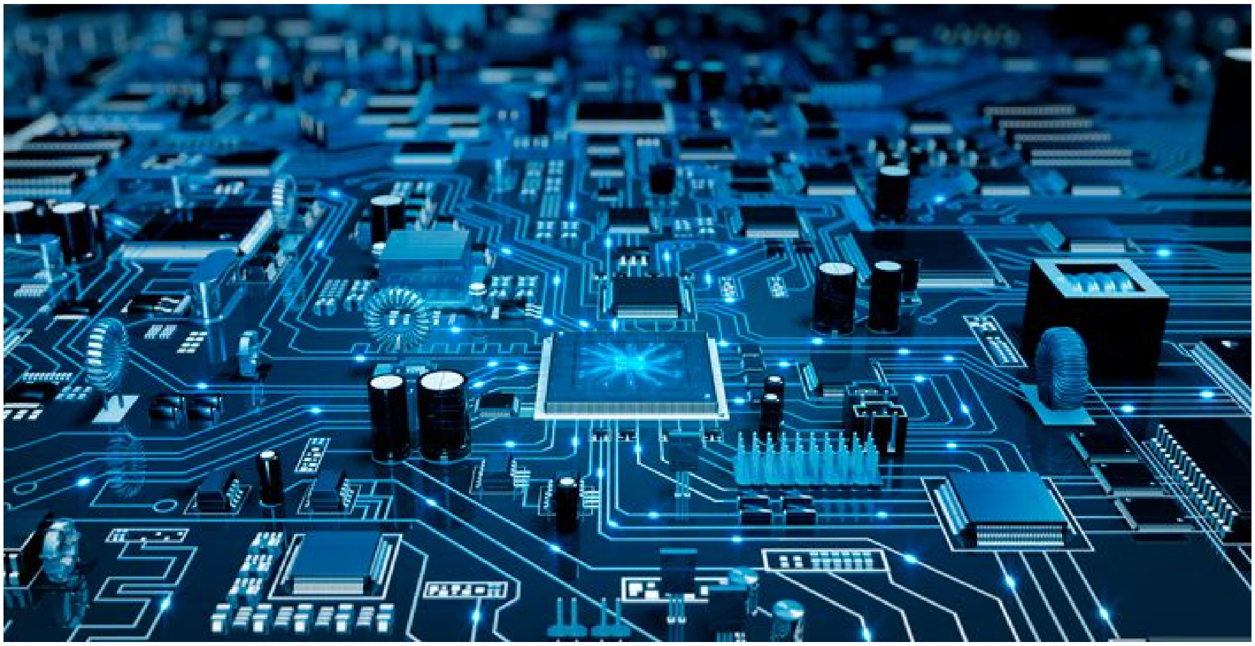

University of Hawaiʻi at Mānoa
Department of Electrical Engineering presents the Fall 2018

EE 496 Poster Session

Thursday, December 6, 2018
9:00 a.m. – 11:00 a.m.
Campus Center Ballroom

UNIVERSITY of HAWAIʻI MĀNOA

College of ENGINEERING
UNIVERSITY OF HAWAIʻI AT MĀNOA

About the EE 496 Poster Session

EE 496 is an advanced level design project that integrates the design content of previous courses under the supervision of a faculty advisor. This capstone project gives students exposure to what they will see in engineering industry with opportunities to develop teamwork and leadership skills, solve real-world problems and needs, and become self-directed learners.

The posters presented today represent the work of a semester or more on a project of the student's choice. Each project must satisfy realistic constraints including reliability, safety, and economic feasibility, and must incorporate consideration of the environmental, ethical and societal aspects, among others. In addition to the poster session, EE 496 students deliver a total of 30 minutes of oral presentation and complete writing intensive assignments of a minimum of 4,000 words during the semester.

The Department of Electrical Engineering within the College of Engineering at the University of Hawaiʻi at Mānoa is proud to showcase our student's achievements. Their work demonstrates a willingness to meet the challenges of the future with knowledge, skill, and drive.

