**W** ELECTRICAL & COMPUTER
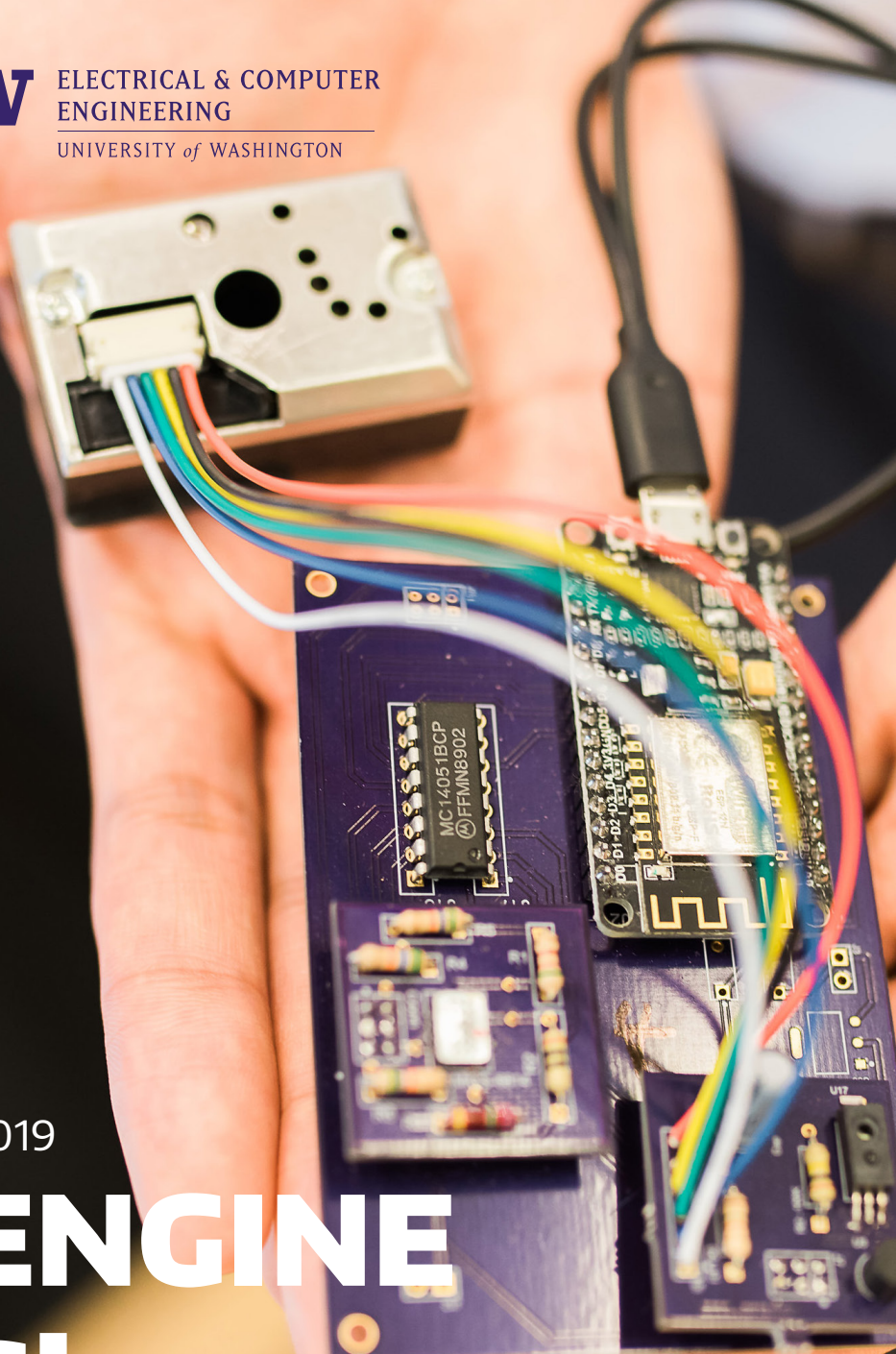ENGINEERING
UNIVERSITY of WASHINGTON

2019
ENGINE
Showcase

# WELCOME

## A LETTER FROM THE CHAIR

Welcome to UW Electrical & Computer Engineering's 2019 ENGineering INnovation and Entrepreneurship (ENGINE) program showcase. It's a delight every year to invite our industry and campus colleagues to join us as we showcase and celebrate the hard work of our students, who will soon be graduating as the next generation of electrical & computer engineers.

This year's fair features nearly 50 team projects on topics as diverse as computer systems architecture, power electronics, machine learning, communications, and robotics. The students here today comprise the majority of our graduating seniors.

