with a focus on data acquisition before moving into systems and signal processing. During this time, he also obtained his MS in Electrical Engineering from Grand Valley State University in 2011.

WHILE IN HIS FIRST ROLE AT GE AVIATION, THE COMPANY OPENED A SATELLITE OFFICE TIED TO MICHIGAN TECH AND HE JUMPED AT THE CHANCE TO MOVE BACK TO HOUGHTON.

After an 11 year career with GE Aviation, he transitioned to GS Engineering as a program and electrical engineering manager, where he developed systems on military vehicles and helicopters. In 2019, Cooke joined Calumet Electronics as the director of engineering services. Here he is responsible for engineering tooling, the software development team, and electronic hardware design.

Cooke believes in giving back to the community—both in the sense of where he lives and the passions he has for electronics through his studies. He joined the External Advisory Committee (EAC) for the department in 2011 and became the chair in the fall of 2020.

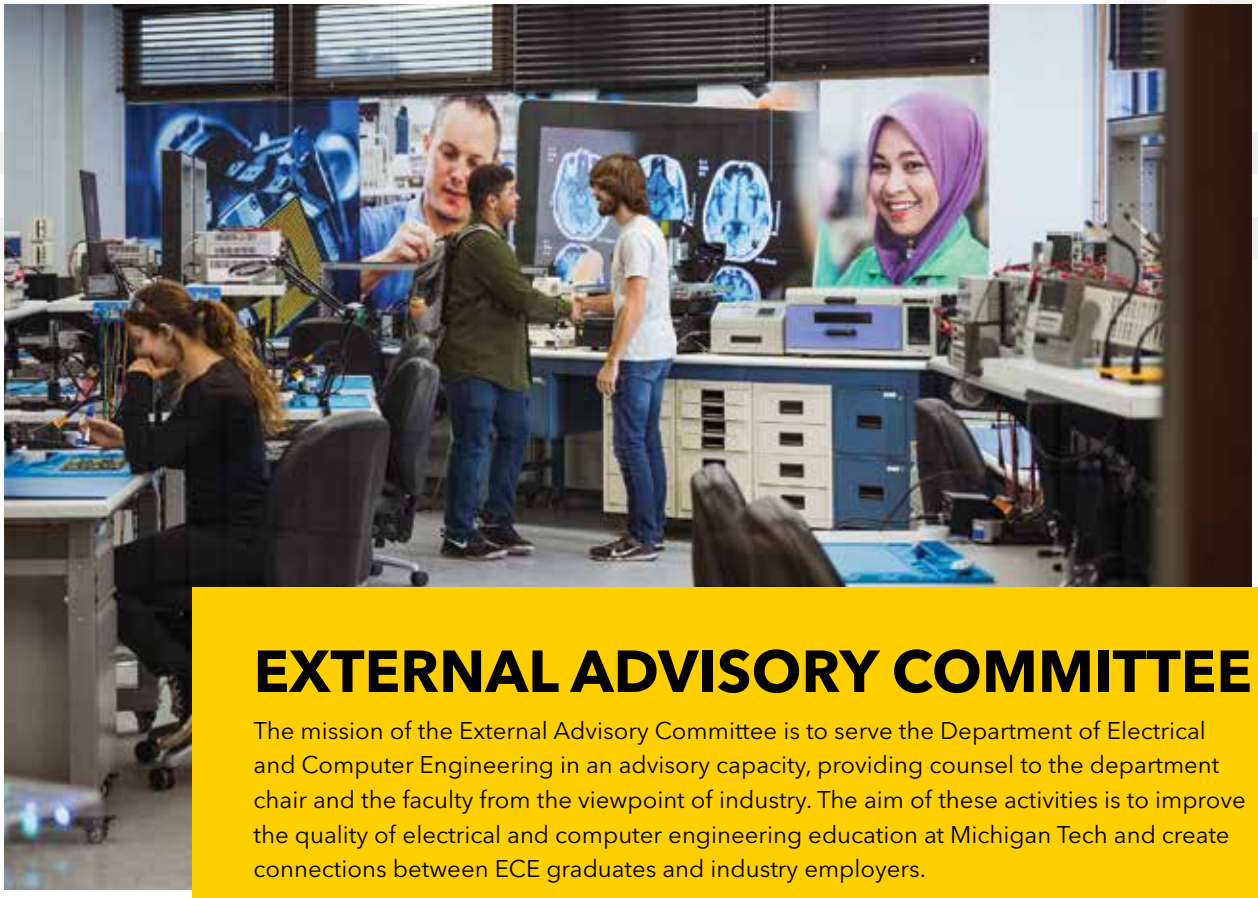
"ON THE COMMITTEE, we provide perspective from industry regarding the educational direction of the department and provide a sounding board for the goals and relevancy of department activities toward industry."

Rob Cooke speaking at the 2023 Senior Banquet. The EAC presents the Larry Kennedy Innovation Award each year (see page 17 photo).

This is further supported through the collaboration between Michigan Tech and Calumet Electronics. "We have a large internship program with Michigan Tech and have further supported the development of and lecture assistance in the EE 2231 Printed Circuit Board Fabrication Laboratory." Cooke says Calumet Electronics further collaborates with Michigan Tech and the ECE department on research projects.

Outside of leading engineering services at Calumet Electronics, Cooke enjoys water skiing, cross country skiing, mountain biking, gardening, and spending time with his family. Fueled by giving back, Cooke spends time doing business consulting outside of work and volunteering.

"I CARE A LOT ABOUT THE COMMUNITY WE HAVE IN THE UP AND HAVE SPENT TIME WORKING WITH ORGANIZATIONS TO HELP THEM GROW, while still maintaining all of the things that make it great to be here. I am passionate about helping companies develop strategy and tactics for growth," says Cooke.



EXTERNAL ADVISORY COMMITTEE

The mission of the External Advisory Committee is to serve the Department of Electrical and Computer Engineering in an advisory capacity, providing counsel to the department chair and the faculty from the viewpoint of industry. The aim of these activities is to improve the quality of electrical and computer engineering education at Michigan Tech and create connections between ECE graduates and industry employers.