Projects:

1. Environmental Sensor Network Nodes
2. Unity Game Development
3. Dielectric Response in Graphene Transistor
4. The Polarization of Information on the Web
5. 'Ike Wai
6. WIP: Sustainable Environmental Sensor Network
7. Dynamic Projection Mirror
8. Proximal Service Activation with Beacon Technology
9. UAV Image Processing and Object Detection/Classification
10. Applying liquid-metal spraying to flexible electronics
11. The Spread of News
12. Drone Security and Applications
13. Model Based Systems Engineering Applied to Neutron-1 CubeSat
14. DuckieTown: Hardware/Communication
15. Duckietown: Vision Processing
16. Precision Delivery Drone
17. Autonomous Aerial Drop and Ground Delivery
18. Noninvasive Blood Pressure Monitoring
19. Smart Campus Energy Lab (SCEL)
20. Microbotics: Automated System Control
21. Renewable Energy Design Modular Energy Kit
22. Droplet Generation
23. Microbotics: Hydrogels
24. Automated Sprinkler Control System
25. UHABS6
26. DiElectric Measurement team
27. Unique Subject Identification using Doppler Radar and Machine Learning

Project Number: 1

Environmental Sensor Network Nodes

Work-in-progress (WIP)

Author(s)

Clyde Felix (ENGR 396), Emily Kane (EE496), Emily Lum (EE496)

Objective

The objective of the Environmental Sensor Network Nodes project is to improve hardware of the third generation module and produce low-power, low-cost, reliable environmental sensor modules that can be reproduced for mass deployment across the University of Hawaii at Manoa campus.

Abstract

The objective of this project is to improve the hardware of the third generation weatherbox modules by increasing functionality, data reliability, and ease of use. The current (4th) generation has the added components of a real time clock and GPS, which will be useful for tracking and organizing data when the node network is implemented. Once a weatherbox module is deployed, it is to be a self-sustaining device that provides meteorological data for an extended period of time. We have debugged and deployed one sensor module to the roof of Holmes Hall. Data that is collected from these boxes will assist in planning future renewable energy installations as well as providing data to be used in forecasting.

Advisor(s)

Dr. Anthony Kuh

Project Number: 2

Unity Game Development

Work-in-progress (WIP)

Author(s)

Sean Teramae (EE 496), Riley Cammack (EE 496), Barry Abe (EE 496)

Objective

To delve deeper into the intricacies of game development, project management, and to garner practical professional skills.

Abstract

The Unity Game Development project is aimed at honing practical professional skills to better prepare students for a career in software engineering. Unity is a popular industry tool for creating great media experiences. This semester, the project team created multiple mini games and one machine learning game to showcase the power of the Unity engine. A website was also created to highlight the progress the team has made and to distribute the completed game once development has ceased. By completing this project, the team has garnered practical skills and experience that will aid in the software engineer interviewing process.

Advisor(s)

Dr. Galen Sasaki

Project Number: 3

Dielectric Response in Graphene Transistor

Final Results

Author(s)

Matthew Chun (EE 496), Melaureen Sato (EE 496), Shane Teig (EE 496)

Objective

The project objective is to test dielectric response of various materials for purposes of acting as a gate in a graphene transistor.

Abstract

The goal of this project is to design, test, and analyze response of dielectric material when used in a graphene transistor. Our means of evaluating performance requires a smooth, controllable transition from a nonconducting transistor with very little to no current flow from our designated source to drain (off) to a conducting transistor allowing current flow from our designated source to drain(on). In addition, we also performed a subjective assessment of the material physical response to the applied voltage regarding how resilient the material is to applied voltage in our test environment. We also perform a limited analysis of cost, environmental impact of materials used, as well as concerns for use and storage of materials.

Advisor(s)

Dr. David Garmire

Project Number: 4

The Polarization of Information

Work-in-progress (WIP)

Author(s)

Thomas Moriyasu, Casey Ibara, Tyler Matsunaga, Kyle Nakanishi, Sheri-Lynn Hirota, Robin Matutina, Rudy Julian, Victoria Soto, Jason Marcos, Lauryn Corpuz

Objective

The objective of this study is to develop a method to quantify the polarity of opinions and information being shared over the web.

Abstract

Many would agree that groups of society are forming increasingly polarized opinions on topics, leading to disagreements over even factual details. The objective of this study is to develop a method to quantify this intuition. An understanding of the polarization of information on the web could be used to help policy makers identify matters of controversy or agreement to better serve their constituents.

The primary focus of this project is to develop a working system for the network of information and opinions on Twitter. We have implemented a data driven approach to modeling the network of tweets with an undirected weighted graph using a feedback loop which applies a state of the art clustering algorithm that was developed in house at UH Manoa's Big Data lab and classical machine learning techniques. Communities of the resulting network are identified and the polarization is then calculated using graph metrics.

We are expecting the system to analyze multiple topics of discussion on Twitter and have the identified communities and polarity calculations be aligned with our intuitions. Future work on this project will be to incorporate more features into the methods for building and weighting the network of information.

