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College of Engineering

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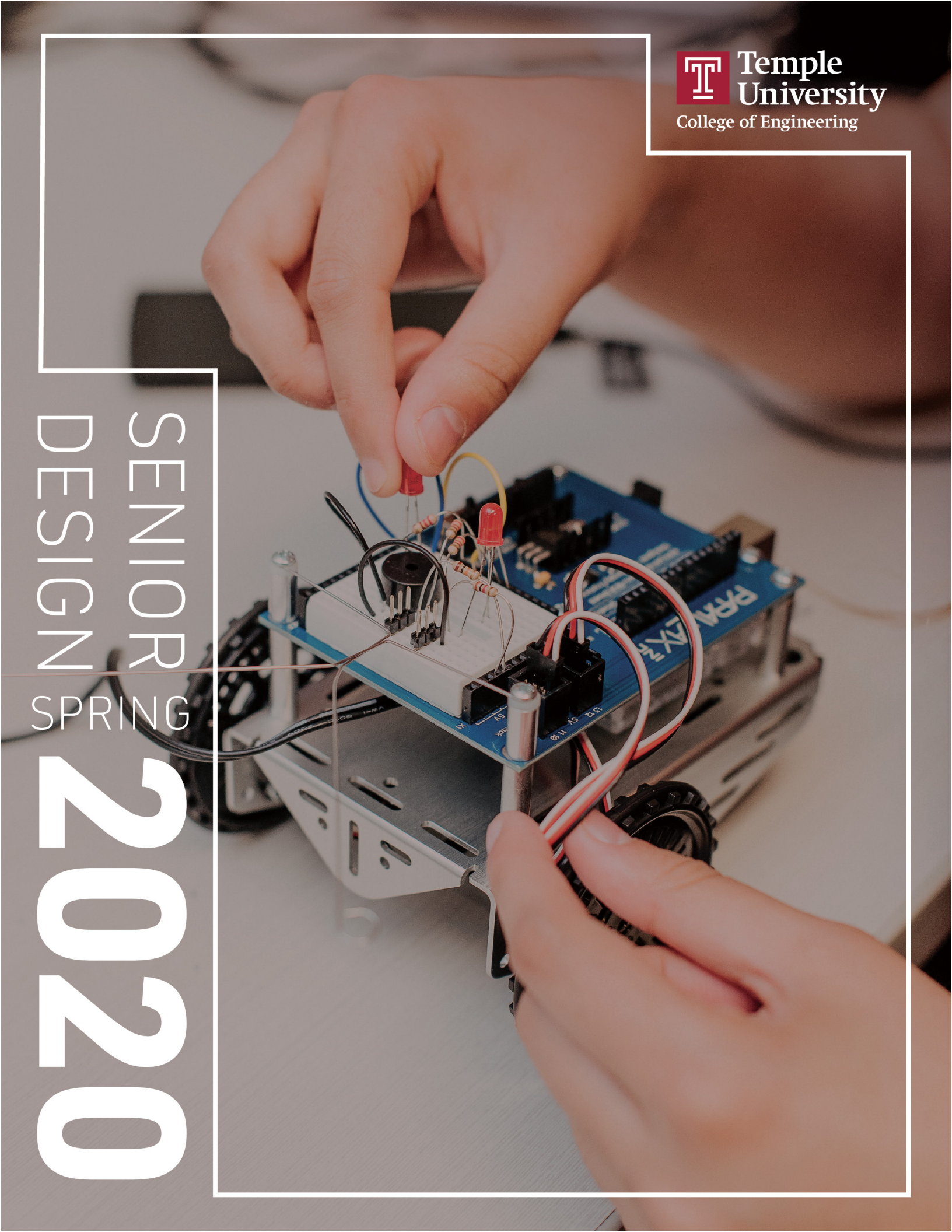
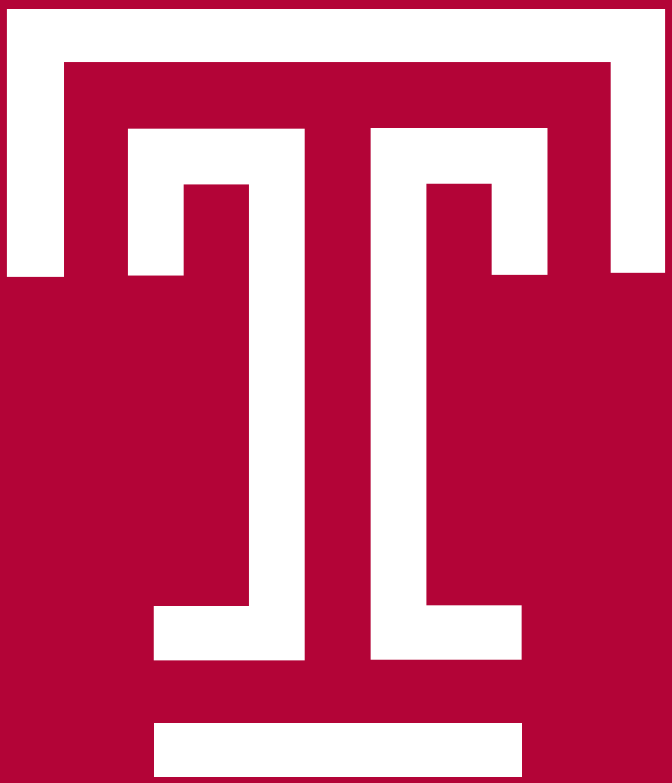


