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

2021 CAPSTONE PROGRAM GUIDE

uidaho.edu/expo

#uidahoEXPO

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 have 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 inherently secure technology and defining the future of cybersecurity.

SEL SCHWEITZER ENGINEERING LABORATORIES

WELCOME TO EXPO 2021

A Vandal tradition for 28 years, EXPO is the longest-running student engineering and technological innovation showcase in the Pacific Northwest.

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.

With safety our highest concern amid the continued COVID-19 pandemic, our University of Idaho College of Engineering's annual Engineering Design EXPO will be held both in-person and on a virtual stage this year.

We are thankful for our sponsors, judges, students, faculty and staff who have worked tirelessly to bring a safe in-person event to fruition, one of the first on the Moscow campus in the last year. Socially distanced and masked, this event will follow current campus safety protocol. Though still different than year's passed, we believe this event is a responsible celebration of Vandal engineering before our students graduate and enter the workforce.

From the success of our entirely virtual 2020 event, we have adopted several changes this year to broadcast the ways our students are pushing the boundaries of science and technology across the nation and world.

In addition to in-person booth presentations, all our capstone team projects will be available to browse online. We anticipate and welcome the thousands who will visit uidaho.edu/expo to explore projects remotely.

More than 60 judges will tune in during online technical presentations to score teams virtually this year. After a significant increase in technical presentation attendance in 2020, we opted to keep this portion of the event online only.

Hundreds of high school and community college students will also participate in our virtual Extended Experience. Students can explore senior capstone projects remotely, follow along in hands-on activities done at home or in the classroom, take a virtual tour of our campus and meet current students, faculty and staff via Zoom.

Despite the challenges of the last year, I am continually humbled by our sponsors, who remain committed to the value of STEM education, hands-on experience and our students' development. EXPO is not possible without the support of our industry partners and friends of the College of Engineering.

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 from our Extended Experience program to providing meals for our judges and capstone students.

Thank you to Idaho STEM Action Center, Battelle Energy Alliance, Avista, GeoTek, Inc., HP, Idaho Power Company, Micron Foundation, POWER Engineers, J.R. Simplot Company Foundation and Idaho Forest Group.

Whether in-person or remotely, I hope you join me in engaging with our up-and-coming Vandal engineers by commenting on team projects, asking questions and encouraging others to participate and learn more about what it means to Engineer Like a Vandal.

Sincerely,

Larry S. Stauffer

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 Extended Experience for high school and community college students

THANK YOU, TO OUR 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:

SEL

Academic Presenting Sponsor:

University of Idaho
Engineering Outreach

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

IDAHO STEM ACTION CENTER

IDAHO'S National Laboratory
Operated by Battelle Energy Alliance

AVISTA

IDAHO POWER
An IDACORP Company

POWER ENGINEERS

GEOTEK

Micron Foundation

Simplot COMPANY FOUNDATION

hp

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!

A Andrasi – University of Idaho

John Barrutia - DC Engineering

Amanda Battles - Clearwater Paper

Matt Binsfield - Navy

Pat Blount - Moscow High School

James (Jim) Brennan - Slayden Constructors/MWH

Myles Brown - The Boeing Company

David Christiansen - Retired

Nicholas Crabbs - Vynyl

Jason Dearien - Schweitzer Engineering Laboratories

Chris Dux - Avista Utilities

Chris Dyer - POWER Engineers, Inc.

Byron Flynn - GE (retired)

Thomas French - Clearwater Paper

Alan Griffitts - NSWCCD Acoustic Research Detachment

Timothy Haener - J-U-B Engineers, Inc.

Chris Hazelton - Coffman Engineers Inc.

Chad Heimbigner - Coffman Engineers Inc.

David Hollenback - Berg Manufacturing

Chris Horgan- J-U-B Engineers, Inc.

Christopher Hyde - University of Idaho

Loren Jenkins - Clearwater Paper

Rick Lewis – POWER Engineers, Inc.

Ken Mays, The Boeing Company

Kelly Moore - Meter Group, Inc.

Tom Moore – Self-Employed

Nadine Morasci - Astronics AES

Douglas Overholtzer - Wagstaff, Inc.

Caitlin Owsley - Janicki Industries

Philip Pintor - Coffman Engineers, Inc.

Jonathan Richards - Schweitzer Engineering Laboratories

Pete Robichaud - USDA Forest Service, Rocky Mt. Research Station

Zane Sapp - EMS

Rob Schaerer - POWER Engineers, Inc

Eric Silk - Schweitzer Engineering Laboratories

Alex Simon – The Boeing Company

Jamie Slippy - Kodiak Aircraft Company

Eric Stubbs - Micron Technology

Todd Swanstrom - Western Trailer Co.

George Tanner - University of Idaho

Steven Wagner - PlayStation

David Watkins - J-U-B Engineers, Inc.

Min Xian - University of Idaho

List reflects judges registered before print deadline. View the full list at uidaho.edu/expo.

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

SMOOTH SHAVING DEVICE FOR ARTHROSCOPIC SURGERIES

The goal of this project is to create a robust device with reusable tooltips that can arthroscopically shave arthritic joint surfaces smooth to lessen pain and lower rehabilitation time. Our device will embody these capabilities via approximation of a random-orbital sanding motion of the shaving platform, as well as offer better ergonomics and user comfort than traditional arthroscopic tools. This tool will enable those suffering arthritic knee pain to lead comfortable and fulfilling lives.