Advisor(s)

Narayana Santhanam

Project Number: 5

Ike Wai

Work-in-progress (WIP)

Author(s)

Tamra Oyama (grad student), Jie Zhou (grad student), Charles Wolstein (496), Brianne Tengan (496), Coleson Costales (496), Cyrus Noveloso (496), Nick Whitcomb (296), Kayla Kwock (499), Logan Oyama (296), Teejay Jacalne (499), Huy Nguyen (396), Micah Shigeta (396), Mark Ayap (396), Dane Kaneshiro (396), Matthew Chan (496), Alex Noveloso (396)

Objective

ʻIke Wai is a collaborative project between numerous STEM disciplines to monitor, analyze, and sustain the quality of water throughout the Hawaiian Islands. The objective of this project is to remotely monitor the water quality in a well in an affordable manner. The UH Manoa team is managed by Dr. David Garmire and mentored by Tamra Oyama and Jie Zhou.

Abstract

Hawaii's groundwater is vital to its future, as water security affects all life. A common testing method used by the Honolulu Board of Water Supply requires a team to collect water samples from a test site and analyze them in a laboratory, which is time-consuming and expensive.

The students are currently developing a water monitoring system called the Downwell Remote Operated Platform (DROP) module, containing three design modules: Chassis, Sensors, and Software. The Chassis team is developing a chassis which must not only house the entire unit, including the solar panel, battery, and electronics, but also lower the Sensor Module into the well. Using a Raspberry Pi Zero W, the Software team is developing the code to control the chassis motor, collect sensor data using I2C, and upload the information to an online database. The Sensor team is developing a water-monitoring module that monitors temperature, water flow direction, bio-contaminants, and salinity. Salinity is monitored indirectly using a conductivity sensor made from polymer-based resistors created in the lab. Although the system's prototype is nearly complete, the students are constantly seeking to improve the current system in both performance and cost using methods like 3D printing to expedite the development of revisions.

Advisor(s)

David Garmire, Anupam Misra

Project Number: 6

WIP: Sustainable Environmental Sensor Network

Work-in-progress (WIP)

Author(s)

Josh Renzo Claudio (EE496), Andrew Obatake (EE496), Mark Cacal (EE496)

Objective

To design, fabricate, program, and deploy an environmental sensor module whose data will be used to optimize future renewable energy installations.

Abstract

In 2014, the Hawaii legislature set up a plan to transition the entire state to 100% renewable energy by the year 2045. This plan inspired UH Manoa to create the Smart Campus Energy Lab (SCEL). The current goal of SCEL is to design, fabricate, program, and deploy an environmental sensor network whose data will be used to optimize future renewable energy installations on campus. The lab has coined the term “weatherboxes” as the name of these sensor modules. Traditionally, SCEL has been doing this by employing the use of the ATmega series of microcontrollers as the heart of these weatherboxes. The objective of this specific team is to design a newer generation of weatherboxes that utilize the ARM Cortex line of microcontrollers to extend the capabilities of the weatherboxes. As of the time of writing this abstract, the breadboard-based sensor module can successfully pull data such as temperature, pressure, humidity, and solar irradiance and successfully transmit the data wirelessly to the SCEL server. In addition to this, the new weatherbox has the added functionality of acting as a range extender for existing weatherboxes. Problems in the parts ordering process has delayed the fabrication of a PCB-based weatherbox.

Advisor(s)

Dr. Anthony Kuh

Project Number: 7

Dynamic Projection Mirror

Final Results

Author(s)

Dawei Yang

Objective

To design a dynamic projection mirror for Ambient Lab. The mirror can move rapidly or slowly to redirect the projection on any surface.

Abstract

Virtual Reality provides excellent participatory experience to users. However, users cannot get rid of VR headsets that are expensive and inconvenient. One low-cost and efficient substitution is environment mapping (reflection mapping). It is a technique for approximating the appearance of a reflective surface by means of a precomputed texture image. The dynamic projection mirror is the heart of this system. The aim of this project is to design a high-level performance device that guarantees accuracy and is compatible with most projectors. With two high resolution steppers, the movement accuracy is approximately 0.056° in both pan mode and tilt mode. A Raspberry Pi is used as a controller. It adopts Zeroconf protocol, so any interconnected node can communicate with it conveniently. It ensures that the defined points in room is projected at the right time with the right image.

Advisor(s)

Dr. Darren Carlson

Project Number: 8

Proximal Service Activation with Beacon Technology

Work-in-progress (WIP)

Author(s)

Sheri-Lynn Hirota (EE 496), George Agustin (EE 396)

Objective

Explore and test application capabilities of Estimote location beacons for proximal service activation.