Most of the projects here arise from ENGINE — our Engineering Entrepreneurial Capstone program. ENGINE was created to enable students to work in teams on industry sponsored projects. This program, generously endowed by our alums Milton and Delia Zeutschel, is designed to develop students' skills in innovation, systems engineering and project management. Initiated only three years ago, ENGINE has grown every year, from just four projects in 2016 to 43 in 2019. Milt and his business partner John Reece have also spent significant time to give feedback and to shape the program. In addition, John has given several lectures to our students over multiple years on career development, team work, entrepreneurship, and leadership.

I wish to extend a special thanks to all of our industry and faculty mentors, ENGINE Program Director, Payman Arabshahi, our wonderful College of Engineering Capstone Director Jill Dalinkus, Associate Dean for Academic Affairs, Brian Fabien, and our amazing ENGINE Teaching Assistants, Shruti Misra, Niveditha Kalavakonda, and Yana Sosnovskaya, without whom these projects would not have been possible.

Congratulations to all students on the completion of your final capstone projects! The knowledge you have gained from this experience will serve you well in the coming years. I have no doubt that you will build successful and rewarding careers.

In closing, I want to take this time to recognize and thank a very special person, our College of Engineering Dean, Michael Bragg, who has been a leader and friend of UW ECE. Without his help and support we could not have built ENGINE at the Department.

I look forward to having the chance to talk with you about future collaborations. Enjoy the ENGINE of UW ECE!

Best to all,

Radha Poovendran
Professor and Chair

*Photos from the 2018 ENGINE Showcase*

## Internet of Life Saving Thing (IoLST) for Firefighters

INDUSTRY MENTOR
**Len Cayetano**

SPONSOR
**Zetron**

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Tianning Li, Hong Zhang, Shen Yuan Yao**

Development of an Internet of Things environmental sensing and communication system for fire rescue operations.

**PLACEMENT #1**

## Customer and Network Prediction and Anomaly Detection

INDUSTRY MENTOR
**Xiang Chen**

SPONSOR
**Tupl**

FACULTY ADVISER
**Payman Arabshahi**

STUDENTS
**Yi-Cheng Chen, Andrew Leung, Shih-Yin Tsai**

Prediction and visualization of customer and network issues with deep Learning using Call Detail Records, Key Performance Indicators, and Twitter datasets.

**PLACEMENT #2**

## An ECG Enabled Smartphone Stethoscope

INDUSTRY MENTOR
**Vikram Chalana**

SPONSOR
**StethIO**

FACULTY ADVISERS
**James K. Peckol, Robert Bruce Darling**

STUDENTS
**Sai Sidharth Doppalapudi, Jason Ku, Edward Lou**

Design and implementation of a single lead electrocardiogram (ECG) system for integration with StethIO's digital stethoscope, and machine learning classification of ECG data.

**PLACEMENT #3**

## Digitally-Controlled Synchronous Battery Charger

INDUSTRY MENTORS
**Jacob Shannon, Gregg Stavig**

SPONSOR
**Crane Aerospace & Electronics**

FACULTY ADVISER
**Brian Johnson**

STUDENTS
**Jonah Au, Cooper McBride, Thaniel Schrimshire**

Development of a digitally-controlled synchronous battery charger for avionic applications. Converter acts as both a battery charger and bus-sustainer upon loss of power.

**PLACEMENT #4**

## Automated Turn Signal Cancellation for Semi-Trucks

INDUSTRY MENTOR
**Ian O'Connor**

SPONSOR
**Kenworth**

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Feng Wei, Ashley Fogwell, Eldon Wen**

Design, build, and test of a system to cancel turn signals automatically for semi-trucks based on CAN bus signals and image processing.

**PLACEMENT #5**

## Over-the-Air Update System for Microcontrollers

INDUSTRY MENTORS
**Cedric Vincent, Adrien Leravat**

SPONSOR
**Witekio**

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Lerzan Cengiz, Connor Kafka, Anusha Kamat**

Design and build of a secure over-the-air firmware update system for ARM Cortex-M4 microcontrollers that enables device maintenance and management.

**PLACEMENT #6**

INDUSTRY MENTORS
**Bradley Buniak,
Avinash Hasirumane,
Thao Hoang**

SPONSOR
**Collins Aerospace**

# Aircraft Non-Intrusive Continuous Level Sensor

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Derek Hines-Mohrman,
Selma Kapetanović,
Jon Champion**

Design, build, and test of a non-intrusive continuous level sensor and communication system for aircraft waste systems.

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INDUSTRY MENTORS
**Kumar Maddali,
Changzheng Jiang,
Shubham Agrawal**

SPONSOR
**Telenav**

# Continuous Destination Prediction Micro Service

FACULTY ADVISER
**Robert Bruce Darling**

STUDENTS
**Sicong Huang, Tyler Ho,
Muhammad Danish
Farooq**

Design of a machine learning model to predict a user's destination continuously during a trip, with the flexibility to adopt time/distance transitions and spatio-temporal data.