Temple University
College of Engineering

SENIOR DESIGN

SPRING

2020



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FOREWORD

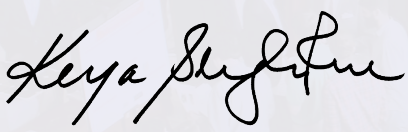
I am proud to welcome you to senior design, the peak of our students' educational journey, and a bridge to their next step as engineers.

Through senior design, Temple Engineering students use their skills as a force for good, seeing a need on campus or in the greater community, and applying themselves. The curriculum challenges students to work collaboratively on projects sponsored by a Temple faculty member, outside organization or as part of an independent project.

Previously, senior design teams have won university-wide recognition, started their own businesses and even used their projects as springboards to further study. All have made a lasting impression as some of the most dedicated students at Temple University.

As always, these projects would not be possible without our faculty who have diligently prepared students and to the project sponsors for their crucial support. Today is our chance to celebrate their achievements while offering a glimpse into their future and support them as Temple Engineers.

Regards,



Keya Sadeghipour
Dean
Temple College of Engineering

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A1

Stefanie Beard
Austin Cook
Katie Martin
Nick Mecca
Alex Wroblewski

ADVISOR

Prof. Damoon Soudbakhsh

PHILLY PHLEET

Sponsor: Dr. Soudbakhsh

Research on autonomous vehicles and their capabilities will allow for more affordable and effective transportation. We developed a 1:10 scale car for research on autonomous cars. The car-like robot is capable of moving at high and low speeds and performs non-holonomic motions, which allows for research in urban areas with congested traffic, as well as backroad driving and in parking areas. It is equipped with various sensors for environment awareness, object detection, and driving autonomously.

Scaled Autonomous Car Prototype

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A2

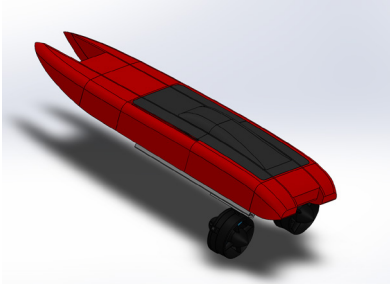
Timothy Philiposian
Justin Lavish
Juan Figueras
Ankit Patel

ADVISOR

Prof. Damoon Soudbakhsh

ROBOBOAT

Design an Autonomous Surface Vessel (ASV) which is distinguished by Guidance, Navigation, and Control (GNC) subsystems. Navigation system maps, measures position and motion within the environment. Using LiDAR, the guidance system passes the desired trajectory to the control system, which in return regulates the thrusters to track ASV's desired trajectory. Together GNC subsystems allow the boat to operate autonomously without human intervention.



ASV hull with attached thrusters

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A3

Taasin Azam
Bhumit Patel
Jonae Allen
Josh Block
John Heveran
Peter Zawycky

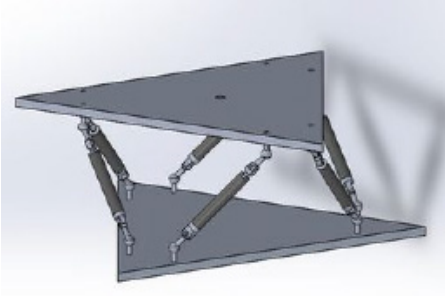
ADVISOR

Prof. Sherwood Polter

LIGHT AIRCRAFT DYNAMIC FLIGHT CONTROL SIMULATOR

Sponsor: Stratus Foundation

The mission of the Light Aircraft Dynamic Flight Control Simulator Senior Design Project is to formulate an alternative solution to train pilots. Specifically, the LA-DFCS goal is to finish creating the first dynamic flight simulator for a Cirrus SR22 Light Aircraft. Our simulator programming and design will be made to mimic a real cockpit of the SR22 aircraft, to generate a realistic experience.



