



University of Idaho
College of Engineering

UNLEASH
THE SPIRIT
OF INNOVATION

EXPO

engineering ▲ design

The longest-running student engineering
innovation showcase in the Pacific Northwest

**2020 CAPSTONE
PROGRAM
GUIDE**

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Cybersecurity demands the best

We're partnering with U of I to deliver it

The world of cybersecurity changes fast. To protect our critical infrastructure, engineers can't just keep up—they need to stay two steps ahead.

We're working with the University of Idaho to develop a new four-year program focused on cybersecurity. Using best practices and cutting-edge research, we'll equip the next generation of engineers with the tools and knowledge they need.

Together, we're creating secure solutions and defining the future of cybersecurity.



WELCOME TO VIRTUAL EXPO



This year will go down in history as the year the University of Idaho College of Engineering's annual Engineering Design EXPO overcame a worldwide pandemic to maintain its 27-year Vandal tradition.

With safety our highest concern amid the COVID-19 outbreak, we also recognize our responsibility to the hundreds of attendees that come to campus each year for this event.

EXPO is the longest-running student engineering and technological innovation showcase in the Pacific Northwest. That is why we've re-envisioned EXPO as a virtual experience.

Working in teams, engineering students from across disciplines present their projects from our college's Senior Capstone Design Program, recognized by the National Academy of Engineering as one of the top seven in the nation for infusing real-world experiences into engineering education. EXPO is the final step before our students graduate and join the workforce.

In this entirely unique landscape, our student teams, faculty advisors and mentors have overcome every unforeseen challenge to bring their designs and prototypes to completion for online exhibition.

Hundreds of K-12 students will participate in our virtual Extended Experience, exploring senior capstone projects remotely, following along in hands-on activities done at home or in the classroom, and taking a virtual tour of parts of our campus.

Our more than 60 volunteer judges have weathered the storm with us to adopt an online scoring system to judge projects and remote technical presentations.

And throughout it all, our sponsors remained steadfast in their commitment to our college and their confidence in our ability to bring our college's senior capstone program, recognized by

the National Academy of Engineering as one of the best in the nation, to a virtual stage.

Over the years, EXPO has grown in significance, bolstering our educational process and our student's development. But EXPO is not possible without the support of our industry partners and friends of the College of Engineering. We depend on your generous support to produce this quality event.

I want to thank this year's corporate and academic presenting sponsors, Schweitzer Engineering Laboratories and Engineering Outreach at the University of Idaho, for their generosity and commitment to EXPO.

In addition, I want to thank all of the sponsors and partners that support EXPO activities and have enabled us to transfer our K-12 Extended Experience into a meaningful virtual event for 5-12th graders this year.

Thank you to Wagstaff, Idaho STEM Action Center, Avista, the Coeur d'Alene Tribe, DC Engineering, GeoTek, Inc., Idaho Power Company, Itron, Idaho National Laboratory, J-U-B Engineers, the Micron Foundation, ON Semiconductor, POWER Engineers and J.R. Simplot Company Foundation.

Though we are not experiencing EXPO from one location this year, I hope you join me in engaging remotely with students and encouraging others to participate and learn more about what it means to Engineer Like a Vandal.

Sincerely,

Larry Stauffer, Dean
College of Engineering
University of Idaho

ATTEND OUR VIRTUAL EXPO

uidaho.edu/expo

- Explore capstone projects
- View electronic posters
- Learn more about our K-12 Extended Experience

THANK YOU, EXPO SPONSORS!

The University of Idaho College of Engineering thanks all of our corporate and academic sponsors for their generous support of the annual Engineering Design EXPO. We value and appreciate your participation and continued commitment to engineering education.

**Corporate
Presenting Sponsor:**



**Academic
Presenting Sponsor:**



Become a Sponsor

Planning the University of Idaho's Engineering Design EXPO is a yearlong activity.

To explore future opportunities to support EXPO, contact:

**College of Engineering
Development Team
208-885-5888
expo@uidaho.edu**

We look forward to talking with you about how you can help support this event and current and future students.

Event Sponsors



ON Semiconductor®



MEET OUR JUDGES

Judges are a critical part of the Engineering Design EXPO experience for University of Idaho College of Engineering students. Interaction between students and judges creates opportunities for students to gain new insight and learn about engineering career paths and the profession in general.

Thank You for Joining Us!

Phillip Arpke, Wagstaff, Inc.

Peter Baran, Design Magnitude Idaho

John Barrutia, DC Engineering

Amanda Battles, Clearwater Paper

Callie Bendickson, Itron

Pat Blount, Moscow High School

Pietro Boyd, Nightforce Optics

Mary Ellen Brewick, University of Idaho

Kara Cafferty, Idaho National Laboratory

David Christiansen, UNC Department of Biostatistics (Retired)

Ed Cimbalik, Micron

Jessica Coakley, Itron, Inc.

Mitch Colburn, Idaho Power

Nicholas Cunningham, ATI Specialty Alloys and Components

Stan Curtis, Urban Systems

Kevin Damron, Avista

Jason Dearien, SEL

Raymond Dixon, University of Idaho

Chris Dux, Avista

Chris Dyer, POWER Engineers, Inc.

Sharon Eroschenko, U.S. Bureau of Reclamation

Byron Flynn, GE

Karen Flynn, Idaho Power

Shannon Fuchs, Self-employed

Nick Gow, Forte Analytical

Alan Griffiths, Naval Surface Warfare Center, Acoustic Research Detachment

Gene Hamacher, U of I TechHelp

Gary Hermann, Velsicol and CH2M Hill (Retired)

David Hollenback, Berg Manufacturing

Christopher Hyde, University of Idaho

Mark Ingram, Micron

David James, Avista

Victoria Kampfer, PSNS & IMF

Zoltan Kiss, USDA Forest Service

Trevin Kretz, Encoder Products Company

Jay Larsen, Idaho Technology Council

Amy Lientz, Idaho National Laboratory

Jim Linford, Eagle Creek Consulting

Dan Mathewson, Electroimpact

Ken Mays, Boeing

Matthew Michael, Avista

Kelly Moore, Meter Group Inc

Nadine Morasci, Astronics AES

John Murphy, Glanbia Nutritionals

Shane Needham, Alturas Analytics, Inc.

Jason Noble, Itron

Alex Olson, Schweitzer Engineering Laboratories

Caitlin Owsley, Janicki Industries

Stacey Page, Ultieg

Lyle Parks, Retired

Nick Peck, Encoder Products Company, Inc.

