



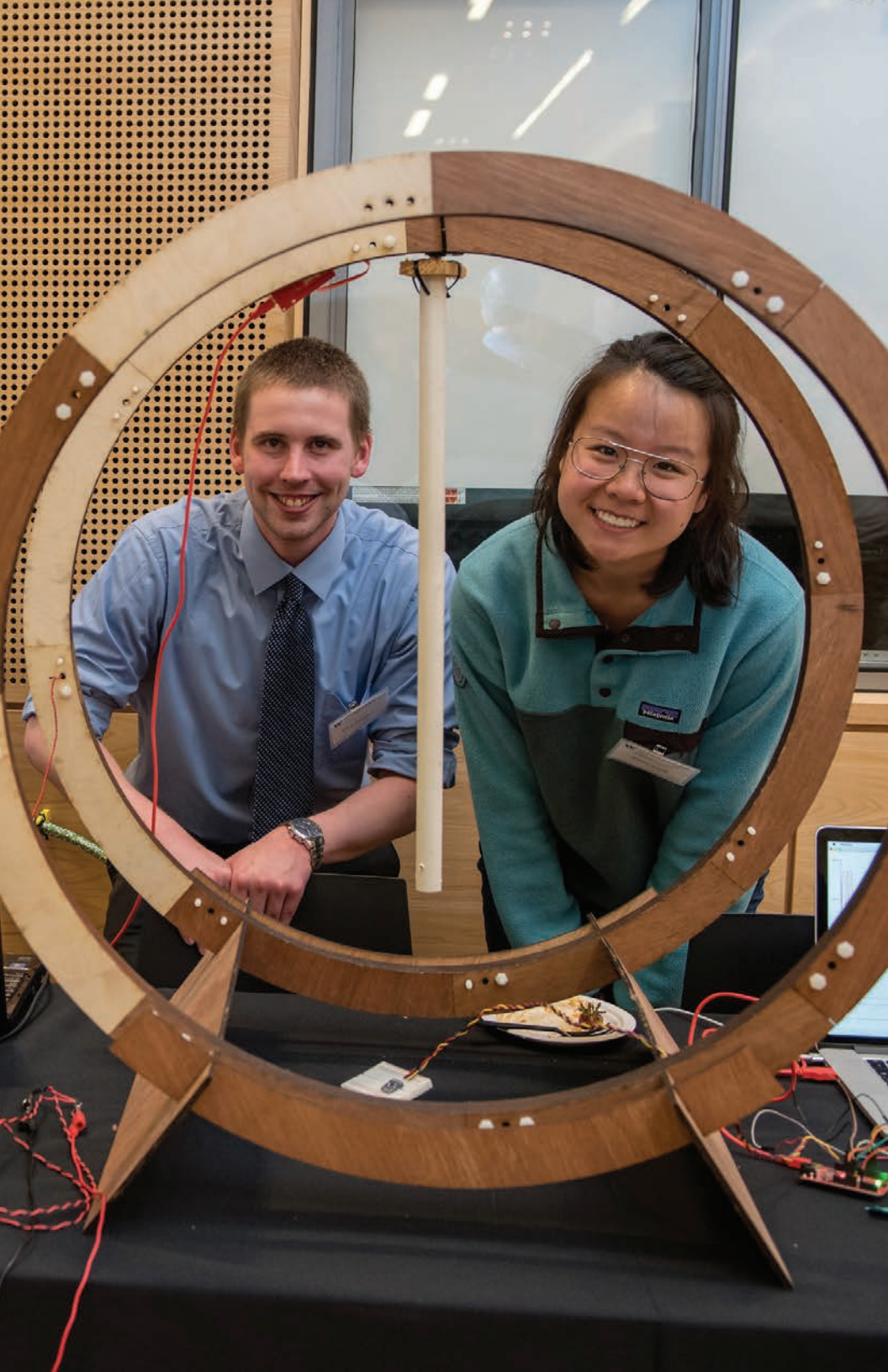
**ELECTRICAL ENGINEERING**  
UNIVERSITY *of* WASHINGTON

**INNOVATION  
STARTS HERE**

A large, stylized graphic of a bear, the mascot of the University of Washington, is rendered in a wireframe or network style. The bear is composed of numerous small, light-colored dots connected by thin lines, creating a mesh-like structure. The bear is positioned in the center of the page, facing right. The background is a dark blue gradient with a subtle grid pattern.

