

FULTOEN FORGE

Student Research Expo



About the Fulton Forge Student Research Expo

Learn about more than 100 research projects spanning seven research themes presented by students in the Fulton Undergraduate Research Initiative (FURI) program, Master's Opportunity for Research in Engineering (MORE) program and Grand Challenges Scholars Program (GCSP) research stipend.

Research opportunities

Fulton Undergraduate Research Initiative

The Fulton Undergraduate Research Initiative enhances an undergraduate student's engineering experience and technical education by providing hands-on lab experience, independent and thesis-based research, and travel to national conferences.

Master's Opportunity for Research in Engineering

The Master's Opportunity for Research in Engineering program enriches a graduate student's engineering and technical curriculum with hands-on lab experience and independent and thesis-based research.

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Grand Challenges Scholars Program research stipend

The Grand Challenges Scholars Program combines an innovative curriculum and cutting-edge research experiences into an intellectual fusion that spans academic disciplines and includes entrepreneurial, global and service learning opportunities. Students supported by the GCSP research stipend conduct research in a grand challenges theme and are invited to present their findings at Fulton Forge.

Sponsored research

Select FURI and MORE students are chosen to receive research funding from industry or other sponsors for one semester. This allows companies to connect with students conducting research aligned with their industries and provides students the opportunity to work with a company in their field. Alternatively, alumni or other sponsors can help students get the important opportunity to pursue research. Learn more about this semester's sponsors and sponsored student on page 10.

Learn about all of this expo's student researchers online at forge.engineering.asu.edu



Scan the QR code or use the link to learn more about the Fulton Forge Student Research

Expo and find in-depth information about our student researchers and their projects. Browse fall research projects by student, research program, theme, student degree program, faculty mentor and more. Read the research abstracts and explore students' posters online at any time.

At Fulton Forge, students will have QR codes on their research posters that attendees can scan to view digital posters and learn more about their projects.

Diego Sanchez

FURI student researcher

Major: Environmental engineering

Graduation: Spring 2026

Hometown: Apache Junction,

► IMPACT STATEMENT

Studying ozone nanobubbles in fresh and brackish water to assess their effectiveness and sustainability for harmful algal bloom treatment.

On the cover

Ozone Nanobubbles for Algae Control in Freshwater and Brackish Water Systems

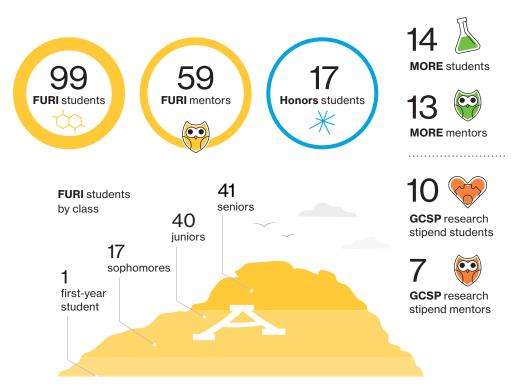
MENTOR SERGI GARCIA-SEGURA

Harmful algal blooms release toxins that threaten human and aquatic life. Conventional mitigation methods often rely on chemical treatments that persist in the environment, causing secondary contamination. Ozone nanobubbles offer a cleaner, more sustainable alternative by rapidly converting ozone to oxygen. Their nanoscale size offers high surface area and enhanced reactivity, enabling efficient and selective oxidation of algal cells and organic matter. This study evaluates the performance of ozone nanobubbles in controlling populations of Microcystis aeruginosa, a widespread and toxic cyanobacteria in freshwater, by examining their ability to suppress algal growth, degrade toxins, and improve water quality through precise ozone treatment.