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# A Wearable Robotic Arm

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Gaohong Liu,
Ethan Wang,
Chunguang Xie**

Design and build of a robotic arm to help users execute operations such as lifting heavy objects by detecting muscle micro-motion.

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INDUSTRY MENTORS
**Nasser Saber,
Joon Hwan Choi,
Fuxing Yang**

SPONSOR
**Verathon**

# Wearable Medical Device for Bladder Volume Monitoring

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Irfan Wisanggeni,
Skyler Justis**

Development of a wearable medical device to periodically monitor bladder volume and send phone alerts when detecting high volume readings.

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INDUSTRY MENTOR
**Vivek Burhanpurkar**

SPONSOR
**Cyberworks Robotics**

# Autonomous Wheelchair with Monocular Visual Odometry

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Ross Bajocich,
Kaiden Field,
Joseph Shieh**

Development and integration of a robust visual odometry package with sensors, an onboard processor, and a user interface, to assist autonomous wheelchair motion.

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INDUSTRY MENTOR
**Chris Balton**

SPONSOR
**Paccar**

# Simulating Localization in a Landmark-Sparse Environment

FACULTY ADVISER
**Ashis Banerjee**

STUDENTS
**Russell DeGuzman,
Everett Key,
Daniel Torres**

Development and simulation of robotic localization based on real-world odometry and LIDAR sensor data in an environment that has very few LIDAR-friendly landmarks.

INDUSTRY MENTORS
**Ricardo Rodriguez,
Duy Nguyen**

SPONSOR
**Fluke**

## Dynamic Load Monitoring System for a Set of Complex Devices

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Dean Khormaei,
Aditya Sharma,
Jingtian Gu**

Development and test of a system for accurate identification and monitoring of different electrical loads.

**PLACEMENT #13**

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INDUSTRY MENTORS
**Keith McCall,
Trina Nelson,
Mason Lanphear**

SPONSOR
**Pollen Systems**

## Unmanned Ground Vehicle for Vineyards and Farms

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Justin Ngo, Yibo Cao,
Maggie Fagan, Jonathan
Ananda Nusantara**

Development of a semi-autonomous ground vehicle which surveys vineyards and other high-value crop fields, with a focus on collecting pictures to evaluate expected yield and plant health.

**PLACEMENT #14**

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INDUSTRY MENTORS
**Ryan Gies,
Prabuddha Biswas**

SPONSOR
**Agilysys**

## Digital Hotel Assistant

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Jessica Dai, Jason Garcia,
Romo Li**

Development of a software plugin that utilizes network voice recognition services to provide voice-to-text and text analysis for guest contact with hotel employees.

**PLACEMENT #15**

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INDUSTRY MENTOR
**Paul McElhany**

SPONSOR
**National Oceanic
and Atmospheric
Administration**

## Smart Light Trap

FACULTY ADVISER
**Tai-Chang Chen**

STUDENTS
**Xavier Yuan,
Lucas Cauthen**

Development of a smart light trap to capture video of zooplankton and their surrounding environment, and development of a software package to analyze the video, giving scientists a view of the composition of species and a count of specimens in a given trap.

**PLACEMENT #16**

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INDUSTRY MENTOR
**Chris Bolton**

SPONSOR
**Paccar**

## Automotive Radar Data Processing System

FACULTY ADVISER
**Sumit Roy**

STUDENT
**Yekaterina Mikhaylyuta,
Matthew Sissel**

Development of radar data processing algorithms to create heat-maps of the environment around a vehicle, and to distinguish between vehicles and pedestrians.

**PLACEMENT #17**

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INDUSTRY MENTORS
**Remington Below,
Vanessa Naff,
John Gruender**

SPONSOR
**Glympse**

## Using GPS Location Data to Score Drivers' Safety

FACULTY ADVISER
**Sreeram Kannan**

STUDENTS
**Allison Torchia,
Youjun Wu,
Brandon Tjio**

Development of a system using GPS location data to detect and categorize dangerous driving maneuvers, and assignment of a driver safety score.

**PLACEMENT #18**

## Motion Control for Cyclotron RF System

INDUSTRY MENTORS
**Robert Emery, Marissa Kranz**

SPONSOR
**UW Medical Center**

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Razan Alraddadi, Akhil Avula, Dylan Tomberlin**

Design, build, and test of a motion control system that tunes the Cyclotron radio-frequency system. Tuning to different frequencies allows the Cyclotron to be used for cancer treatment, isotope creation, and advanced materials testing.