Team Members
Lucas Dibelius, Mechanical Engineering
Jett Murray, Biological Engineering
Maclean Landis, Biological Engineering
Ryan Crowell, Mechanical Engineering

Client/Sponsor
Doug Hiller, Whitman Hospital's Orthopedic Clinic

Faculty Advisor
Joel Perry, U of I Department of Mechanical Engineering

SINGLE-STAGE WATER FILTER WITH DUAL SAND MEDIA SIZES

Clean water is arguably the world's most valuable resource, and it is important to invest in technologies that increase the availability and reliability of filtration processes. By decreasing the size and footprint of a dual-stage sand bed filter, we can increase the portability and efficiency of the system and make it more economically profitable to produce and maintain.

Team Members
Tayson Thompson, Biological Engineering
Blake Urie, Biological Engineering
Benjamin Marek, Biological Engineering
Tobias Flores-Wentz, Biological Engineering
Jaden Cavender, Mechanical Engineering

Client/Sponsor
Greg Mueller, U of I College of Agricultural and Life Sciences, Department of Soil and Water Systems
Martin Baker, U of I College of Agricultural and Life Sciences, Department of Soil and Water Systems

Faculty Advisor
Sarah Wu, U of I Department of Chemical and Biological Engineering

QUAIL EGG ICU MONITOR

Quail embryos provide a time and cost-effective intermediate for testing children's cancer therapies before moving to animal trials. Currently, there is no way to evaluate the effect of the drugs during testing, apart from egg mortality rates. Our goal for this project is to develop a method to continually measure the vitals of the quail eggs to increase the reliability and repeatability of experiments for the development of cancer therapies.

Team Members
Leah Davidson, Biological Engineering
Richard Deming, Computer Science
Gabryel Conley, Computer Science
Silpa Subedi, Biological Engineering
Luis Lopez, Computer Science
Bradley Nicholas, Biological Engineering

Client/Sponsor
Charles Keller, Children's Cancer Therapy Development Institute

Faculty Advisor
Dev Shrestha, U of I Department of Chemical and Biological Engineering

INSTRUMENTATION, DATA COLLECTION FOR DEBALER OF AG MATERIALS

There are a host of applications for agriculture residues left in fields after harvest. The material is often baled for ease of transport, but subsequent processing requires loose material. Forest Concepts needs an automated system to debale material for such processing. Our system will produce a consistent outflow of material, while using a control algorithm between the infeed conveyor and the header to detect and correct bale jams and chute clogs.

Team Members
Nathan Stout, Mechanical Engineering
Hope de Avila, Biological Engineering
Benjamin Zimmerman, Biological Engineering

Client/Sponsor
Dave Lanning, Forest Concepts, LLC.

Faculty Advisor
Brian He, U of I Department of Chemical and Biological Engineering

DEHYDRATING MUSTARD SEED EXTRACT FOR BIO-PESTICIDE

We aim to create a flash evaporation system to dehydrate mustard seed extract. Mustard seeds contain glucosinolates that can be used as a bio-pesticide in organic farming. The current drying process for extracting glucosinolates involves freeze-drying the product, which is slow and ineffective. Our goal is to reduce this drying time by half, reducing a significant bottleneck in lab production.

Team Members
Sophia Bowen, Biological Engineering
Leslie Hurtado, Biological Engineering

Client/Sponsor
Inna Popova, U of I College of Agricultural and Life Sciences Department of Soil and Water Systems

Faculty Advisor
Dev Shrestha, U of I Department of Chemical and Biological Engineering

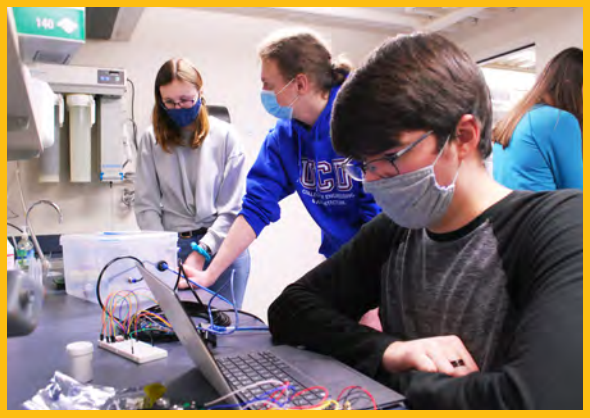
LOW-COST, CONTROLLABLE HYPOXIA CHAMBER FOR EXPLORING STEM CELL BEHAVIOR

A crucial component to conducting stem cell research is maintaining a low-oxygen, or hypoxic, growing environment. Current commercial hypoxia chambers are expensive. The objective of this project is to develop a functional, simple and low-cost hypoxia chamber for stem cell research, and publish the proven design for others to use.

Team Members
Andrew Hartman, Computer Engineering
Alexandra Morrison, Electrical Engineering
Isabell Strawn, Electrical Engineering
Colin Marchus, Biological Engineering
Jacob Knudson, Biological Engineering

Client/Sponsor
Nathan Schiele, U of I Department of Chemical and Biological Engineering

Faculty Advisor
Dev Shrestha, U of I Department of Chemical and Biological Engineering



PRODUCED WATER TREATMENT USING HYDROCYCLONE TECHNOLOGY

The treatment of produced water is one of the leading issues facing the oil industry. Produced water, a byproduct of oil drilling, contains oil, dirt and metals. This project explores using mechanical separation devices and hydrocyclone technology, a new and practical way for treating produced water that is economical and environmentally friendly.