ELLEN BAUMAN
IBM

KEITH BEHNKE
STRYKER

SCOTT BLECKE
GREAT LAKES ENERGY

ESTER BUHL
ITC

BRENT CARLSON
3M ENGINEERING

TONY CHAMPAGNE
NEXTEER

ROB COOKE
CALUMET ELECTRONICS

SEAN FULLER
GENTEX

BEN GALLOWAY
DEMATIC

ERIC JOHNSON
PLEXUS

STEVE KENNELL
FMTCS

KURT LAFRANCE
CMS ENERGY

JON LARSON
SCHWEITZER ENGINEERING LABORATORIES

ERIC LARSON
3M

KEN LEISENRING
FORD

BILL LEPAK
CLEVELAND CLIFFS

STEVE MATHE
HARRIS

BRETT MCNALLEY
MILWAUKEE TOOL

MATT MERRY
MICROSOFT

MATT NIXON
GENTEX

DAVE PERRY
RETIRED

KEVIN SAARI
SYSTEMS CONTROL

NATHAN SALIGA
FCA

NIRMAL SINGH
DTE ENERGY

BIRGIT SORGENFREI
FORD

RADE TRIMCESKI
META

CRAIG ZINSER
GM

FACULTY HIGHLIGHT

BUILDING a Network

Gifted engineers have a knack for recognizing the critical path to meeting a challenge. For **Aurenice Oliveira**, this compelling vision has been a decades-long passion to strengthen the global network of engineering education. To support this goal, Oliveira has been highly active with the Institute of Electrical and Electronics Engineers (IEEE), starting as a student.

OLIVEIRA NOTES:

"As a volunteer for the largest professional society in the world with nearly 500,000 members, one of my roles within IEEE has been to provide evaluations for programs in the disciplines under the IEEE umbrella, including electrical and computer engineering, communications engineering, mechatronics and robotics engineering, optical and photonic engineering, and telecommunications engineering."

Through IEEE, she became a program evaluator and commissioner for the Accreditation Board for Engineering and Technology (ABET), where she has traveled the world to foster development of other educational institutions, support their engineering programs, and exchange experiences she can bring back to her own classroom. Oliveira has served as an ABET evaluator for a number of years and is currently a trainer for new program evaluators.

"I ENJOY THE OPPORTUNITY TO ENGAGE WITH OTHER INSTITUTIONS TO EXAMINE HOW THEY RUN THEIR CLASSROOMS AND LABS, HOW I CAN LEARN FROM THEM, AND HOW I CAN ENCOURAGE THEM TO THINK ABOUT THINGS DIFFERENTLY."

"As an evaluator, we help ensure programs are consistent at each university, meet quality standards, and provide a solid foundation of the technical skills and soft skills to foster a new generation of students with a holistic understanding of engineering."

With over 20 years of dedication to IEEE, she currently serves as the Northeastern Wisconsin Section chair, has been honored with the IEEE Outstanding Branch Counselor and Branch Chapter Advisor Award, and helped the Northeastern Wisconsin Section to receive a 2023 Membership Retention Award. At the campus level, her involvement has led to the student branch receiving grants and industry donations, as well as helping students to develop leadership skills.

Her passion for engineering is further highlighted by fellowships she was awarded in 2023, including Drexel University's Class of 2022-2023 Executive Leadership in Academic Technology, Engineering, and Science (ELATES) and Michigan Tech's Vice-President for Research Faculty Fellow.

AURENICE OLIVEIRA

ELATES is a leadership development program designed to promote women in academic STEM fields into institutional leadership roles. The program has graduated over 150 alumnae from more than 64 institutions across the US and Canada.

"ELATES is an inspiring program focused on training an amazing group of women to become leaders in academic STEM fields. We tap into our strengths to create and encourage growth."

In 2023, Oliveira was selected to participate in the Faculty Fellow Program, sponsored by Michigan Tech's Office of the Vice President for Research. As a faculty fellow, Oliveira helped further establish a culture of undergraduate research on campus by improving access to undergraduate research opportunities and integrating them into the curriculum.

"As a faculty fellow, I was tasked with examining the landscape for undergraduate research at Michigan Tech, while providing recommendations to address the challenges to develop and support a culture of research across campus," she says. "Undergraduate research can be increased by providing incentives to faculty and students such as funding, staff support, recognition, and by sharing information about opportunities.

Aurenice Oliveira at the IEEE SC2023 conference.

Because electrical and computer engineering play a pivotal role in shaping modern society from communications to health care, transportation, energy, and so much more, Oliveira has learned to adapt her research to the changing needs of society.

"NOW MORE THAN EVER, WE KNOW THAT TECHNOLOGY EVOLVES EXTREMELY QUICKLY, SO I'VE LEARNED TO BE FLEXIBLE WITH MY OWN RESEARCH."

"Through my education, I was trained on how to learn and be motivated to learn on my own, so I can pivot toward changing needs around me—whether that is on optical fiber communication or on connected and autonomous vehicles."

Oliveira believes in the mission of lifting the next generation and is steadfast in her view that this grand challenge is best met with a modern curriculum focused on both technical and soft skills. She encourages everyone to learn from all that surrounds us—from the digital systems to the nuances of human culture.

FACULTY HIGHLIGHT

RESHAPING Neural Networks

Electrical engineers solve all manner of problems for society, but few get to develop the structure of a brain. Seeking to apply integrated circuit and artificial intelligence to benefit humanity, **Hongyu An** is stretching the boundaries of neuromorphic computing.

In a project funded by the National Science Foundation, An is developing a neuromorphic system for closed- loop deep brain stimulation focused on Parkinson's disease.

"Initially, we will take real-time measurements of brain activity, performing computations and sending signals back to the brain to influence the neural activities," says An.