Solidworks Platform

BIOENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

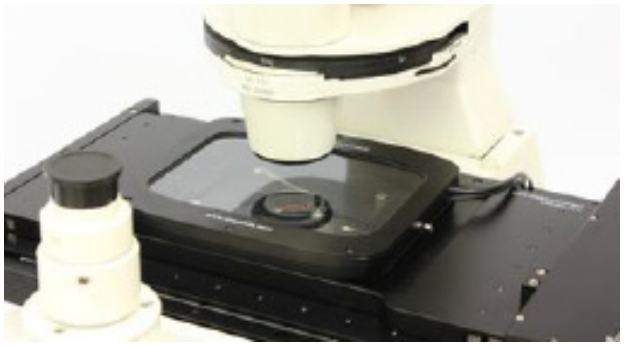
TEAM A4

Lynn Vorwick
Ahmad Alawadhi
Mohamed Elazab
Wala Mohamed

ADVISOR

Prof. Mohammad Kiani

COMPUTER-CONTROLLED MICROSCOPE STAGE TOP INCUBATOR



Sponsor: Dr. Mohammad Kiani

Computer-controlled Microscope Stage Top Incubator is designed to maintain cell cultures. An optical system is utilized to monitor cell cultures over a period of hours, days or even weeks. The controlled incubator would serve as a physiological environment to keep cells in the optimum conditions for their survival and proliferation, ideally maintaining three main parameters in real-time: temperature, CO2 concentration and relative humidity.

CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING

TEAM A5

Brenna Hogue
Stephen Singer
Huner Roonak
Gheorghe Mihailescu

ADVISOR

Prof. Avner Ronen

SUSTAINABLE WASTE MANAGEMENT IN DEVELOPING COUNTRIES

The goal of this project is to begin solving the issue of waste management in developing countries. The basis of this project revolves around Kurdistan, Iraq. Our group member, Huner, is from Kurdistan and recognized a need for waste management in this region that he is from. The goal of this project is to develop a sustainable way to dispose of organic waste. The solution we came up with is a biogas reactor that can break down organic waste and produce methane gas to be used for cooking.

Biogas Reactor Design

BIOENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A6

Emily Nice
Anirudh Srinivasan
Nikolas Meyer
Jithin Matthew

ADVISOR

Prof. Ruth Ochia

CALORIC TESTING DEVICE

Sponsor: Dr. Pamela Roehm

Caloric vestibular testing is used to test for brain stem function in traumatic brain injury (TBI) cases and patients with balance disorders. In 2014 there were 2.87 million TBI-related emergency department (ED) visits, hospitalizations, and deaths occurred in the United States. Approximately 69 million Americans demonstrate some form of vestibular dysfunction. This project aims to reduce the cost and increase the portability of the current devices while still performing the test accurately.

This gure shows the model of the caloric vestibular stimulation device that has been developed.

MECHANICAL ENGINEERING

TEAM A7

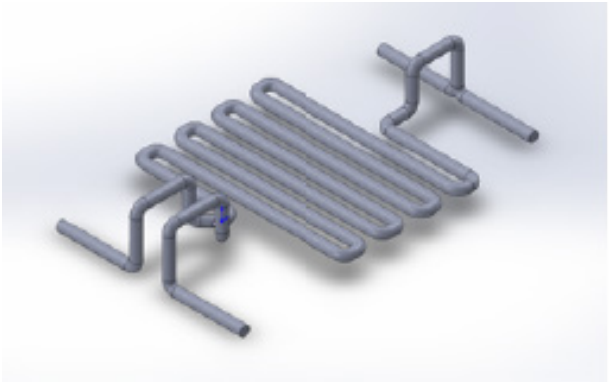
Carlos Silva
Morgan Bocan
Ebenezer Ola

ADVISOR

Prof. Rouzbeh Tehrani

INNOVATIVE MATERIALS AND PROCESSES IN ENVIRONMENTAL ENGINEERING

We were tasked with creating a microfluidic system that would utilize a magnesium oxide nanoparticles to remove lead ions within tap water. The system would consists of a syringe pump that would house two syringes of a lead solution and the other would have the nanoparticle solution. The pump would expel each solution with the same flow rate into our PDMS mixing chamber made using the scaffold removal method with our 3D printed mixing chamber made with an ABS filament.



This is a picture of the SOLIDWORKS structure of our mixing channel as well as the first trial of our 3D printed mixing chamber in PDMS solution.

CIVIL ENGINEERING

TEAM A8

Erin McKenna
Matthew Kelly
Emma Krampe
Mary Hennessy
Elizabeth Shakola
Anastasia Lizzi

ADVISOR

Prof. Evelyn Walters

CLEAN STREAMS

A stream connecting to the Delaware River bisects Roychester Park, a recreational area in Abington Township in the center of a large community. When a storm event happens, the stream floods, impacting the quality of life of nearby residents. The goal of this project is to use structural and nonstructural Best Management Practices to improve water quality in the stream. This is achieved via water quality modeling using the EPA's WASP program to inform BMP designs.