PLACEMENT #19

## Machine Learning Mobility Data Through Security Camera Feeds

INDUSTRY MENTORS
**Tom Wilson, Michael Berman, Brian Brooke**

SPONSOR
**Sound Transit**

FACULTY ADVISER
**Jenq-Neng Hwang**

STUDENTS
**Yifan Bai, Zhe Han, Austin Miller**

Development of a machine learning system which combines image object detection and tracking to produce aggregated mobility data and traffic counts in Link Light Rail stations using station security camera footage.

PLACEMENT #20

## Aerial Shoeslaughter: Semi-Autonomous Drone Shoe Removal

FACULTY ADVISERS
**Howard J. Chizeck Blake Hannaford**

STUDENTS
**Rahul Ramanarayanan, Devon Endsley, Tamara Lin**

Design of semi-autonomous drone system with electro-mechanical actuators and computer vision to remove shoes from transmission lines.

PLACEMENT #21

## Accolade Integration with Apple HealthKit

INDUSTRY MENTOR
**Christopher Diaz**

SPONSOR
**Accolade**

FACULTY ADVISER
**Tai-Chang Chen**

STUDENTS
**Andrew Liu, I-Miao Chien, Kyuri Kim**

Developement of a system to enhance user experience and interaction with physicians by sharing users' health data from Apple Health Kit with the Accolade platform.

PLACEMENT #22

## Laser-Based Insect Eradicator

INDUSTRY MENTORS
**Arty Makagon, Phil Rutschman**

SPONSOR
**Photonic Sentry**

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Ahmad Rasyid, Rogers Xiang, Xincheng Wang**

Development of a system to detect irregularities in object detection and target tracking of bugs in the Photonic Fence laser-based insect monitoring and eradication system.

PLACEMENT #23

## Situational Awareness in Path Finding

INDUSTRY MENTOR
**Colin Reinhardt**
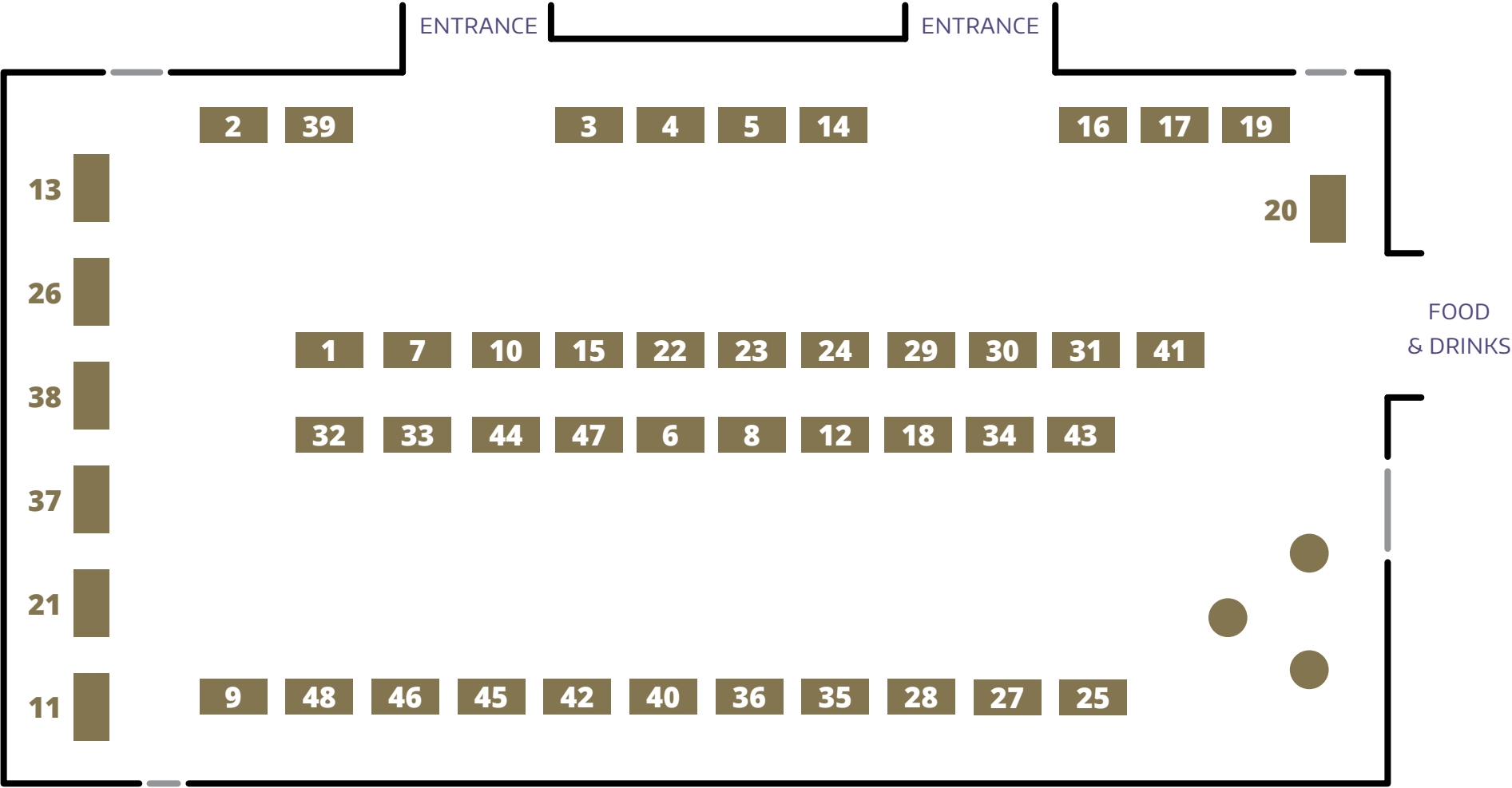
SPONSOR
**Naval Information Warfare Center**