Dale Peterson, Peterson Metal Products

Luis A. Quinones, Palo Verde Generating Station

Behnaz Rezaie, University of Idaho

Jonathan Richards, Schweitzer Engineering Laboratories

Bryan Riga, Idaho Forest Group

Michael Schleich, Itron

Eric Silk, Schweitzer Engineering Laboratories

Alex Simon, Boeing

Luis Skinner, Schweitzer Engineering Laboratories

Jamison Slippy, Kodiak Aircraft Company

Alistair Smith, University of Idaho

Eric Stubbs, Micron

Shawn Swanby, Ednetics

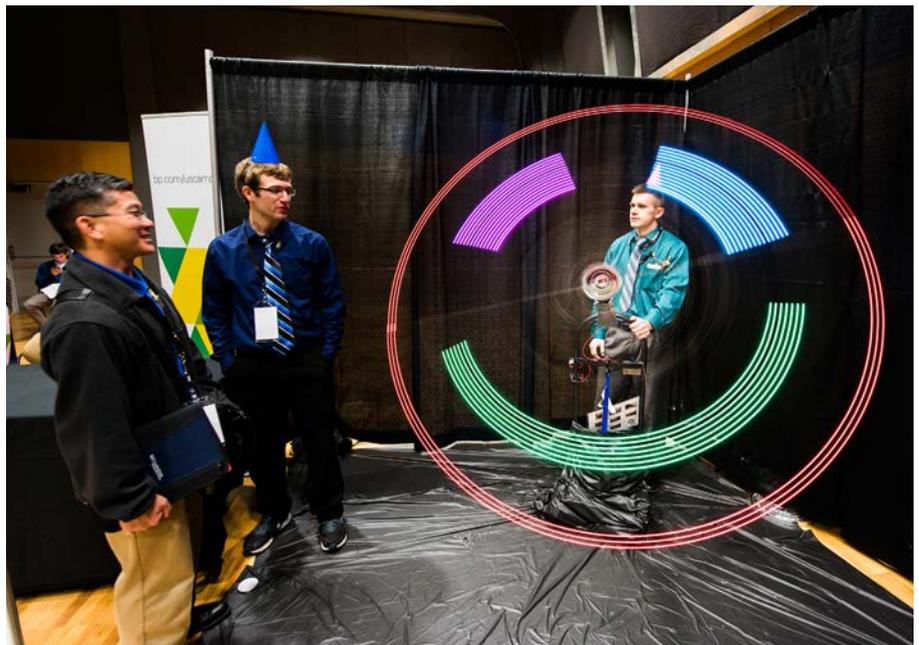
Todd Swanstrom, Western Trailer Co.

Steven Wagner, PlayStation

Dan Walsh, Itron

Jeff Williams, Vista Outdoor

Min Xian, University of Idaho





THE COLLEGE OF ENGINEERING CAPSTONE PROGRAM

Recognized by the National Academy of Engineering as one of the top seven in the nation, the University of Idaho College of Engineering Senior Capstone Design Program infuses real-world experiences into undergraduate engineering education.

Engineering students work in interdisciplinary teams on creative projects sponsored by valued industry partners, private individuals or U of I departments. Courses in the program emphasize the design process and the creation of a thoughtfully engineered, tested and validated outcome or prototype.

Our annual Engineering Design EXPO, the longest-running student engineering innovation showcase in the Pacific Northwest, is the culmination of the capstone program. Seniors present their work at EXPO through professional exhibits and technical presentations.

Biological Engineering

POCKET MICROSCOPE SLIDE SCANNER

The scope of this project is to design a portable microscope slide image capture device that allows doctors to analyze tissue biopsies while maintaining the needs of low cost and durability. The image generated through this device will be later used by our client to make a machine learning grid that identifies specific patterns in biopsy sample to diagnose with 97% accuracy and redirect the image to related physicians.

Team Members

Jeff Crawford – Computer Science
Isaac Riggs - Computer Science
Michael Camerino – Biological Engineering
Archana Dahal - Biological Engineering
Nicolas Yensen - Biological Engineering

Client/Sponsor

Charles Keller, Children's Cancer Therapy Development Institute

Faculty Advisor

Dev Shrestha, U of I Department of Biological Engineering

ARTHROSCOPIC SURGICAL DEVICE FOR SMOOTHING OF ARTICULAR CARTILAGE AND BONE

Millions of people each year undergo arthroscopic surgery to diagnose joint problems such as severe arthritis. Current arthroscopic surgical devices help reduce inflammation but can still leave ripples on articular surface of bones. This results in more discomfort for patients than a perfectly smooth surface would. Our device will smooth articular cartilage and bone without producing a rippling effect. Our device will also be more ergonomic for surgeons, allowing them to operate for longer if needed.

Team Members

Ethan Overfelt - Biological Engineering
Katie Farris - Biological Engineering
LeeAnn Hold - Biological Engineering
Suhaim Altaieb - Mechanical Engineering
Qingyun Wang - Electrical Engineering
Qian Xu - Electrical Engineering
Lissa Nickell - Biological Engineering

Client/Sponsor

W. Douglas Hiller, Whitman Hospital and Medical Center

Faculty Advisor

Dev Shrestha, U of I Department of Biological Engineering

ALGAE HARVESTER AND DEHYDRATOR

The goal of our project is to grow and then dehydrate algae suspended in water to a 15% moisture content for use in biodiesel production. Algae growth and dehydration is an energy intensive process, so our goal is to make an efficient way to produce dry algae. This biofuel feedstock has a great potential to be used in industry, but first must be able to be produced in an energy efficient process.

Team Members

Josh Nisson - Biological Engineering
Stefanie Marikis - Biological Engineering
Nicole Maas - Biological Engineering
Ryan Walters - Biological Engineering
Chance Scriptor - Biological Engineering

Client/Sponsor

U of I Department of Biological Engineering

Faculty Advisor

Dev Shrestha, U of I Department of Biological Engineering

Chemical and Materials Engineering

BP RENEWABLE DIESEL FEEDSTOCK ANALYSIS

Due to a rising demand in energy, pursuing renewables as an alternative fuel source is of great interest. This team evaluated the current diesel fuel system at BP's Cherry Point refinery and determined an opportunity for additional capacity. Through an intensive analysis of various bio-feedstocks, our team has determined the most viable option to accommodate BP's goal to be carbon net zero by 2050.

Team Members

Sahara Waymire - Chemical Engineering
Louise Nicole Yu - Chemical Engineering
Addyson Barnes - Chemical Engineering
Clay Allred - Chemical Engineering

Client/Sponsor

Bennett Williamson, BP
Rick Johnson, BP

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

MICROGRAVITY SIMULATION DEVICE

With renewed efforts to place humans on the moon and beyond, there is a need to understand the effects of microgravity on the human body during prolonged space missions. Our team designed and built a clinostat, which is a device that simulates microgravity. This device is a cost-effective way to study the effects of microgravity on biological samples.