Team Members
Taz Zeliff, Chemical Engineering
Crystal Gallegos, Chemical Engineering
Khalid Alghamdi, Chemical Engineering
Darrik Goettsche, Chemical Engineering

Client/Sponsor
WERC Environmental Design Contest
Matthew Bernards, U of I Department of Chemical and Biological Engineering

Faculty Advisor
Matthew Bernards, U of I Department of Chemical and Biological Engineering

OIL REFINERY UPDATE DESIGN AND ECONOMIC ANALYSIS

The American Institute of Chemical Engineers Student Design Competition team designed a modification to an oil refinery that allows the process to conform to industry standards. The team's design removed hazardous materials from the refined fuel, while also making profitable byproducts in the process.

Team Members
Levi Thomsen, Chemical Engineering
Will Morgano, Chemical Engineering
Malacki Ginner, Chemical Engineering
Luke Huguenin, Chemical Engineering

Client/Sponsor
American Institute of Chemical Engineers Student Design Competition

Faculty Advisor
Matthew Bernards, U of I Department of Chemical and Biological Engineering

Chemical Engineering

TESTING BACTERIA RESISTANT POLYMERS ONBOARD THE INTERNATIONAL SPACE STATION

Our team is a part of the nationwide NASA Student Payload Opportunity with Citizen Science (SPOCS) program aimed at furthering space research and travel. We have designed an experiment that will test two bacteria-resistant polymers on the International Space Station during winter of 2021. We will be teaming up with 3rd through 5th graders at Russell Elementary to assist in our experimental process and inspire them to pursue STEM careers.

Team Members
Adriana Bryant, Chemical Engineering
Niko Hansen, Chemical Engineering
Hannah Johnson, Chemical Engineering
Travis Lindsay, Chemical Engineering
Kael Stelck, Chemical Engineering
Roslyn McCormack, Chemical Engineering

Client/Sponsor
NASA SPOCS

Faculty Advisor
Matthew Bernards, U of I Department of Chemical and Biological Engineering

RECOVERING PRECIOUS METALS FROM ELECTRONIC WASTE BY USING A LIGAND

The goal for our team is to scale up production of a ligand from lab scale to an industrial scale for use in recovering precious metals from recycled electronics. This process is more environmentally friendly than previous processes being used to recover these precious metals. To determine the amount needed, a market analysis was done for the Western U.S., and a profitability study of the scaled-up process was completed. A preliminary design of the process plant will also be done.

Team Members
Mohsen Almalki, Chemical Engineering
Austin Greule, Chemical Engineering
Chad Larsen, Chemical Engineering
Marquis Atkinson, Chemical Engineering

Client/Sponsor
James Moberly, U of I Department of Chemical and Biological Engineering

Faculty Advisor
Matthew Bernards, U of I Department of Chemical and Biological Engineering

Civil Engineering

SEWER PIPELINE REROUTE AND PATHWAY REALIGNMENT

The existing Boise sewer pipeline has extensive hydrogen sulfide corrosion and needs to be replaced. The current pipe runs underneath residential backyards, and must be rerouted. An existing shared-use pathway runs adjacent to the pipeline but does not have capabilities for maintenance access. Our design will solve both these problems with a new pipeline that runs underneath a path large enough for maintenance vehicles with numerous manholes.

Team Members
Samuel Yunker, Civil Engineering
Jaxon Dean, Civil Engineering
Grant Gehring, Civil Engineering
Christian Preszler, Civil Engineering

Client/Sponsor
DeAnn Brown, City of Boise

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

USA CIVIL ENGINEERING STEEL WAREHOUSE AT MCNARY DAM

Our project is to design a warehouse to house turbines and their components for replacement, rotation, and repair.

Team Members
Aaron Crockett, Civil Engineering
Drake Ofsthun, Civil Engineering
Jacob Gesh, Civil Engineering
Ellyn Johnson, Civil Engineering

Client/Sponsor
U of I Department of Civil and Environmental Engineering

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

US-95: DEEP CREEK BRIDGE REPLACEMENT

The current bridge over Deep Creek near Potlatch, Idaho is well-aged and no longer up to current safety and design specifications including bridge width, shoulder width, guardrail, etc. The bridge will be replaced in 2021, and the goal is to design a new, up-to-spec, safe and affordable bridge to help the public and all who drive US-95 daily.

Team Members
Daniel Brands, Civil Engineering
Anthony Clay, Civil Engineering
Cody Peters, Civil Engineering
Jade Williams, Civil Engineering

Client/Sponsor
Shanon Murgoitio, Idaho Transportation Department

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

POST FALLS, IDAHO, OUTFALL PIPELINE REDESIGN

Our project is to redesign the outfall pipeline from the water reclamation facility in Post Falls, Idaho. The current pipeline experiences hydraulic inconsistencies and is not equipped to handle future growth. Our redesign will contribute to the continued operation of the water reclamation facility.