STUDENTS
**Johnson Ly, KuanHsun Lu, Vikram Sringari**

Development of a machine learning Android application that finds the best driving path between two locations based on optimal weather conditions and other user requirements.

PLACEMENT #24

# PROJECT LOCATIONS

## North Ballroom

ENTRANCE          ENTRANCE

| 2 | 39 |   | 3 | 4 | 5 | 14 |   | 16 | 17 | 19 |

13

20

26

FOOD
& DRINKS

| 1 | 7 | 10 | 15 | 22 | 23 | 24 | 29 | 30 | 31 | 41 |

38

| 32 | 33 | 44 | 47 | 6 | 8 | 12 | 18 | 34 | 43 |

37

21

| 9 | 48 | 46 | 45 | 42 | 40 | 36 | 35 | 28 | 27 | 25 |

11

INDUSTRY MENTOR
**Anat Caspi**

SPONSOR
**TCAT**

## Contextually Aware Autonomous Wheelchair

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Benton Kwong, Yeyun Lu, Jesse Lu**

Development of a smart sensor suite to be used in an autonomous wheelchair, enabling context awareness and path reconstruction.

INDUSTRY MENTORS
**Sarah Hovsepian, Eric Junkins, Richard Otis**

SPONSOR
**NASA Jet Propulsion Laboratory**

## PUFFER Autonomous Navigation and Coordinated Search

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Jace Barayuga, Alex Hoffman, Andysheh Mohajeri, Brandon Yee**

A multi-robot navigation and search for the Pop Up Flat-Folding Explore Rover (PUFFER), including computer vision, LIDAR distance sensing, and SLAM, to cooperatively find a goal object.

INDUSTRY MENTORS
**Eric Jones, David Sanborn**

SPONSOR
**Booz Allen Hamilton**

## Bluetooth Multiplexer

FACULTY ADVISER
**James Ritcey**

STUDENTS
**Philip White, Ying Cheng Lin, Chumei Yang**

Design, build, and test of a system using a single host serving multiple bluetooth audio devices which stream the same audio.

INDUSTRY MENTOR
**Manish Engineer**

SPONSOR
**Seattle Art Museum**

## Isolator Base: Seismic Damage Mitigation for Museums

FACULTY ADVISER
**Howard J. Chizeck**

STUDENTS
**Will Gear, John McIntyre**

Development of a system to actively stabilize a sculpture subject to seismic forces, using sensors and motors.

INDUSTRY MENTOR
**Shana Matthews**

SPONSOR
**Microsoft**

## K-12 Data Science Curriculum

FACULTY ADVISER
**Payman Arabshahi**

STUDENTS
**Abhishek Sangameswaran, Kailing Shen**

Development of a hands-on data science curriculum which aims to make K-12 learners data literate as well as introduce them to data science topics such as data visualization, statistics, and machine learning.

INDUSTRY MENTOR
**Junhua Chang**

SPONSOR
**Lightning Network LLC**

## Real Time Financial Transactions Using Lightning Network Protocol

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Brian Yu, Zheng Hong Tan**

Development of a payment app utilizing the Lightning Network to increase the rate of completion of cryptocurrencies to meet consumer needs.

## Community Heals Web App

INDUSTRY MENTORS
**Tatum Fettig,
Ivy Cheung**

SPONSOR
**Sweet Tea Cancer
Connections**

FACULTY ADVISER
**James K. Peckol**

STUDENTS
**Ameer Talal Mahmood,
Siyou Li, Manchen Jin**

Design and build of an app to connect parents who have a child with pediatric cancer, with their child's caregivers.