Team Members

Alathea Davies - Chemical Engineering
Pierce Franklin - Chemical Engineering
Daryl Giglio - Chemical Engineering
Hassna Alghaith - Chemical Engineering

Client/Sponsor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

ANAEROBIC DIGESTION OF ALGAE FOR BIOGAS PRODUCTION

Currently, 80% of our world's energy comes from fossil fuels, which has led to harmful emissions and pollution. Microalgae are an increasingly attractive replacement for current fossil fuel use. Production of biogas from anaerobic digestion remains unfeasible for large scale production due to technical restraints. We will be designing a four-phase anaerobic digester based on a compound stomach and the steps of anaerobic digestion to aid in biogas research at the University of Idaho.

Team Members

Maggi Laan - Biological Engineering
Amani Al Fulaiti - Computer Engineering
Kyle Yates - Biological Engineering
Michael Nguy - Electrical Engineering

Client/Sponsor

Dr. Chuck Peterson, Peterson Endowment
U of I Department of Biological Engineering

Faculty Advisor

Dev Shrestha, U of I Department of Biological Engineering



METAL REMOVAL FROM MINE WATER USING ALGAE

The team is testing the use of algae from mine water to produce clean water and recover metal using a cost-effective method. For the proposed treatment system, algae are mixed with dissolved metals. The algae is then removed from the mine water so the metal can be taken from the algae.

Team Members

Lucas Arnold - Chemical Engineering
Kymberly Bowlby - Chemical Engineering
John Fetzer - Chemical Engineering
Simon Thomsen - Chemical Engineering

Client/Sponsor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

REIMAGINING GOLD EXTRACTION

Cyanide, a highly toxic chemical, has widespread use in gold mining operations. Our team investigated replacing cyanide in gold extraction operations with another chemical known as ATF. The team designed an ATF manufacturing facility and gold extraction operation. Compatibility with downstream and recycling processes and an economic analysis compared to cyanide was also performed.

Team Members

Erik Nelson - Chemical Engineering
Kyle Rigg - Chemical Engineering
Sam Smith - Chemical Engineering
Amber McLenna - Chemical Engineering

Client/Sponsor

James Moberly, Department of Chemical and Materials Engineering

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

PROCESS IMPROVEMENT OF INDUSTRIAL HEAT TREATMENT OF AMMUNITION CASES

The focus of the project is to reduce wastewater and process steps in the manufacture of ammunition cases. The manufacturing process includes multiple stamping and pressing, washing and heating steps, all of which impact the facility's overall water usage. The project team analyzed each of these steps to reduce the number of overall process stages and to find ways to minimize water usage and wastewater generation.

Team Members

Aspen White - Chemical Engineering
Adrien Malinowski - Chemical Engineering
Connor McDonnell - Chemical Engineering
Bryan Hayden - Chemical Engineering

Client/Sponsor

Austin Heinrich, Vista Outdoor

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

DESIGN FOR ACCURATE MEASUREMENT OF INTESTINAL TRANSPORT

Rainbow trout are exceptional biological models due to their well characterized genome and nutritional requirements. They are used as a model to provide data regarding nutritional uptake. Our team designed and built an intestinal transport chamber for future intestinal nutrient uptake studies.

Team Members

Melissa Marsing - Chemical Engineering
Jacuelin Martinez-Alvarez - Chemical Engineering
Saud Almeshari - Chemical Engineering
Faisal Ageeli - Chemical Engineering
Courtney Molvig - Chemical Engineering

Client/Sponsor

Madison Powell, University of Idaho Department of Animal and Veterinary Science

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

CARBON DIOXIDE CAPTURE WITH BOROHYDRIDES

The use of carbon dioxide to form useful precursors has seen marked interest as concerns about human and environmental sustainability peak. Sodium borohydride is a relatively cheap and shelf-stable reagent, which has shown a high affinity for the reduction of atmospheric carbon dioxide. This project is the design of a scalable and continuous method for atmospheric carbon sequestration via sodium borohydride.

Team Members

Mason Anderson - Chemical Engineering
Ahmed Alasiri - Chemical Engineering
Kaed Benski - Chemical Engineering
Jesse Brown - Chemical Engineering

Client/Sponsor

U of I Department of Chemical and Materials Engineering

Faculty Advisor

Matthew Bernards, U of I Department of Chemical and Materials Engineering

Civil Engineering

CRESTVIEW CROSSING SWALE DESIGN

Our project is to design a water quality swale in a residential subdivision in Newberg, Oregon, to treat stormwater runoff from upstream impervious areas.

Team Members

Shion Watabe - Civil Engineering
Alejandro Recabarren - Civil Engineering
Geoffrey Michaelis - Civil Engineering

Client/Sponsor

Phillip Patague, 3J Consulting

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

POST FALLS WELL & WELL HOUSE NO. 10

Due to the growth in the Post Falls, Idaho, area, its water department is adding a production well to the city's main pressure zone. The goal of this project is to provide the city with adequate water supply to support existing and future water demands. This project will include the design and placement of the production well, design of the new well house structure and piping, concept plans for site modification, and provisions for a disinfection system.

Team Members

Topsana Elsfelder - Civil Engineering
Austin Madsen - Civil Engineering
Avery Postera - Civil Engineering
Jessica Smith - Civil Engineering

Client/Sponsor

Jessica Waller, J-U-B Engineers

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering



JULIAETTA, IDAHO BRIDGE REPLACEMENT

Our project is designing a bridge over the Middle Fork of Potlatch Creek in Juliaetta, Idaho. This bridge is being reconstructed because it does not meet current design standards.

Team Members

Brock Anderson - Civil Engineering
Brandon Casanas - Civil Engineering
Brian Skinner - Civil Engineering
Nate Solly - Civil Engineering

Client/Sponsor

Shanon Murgoitio, Idaho Transportation Department

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

CLEAR CREEK EMBANKMENT REPAIR

Our project will design a stream embankment repair that will mitigate erosion and scour caused by a significant flood event of Clear Creek, in Kooskia, Idaho. The damage included erosion of the outboard lane of Clearcreek Road and shearing off of a drainage ditch culvert.

Team Members

Amanda Carlson - Civil Engineering
Tyler Harvie - Civil Engineering
Nestor Madrigal - Civil Engineering
Brandt Souvenir - Civil Engineering

Client/Sponsor

Riannon Zender, J-U-B Engineers

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

HOMESTAKE SYSTEM: ARKANSAS RIVER DIVERSION

A rehabilitation of an existing diversion structure, including intake structure design, fish passage design, spillway structure and temporary bridge for design. The importance of this project is to provide safe passage along the Arkansas River.