Abstract

The main purpose of this project is to utilize Estimote location beacons to activate services on a mobile device with range detection. Understanding the android applications of beacon technology is the first step for future implementation with different interfaces (e.g. Projection-mapped augmented reality, real-time indoor location mapping). After prototyping test apps using Android Studio, we would like to implement this technology in the Ambient Lab.

Advisor(s)

Dr. Darren Carlson

Project Number: 9

UAV Image Processing and Object Detection

Work-in-progress (WIP)

Author(s)

Mace Kanda-Matsumoto (EE 496), Glen Barcelo (EE 496)

Objective

Our objective is to be able to identify and classify objects of interest outside using drones without human identification using image processing and object detection.

Abstract

Unmanned Aerial Vehicles (UAVs) are aircrafts that don't require human pilots to operate. We hope to replace manual human inspection of media with UAVs able to identify and classify objects using image processing and object detection from remote locations. Using Convolution Neural Networks trained from our datasets, we were able to identify and isolate objects of interest using object detection.

Advisor(s)

Yingfei Dong

Project Number: 10

Applying liquid-metal spraying to flexible electronics

Work-in-progress (WIP)

Author(s)

Sasha Yamada (ENGR 496), Cathrin McCaghren (ENGR 396), Janet Ng (ENGR 296)

Objective

Expand upon previous characterizations of the liquid-metal spraying technique, and applying the technique to create a functioning flexible device.

Abstract

This project presents progress in characterizing “liquid-metal spraying”– a technique to deposit films of liquid metal using an airbrush– and preliminary results for a flexible tactile sensor fabricated using the same technique. Liquid-metal spraying has already been established in literature and the results presented here build upon previously published characterizations. One way that this work expands upon previous results is by investigating whether the addition of single-wall carbon nanotubes to liquid metal can increase the conductivity. The liquid-metal spraying technique is also applied to create a flexible tactile sensor, demonstrating its viability for rapid prototyping.

Advisor(s)

Dr. Aaron Ohta, Dr. Wayne Shiroma

Project Number: 11

The Spread of News

Work-in-progress (WIP)

Author(s)

Rodolfo Julian, Michael Rodriguez (Graduate Student)

Objective

The main objective of this project is to analyze the spread and the mutation of of news over time by web scraping and analyzing data collected from different media websites.

Abstract

This project is in conjunction with graduate student Michael Rodriguez and involves researching the mutation and spreading of news over time. This idea of “Fake News” is an idea that news outlets or media outlets slowly spew out false information or modify information and allow such articles into the public. The goal is to show that there are mutations of news as it spreads over time. This research involves the use of Twitter’s API to help pull data and using Python to help web scrape and gather information to help with the different types of analysis. Some of the topics that are brought about in this research and are still a work in progress are trying to find correlations between tweet length versus the number of retweets and finding correlations between tweet time versus the number of retweets. In conclusion, the results of this project are still a work in progress and methods are still being developed to either prove or disprove the mutation of news over time.

Advisor(s)

Dr. June Zhang

Project Number: 12

Drone Security and Applications

Work-in-progress (WIP)

Author(s)

Hongliang Lin (EE 496), Zhiqiang Shi (EE 496)

Objective

Learn the basis of USA in both hardware and software aspects and secure both the system and applications in various ways.

Abstract

The rapid growth of the use of UAS in technology area made us aware of the safety of its security field. We started by learning the basic skills with the open-source software and hardware, and tried to find ways to secure its system and related applications in different aspects. Such as identifying the different areas of the drone network traffic data while during communication, and compare some of the obvious patterns in the existing data library and make a conclusion such as the type of drone, the meaning of the pattern in different byte range. Progress are being made by collecting the data using scripts and observing the patterns to obtain more known types of patterns and add to the existing library. More deeper research will be done to add more known patterns to library and other security methods will take into account such as ways to attack the UAS data and prevent such action being done to drone.

Advisor(s)

Yingfei Dong

Project Number: 13

Model Based Systems Engineering for Small Satellites

Work-in-progress (WIP)

Author(s)

Michelle Masutani

Objective

Convert the Neutron-1 Cubesat mission from document based to model based systems engineering approach. Document this process as a tutorial for new and future users.