**PLACEMENT #31**

## Implementing Driver Logic for Reaction Wheels using FPGA

INDUSTRY MENTORS
**Paul Sturmer,
Jeffrey Chrisope**

SPONSOR
**Husky Satellite
Laboratory**

FACULTY ADVISER
**Robert Winglee**

STUDENT
**Thu Phan**

Development of a reliable FPGA system to drive reaction wheels for UW's first CubeSat satellite.

**PLACEMENT #32**

## Sign Reading In Oblique Aerial Imagery

INDUSTRY MENTORS
**Shay Strong,
Lilly Thomas**

SPONSOR
**EagleView Technologies**

FACULTY ADVISER
**Robert Bruce Darling**

STUDENTS
**Xinbei Gong,
Truong Nguyen,
Mengqi Chen**

**PLACEMENT #33**

Development of a system that uses deep neural networks and optical character recognition techniques to detect and read oblique signage in aerial imagery.

## Individual Horse Identification

INDUSTRY MENTOR
**Evan King**

SPONSOR
**Magic AI**

FACULTY ADVISER
**Eli Shlizerman**

STUDENTS
**Brandon Noyes,
Mingyi Yang,
Hady Ouyang**

Development of a data pre-processing pipeline and classification neural net to individually identify horses.

**PLACEMENT #34**

## Advanced Security Compute Module

INDUSTRY MENTOR
**Jay Lindenauer**

SPONSOR
**WatchGuard**

FACULTY ADVISER
**Scott Hauck**

STUDENTS
**Tin Vo, Benjamin Eastin**

Design and build of a module for storage and computation of network data to be integrated with existing WatchGuard technology to provide users with more information on network traffic.

**PLACEMENT #35**

## NB-IoT Power Line Obstruction Detection

INDUSTRY MENTORS
**Jeff Ahmet,
Ahmad Armand**

SPONSOR
**T-Mobile**

FACULTY ADVISER
**Sumit Roy**

STUDENTS
**Zidi Wei, Ying Kit Chui,
Bogdan Tudos**

Development of an NB-IoT-enabled device to detect obstructions near power lines and report them to a remote web server, assisting in efforts to prevent wildfires and saving lives.

**PLACEMENT #36**

## Helical Structures for Controlling Electromagnetic Waves

FACULTY ADVISER
**Yasuo Kuga**

STUDENTS
**Kuo Yan, Chenxin Su, Cerwyn Chiew**

Design of a stacked helical structure to control linearly polarized and circularly polarized electromagnetic waves.

**PLACEMENT #37**

INDUSTRY MENTORS
**Ilya Goldberg, Michael Calhoun**

SPONSOR
**Mindshare Medical**

## Improved Sensitivity and Specificity with AI on 3D Mammography

FACULTY ADVISER
**Ming-Ting Sun**

STUDENTS
**Drew Clark, Chen Bai, Kyle Zhang**

Design and build of a neural network system for localizing and characterizing breast cancer lesions in 3D tomosynthesis scans, with significantly reduced false positives.

**PLACEMENT #38**

## Intelligent Floor Tile

FACULTY ADVISER
**Steve Tanimoto**

STUDENTS
**Thao Ngo, Jichun Li, Shahrzad Feghhi**

Design, build, and test of an intelligent floor tile that permits arbitrary spaces to have interactive floors, using LED lighting and pressure switches.

**PLACEMENT #39**

INDUSTRY MENTOR
**Amit Mital**

SPONSOR
**Kernel Labs**

## Teleoperated Farming Rover

FACULTY ADVISER
**Sam Burden**

STUDENTS
**Donavan Erickson, Samson Waddell, Zhuoming Zhang**

Design, build and test of a cost-efficient general purpose rover for farm use. The rover is remotely operated and built with a machine learning framework for implementing future applications.

**PLACEMENT #40**

INDUSTRY MENTOR
**Andrew Lee**

SPONSOR
**Washington SuperBike**

## Modular Battery Management System for EV

FACULTY ADVISER
**Robert Bruce Darling**

STUDENTS
**Cole Ballard, Bryan Ford, Bernardo Olivas III, Nathan Williams**

Design and manufacture of a battery management system for an all-electric racing motorcycle. The design features state of charge (SOC) calculation and implements safety measures such as temperature and over/under voltage cutoff.

**PLACEMENT #41**

INDUSTRY MENTORS
**Shwan Ashrafi, Ben Robaidek**

SPONSOR
**Axon**

## Speaker Identification for Voice Command-enabled Body Worn Cameras

FACULTY ADVISER
**Mari Ostendorf**

STUDENTS
**Ashwin Srinivas Badrinath, Alex Hu, Christina Tang**

Development of two neural network systems for text-independent speaker identification of law enforcement officers and other authorized speakers.