Team Members

Sean Conner - Civil Engineering
Jack Krusemark - Civil Engineering
Kylie Cutler - Civil Engineering
Zachary Schaumburg - Civil Engineering

Client/Sponsor

Bryant Charlo, Deere and Ault
Kathrine Feistner, Deere and Ault

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

RAISING CANES RESTAURANT DESIGN

A new Raising Canes Restaurant is to be designed and constructed in Morton Grove, Illinois. The Raising Cane's Restaurant has been providing quality chicken finger meals since 1996. The objective of the project is to provide a safe and cost-effective structural design for both the building and the foundation. The structure will primarily be constructed from timber.

Team Members

Amanda Kalab - Civil Engineering
Holly Terrill - Civil Engineering
Michael Clark - Civil Engineering

Client/Sponsor

Brian Sielaff, Tamarack Grove Engineering
Brendon Collins, Tamarack Grove Engineering

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

WATER RESOURCES RECOVERY FACILITY PUMP STATION IN BORING, OREGON

This project includes the design of a pump station and force main in Boring, Oregon, to convey flow for 60 residential and commercial connections approximately six miles to a separate facility with an elevation change of 120 feet. This project develops real-world experience that we will use in the application of real life.

Team Members

Andrea Boyd - Civil Engineering
Jazmyn Ray - Civil Engineering
Jules Clemens - Civil Engineering
Justin Knight - Civil Engineering

Client/Sponsor

Lynne Chicoine, Water Environment Services
Nathan Seaver, Water Environmental Services

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

BEAR CREEK CANYON BIKE PATH

Our project will help the Latah Trail Foundation extend the bike path between Troy and Kendrick, Idaho by protecting the toe of the slope from creek erosion and stabilizing the collapsing hillside.

Team Members

Erik Buitron - Civil Engineering
Alexandria Campbell - Civil Engineering
Sophia Morosky - Civil Engineering

Client/Sponsor

Jessica Dzara, Alta Science and Engineering, Inc.
Phil Riersgard, Latah Trail Foundation

Faculty Advisor

Fritz Fiedler, U of I Department of Civil and Environmental Engineering

CITY OF MOSCOW LOW-STRESS SEPARATED BIKEWAY PROJECT

The Low-Stress Separated Bikeway Project will create a safe and efficient route of travel for cyclists commuting to the University of Idaho from the north side of town. The major goal of this project is to provide a safe bicycle experience to a wide range of travelers from the more experienced and confident rider to those riders that are much less confident about riding in mixed traffic.

Team Members

Rashed Alsuyqir - Civil Engineering
Devin Carscallen - Civil Engineering
Earl Van Idour - Civil Engineering
Billy Walker - Civil Engineering

Client/Sponsor

Michael Kyte, U of I Department of Civil and Environmental Engineering
Professor Emeritus

Faculty Advisor

Fritz Fiedler, U of I Department of Civil & Environmental Engineering

Computer Science

REALISTIC 3D MODELING OF DIGITAL NETWORKS AND THE INTERNET

Currently, there are no 3D computer-based models of modern computer networks for research and education. Our goal is to establish a basis for a realistic and accurate 3D model of these networks for research and instructional purposes through the game Minetest. Our solution to this problem will be easy to use and allow potential students whose learning method caters to that of a visual learner to flourish in the academic subject of basic computer networking.

Team Members

Benjamin Hallman - Computer Science
Sean Anderson - Computer Science

Client/Sponsor

Daniel Conte de Leon, U of I Department of Computer Science

Faculty Advisor

Bruce Bolden, U of I Department of Computer Science

WEB-BASED MACHINE SHOP SCHEDULER FOR THE UNIVERSITY OF IDAHO

The machine shop in the U of I Department of Mechanical Engineering currently lacks an efficient way to schedule resources for students. Our project resolves this issue by providing a clean and functional website for all students and professors to reserve, manage and access machine usage.

Team Members

Gabriel Hasenoehrl - Computer Science
Delaney Fitzgerald - Computer Science
Blakely Frechette - Computer Science
Irven Perez - Computer Science

Client/Sponsor

Michael Maughan, U of I Department of Mechanical Engineering

Faculty Advisor

Bruce Bolden, U of I Department of Computer Science

SPEECH THERAPY WEB APP USING SPEECH TO TEXT

Research shows that about 8% of children need speech therapy globally. There are many speech therapy apps intended for children in the market, but many of them are expensive, not intuitive for children, or too simplistic for therapists. This project aims to create an affordable application for speech therapy, with a dynamic user-interface system that adjusts its content for individual users in a secure and intuitive environment that is useful to children, therapists and researchers alike.

Team Members

Ian Wood - Computer Engineering
Yiqing Ma - Computer Science
Lucas Jackson - Computer Science

Client/Sponsor

Eric Booth, Micron Foundation

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

AUGMENTED REALITY IN THE COMPUTER SCIENCE DEPARTMENT

In order to better enrich student's experience on campus, we are immersing them in augmented reality throughout the Department of Computer Science. This will provide data about faculty, classes, schedules, and even computer science history right at the students' fingertips, creating a better environment for students to quickly view information.

Team Members

Cameron Dearien - Computer Science
Jubal Mitchell - Computer Science
Adam Odell - Computer Science

Client/Sponsor

Terry Soule, U of I Department of Computer Science

Faculty Advisor

Bruce Bolden, U of I Department of Computer Science

SIMULATED TRANSACTIVE POWER DISTRIBUTION NETWORK

Some power grid users, called prosumers, intermittently generate their own power via renewables such as solar panels or wind turbines. Our team is working with local power utility Avista to simulate the impact of managing transactions between users with minimal utility interaction. We aim to create a robust simulation of a small-scale power system integrated with automated pricing software.

Team Members

Christine Page - Electrical Engineering
Nikki Tran - Electrical Engineering
James Todd - Computer Science
Karstin Neil - Computer Science

Client/Sponsor

Yacine Chakhchoukh, U of I Department of Electrical & Computer Engineering

Faculty Advisor

Yacine Chakhchoukh, U of I Department of Electrical & Computer Engineering



FORTH COMPUTER

We are building an extremely lightweight, low power processor specifically for the FORTH coding language. Designing a computer around the FORTH language allows for a very fast and versatile processing core that can be used in a number of applications while still using very few resources.

Team Members

Jess Totorica - Electrical and Computer Engineering
Thys Ballard - Computer Science
Kyle Hartman - Electrical and Computer Engineering
Kyle Hild - Computer Science
Ronald Crump - Computer Science

Client/Sponsor

Peter Baran, Design Magnitude

Faculty Advisor

Bruce Bolden, U of I Department of Computer Science

HOLISTIC CYBER-PHYSICAL AND CYBERSECURITY SOLUTIONS FOR SMART BUILDINGS (MAHIVE IOT SENSORS)

Illegal hacking is an ever-increasing and evolving threat to our society and our economy. Industry and government need new ways to defend the physical and digital (cyber) worlds. The MAHIVE project's goal is to merge cyber-physical and cybersecurity sensing and analytics into a distributed and holistic detection and prevention platform. Our team will create a hub controller and example sensing devices, enable sensing devices to collect and aggregate physical and cyber events, and then securely send event data to MAHIVE analysis servers using authentication and encryption.