CIVIL ENGINEERING

TEAM A9

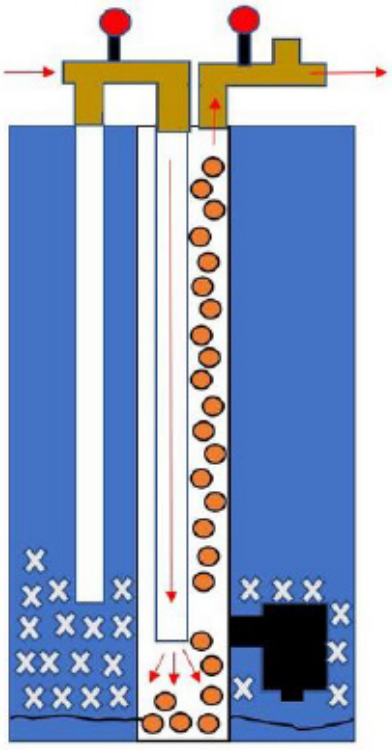
Alex Cammarata
Brian Jessourian
Dom Blanche
Noah Griess

ADVISOR

Prof. Rominder Suri

WATER SOFTENING DEVICE

The team worked to create a working ion exchange water softener capable of softening at a rate of 2 gpm.



BIOENGINEERING
MECHANICAL ENGINEERING

TEAM A11

George Kramarenko
Golam Shadhin
Jules Riehs
Songming Zhang

ADVISOR

Prof. Yah-el Har-el

STRESS IN A MICROGRAVITY BIOREACTOR

Sponsor: Dr. Peter Lelkes, Dr. Yah-el Har-el

The goal of our project is to create a bioreactor capable of inducing uniaxial strain on cells while subjected to microgravity conditions on a random positioning machine. Cells are adhered to a PDMS membrane which is inside of a 3D printed cell culture ask. We used an electromotor actuation system to stretch the membrane and this was controlled remotely through a Raspberry Pi microcomputer to Arduino microcontroller interface.

Cell culture ask and linear actuator sit on top of the housing unit while electrical components are stored underneath. This unit is attached to the RPM stage.

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM A12

Stephen Ching
Benjamin Estrella
Melissa Gallo
David Abrams

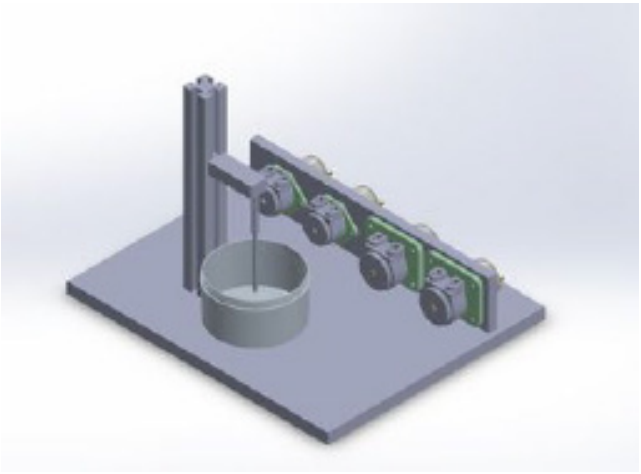
ADVISOR

Prof. Santiago Orrego

IN VITRO ORAL SIMULATOR FOR THE GROWTH OF BIOFILMS

Sponsor: Dr. Santiago Orrego

The Smart Biomaterials Lab in the Kornberg School of Dentistry seeks to exploit the smart features of materials, and develop new biomaterials with specific and tailored interaction with the body. We have been tasked with developing a dynamic oral simulator to replicate the environmental conditions of the mouth in order to test the antimicrobial properties of a novel dental resin. This device will run coherently with LabVIEW to provide a seamless, integrated experience for the user.



ELECTRICAL ENGINEERING

TEAM A14

Sophia Yoo
Royce Pease
Jessee Joo
Elliot Fix

ADVISOR

Prof. Liang Du

AAAC

Sponsor: Schneider Electric

Zeus is a local electrical load control hub. Our goal is to make incorporating battery storage as easy and functional as possible in applications from hospitals to developing remote communities.

Our system implements a RaspberryPi, radio frequency controlled outlets, current and voltage sensors, and an Uninterruptible Power Supply (UPS). Unlike a traditional UPS system, Zeus allows users to organize their local load pro le by various prioritization schemes to maximize battery storage uptime.

High-Level Diagram

ELECTRICAL ENGINEERING
ENVIRONMENTAL ENGINEERING

TEAM A15

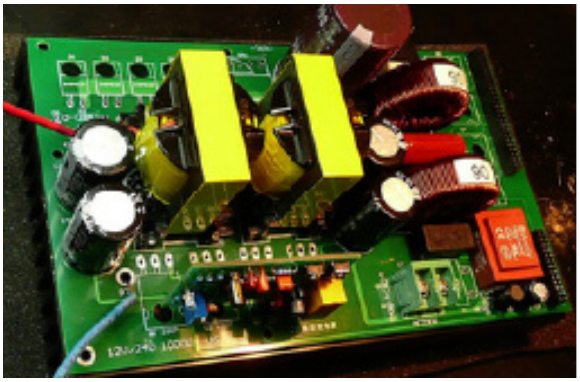
Ian Mears
Martin Mark
Mohit Singh

ADVISOR

Prof. Xiaonan Lu

UNIVERSAL & STANDARDIZED TESTING PLATFORM FOR GRID-INTERACTIVE POWER CONVERTERS

Our project will simplify and regulate the testing process for grid interactive power electronic converters by producing a universal and standardized testing platform to equip vendors or manufacturers with a benchmarking environment to test the integrity of their devices against industry codes and standards.