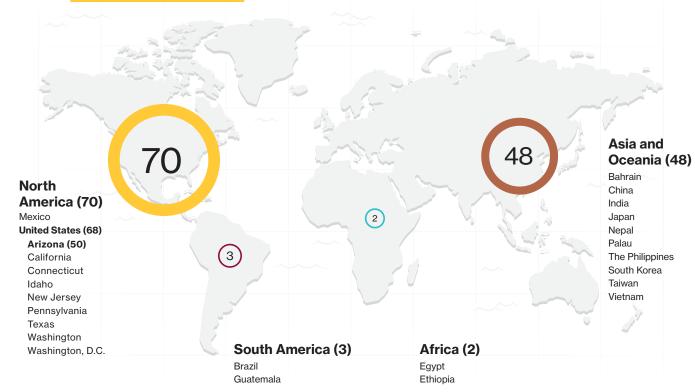
Snapshot fall 2025

Get to know this expo's participants.



Fulton Forge Fall 2025 Student Research Expo	
CONTENTS	
Data	3
Education	4
Energy	5
Health	6
Security	7
Semiconductor manufacturing	8
Sustainability	9
Sponsored research	10
Mentors	12
Participants	13

This expo's student researchers are from...



How do you get started?

- Explore your research interests.
- 2 Identify possible research mentors.
- 3 Contact faculty members.
- Prepare and submit your application.



Contact the Fulton Schools Student Success and Engagement office at fueedlagge-university with questions or advice on next steps.

For more information, visit furi.engineering.asu.edu





The Master's Opportunity for Research in Engineering program is designed to provide research experiences for graduate students who do not have other research opportunities. Develop an idea under the mentorship of a Fulton Schools faculty member and apply for funding!



Grad students: Curious about MORE? Contact more@asu.edu if you have questions about getting started.

Learn more at <u>students.engineering.asu.edu/</u> graduate/research/more



The Grand Challenges Scholars Program, recognized by the National Academy of Engineering, will prepare you when you complete the five program components:

- Complete research or creative project(s).
- Develop an interdisciplinary systems perspective.
- · Gain multicultural awareness.
- Engage in entrepreneurship.
- Give back to the community through service learning.



For more information, please contact asugcsp@asu.edu.

Apply today at gcsp.engineering.asu.edu/apply

Data

In an increasingly digital world, data collection is growing at a rapid pace. Fulton Schools faculty and student researchers devise innovative approaches and tools that will help us better process, analyze, use, manage and access data. New computational tools, algorithms and data analysis techniques, including hardware and software approaches, machine learning, data analytics, data-driven decision-making and more, will help advance scientific discoveries and collaborations across multiple fields where data use and capture is ubiquitous.

► IMPACT STATEMENT

Online waypoint MPC replans fast and safe pick-and-place motions, which cut computing and avoid lateappearing obstacles in robot assembly.

Sandy Lin MORE student researcher Major: Robotics and autonomous systems Graduation: Spring 2026 Hometown: Tainan, Taiwan

Online Waypoint MPC for Real-time Pick-and-place in Robotic Assembly

MENTOR WENLONG ZHANG

Traditional model predictive control (MPC) tracks a precomputed reference path, which is costly to generate and cannot adapt to late-appearing obstacles. This project evaluates waypoint model predictive control (wMPC) for manipulator motion in manufacturing pick-and-place and assembly tasks. wMPC performs online trajectory optimization by splitting the horizon at reachable waypoints, enabling rapid replanning, shorter paths, and collision avoidance with human coworkers and fixtures. A vision tracker updates object poses to drive waypoint updates. Performance will be measured by cycle time, path smoothness, compute time, and safety versus tracking MPC and offline planners.





Education

We are advancing the ways we educate engineering students. Fulton Schools research focuses on learning methods, cognitive theory and best teaching practices, as well as the integration of engineering concepts in K-12 educational programs to engage students early and educate our community about the impact engineering has on everyday life.

► IMPACT STATEMENT

Teaching AI to explain its reasoning helps stakeholders understand not just what is right, but why it is right.



EduCBM: Concept Bottleneck Models for Interpretable Education MENTOR HUAN LIU

Language models for education have demonstrated strong performance in tasks such as automatic essay grading, question answering, and providing tailored responses. Nonetheless, their "black box" nature creates major challenges for responsible implementation in educational environments, where transparency and interpretability are essential for building educator trust and enhancing student learning. We present EduCBM, a framework that transforms opaque educational AI into transparent systems that clearly explain their decision-making processes using recognizable teaching concepts, enabling educators to trust and verify automated grading and tutoring recommendations. Through comprehensive experiments on standardized test datasets, essay scoring corpora, and student response collections, we demonstrate that EduCBM maintains competitive predictive performance while providing valuable insights into model decision-making processes.