Team Members

Tristan Clawson - Computer Science
Jared Gradin - Computer Engineering

Client/Sponsor

Daniel Conte de Leon, U of I Department of Computer Science

Faculty Advisor

Bruce Bolden, U of I Department of Computer Science

PARK-IT-CDA: GARAGE SENSOR SYSTEM OVER A MESH NETWORK

The goal of the project is to provide an intuitive means of visual indication for commuters who are looking for available parking within a specific garage in downtown Coeur d'Alene. The Garage Sensor System (GSS) will allow people to find open parking spaces before they enter the garage, expediting the parking process.

Team Members

Joel Berain - Computer Science
Nikolai Tiong - Computer Science
Tyrel Parker - Computer Science
Zane Goodrick - Computer Science

Client/Sponsor

U of I Department of Computer Science

Faculty Advisor

Frederick Sheldon, U of I Department of Computer Science, U of I Coeur d'Alene

Electrical and Computer Engineering

SEMICONDUCTOR LASER CONTROL AND DATA ACQUISITION FOR QUALITY OPTICAL RESEARCH

Lasers are being used more frequently in scientific instruments. But for experiment results to be valid, the lasers have to be carefully controlled using expensive dedicated hardware. We are producing a cheap, modular and extendable data acquisition and control backbone for laser instruments. This will allow labs and researchers to produce high quality optical research less expensively.

Team Members

John Ashby - Electrical Engineering
Jared Reichle - Electrical Engineering
Alexis Wilson - Computer Engineering

Client/Sponsor

Chris Manning, Thorlabs

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering



TESTBED FOR MEASUREMENT AND CONTROL OF GENERATOR POWER OSCILLATIONS

Generators work effectively via a carefully controlled current. If the system is overloaded, the generator may near its transient stability and incur damage. In some cases, generators have been known to endure current fluctuations without damage. Our goal is to explore those edge cases and design a testbed to examine and collect measurement data. The value of this project is to give engineers some basic data to avoid damage and danger of synchronous machines.

Team Members

Zuhao Zhou - Electrical Engineering
Yutong Chen - Electrical Engineering
Quan Yan - Electrical Engineering
Changyao Xu - Electrical Engineering

Client/Sponsor

Matchyaraju Alla, Schweitzer Engineering Laboratories

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

OPTICAL WIRELESS COMMUNICATION FOR MASS DEPLOYMENT OF IOT-DEVICES

In couple of years, more than 50 billion devices will connect more than 7.6 billion people with exponentially increasing connectivity demand. It is expected that mass deployment of IoT devices will require data traffic that cannot be met by radio frequency-based wireless technologies alone. Optical wireless communication (OWC) will be needed to create high-density and high-capacity indoor IoT networks. Our project is to build several sensor nodes and one OWC hub to demonstrate this idea.

Team Members

Yuhang Dai - Electrical Engineering
Wei Hu - Electrical Engineering
Yanqin Huang - Electrical Engineering
Zhikai Li - Electrical Engineering
Xueren Wang - Electrical & Computer Engineering

Client/Sponsor

Suat Ay, U of I Department of Electrical & Computer Engineering VLSI Sensors Research Group (VSRG)

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

SUBORBITAL FLIGHT COMMUNICATION AND BATTERY FIRE CONTAINMENT UNIT FOR RE-ENTRY VEHICLES

Communicating with satellites returning from orbit is an expensive task due to the need for specialized equipment and systems. In order to reduce this cost, our team is developing electronics hardware and software libraries to leverage the existing Iridium satellite network to stream data from a returning cube satellite. We are also developing a firebox capable of housing batteries to power these devices that will keep flames contained in the event of catastrophic battery failure.

Team Members

Michael Atkinson - Computer Science
Brandon Foss - Computer Science
Collin Heist - Electrical Engineering
Shelby Linafelter - Electrical Engineering
Lennin Rodriguez - Computer Science
MacKenzie Sexton - Mechanical Engineering
Sesily Stewart - Materials Science and Engineering

Client/Sponsor

Avery Brock, NASA Ames Research Center
Marcus Murbach, NASA Ames Research Center

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

LOW-COST ELECTROENCEPHALOGRAM

Our project was to create a low-cost electroencephalogram (EEG) for educational use, providing value to schools through a more economical EEG device that can be used to expose young students to the wonders of neuroscience and inspire neuroscientists of the future.

Team Members

Corbin Schueller - Computer Science
 Hanieh Nezakati - Electrical Engineering
 Drew Schultz - Mechanical Engineering
 Abhilash Reddy - Computer Science
 Jeff Courtright - Biological Engineering
 Michael Lejardi - Computer Engineering

Client/Sponsor

Gautam Kumar, U of I Department of Chemical & Materials Engineering

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

DESIGNING EXERCISES FOR THE INDUSTRIAL CONTROL SYSTEMS LABORATORY

The U of I Department of Electrical and Computer Engineering Industrial Control Systems Lab contains a wide variety of equipment, all of which requires experience to use. There is currently no method for students can learn how to operate equipment without instructor guidance. Our project provides lab exercises for students to follow and learn about the equipment and concepts required for operation.

Team Members

Dakota Pfaff - Electrical Engineering
 Brian Guiana - Electrical Engineering
 Yikai Lu - Electrical Engineering
 Jialong Dai - Electrical Engineering

Client/Sponsor

Brian Johnson, U of I Department of Electrical & Computer Engineering

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering

BACKUP SOLAR GENERATION

U of I Facilities Services owns and maintains two wells that provide clean water to the City of Moscow and the University of Idaho. We are designing a 1-megawatt solar array to provide green backup power to these wells.

Team Members

Emerson Butler - Electrical Engineering
 Salim Al Tubi - Mechanical Engineering
 Joseph Amodemo - Electrical Engineering
 Boxiang Hou - Electrical Engineering
 Jiawen Yu - Electrical Engineering

Client/Sponsor

Marc Compton, U of I Facilities Services

Faculty Advisor

Herbert Hess, U of I Department of Electrical & Computer Engineering

VIRTUAL FENCE SYSTEM FOR CATTLE MANAGEMENT WITHOUT GPS

All virtual fencing for rangeland cattle farmers on the market are GPS-based. This project aims to design a virtual fencing system that is lightweight and more reliable without using GPS. The system will provide farmers an easy interface to locate, identify, rotate and keep their cattle in their property without using fencing.