Abstract

Model based systems engineering (MBSE) is an emerging approach to systems engineering. MBSE uses models instead of documentation to support system requirements, design, analysis, verification, and validation activities. The model based approach allows for reusability and higher levels of abstraction. The Hawaii Space Flight Laboratory currently manages Neutron-1 through documents. This project aims to convert Neutron-1 to MBSE and document the process to combat the steep learning curve for new and future users. First, I researched MBSE methodology and System Modeling Language concepts. I obtained a license for Cameo Systems Modeler from NoMagic. Next, I coordinated with an expert from International Council on Systems Engineering and Object Management Group to learn how to use their generic CubeSat Reference Model. I developed the following step-by-step MBSE process with their assistance: establish stakeholders, establish requirements, define behaviors, define structures, and connect the models to parametric and simulation software. Currently, I am on the second step of the process, populating the model with Neutron-1 stakeholder requirements through live lessons with the expert. Documentation of the entire conversion process is being recorded and formatted as a tutorial on Google Docs for accessibility. Further steps will be completed in future semesters.

Advisor(s)

Miguel Nunes

Project Number: 14

DuckieTown: Hardware/Communication

Work-in-progress (WIP)

Author(s)

Akira Vernon, Arnold Shek, Charles Rafael

Objective

To design and build a platform with autonomous robotic "ducks" that utilizes vision processing techniques to navigate through a town as a means of emulating autonomous vehicles.

Abstract

Automation is a means for increasing efficiency and eliminating human error. This is especially true on public roadways as lapses in judgement and human reaction time can lead to otherwise avoidable traffic congestion. Duckietown is a platform containing small autonomous robotic vehicles that we call ducks. The ducks are equipped with a Raspberry Pi, motors, and a Pi camera with the objective of simulating small scale vision-based autonomous vehicles. This subgroup within Duckietown focuses on hardware/communication. A power breakout board was designed using Eagle CAD and camera mounts were designed using AutoCAD then 3D printed. Additionally, MQTT (Message Queuing Telemetry Transport) was implemented as a communication protocol between a host computer and the ducks themselves. A GUI (Graphical User Interface) was also implemented allowing for commands to be sent to the duck and for the ducks to send back data and video feeds. In the near future, every automobile will be autonomous and with this project, we hope to further explore and understand the benefits of the emerging autonomous vehicle industry.

Advisor(s)

Tep Dobry

Project Number: 15

Duckietown: Vision Processing

Work-in-progress (WIP)

Author(s)

Kyle Chan (EE496), Andy Chu (EE496), Jonathan Lau (EE496), Anthony Martin (EE496)

Objective

To design and build autonomous vehicles (ducks) that utilize image processing techniques to navigate through a town while obeying traffic laws.

Abstract

Automation is a powerful tool to increase efficiency and eliminate human error. This is especially true on public roadways as lapses in judgement and human reaction time can lead to otherwise avoidable traffic congestion. Duckietown is a platform for simulating small-scale vision-centric autonomous vehicles. Python scripts were written on a RaspberryPi to apply image processing techniques on a live video feed. Specifically, we utilized Hough Transforms for lane detection to ensure the vehicle remained on course. Additionally, Local Binary Patterns were supplemented with Support Vector Machines to train a classifier which identifies objects such as road signs and traffic lights. This information was then piped into actuator control loops to drive DC motors. By incorporating these techniques, we were able to create an autonomous robot which was capable of traversing our scaled-down town by following traffic laws. While this project is still a work in progress, we hope to expand this platform to accommodate more autonomous vehicles around the town.

Advisor(s)

Tep Dobry

Project Number: 16

Precision Delivery Drone

Work-in-progress (WIP)

Author(s)

Evan Kawamura (EE 499), David Harris (EE 496), Grace Hayashi (EE 496), Matthan Mejia (EE 496), Cole Jamila, (ENGR 196), Edmond Chong (ENGR 296), Brandon Hewitt (ENGR 296), Jason Chan (ENGR 396), Malorie Valmoja (ME 481), Kaita Tsuchiya (ME 481), Sean Osurman (ME 481), Dagan DeWeese (ME 481), Lauryn Pang (ME 481), Christian Rieta (ME 481), Aesha Higashi (ME 481), Michael Shibata (ME 481)

Objective

The objective of this EE 496 project is to develop a system capable of precision delivery of a payload onto a maritime platform with a fixed-wing unmanned aerial vehicle.

Abstract

High precision payload delivery from a fixed-wing unmanned aerial vehicle enables the possibility of missions involving emergency supply deliveries, food resupply, or sensor deployment. UHDT will be designing, testing and presenting a fully functional system. The project reviews the overall system architecture and goes into specifics on the components of the electronics and communications system. Related works discussing precision landing and delivery were researched with the goal of determining a viable delivery method. This UAV system will consist of 3 top level subsystems. The aircraft subsystem is responsible for determining the airframe, payload placement, and propulsion system required of completing the mission. The delivery subsystem is responsible for determining the most effective delivery method and analyzing the physics influencing the delivery method. The electronics subsystem is responsible for determining the electronics of the flight system including the control and communication electronics. Future research into the integration and testing phases are discussed with the goal of achieving autonomous operations.