Energy

The urgency to discover and deploy new forms of carbon-reducing energy technologies has become an indispensable part of our economic and environmental landscape. Fulton Schools research in renewable and alternative energy sources is multifaceted, with efforts in solar energy, biotechnology, low- and high-power energy storage, power electronics, electric power systems, batteries and hydrogen fuel cells.

▶IMPACT STATEMENT

Designing a desktop application that helps visualize battery characteristics assists individuals to compare contrasting battery data.

Zeyad George

FURI student researcher

Major: Electrical

Graduation: Spring 2027

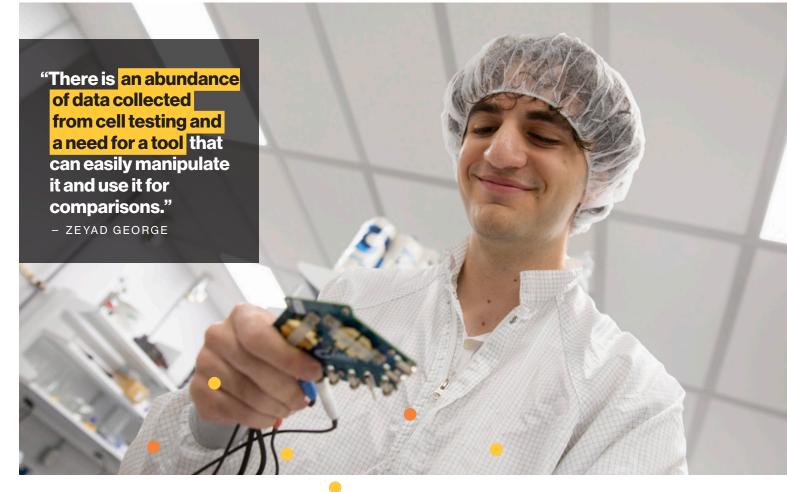
Hometown:



Code-Based Interpretation and Descriptor Extraction from Battery Performance Data

MENTOR YOON HWA

This research project aims to address the need for a simple way to compare multiple data sets and detect battery descriptors from such sets. However, the issue of the difficulty in conglomerating and standardizing multiple data files produced by varying battery testing manufacturers must be solved first. An easy-to-use desktop Python application allows for a straightforward approach for a user to generate multiple plots and compare against an existing database of different battery chemistries with different performance characteristics. If successful, this instrument can assist researchers in consolidation and comparison of data for other research studies.





Health

Fulton Schools efforts in health innovation range from understanding the causes behind Alzheimer's disease and improving methods for predicting epileptic seizures to developing advanced biosensors, bioassays and labon-a-chip devices for clinical diagnostics. Additional areas of research exist in novel biological materials, neural engineering, biomedical informatics, drug-delivery systems, health care systems analysis and modeling, health monitoring devices and human rehabilitation technologies.

► IMPACT STATEMENT

Characterizing the sol-gel chemistry aging process on HA dip coatings will help determine the optimal conditions for HA implant coatings.



Evaluation of Aging of Calcium and Phosphate Sol-gel Precursor Solutions Via Gelation Viscosity Measurement for Determination of Conformal Orthopedic Hydroxyapatite (HA) Implant Coating Quality MENTOR VINCENT PIZZICONI

Given developments in advanced biomaterials, there is a growing interest in replacing metal with non-metal fixation devices. This study is a continuation of an initial FURI project where the natural bioceramic, hydroxyapatite (HA), was synthesized by sol-gel chemistry technology using calcium nitrate tetrahydrate and triethyl phosphate precursors. The goal of this project is to determine if viscosity measurements, made at various times during the gelation process, are a useful indicator of HA-derived dip coatings. Sol gel-derived HA dip coatings, derived from sol-gel solutions at different gelation times and viscosities and further processed with heat treatment using a muffled furnace, were evaluated for HA coating quality. Sol-gel precursor mixtures at various stages of gelation were evaluated using contact angle and Fourier transform infrared spectroscopy (FTIR) measurements, while HA coating quality was assessed with microscopy and X-ray diffraction (XRD) measurements. HA dip coating quality was analyzed statistically to determine if viscosity measurement is a good indicator of sol-gel processing conditions and enhanced dip coating quality.