# UWEE CAPSTONE FAIR

**Friday, June 1, 2018**  
**Event Program**



# WELCOME

## A LETTER FROM THE CHAIR



Welcome to UW Electrical Engineering's annual Capstone Fair. It's a pleasure 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 engineers.

This year's fair features work from nearly 40 groups presenting capstones from courses as diverse as digital signal processing, computer systems architecture 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. The program is designed to develop students' skills in innovation, systems engineering and project management. Developed only three years ago, **ENGINE** has grown every year, from just four projects to 22 projects to 34. Last year 40% of our graduating seniors enrolled in this capstone program. This year we're proud to say that 55% of our graduating students are participating.

**ENGINE** wouldn't be possible without an engaged local innovation community. The department is very grateful for our valuable partnerships with industry. These collaborations yield wonderful outputs, from fostering student preparedness after college to fueling innovative research and design. Indeed, some of last year's **ENGINE** projects were successful and complex enough that they were carried into this year's class.

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.

I hope everyone enjoys the Capstone Fair today. I look forward to having the chance to talk with you about future collaborations.

Best to all,

Radha Poovendran  
Professor and Chair

**EE  
400**

## Pelvic Floor Biofeedback Platform

CONTACT  
**bruced@uw.edu**

FACULTY ADVISER  
**Robert Bruce Darling**

STUDENTS  
**Wei-Hong Li, Cory Kelly,  
Xiaoyu Ye, Yicheng Hu**

SPONSOR  
**UW Electrical  
Engineering**

Development of an EMG biofeedback platform for treating pediatric urinary incontinence in the home.

PLACEMENT **24**

**EE  
448/449**

## Automated Turn Signal Based on Trailer Dynamics

CONTACT  
**bruced@uw.edu**

FACULTY ADVISERS  
**Robert Bruce Darling,  
Howard J. Chizeck**

STUDENTS  
**Madelyn Schneider, Michael  
Zeng, Magdalene Sockness**

SPONSOR  
**Kenworth**

Development of a system for classification of complex semi-truck turns and lane changes using sensors and vehicle dynamics.

PLACEMENT **3**

**EE  
400**

## MUUGUZI Fetal Monitor

CONTACT  
**bruced@uw.edu**

FACULTY ADVISER  
**Robert Bruce Darling**

STUDENTS  
**Carl Terrett, Jaclyn  
Rainey, Ketan Mhetre,  
David Rappaport,  
Anton Nachmanson**

SPONSOR  
**UW Electrical  
Engineering**

Design, build, and test of an autonomous fetal-ECG and contraction monitoring system, with extendability to other vital signs.

PLACEMENT **31**

**EE  
448/449**

## Contextually Aware Autonomous Wheelchair

CONTACT  
**uwtc@uw.edu**

FACULTY ADVISER  
**Howard J. Chizeck**

STUDENTS  
**Kun Su, Kevin Joshua  
Caravaggio, Jacky Cheng**

SPONSOR  
**Taskar Center for  
Accessible Technology**

Design, build, and test of a contextual awareness multi-sensor module for autonomous wheelchairs.

PLACEMENT **6**

**EE  
443**

## Audio Classification Using Neural Networks

CONTACT  
**hwang@uw.edu**

FACULTY ADVISER  
**Jenq-Neng Hwang**

STUDENTS  
**Tianhang Gao, Yiran Fu**

SPONSOR  
**UW Electrical  
Engineering**

Development of models and a system to achieve highly precise, real-time audio classification of numbers and musical instruments.

PLACEMENT **26**

**EE  
448/449**

## OceanLens ROV Underwater Recharging and Data Transfer

CONTACT  
**chizeck@uw.edu**

FACULTY ADVISER  
**Howard J. Chizeck**

STUDENTS  
**Jeffrey Chrisope, Rachel  
Kominek, Ishan Sharma**

SPONSOR  
**Booz Allen Hamilton**

Design, build, and test of a system for wireless underwater charging and data transfer for a remotely operated underwater vehicle, including an autonomous self-docking module.