**PLACEMENT #42**

## 27-30 GHz All Digital PLL Frequency Synthesizer

FACULTY ADVISERS
**Jacques C. Rudell**

STUDENTS
**Andrea Jin, Mohamed Gnedi, Brandon Tjio**

Design of a fully digital PLL synthesizer to operate in the Kurz band. It uses a 100MHz reference crystal oscillator for a 27-30 GHz output with 1 MHz steps.

PLACEMENT #43

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INDUSTRY MENTOR
**Matthew Orr, Jeffrey Hogan**

SPONSOR
**Boeing**

## Boeing Dedicated Air Freighter

FACULTY ADVISER
**Susan Murphy**

STUDENTS
**Cameron Joy, Julian Woo, Keenan Boudan, Ramon Laya, Sean Lam, Matthew Edwards, Dickson Cheung**

Design of a medium size turboprop freighter for entry into service by 2029.

PLACEMENT #44

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## Ultra Thin Camera with Metasurface Lens

FACULTY ADVISER
**Arka Majumdar**

STUDENTS
**Mark Odendahl, Yuxuan Chen, Geyu Yan**

Development of an extremely compact camera using a metasurface lens in conjunction with a convex lens, along with a camera sensor connected with a microcontroller.

PLACEMENT #45

---

INDUSTRY MENTORS
**Aaron Cheng**

## DopCuff: A Blood Pressure Monitor for LVAD Patients

FACULTY ADVISER
**Eric Seibel**

STUDENTS
**Alex Auld, Katie Maskal**

DopCuff will integrate doppler ultrasound and automatic cuff technology into a single device that can detect the initiation of blood flow and associate it with a blood pressure reading for LVAD patients.

PLACEMENT #46

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## A Wearable Sleep Monitor

FACULTY ADVISER
**Robert Bruce Darling**

STUDENTS
**Alvin Cao, Evan Gordon, Andrea Jin**

Development of a wearable sleep monitor for pre-screening sleep testing for disorders such as sleep apnea. The system is comprised of motion and respiration rate sensors, and transmits captured bio-metrics via Bluetooth to a remote device.

PLACEMENT #47

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INDUSTRY MENTORS
**Gaia Borgias, Travis Phelps, Matt Hansen, Michael Berman, Kiley Winsnes**

SPONSOR
**UW Mobility Innovation Center, WSDOT, Challenge Seattle, Sound Transit, King County Metro**

## Mobile Ticketing Enhancements for General Population Incident Avoidance

FACULTY ADVISERS
**Don Mackenzie, Mark Zachry, Richard Kielbowicz, Andisheh Ranjbari**

STUDENTS
**Anny Kong, Catherine Wang, Chris Angkico, Pari Gabriel, Steven Tuttle, Yuki Asakura**

Development of a mobile ticketing prototype that can help the general public navigate or avoid major incidents and related congestion.

PLACEMENT #48

# THANK YOU

## Milt and Delia Zeutschel

UW alums Milton "Milt" and Delia Zeutschel are fervent supporters of education and entrepreneurship. Their own successes come from a strong combination of excellent education at UW—Milt, a BSEE '60 and Delia a B.S. in education, 1958—and unwavering determination and grit, starting and growing three businesses: Zetec, Data I/O Corp., and Zetron, Inc.

In 2017, they cemented their support for education and entrepreneurship with a transformational endowment to establish the ENGINE program at UW ECE. The investment enables our students to engage in real-world industry partnerships and gives local companies an opportunity to benefit from the vibrant innovative culture in UW ECE.

Another component of the endowment is the Milton and Delia Zeutschel Professorship in Entrepreneurial Excellence which was awarded to

Professor Joshua Smith. The professorship allows the department to recruit, retain and reward entrepreneurially-driven faculty who will help build and sustain an engineering entrepreneurial ecosystem at the UW.

UW ECE is very grateful to Milt and Delia for their generous contributions to the department. Not only is their gift a significant resource for ECE students, it also gives back to the university as a whole and the state of Washington. ENGINE is now scaled at the UW College of Engineering and continues to grow.