Team Members
Edie Engelmann, Civil Engineering
Alicia Watson, Civil Engineering
Annie Chen, Civil Engineering

Client/Sponsor
Chris Horgan, JUB Engineers
Jon Baune, JUB Engineers

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

HARBOR FREIGHT TOOLS BUILDING, RUTLAND, VERMONT

Providing a client with structural engineering calculations and structural related drawings for a new commercial Harbor Freight Tools building that utilizes conventional shallow foundations, masonry walls and steel roof structure.

Team Members
Jorge Sencion, Civil Engineering
Jill Hagen, Civil Engineering
Anthony Storro, Civil Engineering

Client/Sponsor
Bikash Sigdel, Tamarack Grove Engineering

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

UIEF TIMBER BRIDGE AND STREAM RESTORATION

This project is to design a pedestrian timber bridge over Big Meadow Creek on the University of Idaho Experimental Forest and create a stream restoration plan at the bridge site. The previous crossing was a culvert that was washed out leaving behind a unstable stream bank and unsafe crossing. The new timber bridge will allow for pedestrians as well as equestrians to cross the stream safely. The stream restoration will promote steelhead passage to promote the upstream habitat.

Team Members
Nikole Lorvick, Civil Engineering
Jacob Laraway, Civil Engineering
Justin Pitcher, Civil Engineering
Bence DaRe, Civil Engineering

Client/Sponsor
Timothy Link, University of Idaho
Robert Keefe, University of Idaho

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

INDIANA AVENUE AND HOMEDALE ROAD INTERSECTION REDESIGN

Our project focuses on analyzing and redesigning the intersection of Indiana Avenue and Homedale Road located in Canyon County, Idaho. This intersection has experienced a crash rate in the past that is five times higher than the expected rate when compared to similar intersections in the state. By conducting a traffic analysis and implementing a new design for the intersection, we hope to improve its overall safety.

Team Members
Cameron May-Penelerick, Civil Engineering
Eric Mulligan, Civil Engineering
Saurav Neupane, Civil Engineering
Jordan Thompson, Civil Engineering

Client/Sponsor
Meagan Larrea, Six Mile Engineering

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

PONDEROSA LIFT STATION REPLACEMENT IN POST FALLS, IDAHO

The City of Post Falls is adding capacity and replacing aging infrastructure throughout their collection system. This project constructed a new triplex lift station and associated infrastructure including site improvements and utility relocation, control building, paved access road and associated stormwater improvements. The new lift station will replace the existing Ponderosa Lift station to accommodate a future force main extension and existing flows as well as build outflows.

Team Members
Alexis Brooks, Civil Engineering
Alexus Connor, Civil Engineering
Sam Gibson, Civil Engineering
Michael Spiers, Civil Engineering

Client/Sponsor
Meghann Kolb, T-O Engineers

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

Computer Science

LAKENET LORA MESH NETWORK

The lakes and waters of North Idaho and the surrounding areas need environmental monitoring and data gathering to maintain the health of the bodies of water. The goal of this project is to implement ESP32s, low-powered microcontrollers, into these bodies of water to create a network of nodes using LoRa, or Long Range communication. This will help monitor and gather data using sensors attached to these nodes.

Team Members
Nathaniel Osterberg, Computer Science
Ronald Keating, Computer Science
Luke Ryssel, Computer Science

Client/Sponsor
John Shovic, U of I Department of Computer Science, Coeur d'Alene

Faculty Advisor
Bruce Bolden, U of I Department of Computer Science

CLOUD-BASED LAB INSTRUMENTATION SYSTEM

There are more devices connected to the Internet today than ever before, but many lightweight Internet devices don't support security features like encryption due to hardware limitations. This system uses state-of-the-art security protections to gather and guard sensitive measurements for both research and agricultural purposes. Additionally, this system offers more flexibility in measuring any kind of data, including live video.

Team Members
Benjamin Budai, Computer Science
Connor Williams, Computer Science
Lucas Thoms, Computer Science

Client/Sponsor
Dev Shrestha, U of I Deaprtment of Chemical and Biological Engineering

Faculty Advisor
Bruce Bolden, U of I Department of Computer Science

SMART TRIP PLANNING

Our project is an app that seeks to make long road trips more efficient by calculating a car's travel distance and suggesting optimal refueling locations. The application uses a cars OBD2 port to extract necessary data for calculations and the google maps API for navigation.

Team Members
Hunter Hawkins, Computer Science
Damien Spencer, Computer Science
Austin Penelerick, Computer Science
Caleb Seely, Computer Science

Client/Sponsor
Hasan Jamil, Smart Tech

Faculty Advisor
Bruce Bolden, U of I Department of Computer Science

MECHANICAL ENGINEERING SCHEDULING SOFTWARE

Our project helps solve the problem of mechanical engineering students not knowing when machines are available for use by creating a website for scheduling equipment use from anywhere at anytime.

Team Members
Sydney Petrehn, Computer Science
Joshua Tan, Computer Science
Trinity Paulsen, Computer Science

Client/Sponsor
Michael Maughan, U of I Department of Mechanical Engineering

Faculty Advisor
Bruce Boulden, U of I Department of Computer Science

ENTERPRISE VIRTUALIZATION IN MINECRAFT

The goal of the project is to create a Minecraft mod that will integrate remote Virtual Machine software directly into the gameplay of Minecraft. This will allow you to open a connection to a virtual machine and issue commands to it remotely, all without leaving Minecraft.