Team Members

Xuyue Gu - Electrical Engineering
 Ziqing Zhu - Electrical Engineering
 Lauren Smith - Electrical Engineering
 Samantha Baran - Electrical Engineering
 Austin Grieve - Electrical Engineering

Client/Sponsor

Jason Karl, U of I College of Natural Resources
 Peter Baran, Design Magnitude

Faculty Advisor

Feng Li, U of I Department of Electrical & Computer Engineering



SECURE AND SAFE MICROGRID ON THE U OF I CAMPUS

U of I is seeking to establish a microgrid on campus in the event of a power outage. Our team will unveil the underlying issues associated with integrating a 1-megawatt solar array power generation source, as well as power for the well pumps on campus, which under emergency conditions could be used for fire suppression. The final product will analyze power flow, fault, contingency, seasonality, load shedding, and protection to ensure the efficiency and safety of the microgrid.

Team Members

Shaun Andrews - Electrical Engineering
 Christopher Cervino - Electrical Engineering
 Shawn Naughton - Electrical Engineering
 Ziyu Qian - Electrical Engineering
 Huiyu Zhao - Electrical Engineering

Client/Sponsor

Marc Compton, U of I Facilities Services

Faculty Advisor

Herbert Hess, U of I Department of Electrical & Computer Engineering

INSULATION MEASURING AND CUTTING MODULE

Our project reduces waste and human error in cutting costly insulation that goes onto the tubing of Boeing's airplanes. We have worked to transition the process of measuring and cutting insulation from a purely human job to an automated process.

Team Members

Rennie Scott - Mechanical Engineering
 Alyssa Keyes - Mechanical Engineering
 Ian Glasgow - Mechanical Engineering
 Kyle Deeter - Mechanical Engineering

Client/Sponsor

Angel Mora, Boeing

Faculty Advisor

Matthew Swenson, U of I Department of Mechanical Engineering

OPTIMIZED RIFLESCOPE MOUNT

In order to provide quality products to customers, industry is always moving toward innovative designs, lighter weight materials and ensuring reliable performance. Nightforce Optics has proposed that our team optimize their current rifle scope mount by making it lighter weight, redesigning high-stress regions and reducing manufacturing costs.

Team Members

Jacob Weber - Mechanical Engineering
 Hector Magana - Mechanical Engineering
 Travis Goehring - Mechanical Engineering
 James Zillinger - Materials Science and Engineering

Client/Sponsor

Nightforce Optics

Faculty Advisor

Michael Maughan, U of I Department of Mechanical Engineering

FATIGUE TESTING DEVICE TO EVALUATE SHEET METAL COMPONENTS

The methodology for testing the performance the long-term durability of sheet metal components is not readily available. The goal of our project is to design a low-cost system for measuring the useful life of sheet metal samples under various conditions. The team has designed and built a fully operational system enabling repeatable measurement of fatigue properties of sheet metal samples up to six inches in size.

Team Members

Chase Croft - Mechanical Engineering
 Anthony Kitchen - Mechanical Engineering
 Alex McNurlin - Mechanical Engineering
 Ryan Blair - Mechanical Engineering

Client/Sponsor

Jonathan Richards, Schweitzer Engineering Laboratories

Faculty Advisor

Matthew Swenson, U of I Department of Mechanical Engineering

AUTOMATED DATA LOGGING RAPID BUTTON CYCLER

Buttons are the main way we interact with machines. When they fail, it can be a nuisance to an outright disaster. That is why our team designed a data-logging button cycler for our client Advanced Input Systems. Our device tests the life of multiple buttons over millions of presses while giving real-time feedback on switch health and failures.

Team Members

Andrew Overby - Mechanical Engineering
 Cody Kasper - Mechanical Engineering
 Chris Crozier - Mechanical Engineering

Client/Sponsor

Ben Medeiros, Advanced Input Systems
 Brett Harned, Advanced Input Systems

Faculty Advisor

Steve Beyerlein, U of I Department of Mechanical Engineering

LEAN MANUFACTURING ANNEALING PROCESS FOR AMMUNITION MANUFACTURING

Vista Outdoor ammunition is supplied to law enforcement, who face life and death situations. A properly heat-treated shell is crucial to ensure proper ammunition performance. Instead of using a batch oven process, we are designing a product that uses induction technology to anneal shell cases faster and more efficiently.

Team Members

Matthew Meagher - Mechanical Engineering
 Josh Clark - Mechanical Engineering
 Zachary Woffinden - Mechanical Engineering
 Dwain Stucker - Mechanical Engineering

Client/Sponsor

Jeff Williams, Vista Outdoor

Faculty Advisor

Michael Maughan, U of I Department of Mechanical Engineering

HOME SECURITY DEVICE THAT SHOCKS INTRUDERS AT THE DOOR

Our team will provide an alternative safety device for preventing access to a room or house, using a Tesla Coil design. The design will electrically shock intruders with triple the voltage of a standard taser, with the intent to deter intruders but not injure.

Team Members

Julia Roach - Biological Engineering
Eric Hedine - Electrical Engineering
Tim Mattson - Electrical Engineering
Danny Pierce - Mechanical Engineering
Wyatt King - Mechanical Engineering

Client/Sponsor

Herbert Hess, U of I Department of Electrical & Computer Engineering

Faculty Advisor

Daniel Cordon, U of I Department of Mechanical Engineering

3D PRINTED SMART WATER FILTER

Filters in dangerous environments have a large cost of replacement. Our 3D printed smart water filter will be a handsfree, low maintenance filter that can be scaled to fit various pipes and used in various configurations to provide the required filtering. This project is a proof of concept for further research in developing a similar product for a more precise implementation.

Team Members

Michael Sanabia - Mechanical Engineering
Phillip Flexer - Mechanical Engineering
Mohammed Alqahtani - Materials Science and Engineering
Abhishek Rathod - Mechanical Engineering

Client/Sponsor

Krishna Raja, U of I Department of Chemical and Materials Engineering
Michael Maughan, U of I Department of Mechanical Engineering

Faculty Advisor

Michael Maughan, U of I Department of Mechanical Engineering

REAR-DRIVE SNOWMOBILE

Rear-drive is different than conventional snowmobile drive configuration. When driving the track from the front, the top side of the track is pulled in tension, and the bottom of the track is pushed into compression. The bottom portion of the track in contact with the snow, being in compression, causes fuel loss and other inefficiencies while decreasing overall handling. Our team explored a rear-drive concept that would be eco-friendly and rider-friendly.