"WITH THIS DEEP BRAIN STIMULATION, WE HOPE TO SUPPRESS THE SYMPTOMS OF PARKINSON'S DISEASE."

Through the work, An is designing both the software and the hardware. Initially using an Intel Loihi chip with artificial neurons and synapses within the chip, An and his team are working to create particular Spiking Neural Networks (SNNs) that will be used in neuromorphic chip fabrication as part of the research process.

This Intel Loihi chip contains artificial neurons and synapses.

"With the designed neuromorphic closed-loop, deep brain stimulation chip, we can test the procedure on rats that have Parkinson's. If we succeed with rat models, we envision using the whole system to help patients who are suffering with Parkinson's disease," says An.

Graduate students Ananna Biswas (left) and Tianze Liu working with the robotics lab map.

Graduate student Ananna Biswas (left) and Hongyu An working with the stereotactic instrument.

His second research project is funded by the National Science Foundation and centered on building a self-learning robot system using neuromorphic computing.

"We are using a model of the hippocampus to train the robot to navigate through the maze, comparing the neural activities of our hippocampus model with the actual hippocampus of a rat also going through a similar shape maze," says An.

"WE ARE BUILDING AN UNDERSTANDING OF HOW PEOPLE AND ANIMALS LEARN, MEMORIZE, AND MAKE DECISIONS."

The robots have several inputs to sense the environment, process information and make decisions, including a visual signal from a camera, vibration feedback, and LIDAR signals to detect distance with reflection.

"The robot is using a sophisticated sensing system coming from the artificial hippocampus, which can build a spatial map of the maze and decide where it should go to achieve the goal."

With collaborative support from two graduate students, An is developing novel technologies for artificial intelligence. His research efforts thus deliver two levels of impact, helping advance human health through medical device creation and artificial intelligence, and creating experts who can shape the industry.

"I currently have two graduate students working with me, including **Tianze Liu** and **Ananna Biswas**. They chose this research group because of their interest in SNNs for AI that are inspired by the brain," says An.

"EVERYTHING STARTS WITH THE BRAIN. THE MORE WE LEARN ABOUT THE BRAIN AND ITS FEATURES, THE MORE WE CAN ADVANCE AI."

PINAR RECOGNIZED
for Teaching Excellence

ECE AWARDS AND HONORS

JULY 1, 2022 - JUNE 30, 2023

FLAVIO BEZERRA COSTA
ASSISTANT PROFESSOR
Best Paper, IEEE Computing and Communication Workshop and Conference (CCWC), March 15, 2023

JOHN LUKOWSKI
ASSOCIATE PROFESSOR
Finalist, MTU Distinguished Teaching Award, CFTLFD

Former College of Engineering Dean Janet Callahan selected Associate Teaching Professor **Anthony (Tony) Pinar** as the first member of this spring's Deans' Teaching Showcase. Pinar will be recognized at an end-of-term luncheon with other spring showcase members, and is a candidate for the next CTL Instructional Award Series.

ECE Capstone Design is a complex ecology formed of students, the Enterprise Program office, industry partners, faculty subject matter experts, and other departments' capstone programs. It takes someone very special to be able to balance the interests of all those constituents and maintain a robust educational experience for every possible combination of project, team, and sponsor. Pinar manages it with grace and a resolute commitment to excellence.

PINAR RECEIVED HIGH PRAISE FROM A TOUGH AUDIENCE– ONE OF HIS STUDENTS:

"Almost everything about the class was amazing. Honestly, I believe this may be the best formatted, run, and taught class I've taken so far at Tech."

The strategy Pinar takes with the ECE Senior Design applies a common framework of tasks and deliverables across all Senior Design teams and allows for relatively autonomous advisor roles. This means that all teams have overall similar capstone experiences, but faculty advisors are able to coordinate, manage, and assess their teams using their own individual styles.

The framework stresses the importance of objective decision-making, following appropriate engineering standards, and communicating engineering problems to other engineers. The common framework also helps ensure that the program meets external assessment criteria (e.g., ABET) and also provides a mechanism for the department to assess a large number of ECE students for program improvement.

JANET CALLAHAN, FORMER COLLEGE OF ENGINEERING DEAN:

"Dr. Pinar's hard work and expertise prepares our students for excellence. Through his efforts our graduates are well prepared not only to technically excel, but also to communicate within and beyond their team beginning from the first position they hold."

Projects in Senior Design generally challenge the students' technical skills. Pinar coordinates the ongoing relationships with our industry sponsors and manages expectations when necessary. He has a wealth of industry experience that provides context for the students. His individual coaching helps students as they navigate the transition between communicating with peers and communicating in a professional environment as engineers.

JIN CHOI, ECE DEPARTMENT CHAIR:

"We are proud of the improvements Tony has made to make this a more effective program. The students have really benefited."

Teams are required to present several times throughout the year-long project. Pinar has crafted a common rubric that allows faculty, staff, and industry sponsors to evaluate the students' technical approach as well as individual presentation skills.

This provides an opportunity for meaningful feedback from a variety of perspectives. This increases the quality of our students' technical presentation skills, and their communication skills when discussing technical topics with fellow engineers. This quality increase has been noted by our own internal faculty advisors and by members on our External Advisory Committee.

AURENICE OLIVEIRA
ASSOCIATE PROFESSOR
IEEE Northeastern Wisconsin Section to Membership Retention Award, IEEE (January 28, 2023)

Michigan Tech Faculty Fellow for 2022-2023, MTU (August 15, 2022)

ASEE ELATES Fellowship Program Scholarship, ASEE and ELATES Drexel (August 5, 2022)

ANTHONY (TONY) PINAR
ASSOCIATE TEACHING PROFESSOR
Dean's Teaching Showcase Nomination, MTU College of Engineering (January 13, 2023)

TIMOTHY SCHULZ PROFESSOR
Fellow of the International Society for Optical Engineering, SPIE; Fellow of the Optical Society of America; Member, Tau Beta Pi

NEW FACULTY

KAICHEN YANG

ASSISTANT PROFESSOR

Kaichen Yang joined the department in the fall of 2022 as an assistant professor. He has been teaching the Computer Systems Engineering & Performance and the AI Engineering Applications courses. His research interests are in deep learning-related cybersecurity, hardware security, and network security.