Advisor(s)

Dr. Wayne Shiroma, Dr. Zachary Trimble

Project Number: 17

Autonomous Aerial Drop and Ground Delivery

Work-in-progress (WIP)

Author(s)

Grace Hayashi (EE 496), Justin Pagtolingan (EE 496), Aaron Villanueva (EE 496), Jaymark Ganibi (EE 496), Austin Haigh (EE 496), George Manolakis (EE 496), Huy Lam (EE 496), Malorie Valmoja (ME 481), Dimitrios Nicholas (ME 481), Brandon Chau (ME 481), Patrick Gasman (ME 481), Kaulike Sibayton (ME 481), Keola Wong (ENGR 396), Spencer Young (ENGR 396), Ryan Li (ENGR 396), Kurt Tanaka (ENGR 296), Eliesse Hihara (ENGR 296), Creselle Morales (ENGR 296), Sydney Dempsey (ENGR 296), Johnson Huynh (ENGR 296)

Objective

The team's objective is to design and implement hardware and software within an Unmanned Aerial System (UAS) to simulate a care package delivery. This delivery consists of a precision aerial drop of a payload, and an aerial drop and driving of an Unmanned Ground Vehicle (UGV) to drop off another package.

Abstract

The U.H. Drone Technologies Competition team strives to gain a better understanding of drones by developing a UAS with real-world applications such as search and rescue or package delivery. Each year, the team works to accomplish this through the use of an image processing algorithm and adjustments to previous years' work in order to compete at an annual Student Unmanned Aerial Systems (SUAS) competition. This year, the object detection, classification and localization requirements of the competition will be achieved by enhancing the system's object detection, alphanumeric recognition, and color recognition to more accurately identify targets and their characteristics. This will be accomplished using a Convolutional Neural Network built on TensorFlow, the k-means color segmentation algorithm implemented with OpenCV in Python, and by calculating the GPS location of a target by capturing live telemetry data to be used in geotagging formulas. Additionally, adjustments to the aerial system include an improved PDB design, antenna tracking, and an upgrade to the existing on-board computer and GPS modules. Finally, with the addition of an Unmanned Ground Vehicle (UGV) to this year's competition mission, the electronics and communications subsystem will implement a brand new autonomous system in addition to the existing aerial system.

Advisor(s)

Dr. Wayne Shiroma, Dr. Zachary Trimble

Project Number: 18

Noninvasive Blood Pressure Monitoring

Final Results

Author(s)

Peiyi Kwok (EE496), Toni Graves (EE496), Austin Tanaka (EE 396)

Objective

The objective is to conduct noninvasive blood pressure monitoring using pulse transit time (PTT) with doppler radar and piezoelectric sensors.

Abstract

Blood Pressure is a common way to assess cardiovascular disease. The current noninvasive standard of monitoring blood pressure is using a blood pressure (BP) cuff that is uncomfortable and unable to continuously measure BP. There are many advantages of monitoring BP continuously, such as, sleep studies, observing hypertension medication effects and getting a better average of a person's BP to diagnose hypertension early. This project uses the pulse transit time (PTT) to determine BP with doppler radar and piezoelectric sensors. To calibrate PTT to BP, linear regression was used with varying mathematical models. During this project minimal data was collected and only in the resting position, therefore results may need further exploration. But our results do concur with other resources that PTT is definitely a promising method of continuously monitoring BP and should be studied further.

Advisor(s)

Olga Boric-Lubecke

Project Number: 19

Smart Campus Energy Lab (SCEL)

Work-in-progress (WIP)

Author(s)

Kenneth Lauritzen, Sawinna Huang, Rammell Transfiguracion (EE 396)

Objective

The objective of the Smart Campus Energy Lab (SCEL) is to create a network of sensors that will eventually collect meteorological data that will be used to create an energy system that will help save energy across the University of Hawaii at Manoa campus. In order to achieve this, SCEL plans to design, fabricate, and deploy weatherboxes on various rooftops across the campus. Deploying Weatherboxes across the campus will help the lab get a set of data readings to determine optimal places on campus to install photovoltaic panels.