12 Volt 1000 Watt Power Inverter

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM A16

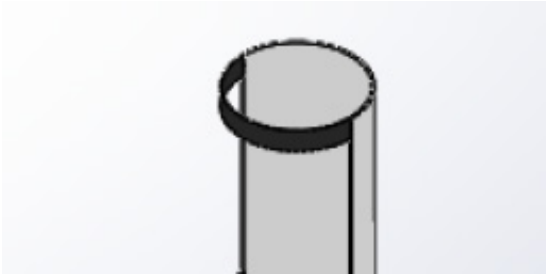
William Schreiber
Owen Papa
Najafa Islam
Neil Tran
Denis Manchon

ADVISOR

Prof. James Furmato

ENHANCED LOCOMOTION FOR LOW GRAVITY EXPLORATION

This project attempts to take advantage of the concept of the Froude ratio by extending the length of the leg via stilts in order to mimic a gait typical of what would be expected in a low gravity environment. The gait while on stilts, as well as the energy expenditure associated with it, is studied in order to identify trends associated with movement in low gravity environments.



The design of stilt intended to be used during testing

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A17

James McCarron
Ian Warner
Franka Stamo

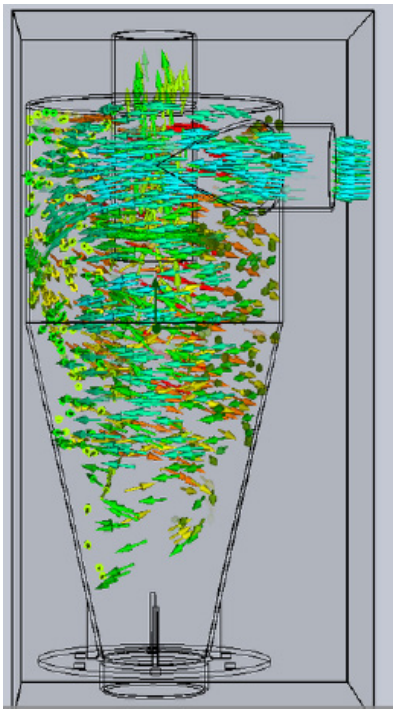
ADVISOR

Prof. Laura Riggio

GRAPHENE ATOMIZER

Sponsor: Dr. Dmitriy Dikin

Our senior design project aims to extract graphene from a liquid solution, in such a manner that the graphene does not re-stack into graphite. To accomplish this, our we are atomizing the liquid solution and drying the vapor so that the graphene forms 3D crumpled graphene that could be sold or turned into useful products.



ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM A19

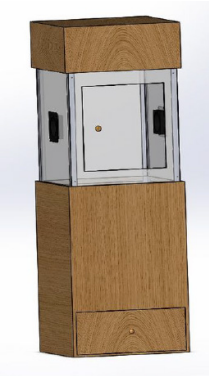
Avery Hand
Julie Lee
Veronica Refela

ADVISOR

Prof. Hamid Heravi

AUTONOMOUS GREENHOUSE CONTROL SYSTEM

The Sprout, is an autonomous micro-greenhouse capable of utilizing 4 square feet of growing area to produce vegetables and herbs continuously. The project aims to address the evident food desert present in the North Philadelphia community, using a novel solution in cases where other options cannot be utilized. The micro-greenhouse will be used as a source of healthy, organic produce as well as a community teaching tool on urban gardening and healthy food consumption.



19A Greenhouse CAD Model

MECHANICAL ENGINEERING

TEAM A20

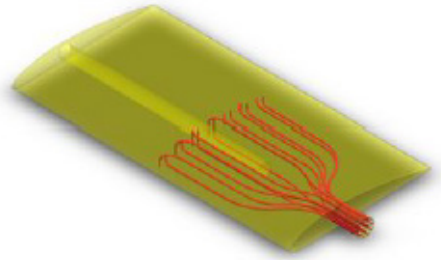
Kason Leung
Quan Pham
Andrew Ortlieb
Zachary Pick

ADVISOR

Prof. Tony Boehm

R.A.P.I.D.

The project will advance the curriculum of the Fluid Mechanics Laboratory at Temple by improving the wind tunnel, airfoil testing lab assignment by allowing for examination of ground effect phenomena. Due to deteriorating conditions of the current non-cambered airfoil, a new 3D printed airfoil will be created to be implemented in the wind tunnel. The project has been extended to include a design and manufacturing process which will allow students to design and print their own airfoils to test.



CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING

TEAM A21

Connor Stevenson
Raina Daynorowicz
Kodi Lawrence
Elliot Bashore

ADVISOR

Prof. Robert Ryan

STORMWATER HEROES

Sponsor: Dr. Ryan

In the highly urbanized Abington Township, stormwater issues have become prevalent in the area. The goal of this project is to create a model of the surrounding area to design and test different stormwater management practices (SMPs). These SMPs are hypothetically implemented, into the model, to see their affect on sediment removal, stream volume, and stream flow in the Sandy Run during rain events.

Image of the model our team is working on in PCSWMM

BIOENGINEERING
ELECTRICAL ENGINEERING

TEAM A22

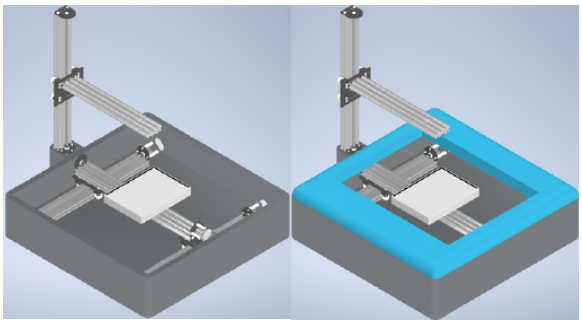
Grant Gsell
Alexandra Abruzzo
Eleanor Caston

ADVISOR

Prof. Nancy Pleshko

AUTOMATED STAGE FOR SPECTRAL IMAGING DATA ACQUISITION

We designed a fully automated stage that interfaces with a ber optic probe coupled with a spectrometer to acquire spectral imaging data for use in the Pleshko lab. Our multifaceted design implements precise and controllable physical movement in the X, Y, and Z axis by utilizing hybrid bipolar stepper motors as well as a custom designed peripheral system consisting of a distance sensor, camera and, virtual keyboard. When implemented, our system drastically reduces sampling time and human error.



Fully constructed system with and without the base top.

CIVIL ENGINEERING

TEAM A23

Luke Smirga
Kevin Breslin
Cassandra Snook
Hamad Alsabea

ADVISOR

Prof. Felix Udoeyo

THE CONCRETE CONNOISSEURS

Concrete composites encompass a wide variety of modifications to Portland cement. A range of materials could increase certain advantageous properties, such as strength, durability, and permeability, while reducing environmental hazards, such as emissions from cement production. The goal of research is designing and testing a stronger product for bridge elements without sacrificing efficiency and permeability. The optimum ratio of nanosilica to fly ash and cement will be the recommended design.

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM A24

Brandon Krauth
Kang Xue
Michael Pathisseril

ADVISOR

Prof. Mary Barbe

RAT PUSH FORCE

Our goal of this project was to discover the average push force a rat produces when leaning on a wall. This data will be used in later studies to help with research in how to prevent human muscular disorders due to overexertion or repetitive tasks.

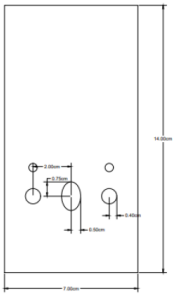


Diagram of plate wall with force sensor locations labeled out.

BIOENGINEERING

TEAM A25

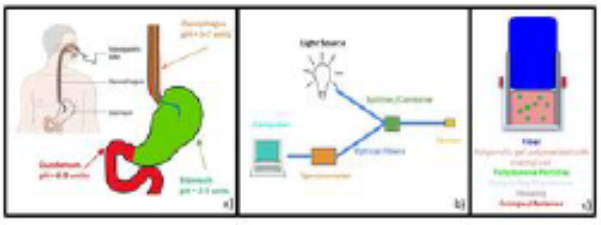
Kavya Sreeram
Aaron Acosta
Nina Mucciolo

ADVISOR

Prof. Chetin Patil

NASOGASTRIC TUBE LOCATION SENSOR

Nasogastric (NG) tubes are mainly used to provide nutrients and medicine for those who cannot independently consume them. An NG tube is often placed "blind" without any real-time guidance, causing the major problem of misplacement leading to dangerous complications. Therefore, the proposed solution is the use of the GI tract's pH gradient to provide quantifiable data via fiber optic technology to verify the location of the NG tube with a quick response time during and after placement.



Section (a) shows how the NG tube is going through the system. Section (b) shows the optical pathway system. Section (c) shows the sensor in detail.