Security

As technology develops at a faster rate, there is a growing need to develop engineering systems to keep people and infrastructure safe, including securing cyberspace, advancing secure communications, developing self-healing systems resilient to attack and identifying, monitoring and reducing threats. Fulton Schools faculty and student researchers address issues of national defense. homeland security, border security, cyberwarfare and more, devising technology solutions and addressing legal, policy and social implications.

► IMPACT STATEMENT

Improving software reliability and security by studying how program structure influences the effectiveness of automated repair tools.

Sameera Shah

FURI student researcher

Degree: Computer

Graduation: Spring 2026

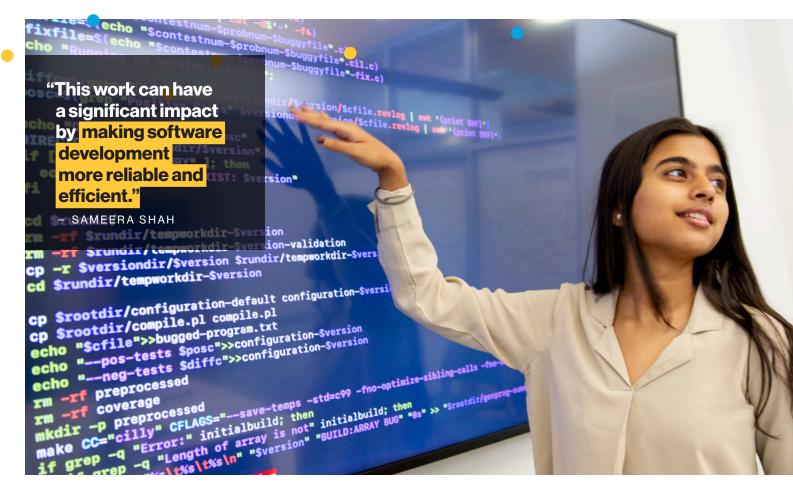
Hometown: Pune, India



Exploring and Explaining the Performance of PREP's Impact on GenProg

MENTOR STEPHANIE FORREST

Automated program repair (APR) repairs software bugs by automatically suggesting small changes to the software. Program repair enhancement via preprocessing (PREP) investigates one potential explanation for this: that the way that source code is represented does not match the operators used by APR tools. PREP transforms input programs before they are passed to APR tools, which helps existing tools like GenProg discover new and correct patches that were previously missed. This research evaluates the effectiveness of PREP transformations in improving GenProg's performance to automatically improve the reliability and security of software programs.



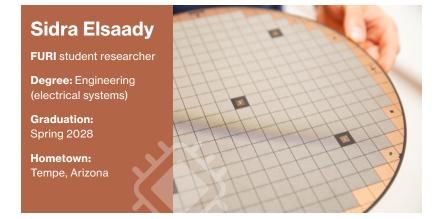


Semiconductor manufacturing

Semiconductor devices are part of our everyday lives, and the demand for techniques and processes to promote them continues to grow. Fulton Schools researchers drive innovation forward through advances in areas such as power electronics, wireless and mixed-signal circuit design, memory devices and architectures, solar energy and batteries, advanced packaging and new semiconductor materials. Expansive industry collaborations and unique facilities at ASU center Arizona as a hub for the American semiconductor revolution.

► IMPACT STATEMENT

Open-air plasma could replace UV ozone by improving surface roughness, wettability, adhesion, and reliability in semiconductor packaging.