Since coming to campus, he has been able to publish papers and present at top-tier AI and security conferences. He further serves as a reviewer for several top journals and conferences to contribute to the boarder research community in the world of security.

Through his work, Yang has been able to engage with students and colleagues to develop innovative solutions in the field of cybersecurity and network security, while collaborating with other researchers from Michigan Tech and beyond. Yang continuously seeks to bridge the gap between theoretical research and practical applications in cybersecurity to advance the security of digital systems and networks.

He received his Bachelor of Science in Information Science, as well as his Master of Science degree in Information Science from the University of Science and Technology of China. Yang graduated with his PhD in Electrical Engineering from the University of Florida in 2022 and has since joined the vibrant academic community of Michigan Tech.

TAN CHEN

ASSISTANT PROFESSOR

Tan Chen started his academic teaching career in the department in the fall of 2022, where he teaches control and robotics-based courses. His research interests lie in robotics, control theory, and machine learning with a focus on robust legged locomotion control and navigation, using robotic technology in healthcare, and learning-based control for complex dynamic systems.

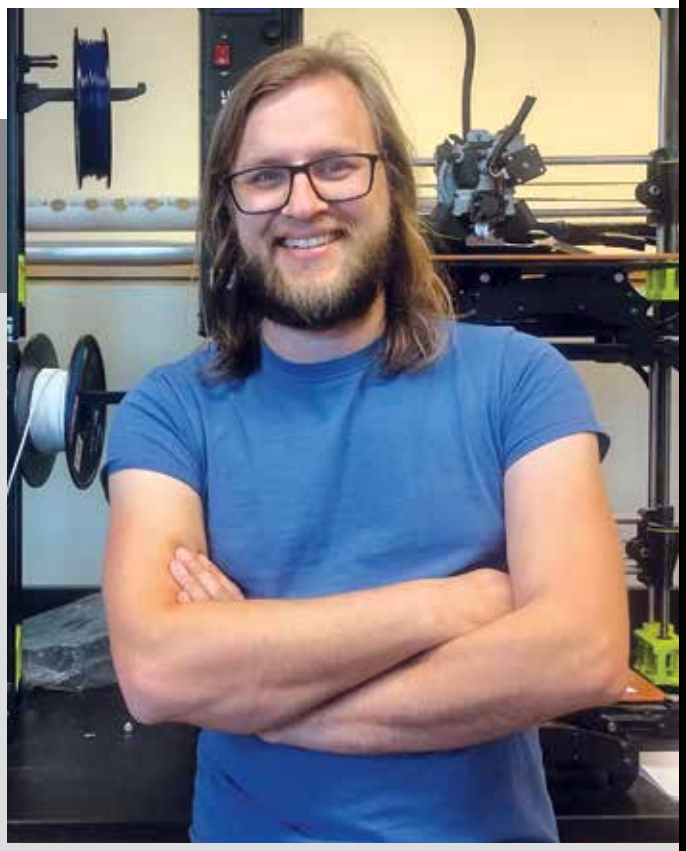
Chen received his BS in mechanical engineering from Shanghai Jiao Tong University and a joint master's degree from Shanghai Jiao Tong University of École des Mines de Douai, France. During his time in France, Chen was able to complete an internship in Atos Wordline and Renault Group.

He then completed his PhD in Aerospace and Mechanical Engineering from the University of Notre Dame, where he taught courses in robotics and controls. Prior to coming to Michigan Tech as an assistant professor, he completed a postdoc at Coordinated Science Laboratory at the University of Illinois Urbana-Champaign, where he explored motion planning and human-robot interaction.

In the campus community, Chen has grown to love the beautiful region and the safe environment to hike, jog, and swim, while managing the Robotics, Locomotion, and Applied Control Lab.

SHANE OBERLOIER

ASSISTANT TEACHING PROFESSOR



Assistant teaching professor **Shane Oberloier** joined the department in the fall of 2022 after graduating from Michigan Tech with his PhD in electrical engineering in 2021 with a focus on open source TIG-based metal 3D printing. His areas of teaching include digital logic, microcontrollers, robotics, and additive manufacturing.

Oberloier completed his bachelor's degree in electrical engineering at Saginaw Valley State University before coming to Michigan Tech for his master's and PhD. He chose to stay at Michigan Tech because of the area's natural beauty that allows him to woodwork, ski, OneWheel, and push around snow.

He focuses his teaching style on maintaining engagement for maximum comprehension by adjusting the pace of the courses as needed and giving relatable examples. He shares educational videos online relating to the world of electrical engineering to provide resources to students and also hosts a podcast where he speaks with students, faculty and staff at Michigan Tech to share their experiences.

Oberloier notes his favorite part of the job is serving as the advisor for the Open Source Hardware Enterprise, where he leads students through the process of turning ideas into working prototypes that are released as open source designs for the world to utilize. Teaching and leading from the practical side of engineering, Oberloier finds satisfaction in helping students get to their "a-ha" moments.

SEE THE FULL FACULTY LISTING ON **PAGE 36**

NEW ADVISORS

KAILEE LAPLANDER

ACADEMIC ADVISOR

In May 2023, **Kailee Laplander** joined the department as the academic advisor for electrical engineering and robotics engineering. Prior to joining the department, she spent ten years at Finlandia University in pre-college advising, advancement, and the president's office.

As an advisor, Laplander advises more than 500 students within electrical and robotics engineering, as well as students with a minor in electrical engineering. She helps students understand degree requirements, adjust scheduling, and overcome hurdles they face in their academic journey.

While at Michigan Tech, Laplander has enjoyed being back on the academic and student-facing side of higher education. She further assists the department on various committees and working groups, as well as the university's upcoming Essential Education program.