PLACEMENT **9**



**EE**  
**448/449**

## Neutron Therapy Precision Platform

CONTACT  
**chizeck@uw.edu**

FACULTY ADVISER  
**Howard J. Chizeck**

STUDENTS  
**Preston Fowler, Fabian Sutandyo, Kelson Kaiser**

SPONSOR  
**UW Medicine**

Development of a software system to control a robotic arm and design of a micro-collimator for a neutron beam, allowing UW Medicine to conduct experiments for cancer treatment.

PLACEMENT **15**

**EE**  
**448/449**

## Precision Delivery Device for Sensors and/or High Value Cargo

CONTACT  
**chizeck@uw.edu**

FACULTY ADVISERS  
**Howard J. Chizeck, Sumit Roy**

STUDENTS  
**Jordan Coult, Samuel Scherer, Thomas Longanecker**

SPONSOR  
**Applewhite Aero**

Development of a motion controller and tablet application for directing a cargo-carrying drone to precise locations.

PLACEMENT **35**

**EE**  
**448/449**

## Automated Juvenile Fish Counter

CONTACT  
**chizeck@uw.edu**

FACULTY ADVISER  
**Howard J. Chizeck, Tai-Chang Chen**

STUDENTS  
**George Foggin, Symone Griffin, Josh Walewander**

SPONSOR  
**Tacoma Power**

Design, build, and test of an automatic fish counting system using a near-infrared camera and a debris recognition system.

PLACEMENT **27**

**EE**  
**497/498**

## Low-cost Physical Shopping Cart Content Tracking

CONTACT  
**jdsahr@uw.edu**

FACULTY ADVISER  
**John D. Sahr**

STUDENTS  
**Attila Herrera, Alvin Cao, Hung Huynh**

SPONSOR  
**Xinova**

Design, build, and test of a system for live content tracking of physical shopping carts, giving brick-and-mortar stores the same level of real-time consumer analytics afforded by online shopping.

PLACEMENT **1**

**EE**  
**448/449**

## Machine Vision System for Optical tracking of a Laser Power Beaming System

CONTACT  
**chizeck@uw.edu**

FACULTY ADVISERS  
**Howard J. Chizeck, Arka Majumdar**

STUDENTS  
**Issac Huang, Qingrou Deng, Chenglong Li**

SPONSOR  
**Powerlight Technologies**

Development of an optical tracking system to enable laser aiming for a laser powered aircraft.

PLACEMENT **29**

**EE**  
**497/498**

## Video Analytics of Pedestrian Traffic using Deep Neural Networks

CONTACT  
**arka@uw.edu**

FACULTY ADVISER  
**Arka Majumdar**

STUDENTS  
**Chang Li, Jiwei Wang, Jiachen Zou**

SPONSOR  
**Sound Transit**

Development of a system for real-time pedestrian counting in Light Rail stations using image-based object detection methods.

PLACEMENT **2**

## EE 497/498

CONTACT  
**denisew@uw.edu**

SPONSOR  
**Deako**

PLACEMENT **4**

## Scalable Quality Control with Machine Vision for Home Smart Lighting Systems

FACULTY ADVISER  
**Denise Wilson**

STUDENTS  
**Yang Zheng, Steven  
Huang, Radleigh Ang**

Design, build, and test of an automated, scalable quality control system for smart lighting systems, ready for factory floor implementation.

## EE 497/498

CONTACT  
**bruced@uw.edu**

SPONSOR  
**Millennium Space  
Systems**

PLACEMENT **8**

## Spacecraft Radio Receiver Signal Detector

FACULTY ADVISER  
**Robert Bruce Darling**

STUDENTS  
**Daniel Huynh, Nathan  
Thai, Nathan Hirsch**

Design, build, and test of a low-power system that detects a radio frequency signal and wakes up the primary radio receiver on a satellite.

## EE 497/498

CONTACT  
**ksreeram@uw.edu**

SPONSOR  
**BGI**

PLACEMENT **5**

## A Smartphone Voice-Command Query App for Your Genetic Report

FACULTY ADVISER  
**Sreeram Kannan**

STUDENTS  
**Bassam Halabiya  
Halabiya, Zhengjie Zhu,  
Sachi Verma**

Development of an Android app using natural language processing to process a user's genetic report and communicate with him/her in a chat format.