Team Members
Nathan Zander, Computer Science
Graeme Holliday, Computer Science
Blake Rude, 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

ELECTRIC POWER FLOW MODELING IN MINECRAFT

Our project enables electrical and power engineers to build and model power grids in the game Minecraft. Traditional tools used to design and simulate power flow require a strong technical background and are not readily accessible to novices. Electric Blocks solves this problem by merging validated open source power systems analysis tools with the intuitive interface of Minecraft. This makes Electric Blocks a great educational tool and platform for rapid prototyping and real-time collaboration.

Team Members
Zachary Sugano, Computer Science
Christian Whitfield, 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

RASPBERRY PI REAL TIME IMAGE PROCESSING

Pesticides are currently being sprayed manually by small, personal planes. Our goal is to implement a pre-trained artificial neural network to detect various types of crops and weeds by integrating a Raspberry Pi and Intel Neural Compute Stick 2. We can use this small computing system atop a drone to detect weeds and trigger a spraying mechanism to save farmers time and money. Our weed spraying drone will be easier to store, cost-effective, more accurate, and require brief human interaction.

Team Members
Victoria Gehring, Computer Science
Isabel Hinkle, Computer Science
Jon Gift, Computer Science
Oshan Karki, Computer Science

Client/Sponsor
Dev Shrestha, U of I Department of Biological Engineering

Faculty Advisor
Bruce Bolden, U of I Department of Computer Science

Electrical and Computer Engineering

DEVELOPMENT OF A LOW-COST PYRANOMETER

KiloWatts for Humanity is a nonprofit that builds renewable power stations in third world countries. Our pyranometer measures the light energy that interacts with their solar panels. This data helps to understand when solar panels are underperforming or need maintenance. Creating a reliable, cost effective alternative will aid in improving people's lives and fostering sustainable business.

Team Members
Adriana Oliveira, Electrical Engineering
Brady Jerome, Electrical Engineering
Lukas Vermeulen, Electrical Engineering
Nickolas Borek, Mechanical Engineering

Client/Sponsor
Steve Szablya, KiloWatts for Humanity
Asad Mohammed, Schweitzer Engineering Laboratories

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

ELECTROENCEPHALOGRAM HEADSET FOR HUMAN AND RAT

Our device for humans will be cheap, easy-to -use Electroencephalogram, or EEG device, that will get high school students interested in STEM fields. Our development for rats will provide an EEG that doesn't require surgery and can accurately record brain signals.

Team Members
Jake Varney, Biological Engineering
Mohamed Hasan, Electrical Engineering
Kate Antonov, Electrical Engineering
Grace Frazier, Mechanical Engineering
Kiran Pelluri, Computer Science
Shubhangi Kaushik, Biological Engineering
Max Moore, Computer Science

Client/Sponsor
Gautam Kumar, U of I Department of Chemical and Biological Engineering

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

INFRASONIC WILDFIRE DETECTION

We are creating a device that uses infrasonic detection and signal processing to rapidly detect wildfires. Our aim is to set up a mesh network of durable devices that can detect infrasound waves (0 to 20 Hz) and communicate this information wirelessly.

Team Members
Meridian Haas, Mechanical Engineering
Cory Holt, Electrical Engineering
Andrew Malinowski, Electrical Engineering
Carlos Santos, Computer Engineering

Client/Sponsor
Joe Stanley, Stanley Solutions

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

FPGA DATA ACQUISITION AND CONTROL

Traditional data acquisition and control systems are incredibly expensive and specialized. By using Field Programmable Gate Arrays, a sort of easily reconfigured hardware, we seek to create an adaptable system that undercuts the traditional systems by a wide margin.

Team Members
Cameron Williams, Electrical Engineering
Taylor Stewart, Electrical Engineering
Jacob Jackson, Electrical Engineering

Client/Sponsor
Chris Manning, ThorLabs

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

INDEPENDENTLY RAN RENEWABLE, INTEGRATED SYSTEM FOR CROSSWALKS

This projects focus was to design an affordable attachment to mount to current crosswalk signs to help make crosswalks safer for pedestrians around campus. Our unit is enclosed, powered by a solar panel, has flashing LEDs and adjustable mounting.

Team Members
Charlie Dimke, Electrical Engineering
Jason Floyd, Electrical Engineering
Kathryn Warner, Electrical Engineering

Client/Sponsor
Kenneth Corbett Endowment

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

SATELLITE ATTITUDE DETERMINATION, COMMUNICATION AND CONTROL WITH AI

Commercial CubeSats miniature satellites are expensive, but individual components are less so. This project will reduce cost by integrating commercially available orientation control and communication systems. Another focus is on radiation shielding materials to enable the use of advanced processors on subsequent space flights. The solutions created will allow for more advanced features onboard CubeSats and higher rates of data transmission with ground.

Team Members
Grace Rosenvall, Mechanical Engineering
Joseph Dennison, Computer Engineering
Andrew Pilchard, Computer Engineering
Harrison Thomsen, Electrical Engineering
Lillian Mortensen, Materials Science and Engineering
Taegan Williams, Computer Science
Cosette King, Computer Science
Robert Goes, Computer Science
Finan Bryan, Mechanical Engineering

Client/Sponsor
Marcus Murbach, NASA
Avery Brock, NASA

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

TESLA COIL BASED SECURITY SYSTEM

Our project is to utilize a prebuilt Tesla Coil to redirect the current from the main coil to the frame of a doorway. The intent is to generate horizontal arcs across the doorway to deter possible intruders. This project is beneficial, as most modern day security systems are strictly passive, while this method of security would provide an offensive way to combat unwanted intrusions before the undesirable individual even approaches the door through the use of visual and auditory deterrence.