Outside of the university, Laplander enjoys collecting vinyl records, attending concerts, and spending time with her fiancé and her nieces.

LAUREN HUESTED

ACADEMIC ADVISOR AND OUTREACH SPECIALIST

Serving as the academic advisor and the outreach specialist, **Lauren Huested** joined the department in January 2023. She moved to the Upper Peninsula in the fall of 2020 to serve as the dual-enrollment advisor at Finlandia University, where she also worked as the education partner manager and event planner for prospective student events. Prior to that, she was at Davenport University as an admissions counselor and events coordinator.

She found her passion for advising at Finlandia and has enjoyed helping students through tough times and celebrating their successes. She also collaborates with other departments to bring prospective students to campus and get them excited about their degree and career opportunities.

To build their passion for learning, Huested's role as outreach specialist focuses on activities for K-12 students and the department's Summer Youth Program involvement. Through this work and as chair of the Diversity & Outreach committee, she hopes to see growth not only in enrollment, but also in diversity in the department and across campus. In her free time, she enjoys hiking, traveling, concerts, reading, cooking, and thrifting.

DEVELOPING Energy Solutions

Shaping the future of energy research through partnerships across the globe is a pride point for **Bruce Mork**, professor of electrical engineering who runs collaborative research projects with the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. Along with Mork's research work, Michigan Tech has maintained a student exchange program with NTNU since 1999.

After studying for a year at NTNU during his PhD program, Mork found a passion for the culture and the research and continued his visits.

"After receiving tenure at Michigan Tech, I engaged my contacts in Norway as part of my funded research activities. I went back in 2001-2002 as a Fulbright Scholar and visiting researcher at Sintef Energy Research Center and was again a visiting researcher in 2013," he says. "In recent years as part of my work, I make frequent visits as part of ongoing projects—spending a month or two of the summer there to collaborate with colleagues there."

Mork's current research is funded two-thirds from the Norwegian Research Council and one-third from industry partners. Organized into seven projects, the collaboration employs four graduate students and one postdoc.

Graduate research assistant Aamir Rahmani (left) and Dr. Bruce Mork discuss modeling the renewable energy resources to test the transmission line protection schemes.

Graduate Research Assistant Aamir Rahmani in front of NTNU Library

"The laboratory test set-up is based on the digital substation protection and control architecture. The equipment includes a state-of-the-art microprocessor with protective relays, ethernet switches, real-time automation controllers, GPS clocks from SEL, and a real-time hardware-in-the-loop simulator from OPAL-RT," says graduate research assistant, **Aamir Rahmani**.

With the introduction of digital substations, there is opportunity for a smaller footprint in terms of wiring, easier expansion through plug-and-play systems, simplified documentation and engineering with faster upgrade potential.

Through this research, Mork has been able to provide an international experience for his graduate students with multi-year funding support.

"WE HAVE HAD FOUR FUNDED MULTI-YEAR PROJECTS THAT HAVE SUPPORTED FOUR MICHIGAN TECH PHD STUDENTS."

"In addition, Norway is an energy mecca. They are ahead of us in deregulation, green energy, industry application of smart grid technologies, and penetration of distributed energy resources and electric vehicles."

By working with graduate students in an energy powerhouse, the collaborative project between Michigan Tech, NTNU, the Norwegian Research Council, and the industry partners helps establish procedures and new technologies that will power the grid for generations to come.

NEW STAFF

DAWN PICHETTE
ADMINISTRATIVE AIDE

Dawn Pichette joined the department in summer 2023 as an administrative aide. In her role, Pichette will support the chair and the department, assist with operations of the front office, supervise student staff, and student payroll. She will further oversee event planning and departmental accounting procedures.

Pichette is no stranger to Michigan Tech, having worked on campus for 13 years serving various areas, including University Marketing and Communications, School of Technology, Sponsored Programs, and the College of Engineering. Before coming to Michigan Tech, she worked at Citizens Bank for nearly 22 years.

LYNN MCCORMICK
GRADUATE PROGRAM COORDINATOR

Serving as the graduate program coordinator, **Lynn McCormick** joined the department in spring 2023. Her primary responsibilities are focused on graduate program administration and ECE student payroll processes.

She took on additional responsibilities, serving as the instructor for the EE 3901 Design Fundamentals for both the fall 2023 and spring 2024 courses. Given her electrical engineering degree from the University of Michigan and an MBA from the University of Detroit, and 26 years of industry experience working as an engineer and an engineering manager, the department felt she would be a great fit for the instructor position. Prior to joining the ECE department, she worked in Michigan Tech's payroll office.

JOHN PAKKALA

50 YEAR CAREER

Following a 50 year career spanning industry and academia, **John Pakkala** retired from the department after having served as the graduate academic advisor and adjunct assistant professor since 2017. Beginning his career, Pakkala worked in machine design in the automotive, aircraft, and defense industries before returning to school for his PhD.

Pakkala earned his PhD in electrical engineering from Michigan Tech in 2011 and served as an associate professor in mechanical engineering at the Milwaukee School of Engineering. He also was the director of the mechanical engineering technology program and directed a dual-BSME degree program with Fachhochschule Lübeck in Lübeck, Germany.

He came back to Michigan Tech in 2017, where he enjoyed talking with students about learning paths and how they could apply their skills to charting a career in electrical engineering. Although he has retired from full-time teaching, he has since taught courses at California Polytechnic State University in mechanical engineering and came back this spring to teach controls.

In his retirement, Pakkala has enjoyed hiking in the mountains, walking on the beach, visiting art museums, and attending concerts.