## EE 497/498

CONTACT  
**hwang@uw.edu**

SPONSOR  
**Volvo**

PLACEMENT **10**

## Portable Platform for Image/Video Annotation

FACULTY ADVISER  
**Jenq-Neng Hwang**

STUDENTS  
**Sujie Zhu, Max Pfeiffer,  
Yuanxin Wang**

Development of a portable annotation platform for images and videos captured by a vehicle camera system.

## EE 497/498

CONTACT  
**anantmp@uw.edu**

SPONSOR  
**Intellectual Ventures**

PLACEMENT **7**

## High Throughput Droplet Scanning for Limited Resource Bacterial Infection Monitoring

FACULTY ADVISER  
**M.P. (Anant) Anantram**

STUDENTS  
**Meejin Moon, Qinghao  
Meng, Yueyang Cheng**

Development and testing of peak detection algorithms for counting the number of bacteria-infected droplets in a high-throughput infection scanning system.

## EE 497/498

CONTACT  
**shlizee@uw.edu**

SPONSOR  
**UW Electrical  
Engineering**

PLACEMENT **11**

## Crowd Sensing

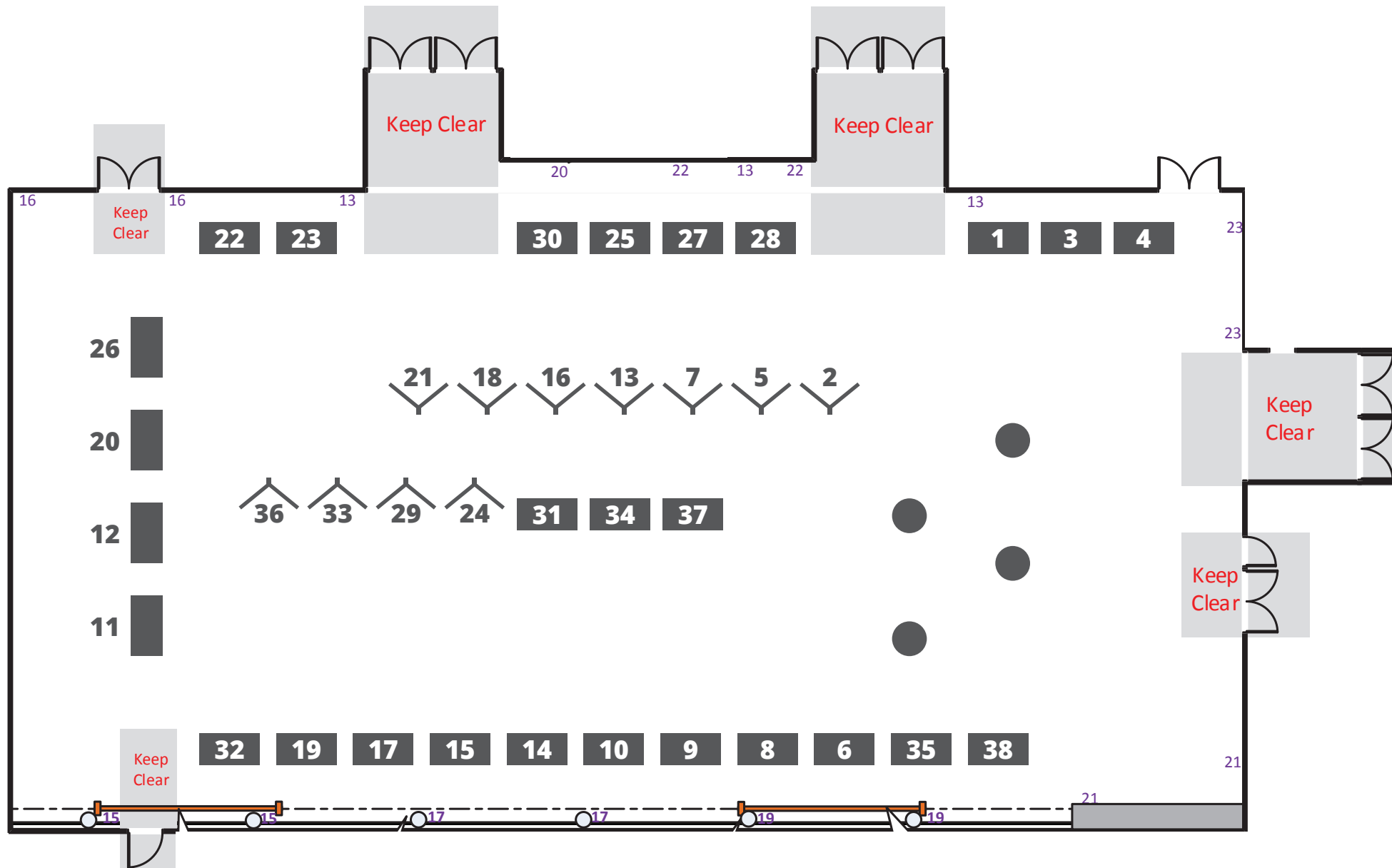
FACULTY ADVISERS  
**Eli Shlizerman,  
Jeff Riffell**