Team Members

Thomas Entwit - Mechanical Engineering
Brannon Hudson - Mechanical Engineering
Aref Hakami - Mechanical Engineering

Client/Sponsor

Daniel Cordon, U of I Department of Mechanical Engineering

Faculty Advisor

Daniel Cordon, U of I Department of Mechanical Engineering

POWDERED ALLOY PACKING SYSTEM FOR ADDITIVE MANUFACTURING

Additive manufacturing is a method for making intricate parts in a fast and efficient manner. These parts are used in many high-impact industries from space exploration to robotics and even some medical fields. Materials used for additive manufacturing are often advanced and sensitive to environmental conditions requiring they be packaged carefully. Our team has been tasked with creating a system that will quickly and safely package these alloys for transport.

Team Members

Nicholas Ayers - Materials Science and Engineering
Austin Beyer - Mechanical Engineering
Kaitlin Coad - Mechanical Engineering
Kate Seegmiller - Mechanical Engineering

Client/Sponsor

Nicholas Cunningham, ATI Specialty Alloys and Components
Curtis Denos, ATI Specialty Alloys and Components

Faculty Advisor

Matthew Swenson, U of I Department of Mechanical Engineering

DEBALING AGRICULTURAL MATERIALS FOR BIO-BASED PRODUCTS

With the rise of agriculture-based feedstocks for biofuels and bio-based products, there is a need for debaling agricultural-based materials. The problem then becomes how can we effectively and efficiently turn compressed agricultural materials into a loose, consistent density flow while still maintaining maximum particle length? Our goal is to design and build a prototype that fulfills these requirements. The final design will require minimal maintenance and little input from an operator.

Team Members

Sean Leonard - Mechanical Engineering
Loren Jenkins - Mechanical Engineering
Yaser Alghreeb - Mechanical Engineering
Steven Mortensen - Biological Engineering

Client/Sponsor

Forest Concepts

Faculty Advisor

Daniel Cordon, U of I Department of Mechanical Engineering



ENCODER INTERACTIVE DISPLAY

Encoders, high-accuracy mechanical sensors, are utilized in elevators, large cranes, vending machines, assembly lines and many other daily applications. Our team has been tasked with creating a visual, interactive display to help Encoder Products Company (EPC) showcase their products so more individuals can learn about the power of encoders and their impact on the world around them.

Team Members

Mark Jennings - Electrical Engineering
Tanner Sloan - Mechanical Engineering
Jacob Metter - Mechanical Engineering

Client/Sponsor

Trevin Kretz, Encoder Products Company (EPC)
Nick Peck, Encoder Products Company (EPC)

Faculty Advisor

Steven Beyerlein, U of I Department of Mechanical Engineering

BATTERY LIQUID COOLING SYSTEM FOR ELECTRIC ENGINES

In an effort to meet the modern demand for reduced carbon pollution, the Hyster-Yale Group is converting one of its diesel forklifts into an electric one. To aid in these efforts, this group has designed a modular liquid cooling system to help batteries maintain a safe temperature. The liquid cooling system can be upscaled or downsized for any future conversions, and makes the future – hot swapping any combustion engine for an electric system – closer to reality.

Team Members

Tarrin Funderburg - Mechanical Engineering
Donald Funk - Mechanical Engineering
Jesus Barrera - Mechanical Engineering
Ryan Gonzalez - Mechanical Engineering

Client/Sponsor

Samuel Weiss, Hyster-Yale Group

Faculty Advisor

Matthew Swenson, U of I Department of Mechanical Engineering

DUAL ROBOTIC ARM LOG HANDLING

The modern process of breaking down logs through a series of cutting operations for commercial sale is expensive and requires extensive upkeep and resources. Our RoBoLoG system aims to continuously improve this process by utilizing robotic arms to move a log through a saw to break it down. This system will reduce maintenance, infrastructure and computing power costs.

Team Members

Sam Malinowski - Mechanical Engineering
An Le - Mechanical Engineering
Deryk Ahner - Mechanical Engineering
Jongin Hwang - Mechanical Engineering

Client/Sponsor

Jeremy Fromm, Idaho Forest Group
Chad Kosmicki, Idaho Forest Group

Faculty Advisor

Steve Beyerlein, U of I Department of Mechanical Engineering

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- Introduce students to best practices in industry for design and manufacturing.

Projects for the year are identified, scoped and budgeted by Aug. 1.



Learn more about sponsorship opportunities at
uidaho.edu/engr-capstone

INVENT IDAHO FINALISTS

Young inventors grades 1st through 8th are awarded scholarships to attend the University of Idaho College of Engineering based on competition projects. Learn more at inventidaho.com.

Alexandria Johnson - "Opt-Out Glasses"

Kenny Nejely - "The Cuttin' Baler"

Magnus Rants - "Magnetic Legos"

Catherine Roco - "Potato Plastic Bags"

Kate Ruegner - "Mez-Sure"



U of I College of Engineering Dean Larry Stauffer poses for a photo with the 2020 Invent Idaho Finalists.

2020 EXPO ORGANIZING COMMITTEE

For questions related to sponsorship, K-12 outreach and other ways you can get involved, please email expo@uidaho.edu or contact an individual representative below.

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- Chloe Rambo, Former Associate Director of
Development

Senior Capstone Design Program

- Matt Swenson, Capstone Program Director
Assistant Professor, Mechanical Engineering
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- Dan Cordon, Capstone Instructor
Clinical Faculty Assistant Professor, Mechanical Engineering
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- Marie Wagner, Student Services & Programs Coordinator
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- Jenine Cordon, Web Coordinator
jenine@uidaho.edu

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– PayScale 2019 College Salary Report

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– 2019-2020 Financial Aid Data

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– National Academy of Engineering*

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*– 2016-2018 U of I Career Services Outcomes
Survey*

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– American Society for Engineering Education

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-Center for Cyber Safety and Education