Evaluating UV Ozone vs. Open-Air Plasma Comparisons for Underfill Effectiveness

MENTOR NICK ROLSTON

Underfill materials are essential in semiconductor packaging, as they reinforce mechanical stability and protect solder joints from thermal and mechanical stress. Semiconductor surfaces are typically treated to improve adhesion and activation for reliable underfill bonding. UV ozone is commonly used for this surface activation, but open-air plasma may provide a more scalable and costeffective alternative. In this study, silicon substrates coated with a tin oxide layer are treated using both methods and evaluated through profilometry, contact angle measurements, and adhesion testing to determine which provides better surface conditioning.

Sustainability

The central thrust behind sustainability is the capacity of metropolitan areas to grow and prosper without destroying or depleting natural resources. Fulton Schools research focuses on restoring and improving urban infrastructure, access to clean water and air, advanced construction techniques and management, environmental fluid dynamics, transportation planning as well as geotechnical and geoenvironmental engineering.

▶IMPACT STATEMENT

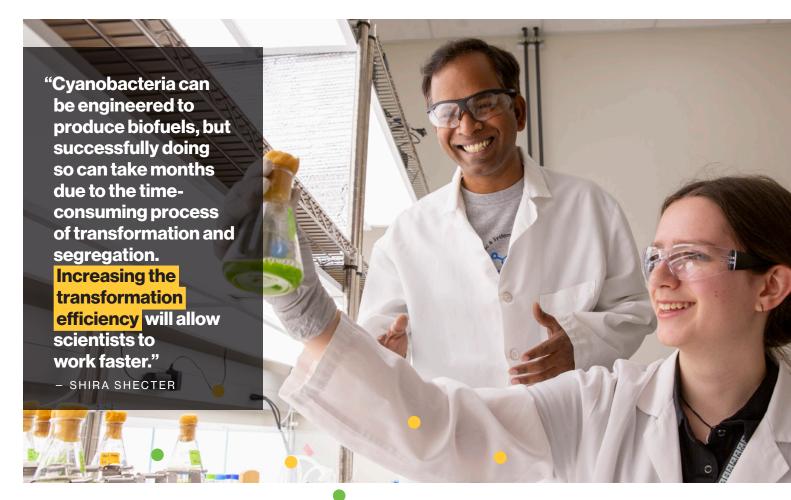
Improving transformation efficiency will make the cyanobacterium a more effective host for developing sustainable fuels and chemicals.



Optimizing Transformation Conditions for the Cyanobacterium Synechococcus sp. PCC 11901

MENTOR ARUL MOZHY VARMAN

Synechococcus sp. PCC 11901 is a newly discovered cyanobacterial strain for which the transformation protocol is still in its infancy. This research aims to optimize the transformation conditions for introducing foreign plasmids into Synechococcus sp. PCC 11901. The study will evaluate key variables, including culture media, light intensity, temperature, DNA concentration, and incubation time. Optimizing these parameters is expected to increase both the likelihood of successful colony formation after transformation and the total number of transformants per plate, thereby streamlining metabolic engineering efforts in Synechococcus sp. PCC 11901.



Sponsored research

What are research sponsorships?

Industry companies or endowments sponsor select students presenting at Fulton Forge. These sponsors recognize the importance of undergraduate research in helping students learn and build knowledge through experience as well as the effect student projects can have in advancing society through technological developments.

What are the benefits?

Connect with top undergraduate students interested in research aligned with your industry. More than 150 students participate in undergraduate research each year. Funding support provides project supplies as well as faculty and student connections for \$500 per project per semester.

Ahmad **Family Fulton** Undergraduate Research **Initiative Fund**

Jalal U. and Syeda F. Ahmad and their children - Jaheen N., Raisa N. and Nafisah N., all of whom attended the Fulton Schools established a fund to give back and support undergraduate students in their pursuit of knowledge and the advancement of research. Their endowment, which funds materials science. mechanical, chemical, biomedical or electrical engineering students, was created to help more students have the life-changing experience of conducting research through FURI.