Team Members
Justin Stephens, Mechanical Engineering
Connor Radford, Electrical Engineering
Andrea Cardona, Electrical Engineering
Nico Piccioni, Mechanical Engineering

Client/Sponsor
Herbert Hess, U of I Department of Electrical and Computer Engineering

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

DEVELOPMENT OF INDUSTRIAL CONTROL SYSTEM LABORATORY EXERCISES

Industrial control systems in power, water and fuel delivery systems and many factories use automation systems to control all the operating processes. Our team's mission is to develop a platform for off-campus students in courses teaching industrial control systems to perform the lab exercises remotely so that they can have a hands-on experience for a better learning experience. Also, we need to configure the system for off-campus convenience for students in any timezone around the world.

Team Members
Yuhao Li, Electrical Engineering
Yi Ding, Electrical Engineering
Yifan Zhu, Electrical Engineering

Client/Sponsor
Brian Johnson, U of I Department of Electrical and Computer Engineering

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

DIRECTIONAL ANTENNA ALIGNMENT CONTROL SYSTEM (D.A.A.C.S)

This device's aim is to align a barge-mounted directional antenna towards a fixed antenna. Using GPS coordinates, it calculates how much the antenna should rotate relative to the bow of the barge. This will assist the U.S. Navy Acoustic Research Detachment in Bayview with speeding up their antenna alignment process.

Team Members
Cade Knott, Electrical Engineering
Steven Haener, Mechanical Engineering
Ethan Morris, Mechanical Engineering

Client/Sponsor
Patrick Molvik, United States Navy Acoustic Research Detachment
Herbert Hess, U of I Department of Electrical and Computer Engineering

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

RTDS SIMULATION OF SOLAR ENERGY IN A SMALL POWER SYSTEM

The goal of our project is to implement a scheme to integrate solar energy into a power distribution system. To do this, we will link a real-time automation controller into a simulation of a power grid running on a real time simulator. This is a valuable technique for commissioning equipment in the power industry, as it allows engineers to test and refine control programs under various conditions prior to their physical installation. This greatly decreases the chances of misoperation.

Team Members
Lance Carr, Electrical Engineering
David Lowe, Electrical Engineering
David Bowman, Electrical Engineering

Client/Sponsor
Brian Johnson, U of I Department of Electrical and Computer Engineering

Faculty Advisor
Feng Li, U of I Department of Electrical and Computer Engineering

Mechanical Engineering

FUEL CELL VOC FILTRATION MONITORING SYSTEM

VOC's are harmful to expensive hydrogen fuel cell stacks and need to be filtered out of inlet air to increase the stacks life. The filtration monitoring system will help create in house test data and curves for filter prototypes that would prevent damage to fuel stacks.

Team Members
Michael Eckert, Mechanical Engineering
Jessy Faulkner, Mechanical Engineering
Matthew Murphy-Sweet, Mechanical Engineering

Client/Sponsor
John Robey, Hyster-Yale Group
Ammon Markstellar, Hyster-Yale Group

Faculty Advisor
Matthew Swenson, U of I Department of Mechanical Engineering

STREAM VELOCITY MEASUREMENT DEVICE

Using two conductivity probes and a salt solution, we are improving the USDA Forest Services outdated method of stream velocity data collection by making it wireless, compact and accessible from a smart device.

Team Members
Max Rietze, Mechanical Engineering
Anthony DeSantis, Mechanical Engineering
Joshua Camper, Mechanical Engineering
Cole Bailey, Electrical Engineering

Client/Sponsor
Pete Robichaud, USDA Forest Service
Bob Brown, USDA Forest Service

Faculty Advisor
Steven Beyerlein, U of I Department of Mechanical Engineering

INL COMPACT GLOVEBOX TENSILE TESTING SYSTEM

Idaho National Laboratory has asked us to create a glovebox-based tensile testing system that can perform tests at up to 700 C for the purpose of testing Ur-Pl-Zr alloys. While small-scale tensile testers do exist, they do not meet INL's requirements. The goal is to create a tensile testing machine that can perform high temperature tests and fit through the 8â€ port in the glovebox or be easily assembled once inside.

Team Members
James Bradley, Mechanical Engineering
Logan Matti, Mechanical Engineering
Matthew Uptmor, Mechanical Engineering
Jared Gray, Mechanical Engineering

Client/Sponsor
Randall Fielding, Idaho National Laboratory

Faculty Advisor
Michael Maughan, U of I Department of Mechanical Engineering

MARCHING BAND MOBILE PLATFORM

Our team is creating a mobile platform to mount a piano, drum set, etc., for the University of Idaho Vandal Marching Band performances in the Kibbie Dome.

Team Members
Annika Esau, Computer Science
Cole Brusven, Mechanical Engineering
Kaitlin Tabaracci, Mechanical Engineering
Zachary Laymon, Mechanical Engineering

Client/Sponsor
Spencer Martin, University of Idaho Vandal Marching Band
Edwin Odom, U of I Department of Mechanical Engineering

Faculty Advisor
Steven Beyerlein, U of I Department of Mechanical Engineering

EMBER GENERATOR FOR FOREST FIRE TESTING

Our project consists of designing and building a system that will be used by the University of Idaho CNR for forest fire testing and research. The prototype will emit a steady stream of embers for a minimum of 15 minutes with the goal of testing how common building materials hold up to wildfires. The small scale testing this project provides will give valuable information on how wildfires behave and interact with urban areas.