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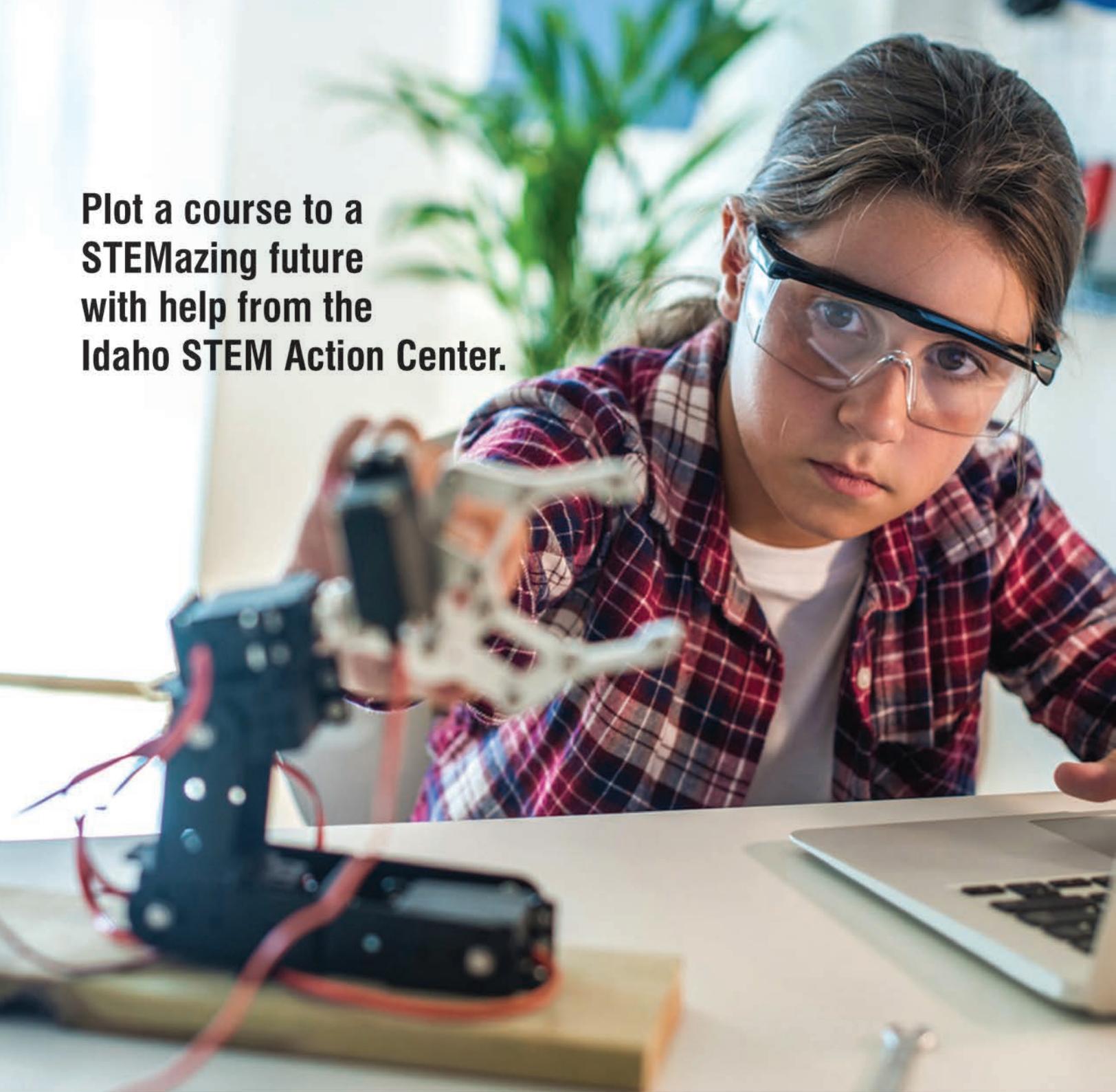
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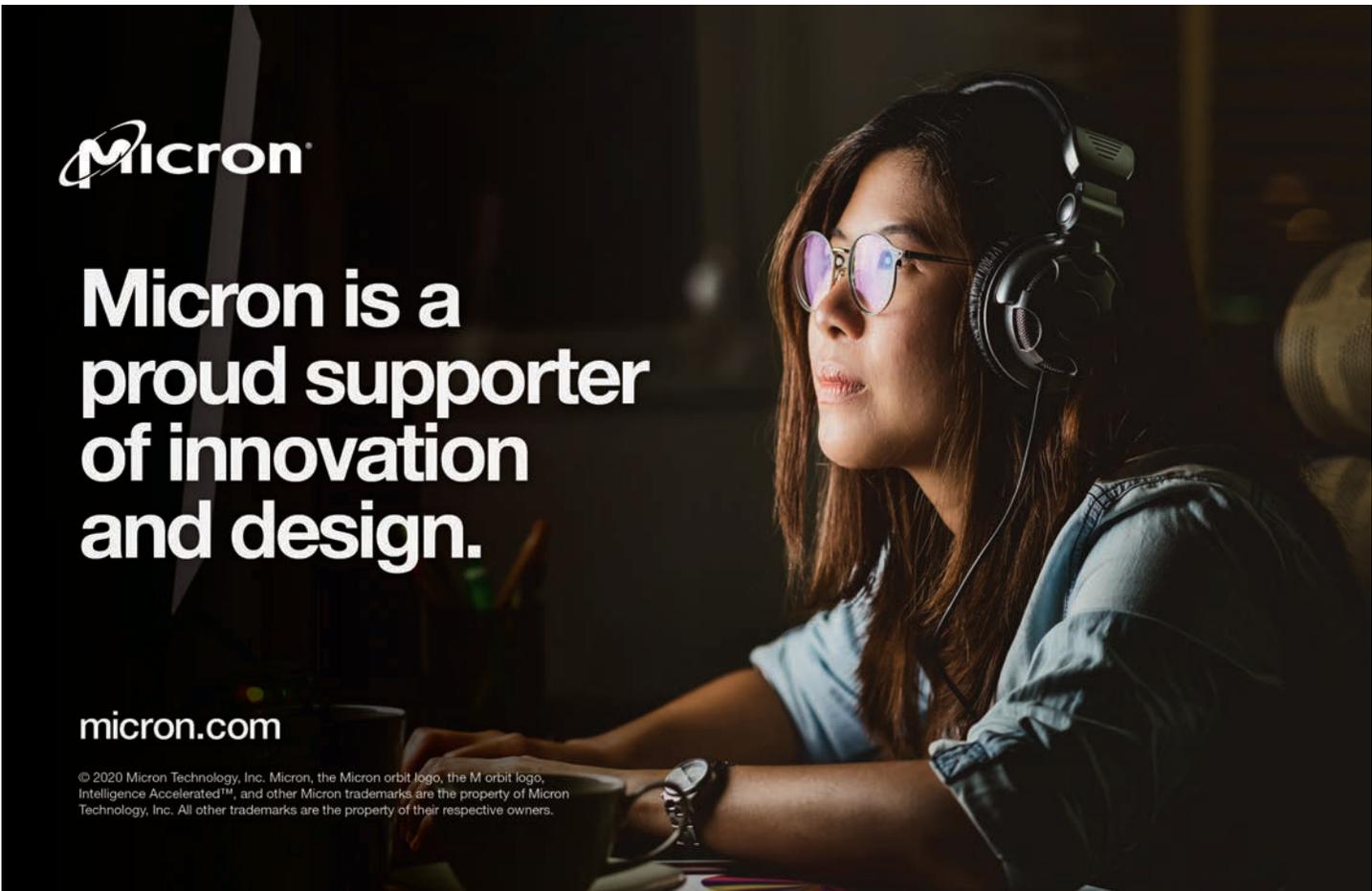
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