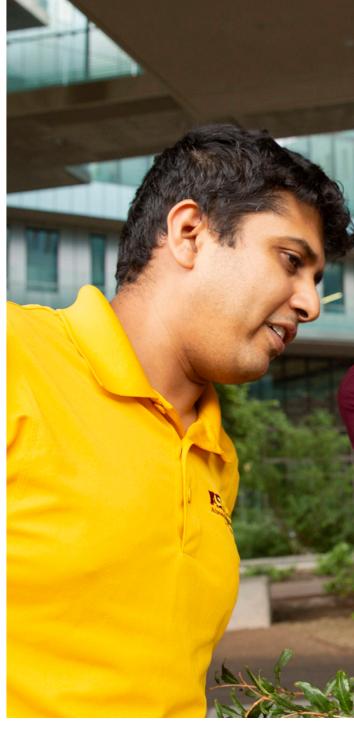


To learn more about sponsorship, contact **David Wahls at** david.wahls@asu.edu



Learn all about **Ahmad Family** sponsored projects.





FALL 2025 AHMAD FAMILY SPONSORED STUDENT

Ahadu Assegued

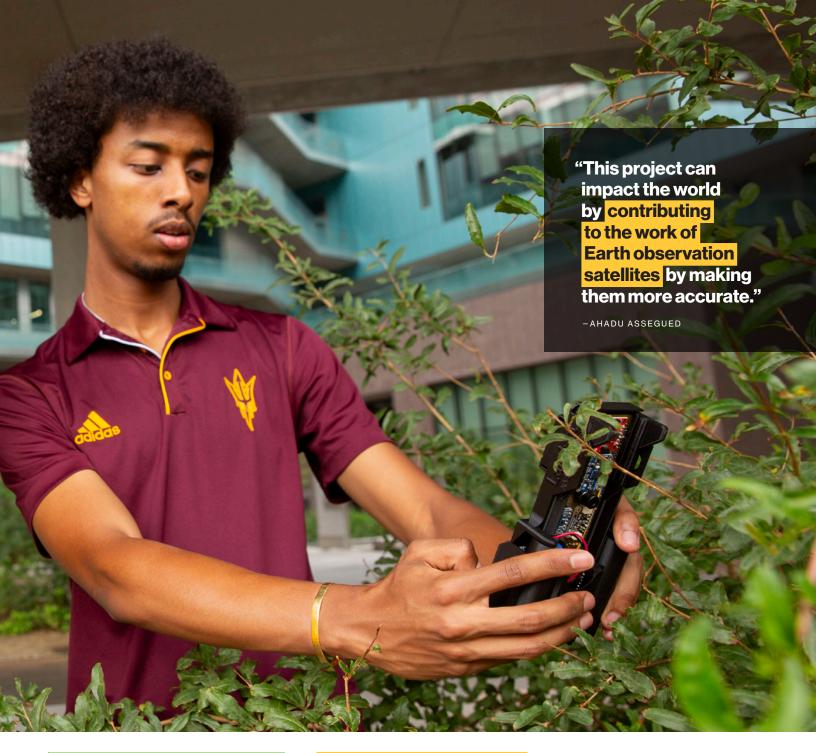
FURI student researcher

Major: Aerospace engineering

Graduation: Spring 2027

Hometown: Addis Ababa, Ethiopia





► IMPACT STATEMENT

Using affordable and userfriendly spectrometers for water and soil quality assessment for satellite-based Earth observation calibration.

Ahmad Family sponsored research

Handheld Off-the-shelf Multispectral Spectrometer for Improving Water **Quality Estimations from Satellite-based Earth Observation MENTOR** SAURAV KUMAR

The purpose of this study is to evaluate the performance of STELLA (Science and Technology Education for Land/Life Assessment) spectrometers as a potential tool for calibrating satellite-based EO (Earth observation) data in a more affordable way. This is done by comparing reflectance values obtained from calibration plates and soil samples using two STELLA devices with those of a hyperspectral imager. The results highlight similarities in behavior between the STELLA spectrometers, although inaccuracies are noted when compared to more accurate data. Despite this, the data collection from STELLA, when integrated with more accurate devices such as hyperspectral imagers, could offer a more efficient way of collecting in-situ EO measurements.

Mentors 🖁







What is a faculty mentor?