BIOENGINEERING

TEAM A26

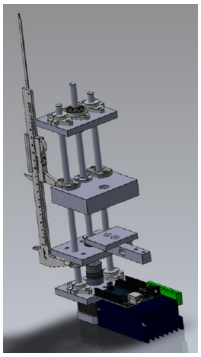
Katherine Locke-Brubaker

ADVISOR

Prof. Jon Gerstenhaber

ROOK MECHANICAL TESTING SYSTEM

A laser-cut/3D printed mechanical testing system for student use, with intended applications in the compression of hydrogels, tension of muscle samples, and 3-point bending of chicken bones. This system will: 1. provide accurate mechanical functionality of each part and as a system for data collection, 2. utilize a comprehensive yet simplistic design to provide experience and maximize educational gain, 3. cost under $200 USD, and 4. use recycled material for all 3D-printed parts (up to 30%).



ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM B1

Melony Breeze
Noah Pelroth
Alec Lothian
Morgan Basileo
Taha Shamashudin

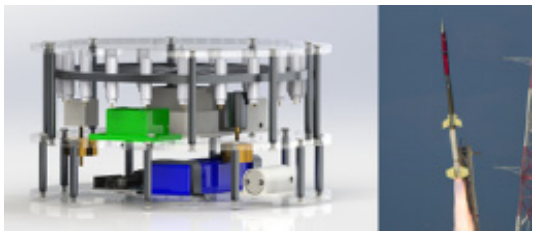
ADVISOR

Prof. Brian Thomson

THE EXCELSIORS

Sponsor: Dr. Helferty

Development of a payload that contains an experiment to be placed in a sounding rocket launched from NASA's Wallops Flight Facility in June 2020. The payload will collect samples of air from varying altitudes in the upper atmosphere, which will be returned post-launch. We will analyze the air samples to determine concentrations of nitrogen oxide and sulfur dioxide species at various altitudes, and submit a report of our data and conclusions to NASA post-launch.



Payload Render and RockSat Launch

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM B2

Steven Dinh-Vo
Yanghong Wang
Haydon Stojanov

ADVISOR

Prof Brian Thomson

NASA ROBOTIC MINING COMPETITION

Sponsor: Dr. Helferty

RMC Lunabotics is a university level competition sponsored by NASA in support of the Artemis program and future missions to Mars. Students design and create tele-operable mining robots fit for future space exploration.

NASA Robotic Mining Competition - Lunabotics 2020

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM B3

Christian Gutierrez
Alec Beiswinger
Philip Triano
Zicong Huang
Yu Mei
Abdullah Alhasem

ADVISOR

Prof. Peter Cavallo

TEMPLE LAUNCH TEAM

Rocket model with rover. The rocket need to reach an apogee of 3900+ ft. The rover need to collect at least 10 ml ice sample.

ELECTRICAL ENGINEERING
ENGINEERING
MECHANICAL ENGINEERING

TEAM B4

Byron Gaspard
Samuel Sadel
Justin Johnson
Zhao Gao
Jiaxin Xi

ADVISOR

Prof. Brian Thomson

ROBOBOAT

Sponsor: Dr. Li Bai

RoboBoat is an annual student competition where participants develop an autonomous surface vehicle to navigate courses that emulate environments that a commercial vessel would encounter. The project was started at Temple in 2014 but has only competed once. Our goal was to develop the boat's core systems to create a base that the next team can iterate from instead of repeating work once again. Our contributions were in three areas: power distribution, data aggregation, and communication/control.

CIVIL ENGINEERING

TEAM B5

Jaser Ayoub
Warren Dodd
Stephen Orliw
Evan Thomas
Mohammad Al-Buloushi

ADVISOR

Prof. Joseph Coe

THE MOLE MEN

The ASCE Mid-Atlantic Regional GeoWall competition is held annually where teams compete in building an e cient Mechanically Stabilized Earth Retaining Wall.

Our team's project focuses on modeling and building a small scale MSE retaining wall using kraft paper as reinforcement. The design objective is to use the least amount of kraft paper to reinforce our model that will be subjected to, both, vertical and horizontal surcharge loadings.

Last Year's Model and Reinforced Facing

ELECTRICAL ENGINEERING

TEAM B6

Sean Ferrel
Stephanie Torres
Shagar Biswas
Adam Pienkowski

ADVISOR

Prof. Dennis Silage

DRAGON ROVER

The Disaster Relief Assistance Ground OperatioN (DRAGON) Rover is a semi-autonomous ground vehicle that is designed to enter disaster areas in place of rst responders and send back video feed and environmental data. By utilizing radio communication and the amateur radio network, the DRAGON Rover can be operated from great distances in an accurate and secure manner. This rover has the potential to protect rst responders from unnecessary danger in a wide variety of situations.

CIVIL ENGINEERING

TEAM B7

Alyssa Corse
August Matarazzo
Hussain Alkhawari
Kevin DeCaesar
Xiaoyi Dai
Harry Hua
David Spatichia
Yuanming Song

ADVISOR

Prof. Bechara Abboud

CONCRETE CANOE COMPETITION

Every year, the ASCE hosts Regional Concrete Canoe competitions in which engineering students from schools across the country design and build canoes to race against each other. The design process for each canoe involves hull design, structural analysis calculations of the proposed design, lightweight concrete mix design, construction of the mold, and construction of the canoe. At the competitions, the teams are judged in: Design, an Oral Presentation, the Final Product, and 5 Canoe Races.