Abstract

The objective of this project is to design and fabricate a fifth iteration of the Smart Campus Energy Lab's (SCEL) weatherboxes. The weatherbox system is designed to collect meteorological data from the rooftops of buildings across the University of Hawaii at Manoa (UHM) campus. This data will be used to help UHM implement ways of reducing energy consumption. Key characteristics that this iteration, dubbed "Guava", is different from the four previous iterations are updated sensors, increased battery capacity, and a more powerful microprocessor.

Advisor(s)

Anthony Kuh

Project Number: 20

Microbotics: Automated System Control

Work-in-progress (WIP)

Author(s)

Resha Engbino (EE 496), Matthew Salcedo (EE496), Marion Villanueva (EE 396), Neil Garcia (EE496), Fernand Collado (EE496)

Objective

Develop a user interface for the control of Microbots to be used to create organs for transplant. The Microbots are operated on a microscopic scale and these robots are controlled utilizing Red Tweezers in a software called LabVIEW.

Abstract

The main motivation for this project is to resolve the issues of the shortage of organ transplant donors across the world. The VIP team led by faculty advisor Dr. Aaron Ohta, are utilizing microbots to aid in the process of creating these organs. These microbots are controlled from a user interface in the program LabVIEW. The subgroup Automated System Control are given the task of improving the user interface for the microbots. The project at its current state is a work in progress, and is built around the program called Red Tweezers. Red Tweezers is a holographic software that displays these microbots on a workspace to help the user to control the robots. At its current state the program is able to move up to 12 microbots and is able to detect any object. The microbots are navigated using a combination of coordinates and angles to move the detected object whether they be a cell or a transport device. The project itself is still in the development on improving the user interface and further advancements is needed before testing with cells are to take place.

Advisor(s)

Dr. Aaron Ohta

Project Number: 21

Renewable Energy Design Modular Educational Kit

Work-in-progress (WIP)

Author(s)

Leivy Mae Micua (EE 496), Minami Morita (EE 396)

Objective

The objective of the project is to design an education kit for middle and high school students that will teach students basic electric analysis and programing. This kit will help encourage interest in these subjects along with renewable energy.

Abstract

Our goal for the project is to create a two part STEM kit that allows middle/high school students to learn about electrical engineering and renewable energy as well as its importance. This project will be a two semester project, with the first semester focusing on testing different STEM kits, while the second semester would focus on allowing high school students a deeper dive into electrical engineering. We plan on researching and listing standard curriculums that would work best with the kind of STEM kits that we are planning on designing. With the focus on teaching basic electronics and introducing renewable energy, we will create a worksheets and lesson plans accordingly. Our basic idea for the kits is to create an electrical system shaped as a house, with a solar panel, wind turbine, and an energy source (battery) attached. Once the first initial part of the system is created, we will then start creating a curriculum for students to learn how to program Raspberry pi's and Arduinos. We plan on putting together libraries for students to see and use with the arduino/Raspberry Pi's as well as with Part 1 of the kit.

Advisor(s)

Reza Ghorbani

Project Number: 22

Droplet Generation

Work-in-progress (WIP)

Author(s)

Kaiaka Kepa-Alama (EE 496), Brittney Whaley (EE 396), Carissa Nakao (EE 396), Nicholas Yama (EE 496)

Objective

The purpose of this project is to design, fabricate, and characterize a droplet-based microfluidic device capable of encapsulating single cells with PCR reagents for gene expression analysis.

Abstract

Droplet based microfluidics has shown promise as a powerful tool for biomedical research by providing a means of a high-throughput and high-resolution improvement to the traditional method of transcriptional cell assay. Such devices operate on the principle of suspending sub-milliliter volumes of fluid in a second immiscible fluid. The purpose of this project is to produce a device that will encapsulate individual cells into single aqueous droplets with PCR reagents which can then be broken and analyzed in large quantities. There are two main focuses: (1) the development of a design from theoretical modeling and (2) the fabrication and testing procedures of a physically implemented device.

Advisor(s)

Aaron Ohta

Project Number: 23

Microrobotics: Hydrogels

Work-in-progress (WIP)

Author(s)

Zero Wu(EE496), Benjamin Philavanh(EE496), Terry Pham(EE 396)

Objective

Create microrobots that can potential assist the manufacture of artificial organ that can be use for organ transplantation.

Abstract

Organ transplantation has always been on high demand, but due to shortages of organ supplies, alternate solutions had to be explored. Solutions such as artificial organs or man-made organs that can replace natural organs, have become a necessity. This subteam focuses on the production of hydrogel scaffolds with magnetic particles that may contribute to the creation of artificial organs. By using Microrobots, cells can be positioned in specific shapes, patterns, and orientations that potentially form artificial organs. The hydrogels will be controlled using a combination of laser and magnetism. This is accomplished through the manipulation of current in designed electromagnets and the heat generated by the laser, allowing the hydrogels to move in all 3-dimensions.