Fulton Schools faculty members guide students through the research process in their role as FURI and MORE research program mentors. Mentors meet with their student researchers one-on-one and in lab settings for training, professional etiquette coaching and to serve as their students' guide for writing abstracts and designing research posters. Faculty mentors provide advice and professional development opportunities, including submitting research to conferences, applying for travel grant funding, submitting papers for publication and discussing career goals.

How to get involved

How would additional students help your lab? Encourage Fulton Schools students you know to apply for FURI or MORE research funding. Faculty members can mentor up to five students in each program per semester.

Each student will submit their research proposal, five research references, timeline, budget, personal statement, resume and unofficial transcript in their FURI or MORE application. Then faculty mentors are prompted to submit a Faculty Mentor Acknowledgment. If the review committee accepts the application, the student and faculty member will receive FURI or MORE funding for the chosen semester. If you don't currently have undergraduate or graduate student researchers and would like to find qualified applicants, you can reach out to furi@asu.edu or more@asu.edu and request to add your profile to forge.engineering.asu.edu/mentors for students to peruse.

Find out more at faculty.engineering. asu.edu/mentor-students

Meet this semester's outstanding mentors

Each semester, the FURI, MORE and GCSP research stipend programs select an outstanding faculty mentor from student nominations. These mentors share expertise, empower growth and autonomy, and support student success in a variety of research endeavors. Learn more about this semester's awardees and other exemplary mentors at forge. engineering.asu.edu/featured-mentors.

SUMMER 2025 FURI OUTSTANDING MENTOR Saurav Kumar Assistant professor, School of Sustainable Engineering and the Built Environment **Expertise:** Monitoring and modeling carbon and water systems to improve sustainable water management

FALL 2025 FURI OUTSTANDING MENTOR

Ben Zhou Assistant professor, School of Computing and Augmented Intelligence **Expertise:** Controllable and trustworthy reasoning in natural language processing and AI systems

MORE OUTSTANDING MENTOR **Heejin Jeong** Assistant professor, The Polytechnic School **Expertise:** Human decision-making in interactions with autonomous and intelligent systems

GCSP RESEARCH STIPEND OUTSTANDING MENTOR **Rakibul Hasan** Assistant professor, School of Computing and Augmented Intelligence **Expertise:** Public privacy and security



"Professor Kumar is always ready to help out students even if he is away. He is one of the easiest people to work with, and he treats everyone with respect."

-KOUSHIK THIPPIREDDY, ENVIRONMENTAL **ENGINEERING FURI STUDENT**



"Professor Hasan has been outstanding because he goes beyond simply guiding us through our projects and supports our pursuit of research at a foundational level. He fosters a wonderful lab environment where students feel comfortable and supported, and he emphasizes that at the end of the day, research is a mindset and a lifestyle."

- PAYGE SAKURAI, COMPUTER SCIENCE GCSP RESEARCH STIPEND STUDENT



"Professor Jeong has been an outstanding mentor this semester. He always takes time to explain complex research ideas clearly and guides me with patience and encouragement."

-BHAIRAVI JANGALE, USER EXPERIENCE MORE STUDENT



"Professor Zhou lets me take risks. He regularly advises me on research practices, going above and beyond just telling me to 'work hard' and instead telling me what kinds of papers to avoid, how to spot genuine research and how to become a better researcher myself."

-JOSHUA TOM, **COMPUTER SYSTEMS ENGINEERING FURI STUDENT**

Q&A with summer and fall outstanding faculty mentors

What made you want to get involved as a faculty mentor?

SAURAV KUMAR I feel undergraduate research is a unique way for students to connect classroom learning to real-world engineering challenges and develop a passion for research. FURI programs provide students with the structure, some funding incentives and community necessary to explore ideas and develop essential research and communication skills. My primary goal was to engage undergraduates.

How have your FURI, MORE and GCSP research stipend students affected your research? Have they come up with any surprises or proposed new directions for your lab?

RAKIBUL HASAN Two of my GCSP research stipend recipients have already published papers at top-tier security venues. One FURI student is currently working on women's health app data privacy, an increasingly critical topic. I would not have pursued these directions if the students did not take initiative.

What is your favorite part about seeing your students conduct research?