STUDENTS  
**Yiyu Feng, Mihir Modi,  
Vinh Nguyen**

Design, build, and test of a portable and low cost air quality monitoring device for everyday use.

# PROJECT LOCATIONS

## North Ballroom



**EE**  
**497/498**

## Utility Data Collection, Monitoring and Analytics System

CONTACT  
**zhangbao@uw.edu**

FACULTY ADVISER  
**Baosen Zhang**

STUDENTS  
**Zihao Tao, Ryan Linden,  
Sixiang He**

SPONSOR  
**Tupl**

Development of a data collection, monitoring and analytics web application for utility data for easy visualization and discovery of problems associated with readings.

PLACEMENT **12**

**EE**  
**497/498**

## Device-to-Device (D2D) Offline Communications App

CONTACT  
**jar7@uw.edu**

FACULTY ADVISER  
**James A. Ritcey**

STUDENTS  
**Ethan Tarr, Walker  
Kasinadhuni, Abdulkader  
Katanani**

SPONSOR  
**M87**

Development and testing of a Wi-Fi Direct app on smartphones to allow them to communicate with each other without being online.

PLACEMENT **16**

**EE**  
**497/498**

## Cloud Based Machine Learning Portable Inference Models Using NeoPulse AI Studio

CONTACT  
**blake@uw.edu**

FACULTY ADVISER  
**Blake Hannaford**

STUDENTS  
**Griffin Wu, James Guo**

SPONSOR  
**DimensionalMechanics**

Development of a cloud based platform that simplifies machine learning; using AI to build AI.

PLACEMENT **13**

**EE**  
**497/498**

## Wearable Heart Rate Monitor

CONTACT  
**bruced@uw.edu**

FACULTY ADVISER  
**Robert Bruce Darling**

STUDENTS  
**Denis Jivaikin, James  
Goin, Camila Palacio**

SPONSOR  
**Oculus**

Design, build, and test of a wearable device to be worn on or around the facial region, specifically around the head or neck, to measure and monitor the user's vitals.

PLACEMENT **17**

**EE**  
**497/498**

## Web Platform for Management of Data Science as a Service

CONTACT  
**paymana@uw.edu**

FACULTY ADVISER  
**Payman Arabshahi**

STUDENTS  
**Emi Harada, Alex Castro,  
Haobo Zhang**

SPONSOR  
**Sonos**

Development of a data science web platform to enable rapid scripting, data analytics, and data categorization.

PLACEMENT **14**

**EE**  
**497/498**

## RF Fingerprinting Using OneRadio MVP Platform

CONTACT  
**jdsahr@uw.edu**

FACULTY ADVISER  
**John D. Sahr**

STUDENTS  
**Alex Finestead,  
Jesse Yang**

SPONSOR  
**OneRadio**

Development of a system for algorithmically determining the identity of a radio frequency transmitter using a software defined radio platform.

PLACEMENT **18**

**EE**  
**497/498**

## A Platform for Evaluating the Benefit of Virtual Travel for Clinical Conditions (Alzheimer's or Pain Management)

CONTACT  
**paymana@uw.edu**

FACULTY ADVISER  
**Payman Arabshahi**

STUDENTS  
**Niveditha Kalavakonda,  
Pinzhu Qian, Jamie Santos**

SPONSOR  
**Booz Allen Hamilton**

Development of a virtual reality EEG system to study the potential of virtual travel for Alzheimer's prevention.