Advisor(s)

Dr. Aaron Ohta

Project Number: 24

Automated Sprinkler Control System

Work-in-progress (WIP)

Author(s)

Kyle Groussis-Henderson

Objective

Design and test an automated control system for sprinklers to minimize water waste.

Abstract

NASA estimates that grass lawns in the United States cover over 128,000 square kilometers (49,000 square miles) and the EPA estimates that lawns account for the majority of daily outdoor water usage, around 30% of total daily water usage, or 7.8 billion gallons out of the 26 billion gallons consumed daily in the US. As fresh water becomes more important in the future it is vital that communities start to reduce water usage by more efficiently managing the local supply. If the US refuses to get rid of lawns, then there need to be ways to decrease the amount of water that lawns currently use.

This project seeks to replace sprinkler systems that only use a timed controller with a system that has a single water controller unit to receive wireless data from multiple deployed units that monitor local weather & soil moisture levels. Gathering and analyzing this data would also allow the system to increase efficiency over time.

Advisor(s)

Matthias Fripp

Project Number: 25

UHABS6

Author(s)

Jacob Keomaka (ME 481), Akira Yokoyama (ME 481), Austin Quach (ME 481), Bryson Inafuku (ME 481), Christian Feria (ME 481), David Carranza (ME 481), Ian Fujitani (EE 496), Reginald Tolentino (ME 481), Trevor Shimokusu (ME 481)

Objective

The objective of the UHABS-6 mission is to develop a high altitude balloon satellite capable of operation and collection of data in a near-space environment. The system is to use COSMOS as mission software and to return automatically to a designated recovery site upon landing in the ocean.

Abstract

The University of Hawaii Advance Balloon Satellite (UHABS) project attempts to address the lack information and ability to obtain information on the environment of the Earth's atmosphere near space. In doing so, the Balloon satellite will test the ability to safely carry a small payload to a near-space environment. The system is to be capable of reaching up to 100,000 feet in altitude and to be released from flight on command. The system is also to be capable of returning to a location autonomously, upon landing in the ocean. Along the way, the balloon satellite system will be testing technology and providing data and results valuable to the Hawaii Space Flight Laboratory.

Advisor(s)

Trevor Sorensen

Project Number: 26

DiElectric Measurement Team

Author(s)

Nicholas Yama

Objective

Determine various dielectric constants for various solutions. Liquid metal needs to be immersed in Sodium Hydroxide which in turn can cause the transmission line to become lossy. We would like to prevent or reduce how lossy it becomes.

Abstract

The importance of sodium hydroxide (NaOH) in many liquid metal applications, particularly those in antennas and reconfigurable microwave electronics, necessitates a complete characterization of its RF and microwave frequency response. The purpose of this project is to measure the dielectric properties of NaOH electrolyte solution at several different concentrations in several different ways, aiding in the development of more precise and reliable liquid metal electronic devices.

Advisor(s)

Dr. Wayne Shiroma, Dr. Aaron Ohta

Project Number: 27

Unique Subject Identification using Doppler Radar and Machine Learning

Author(s)

Abraham Sylvester(EE 496), Michael Angelo Fernandez(EE 396), Brandon Tomota(EE 396), Zedekiah Dela Cruz(EE 296), Douglas Moore(EE 296)

Objective

Extract unique breathing features from doppler radar signals of respiratory motion for use in future neural network training.

Abstract

There is an increasing interest in technology for unobtrusive and non-contact methods of measuring human vital signs for a variety of applications. Non-contact vital sign monitoring using microwave doppler radar has shown great promise for applications in the healthcare field. In addition, human subjects have been seen to exhibit distinct and unique breathing pattern which has been proven and investigated in several studies. For non-contact continuous authentication or unique identification of human subjects, unique feature extraction from captured respiratory pattern is very critical. In this work, we have extracted eleven distinct breathing features (Breathing rate, peak distribution, standard deviation of peaks, minima distribution, standard deviation of minima, breathing energy, chest displacement, power spectral density, inhale rate, exhale rate, ratio of dynamic segmentation areas) from four different subjects. Unique feature extraction can be a powerful tool for continuous authentication of individuals which can overcome the limitation of existing traditional one-pass validation systems. This work has potential applications in medical diagnostics, security, surveillance, and in search and rescue.

Advisor(s)

Victor Lubecke