HEEJIN JEONG My favorite part is witnessing students grow in confidence and independence. Many begin the program uncertain of their abilities, but by the end, they can clearly and confidently explain their research to others.

It's particularly rewarding to see them take ownership of their projects, defining problems, designing methods and interpreting results. Watching that transformation from "Can I really do this?" to "I know how to tackle this challenge" is one of the most fulfilling aspects of mentorship.

What advice would you give to students who might be interested in participating in FURI, MORE and the GCSP research stipend program?

BEN ZHOU I encourage more students to get involved; there are many more things that you can accomplish by starting early, regardless of what background you have. If you are motivated and passionate about something, you should try to make it happen! You will be surprised to see how much you can accomplish.

SUMMER AND FALL 2025 STUDENT RESEARCHERS

Jesus Aguilar Munia Ahmed Genevieve Alexander Hemanth Narayana Allam Ahadu Assegued Clara Azevedo Rocco Barletta Brianna Botello Te Bu Connor Cagno Dibo Cai Travis Cain Garret Chastain Kumar Satvik Chaudhary Parnika Chaudhary Saniav Chezhian Dheeraj Chilukuri Jessica Cole Rvan Crane Francesca Cristobal Diego Curiel Shriya Danekar **Andrew Dalbins** Jacob Damon Camila De Barros Leandro Bernardo De Oliveira Geissmann Shivam Ravindra Deotarse Saurabh Dingwani Nishrey Dubey Jordan Dunn

Ryan Duong John Dviak Jonathan Reggie **Fhenezer** Sidra Elsaady Keegan Erdmann Ari Everett Luca Felicioli Asuka Firdaus Zevad George Sanjay Giridharan Soham Goel Keerthana Gontu Ram Goninath Robert Halloran Selin Hanci Yura Hashimoto Willem Hurley Shatakshi Iksha Aramis Jang Bhairavi Jangale Marko Jojic Prajakta Punjaji Kadukar Mollee Kahan Aditya Kakadia Aryan Prathamesh Kalelkar Bhavana Kannan Soham Karandikar Sakshi Ritesh Katargamwala Ramneek Kaur Aryan Vinod Keluskar

Michelle Kim Sunvoung Kim Mia Kineyko Anish Kulkarni Anish Pravin Kulkarni Donovan Lerma Matt Lin Sandy Lin Alexander Liu **Emily Lopez** Esther Low Joshua Lumpkin Lune Martin Rex Maxwell Shayan Mazhar Ethan McClintic Isaiah Milkey Erin Diadem Mongen Katha Naik Nidhin Nair Emma Nance Ahmed Nasr Thomas Nicholas Changmin Oh Saee Sarang Pangarkar Divyanshu Binish Parikh Yashu Gautamkumar Patel Raje Patil Vijeth Ganapatigouda Patil Siri Poluri

Andrew Postik Anui Prabhu Diego Puerta Ishita Ranian Aditi Rao **David Reves** Andrew Rubio Payge Sakurai Aditya Sally Diego Sanchez Nauman Sayed Deep Snehalkumar Shah Sameera Shah Vedang Sharma Shira Shecter Aditi Shrestha Pramath Shukla **Brendan Sourwine** Ash Srivastava Alex Stephenson Chloe Stoops Koushik Reddy Thippireddy Joshua Tom Octavio Tuxtla Garcia Jaideep Varidireddy Albert Vo William Wu Qizheng Yang Sai Bhavana Yeedubilli Sergio Yepiz Hui Zhuang



Fueling innovation, building engineers

AT ARIZONA STATE UNIVERSITY, we've been educating engineers for Arizona and the world for nearly 70 years. With more than 32,000 students, we are building the engineers of the future and pursuing the discoveries and solutions to challenges facing society.

In 2003, Ira A. Fulton, founder and CEO of Arizona-based Fulton Homes, established an endowment of \$50 million

in support of ASU's College of Engineering and Applied Sciences.

His investment served as a catalyst, enabling the development of a dynamic portfolio of strategic initiatives that benefit our students and faculty and the communities where they live and work.

Throughout the years, Ira A. Fulton has been an active supporter of the school that bears his name.