PLACEMENT **19**

**EE**  
**497/498**

## Wirelessly Powered Left Ventricular Assist Device (LVAD)

CONTACT  
**jrs@cs.uw.edu**

FACULTY ADVISER  
**Joshua R. Smith**

STUDENTS  
**Thaolam Ngo, Cloe Lee,  
Tin-tin Patana-anake**

SPONSOR  
**UW Electrical Engineering**

Design, build, and test of a wireless power system for left ventricular assist devices for heart disease patients.

PLACEMENT **22**

**EE**  
**497/498**

## Wearable Medical Device for Bladder Volume Monitoring

CONTACT  
**tcchen@uw.edu**

FACULTY ADVISER  
**Tai-Chang Chen**

STUDENTS  
**Harshit Kyal, Liwen Zeng,  
Olivia Nelson**

SPONSOR  
**Verathon**

Design, build, and test of a wearable bladder monitor that allows for patient mobility, enables continuous bladder monitoring, and provides smartphone alerts.

PLACEMENT **20**

**EE**  
**497/498**

## A Smart Light Trap for Zooplankton Monitoring

CONTACT  
**lylin@uw.edu**

FACULTY ADVISER  
**Lih Lin**

STUDENTS  
**Elizabeth Zhang, Edmund  
Trinh, Yu-Hao Cheng**

SPONSOR  
**NOAA**

Design, build, and test of a smart light trap using an underwater camera system for capturing and imaging zooplankton species.

PLACEMENT **25**

**EE**  
**497/498**

## Advanced Driver Assistance Systems Radar Blindspot Monitoring

CONTACT  
**mamishev@uw.edu**

FACULTY ADVISER  
**Alexander Mamishev**

STUDENTS  
**Matthew Lee, Jerrold  
Erickson, Yi-Ting Tsai**

SPONSOR  
**Daimler**

Development of a video analysis system to enhance the detection performance of truck mounted radar systems, specifically addressing issues with radar blindspots.

PLACEMENT **21**

**EE**  
**497/498**

## Industrial Wireless Network

CONTACT  
**jkp@uw.edu**

FACULTY ADVISER  
**James K. Peckol**

STUDENTS  
**Mitchell Orsucci, Tiffany  
Luu, Nesta Isakovic**

SPONSOR  
**Fluke**

Development and rollout of an internet connected network of 100 wireless nodes for industrial applications.

PLACEMENT **28**



**EE**  
**497/498**

## Using RAIN (RFID) to Locate a Lost Person

CONTACT  
**jcrudell@uw.edu**

FACULTY ADVISER  
**Jacques "Chris" Rudell**

STUDENTS  
**Marcus Deichman, Ben Nguyen, Megan Swanson**

SPONSOR  
**Impinj**

In a contained setting like an amusement park, our project uses Impinj's RAIN (RFID) technology to provide a faster and more efficient way to locate a lost person.

PLACEMENT **30**

**EE**  
**497/498**

## Root Cause Analysis and Streaming Prediction of Call KPIs in Call Center Based on Transcription and Voice Features

CONTACT  
**shlizee@uw.edu**

FACULTY ADVISER  
**Eli Shlizerman**

STUDENTS  
**Titus Berndt, Kevin Hsu, Ricky Zhang**

SPONSOR  
**Spoken Communications**

Development of machine-learning models for customer-service representatives to predict a call's duration within its first minute.

PLACEMENT **34**

**EE**  
**497/498**

## Car Repositioning System for Staff, Users, and Autonomous Vehicles

CONTACT  
**sburden@uw.edu**

FACULTY ADVISER  
**Samuel Burden**

STUDENTS  
**Yaying Huang, Nguyen Lai**

SPONSOR  
**BMW ReachNow**

Development of a system to predict car demands based on various parameters (hour of day, day of week, day of month, weather, coordinates) to enable optimum car relocation and repositioning.

PLACEMENT **32**

**EE**  
**497/498**

## 6LoWPAN HTTP Client-Server

CONTACT  
**ksreeram@uw.edu**

FACULTY ADVISER  
**Sreeram Kannan**

STUDENTS  
**Pezhman Khorasani, Ran Wei**

SPONSOR  
**Kirio**

Development of a low-power wireless client-server system for smart home connected devices and sensors.