Team Members
Jacob Roy, Mechanical Engineering
Zachary Schirado, Mechanical Engineering
Garrett Borth, Mechanical Engineering
Addie White, Biological Engineering
Kaitlyn Lindholm, Biological Engineering

Client/Sponsor
Doug Hardman, Electrical Engineering and CNR Ph.D.
Alistair Smith, U of I College of Natural Resources Department of Forest, Rangeland, and Fire Sciences

Faculty Advisor
Michael Maughan, U of I Department of Mechanical Engineering

AUTOMATED CENTER OF GRAVITY MEASUREMENT DEVICE

This project is sponsored by Schweitzer Engineering Laboratories to create a device to find the Center of Gravity (CG). The CG is the average location of all the weight of an object. The mass center is an important property for failure analysis. For example, when a device undergoes a vibration test, knowledge of the location is crucial. If the CG is inaccurately known, an object may be improperly mounted to a testing table, causing vibrations to propagate through the device, leading to failure.

Team Members
Cameron Eggart, Mechanical Engineering
Joseph Cornwall, Mechanical Engineering
Mark Jaszkowiak, Mechanical Engineering
Keegan Stanphill, Mechanical Engineering

Client/Sponsor
Jonathan Richards, Schweitzer Engineering Laboratories

Faculty Advisor
Michael Maughan, U of I Department of Mechanical Engineering

TANGIBLE OBJECT RECOGNITION SYSTEM

The goal of the project is to develop a system capable of interpreting inputs from multiple types of objects (knob, puck, switch, and joystick) through a touchscreen. Our prototype solution has a working Tangible Object Recognition Unit (TORU) and a host system that can display inputs through a Graphic User Interface (GUI).

Team Members
Preyusha Aryal, Computer Engineering
Reiley Wolfe, Computer Engineering
Andrew Brown, Computer Engineering

Client/Sponsor
Mitchell Butzer, AIS

Faculty Advisor
Dr. Steven Beyerlein, U of I Department of Mechanical Engineering

EVALUATION OF NANOTECHNOLOGY COATINGS FOR ELECTRICAL ENCLOSURE APPLICATIONS

Our project focuses on evaluating two paint additive technologies with the goal of reducing the internal temperature of an electrical enclosure during the warmer seasons and retain the internal temperature during the colder seasons. While the original aim was to extend the life of electrical components inside these enclosures, if shown to have a significant impact on the performance of the painted material, this technology could have a multitude of applications across coating industries.

Team Members
Mark Currier, Materials Science and Engineering
Tyler Wallace, Materials Science and Engineering
Sara Beatty, Materials Science and Engineering
Cassidy Story, Mechanical Engineering
Kyle Mays, Mechanical Engineering

Client/Sponsor
Mark Thomas, Schweitzer Engineering Laboratories
Scott Hulme, NIC

Faculty Advisor
Matthew Swenson, U of I Department of Mechanical Engineering

HYSTER-YALE CARRIAGE BOUNCE CONTROL SYSTEM

Forklift carriages can bounce causing the forks to drop its contents. Using a brake mechanism to hold the carriage steady will reduce carriage bounce and can ensure more efficient transport of products leading to increased profits and a safer work environment.

Team Members
Bryce Bilderback, Mechanical Engineering
Conner Krezman, Mechanical Engineering
Nick Daquila, Mechanical Engineering
Sean Blatner, Mechanical Engineering

Client/Sponsor
Hyster-Yale

Faculty Advisor
Mathew Swenson, U of I Department of Mechanical Engineering

SHEET METAL FATIGUE FIXTURE

Sheet metal is used in a variety of applications, and sheet metal materials can have unique mechanical properties that are not always well-known by designers. The objective of this project is to design and build a tabletop fixture for measuring the long-term durability of sheet metal components when exposed to repeated loading.

Team Members
Dylan Card, Computer Science
Yingruo Liu, Computer Science
Siobhan McGuire, Mechanical Engineering
Tyson Ostberg, Mechanical Engineering

Client/Sponsor
Jonathan Richards, Schweitzer Engineering Laboratories
Sally Mei, Schweitzer Engineering Laboratories

Faculty Advisor
Matthew Swenson, U of I Department of Mechanical Engineering

MANUFACTURING PROCESS FOR INFECTION-PREVENTING FOLEY CATHETER

Every year hundreds of thousands of urinary catheters are utilized, and over time, bacteria builds up in the urethra potentially causing a catheter-associated urinary tract infection (CAUTI). CAUTIs cause over thirteen thousand deaths a year. A revolutionary redesigned catheter has been created in a previous capstone, and we aim to validate this design. Our goal is to create a manufacturing process and design a fluid-catching device for the catheter remodel.