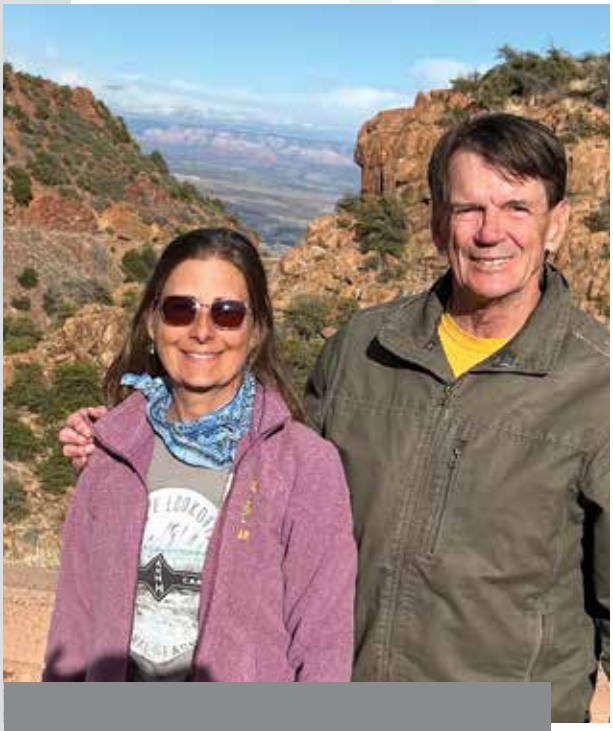
RETIREMENTS

After nearly 19 years as an academic advisor in the department, **Judy Burl** retired in the spring of 2023. During her time at Michigan Tech, she helped over 2,000 students plan and meet degree requirements to graduate. She served as the advisor for computer engineering, electrical engineering, and robotics engineering, assisting students in their academic planning and career path options.

Under the leadership of Glen Archer, she helped plan the new robotics curriculum and assisted in the implementation of the departmental curriculum changes in 2012 where circuits was moved to two semesters with a combined lecture and lab component.

Now in retirement, Burl enjoys visiting family on long road trips or short flights in the Midwest and spending time outdoors to hike, paddleboard, and downhill and cross-country ski. Burl looks forward to a tradition of a winter-getaway, which started this year on a four-week road trip to New Mexico, Arizona, and Utah.

Committed to education, Burl has taken up learning the violin and pickleball, while serving part-time as the interim academic advisor for the Chemical Engineering Department after her retirement from ECE.



JUDY BURL

ACADEMIC ADVISOR FOR ~19 YEARS

FACULTY DIRECTORY

GLEN ARCHER
Interim Chair/Teaching Professor
PhD, Electrical Engineering, Michigan Technological University

Image processing, security information operations, electronic warfare, counter-terrorism, information operations

HONGYU AN
Assistant Professor
PhD, Electrical Engineering, Virginia Polytechnic Institute and State University (Virginia Tech)

Neuromorphic engineering/computing, energy-efficient neuromorphic electronic circuit design for artificial intelligence, emerging nanoscale device design, spiking neural networks

PAUL BERGSTROM
Professor
PhD, Electrical Engineering, University of Michigan

MEMS, nanotechnology, micro-electromechanical systems, inertial pressure, micromachining materials and process technologies

LEONARD BOHMANN
Professor/Associate Dean, College of Engineering
PhD, Electrical Engineering, University of Wisconsin

Power systems, renewable energy, renewable energy generation and integration in power systems

JEREMY BOS
Associate Professor
PhD, Electrical Engineering Michigan Technological University

Atmosphere optics, autonomous vehicles and vehicular networks, industrial automation and controls, image processing, machine intelligence, statistical optics, quantum optics

BO CHEN
Professor of Mechanical Engineering and Electrical Engineering
PhD, Mechanical and Aeronautical Engineering, University of California-Davis

Intelligent mechatronics, embedded systems

TAN CHEN
Assistant Professor
PhD, Aerospace and Mechanical Engineering, University of Notre Dame

Legged locomotion, applied control, rehabilitation robotics, collaborative robots, learning-based control

CHRISTOPHER (KIT) CISCHKE
Teaching Professor, Undergraduate Programs Committee Chair
MS, Computer Engineering, University of Minnesota

Parallel computing and UPC

FLAVIO BEZERRA COSTA
Assistant Professor
PhD, Electrical Engineering, Federal University of Campina Grande (UFCG), Campina Grande, Brazil

Integration of renewable energy systems, power system protection, control and monitoring, power quality, power systems and electronics, AC/DC microgrids, high-voltage direct current (HVDC), electric power transmission systems, applications of signal processing in power systems, including machine learning in the power systems

DURDU GUNEY
Associate Professor
PhD, Electrical and Computer Engineering, University of California-San Diego

Metamaterials and plasmonics, metamaterials, metasurfaces, photonic crystals, plasmonics, quantum computing, communications and cryptography

TREVER HASSELL
Associate Teaching Professor
MS, Electrical Engineering, Michigan Technological University

Power electronics, control systems, electric drives and machinery, hybrid and electric vehicle systems, microgrids

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JOHN LUKOWSKI
Associate Professor, Assessment Committee Chair
MS, Electrical Engineering, Michigan Technological University

Power, energy, factory automation, robotics

CHRISTOPHER MIDDLEBROOK
Professor, Associate Chair, Lab and Space Committee Chair
PhD, Optics, University of Central Florida

Electronic design and manufacturing, infrared detectors, optics, photonics, radiometry

BRUCE MORK
Professor
PhD, Electrical Engineering, North Dakota State University

Power systems transients (ATP/EMTP), non-l; linear dynamics and chaos theory, power systems protection, smart grid, computer simulation, transients in electrical power systems, power quality, photovoltaics renewable energy, wind energy, solar energy

SHANE OBERLOIER
Assistant Teaching Professor
PhD, Electrical Engineering, Michigan Technological University

Open source hardware, additive manufacturing, digital design, robotics design, engineering education

AURENICE OLIVEIRA
Associate Professor
PhD, Electrical Engineering, University of Maryland, Baltimore County

Optical fiber communications, wireless communications, signal processing, network security, intelligent transportation systems (ITS), communication networks and systems

ANTHONY (TONY) PINAR
Associate Teaching Professor
PhD, Electrical Engineering, Michigan Technological University

Machine learning, signal and image processing, data fusion, electronic design

TIMOTHY SCHULZ
Professor
DSc, Electrical Engineering, Washington University, St. Louis