PLACEMENT **36**

**EE**  
**497/498**

## Cancer Medical Record Time Slicer and Classifier

CONTACT  
**paymana@uw.edu**

FACULTY ADVISERS  
**Payman Arabshahi, Arindam K. Das**

STUDENTS  
**Cece Landau, Kevin Lau, Alexander Kasiniak**

SPONSOR  
**All4Cure**

Development of a machine learning system to capture and learn from the experiences of patients with myeloma, and using the gained knowledge to predict patient response to treatments.

PLACEMENT **33**

**EE**  
**497/498**

## Interactive Spectrum Management Tool

CONTACT  
**sroy@uw.edu**

FACULTY ADVISER  
**Sumit Roy**

STUDENTS  
**Fizza Aslam, Daniel Tran**

SPONSOR  
**T-Mobile**

Development of an interactive web tool that provides information on current state of FCC wireless spectrum bands including current and future band allocations.

PLACEMENT **37**

# EE 497/498

## Pothole Detection Using Smartphones

CONTACT  
**manisoma@uw.edu**

FACULTY ADVISER  
**Mani Soma**

STUDENTS  
**B. Kevin Ramada, Sam Shen, Jeremy Liem**

SPONSOR  
**Uber**

Development of an iOS application for geolocated pothole detection while driving a car, and creation of a citywide heat map of potholes.

PLACEMENT **38**

# CSE 548

## Multi-Issue Risc-V Micro-processor Based on Ariane

CONTACT  
**prof.taylor@gmail.com**

FACULTY ADVISER  
**Michael B. Taylor**

STUDENTS  
**Gaohong Liu, Yongqin Wang**

SPONSOR  
**UW Computer Science and Engineering**

Development of an enhanced multi-issue and out of order microprocessor based on the Ariane RISC-V, which is a single issue and in order microprocessor.

PLACEMENT **23**

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# PATRONS OF ENTREPRENEURSHIP



For UW alums Milton "Milt" and Delia Zeuschel, education and entrepreneurship are lifelong passions. Milt received his BSEE in 1960 and went on to found five companies, three of which — Zetec,

Data I/O Corp. and Zetron, Inc. — were met with resounding success. After receiving her bachelor's from the College of Education in 1958, Delia entered a career as a teacher. To support education of the next generation of entrepreneurs, the Zeuschels have made an important endowment to the Department of Electrical Engineering.

### SUPPORTING ENGINE

The first portion of the Zeuschels' endowment went to support ENGINE, UW EE's Entrepreneurial Capstone Program. Capstone projects have always been an important part of an electrical engineering education, but students who enroll in ENGINE get the significant advantage of mentorship from engineering professionals and a focus on project management and project development. This real-world focus was important to Milt Zeuschel. "Over the years, I learned a lot of what to do and what not do to run a company," Zeuschel said. "A lot of new engineers think that solid engineering sells a company. But it's more than that. To be successful, you need to create a product that sells to the customer and that the customer is willing to pay for. Having interactions early on in your education about all that it takes is key."

### PROMOTING ENTREPRENEURIAL EXCELLENCE

In December 2017, UW EE Professor Josh Smith was named the first Milton and Delia Zeuschel Professor for Entrepreneurial Excellence. In his research, Smith has an affinity for developing groundbreaking technologies — his group revealed a prototype for a battery-less cell phone in the summer of 2017. As an entrepreneur, Smith and students from his lab have spun off many start-up companies over the years: WiBotic, Jeeva Wireless and eLoupes to name a few.

Of the partnership with Milt and Delia, Professor and Chair Radha Poovendran said, "We are very grateful for the Zeuschels' contributions to UW EE. This gift will not only be a significant resource to our students; it will also give back to the university as a whole and to the State of Washington."

Top left—Milt and Delia Zeuschel at the investiture of Josh Smith (left) as the first Milton and Delia Zeuschel Professor for Entrepreneurial Excellence.

Below—Milt and Delia Zeuschel visit Josh Smith's lab with Professor and Chair Radha Poovendran (front left).





**Innovation  
starts here.**



**ELECTRICAL ENGINEERING**  
UNIVERSITY *of* WASHINGTON