*From left to right: College of Engineering Dean, Micheal Bragg, Milt Zeutschel, John Reece, and ECE Chair, Radha Poovendran*
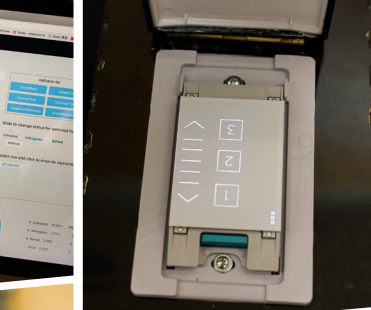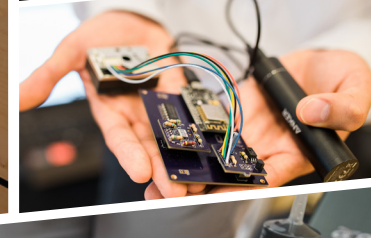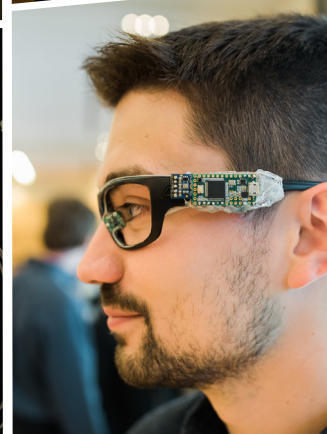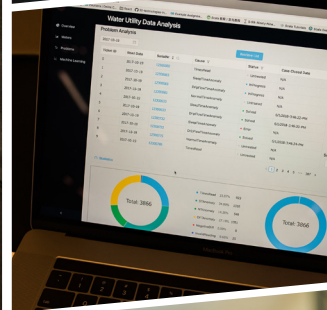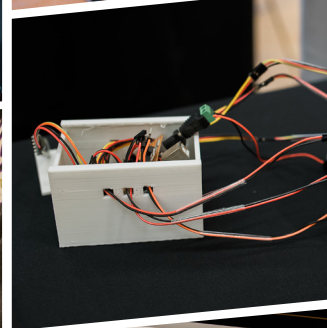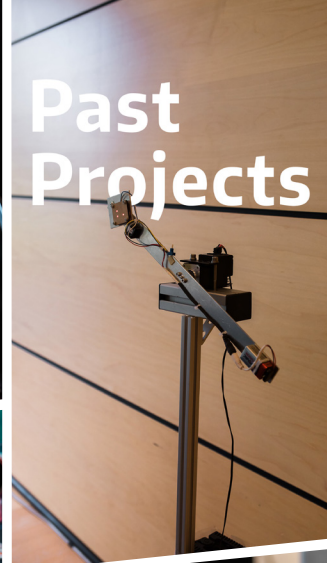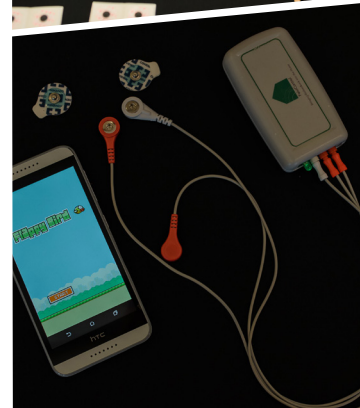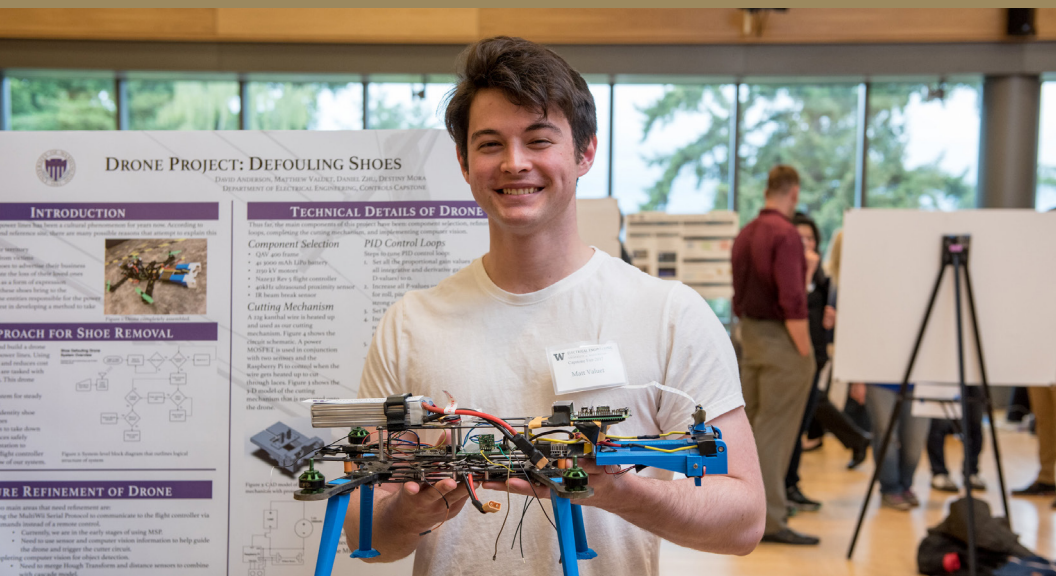
# 43

Partnerships

# 40

Sponsors

# 120

Students

## Innovation starts here.