Statistical signal processing, computational photography

ELENA SEMOUCHKINA
Professor
PhD, Materials (Engineering option), The Pennsylvania State University

Computational electromagnetic analysis, resonance phenomena in complex media: metasurfaces, high-contrast materials integration for electronic and photonic systems, materials and device characterization to microwaves

ANNA STUHLMACHER
Assistant Professor
PhD, Electrical Engineering, University of Michigan

Power systems, distributed energy resources, optimization, Interconnected critical infrastructure systems

CHEE-WOOI TEN
Professor
PhD, Electrical Engineering, University College

Dublin power infrastructure cybersecurity, future control center framework, SCADA/EMS/DMS applications, smart home and robotic technologies, attack/defense combinatorics

KAICHEN YANG
Assistant Professor
PhD, Electrical Engineering, University of Florida

Network security, hardware security, cyber-physical system security, deep learning

LAN (EMILY) ZHANG
Assistant Professor
PhD, Electrical and Computer Engineering, University of Florida

Wireless communications (e.g., RIS, mmWave, CPS, industrial -IoT), big data (e.g., machine learning, smart transportation, eHealth), cyber security and privacy (e.g, IoT/CPS, learning pipeline, blockchain)

CONTRACTS & GRANTS

AWARDED IN FY 2023
July 2022 - June 2023

Engineering research and development are key to technological progress and economic revitalization, and the ECE Department at Michigan Tech is busy doing its part.

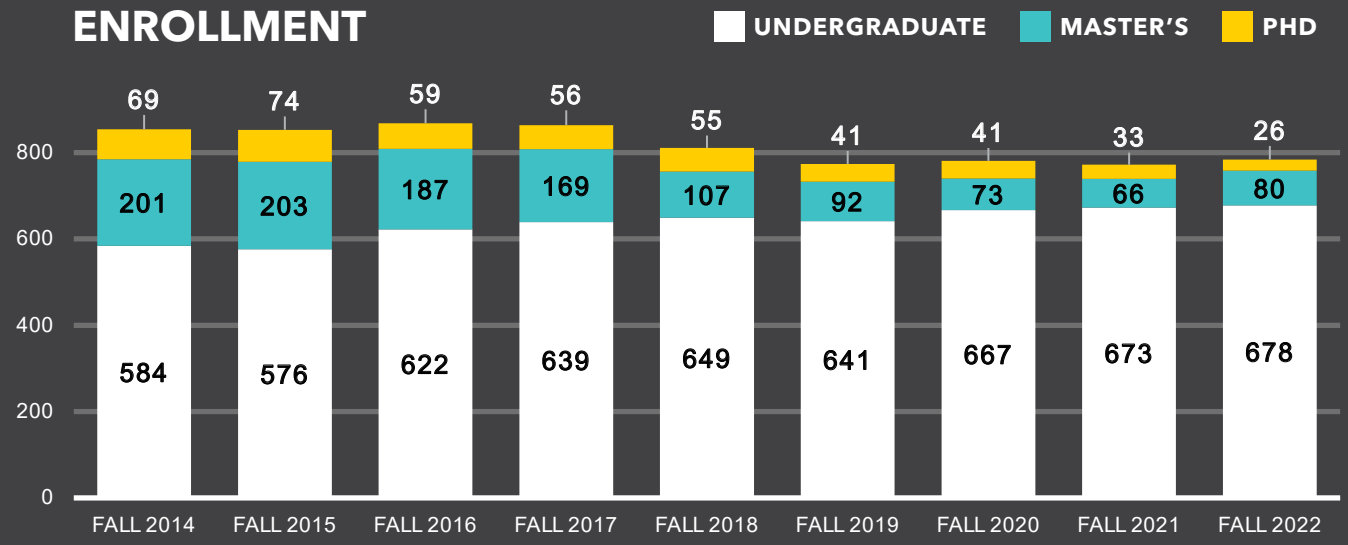
Our faculty, graduate students, and undergraduates work together in modern, well-equipped laboratories to bring practical solutions to real-world problems in signal processing, wireless communications, computer-aided design, energy systems, electronic materials and devices, photonics, and much more.

We are eager to tackle new challenges and always looking for new opportunities that are well matched to the interest and expertise of our faculty.