Team Members
Tyler Haglund, Biological Engineering
Matt Hodgson, Mechanical Engineering
Niklas Gillihan, Mechanical Engineering

Client/Sponsor
George Tanner, U of I College of Business and Economics
John Crepeau, U of I College of Engineering

Faculty Advisor
Michael Maughan, U of I Department of Mechanical Engineering

THUMB EXOSKELETON MECHANICAL DESIGN

Our project goal is focused on the creation of a robotic mechanism that will aid in the rehabilitation of stroke victims. The design goal of the project is creating a 2-degree of freedom, 5-bar spherical mechanism that attaches to a patient's thumb. This thumb mechanism will be added to an existing robotic exoskeleton that is designed for curling the middle and index fingers. The whole robotic system will be used to administer and study movement therapy after a patient has experienced a stroke.

Team Members
Ryan Burr, Mechanical Engineering
Avery Fraizer, Mechanical Engineering
Royal Elder, Mechanical Engineering

Client/Sponsor
Eric Wolbrecht, U of I Department of Mechanical Engineering

Faculty Advisor
Joel Perry, U of I Department of Mechanical Engineering

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

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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.**

Chelsea Venning

"The Plant Saver"

Summer Spiker

"Helmet Trackey"

Samuel Wilson

"Tree Cannon"

2021 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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— U.S. News & World Report

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— National Academy of Engineering

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— PayScale 2019 College Salary Report

91% GRADUATE WITH JOBS

or are enrolled in additional education or military service

— 2018-2019 Career Services Outcomes Survey

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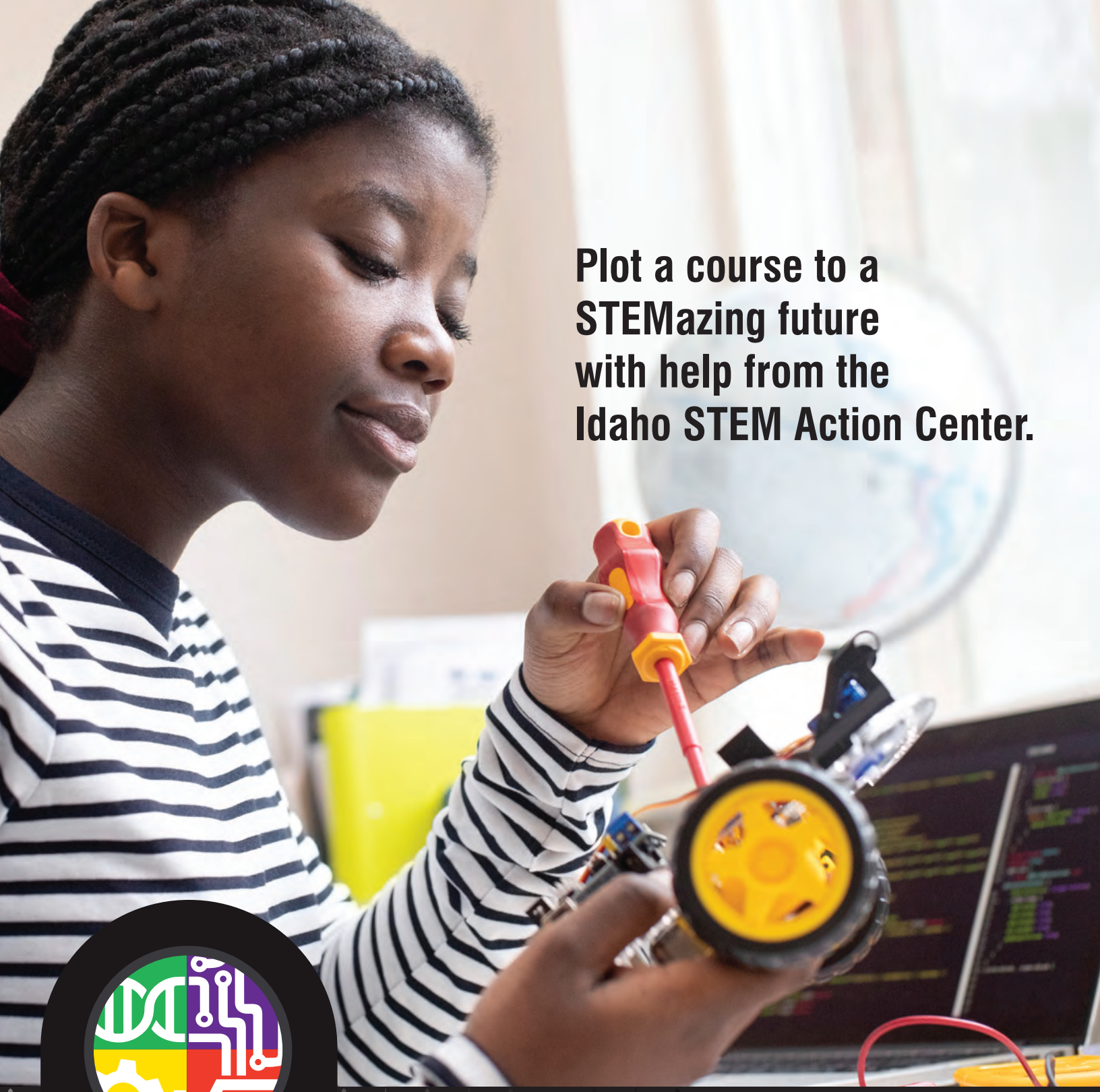

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TOMORROW'S STEM BREAKTHROUGHS REQUIRE IDAHO'S STUDENTS IN THE STEM WORKFORCE

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STEM in the lab

For more information visit
stem.inl.gov

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