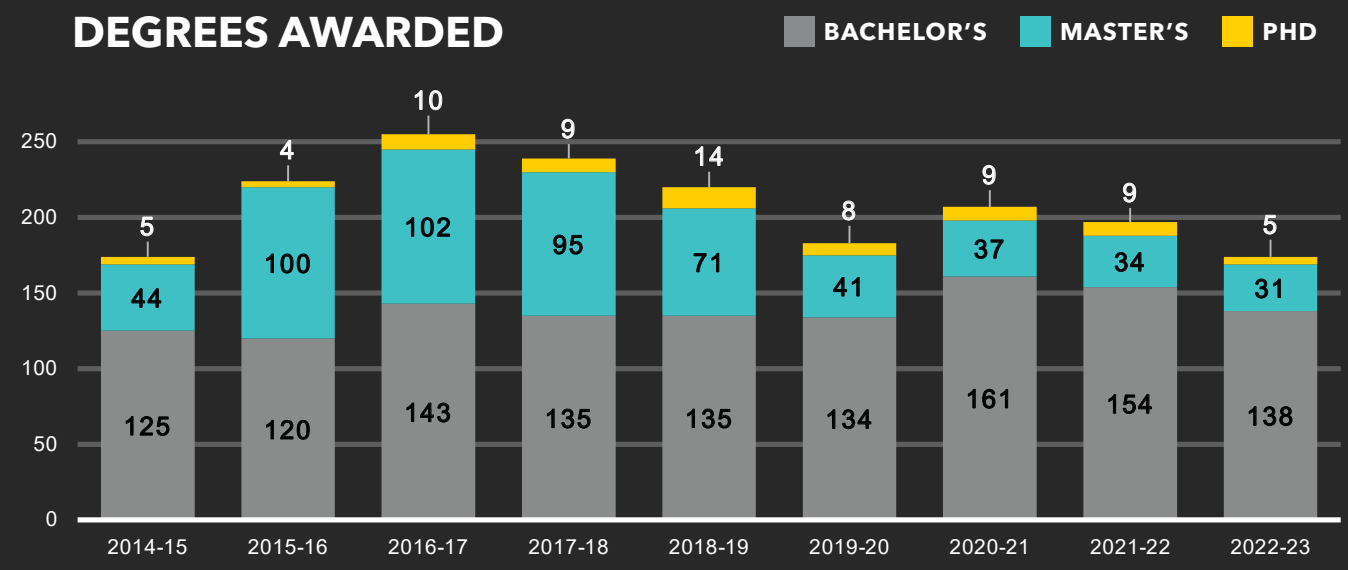
TITLE	PI NAME	SPONSOR	AWARD
REF-RS: Using High-Fidelity Contact Models for Slip-Aware Biped Locomotion on Slippery Surfaces	Tan Chen	Michigan Technological University/AVPRD	$30,000
Enterprise: NSWG 802 Computer-Based Electrical Simulator for Submersible Maritime Platform	Glen Archer	Stevens Institute of Technology (DOD)	$5,000
Enterprise: Extreme Environment Electric Actuator-Phase 1	Glen Archer	Oshkosh Corp	$8,500
NSF Convergence Accelerator Track I: Energy-efficient MetaConductors for Convergence of Sustainable Electronics (E-MC2 of Sustainable Electronics)	Jin Choi	University of Florida (NSF)	$180,000
Development of Intelligent Complex Process Manufacturing for Flexible Flat Cable for Automobile Harness	Jin Choi	Korea Institute of Industrial Technology (KITECH)	$230,767
Enterprise: Battery Management System	Christopher Cischke	FCA US LLC (Fiat Chrysler Automobiles)	$17,500
I-Corps: Prototyping Power Substation Blackbox	Chee-Wooi Ten	National Science Foundation(NSF)	$50,000
IRES Track I: Collaborative Research: Interdisciplinary Research in Korea on Applied Smart Systems (IRiKA) for Undergraduate	Jin Choi	National Science Foundation(NSF)	$47,809
Enterprise: NSWG 801 Electronic Operations Manual for Submersible Maritime Platform (Everything Tablet)	Glen Archer	Stevens Institute of Technology (DOD)	$5,000
Student Design: USASOC 03 Drone Video to Cell Tower	Anthony Pinar	Stevens Institute of Technology (DOD)	$5,000
ERI: Memristor-based Neuromorphic Circuit Design for Closed-Loop Deep Brain Stimulation	Hongyu An	National Science Foundation(NSF)	$198,463
Mesosphere Observation Mission for Beacon Observation (MOMBO)	Christopher Middlebrook	Next Gen Federal Systems LLC (DOD)	$10,000
Mesosphere Observation Mission for Beacon Optimization	Christopher Middlebrook	Next Gen Federal Systems LLC (DOD)	$38,951
Student Design: Waterfowl Retrieving System	Anthony Pinar	Riverbend Lepak LLC	$6,500

ECE DEPARTMENT STATISTICS

ENROLLMENT

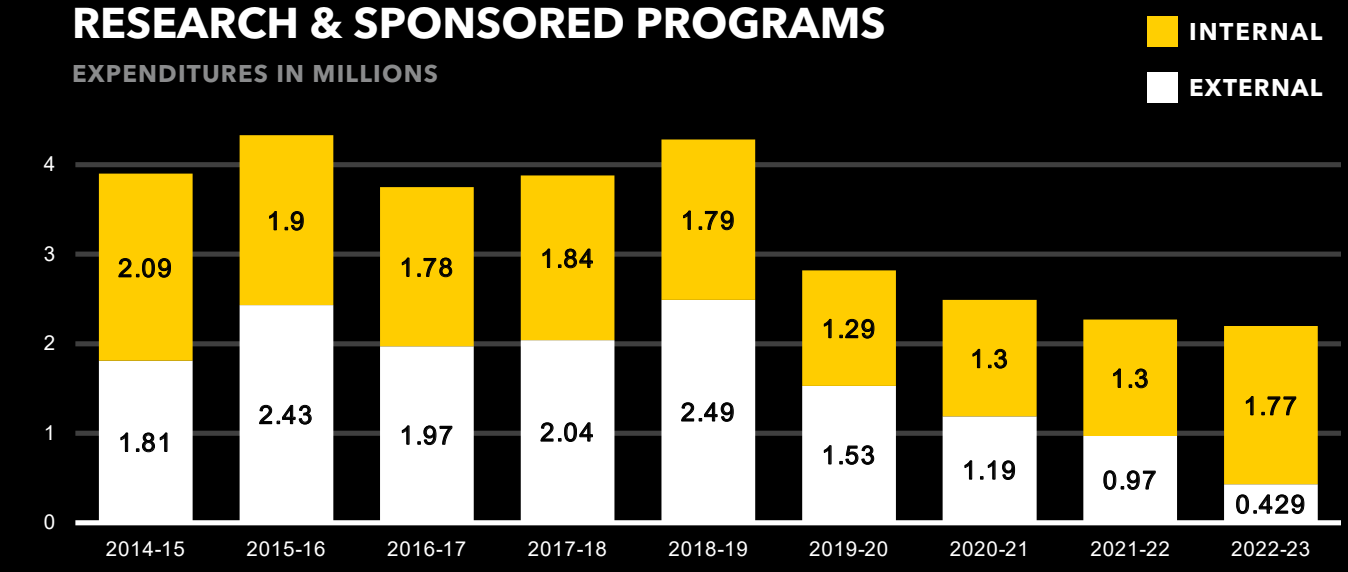


DEGREES AWARDED



RESEARCH & SPONSORED PROGRAMS

EXPENDITURES IN MILLIONS



Michigan Technological University

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