CIVIL ENGINEERING

TEAM B8A

Aishah Alkhaldi
Mayim Kim
Sean Nasri
Jose Rosado
Aaron Rodriguez
Mark Griffenberg

ADVISOR

Prof. Sanghun Kim

STUDENT STEEL BRIDGE COMPETITION TEAM A

The 2020 Student Steel Bridge Competition challenged our Team B08- A, B, and C to design, fabricate, and construct a scale-model steel bridge. Firstly, RAM Elements was used to utilize the design capability to hold 2500 lbs with maximum vertical and lateral de ections of 3" and 1" respectively. Secondly, our fabricator CBX Corporation, manufactured the bridge from our AutoCAD shop drawings. Lastly, our building team constructed the fabricated bridge and it exceeded the competition rules.

AISC SSBC - Team B08 Steel Bridge 2020

CIVIL ENGINEERING

TEAM B8B

Thomas Kurchinsky
Annamaria Furmato
Dante Falcone
Maryam Mohammad
Nicholas Renda

ADVISOR

Prof. Sanghun Kim

STUDENT STEEL BRIDGE COMPETITION TEAM B

The 2020 Student Steel Bridge Competition challenged our Teams B08- A, B, and C to design, fabricate, and construct a scale-model steel bridge. Firstly, RAM Elements was used to utilize the design capability to hold 2500 lbs with maximum vertical and lateral de ections of 3" and 1" respectively. Secondly, our fabricator CBX Corporation, manufactured the bridge from our AutoCAD shop drawings. Lastly, our building team constructed the fabricated bridge and it exceeded the competition rules.

AISC SSBC - Team B08 Steel Bridge 2020

CIVIL ENGINEERING

TEAM B8C

Almuhannad Ahazmi
Sarah Almahdi
Fatemah Husain
Matthew Podrazaa
Nicholas George

ADVISOR

Prof. Sanghun Kim

STUDENT STEEL BRIDGE COMPETITION TEAM C

Sponsor: Sanghun Kim

The 2020 Student Steel Bridge Competition challenged our Team B08- A, B, and C to design, fabricate, and construct a scale-model steel bridge. Firstly, RAM Elements was used to utilize the design capability to hold 2500 lbs with maximum vertical and lateral de ections of 3" and 1" respectively. Secondly, our fabricator CBX Corp. manufactured the bridge from our AutoCAD shop drawings. Lastly, our building team constructed the fabricated bridge and it exceeded the competition rules.

CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING
MECHANICAL ENGINEERING

TEAM B9

Susha Nataraj
Ivy Attenborough
Michael Wasch
Katherine Tran

ADVISOR

Prof. Erica McKenzie

PEOPLE, PROSPERITY, AND PLANET (P3)

Biochar is charcoal made from burning organic materials; this biochar is a never-been-done combination of common water hyacinth (an invasive Brazilian plant) and spent coffee grounds. It is designed to attack lead contamination in drinking water, as old pipes can still leech lead. Housed in a simple container, the biochar captures lead particles in its pores as water passes through. This project is favorably reviewed by the EPA in the P3 Competition (People, Prosperity, and the Planet).

Deconstructed Biochar Water Filter. Pictured left to right is the simple lter design, biochar to be placed inside, and the resultant lead-free water.

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM B10

Timothy Kelly
Shane Buckley
Alex Kushlan
Daniel Fech
Christopher Buchser

ADVISOR

Prof. Richard Cohen

HUMAN POWERED SUBMARINE

Sponsor: Dr. Heravi

The team focused on setting the foundation for Temple University to eventually create a team to enter into the International Submarine Racing Competition. The team focused their efforts on a half-scale platform while adhering to Reynolds Scaling to ensure accurate test results that would translate to the eventual full-scale implementation.

Half Scale Model Internal Systems

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM C1

Daniel Lee
Yousef Abdulerdha
Hussain Askar
Ryan Zbik

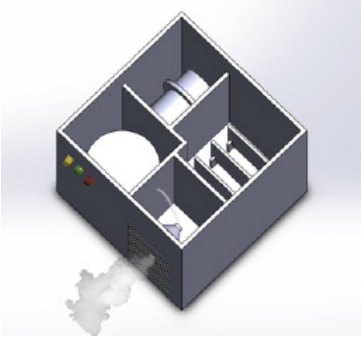
ADVISOR

Hava Health LLC

HAVA HEALTH

Sponsor: Hava Health LLC

Hava Fresh is a healthier smart air freshener. Current air freshers on the market use chemicals that are harmful to people's health. By accident, the sponsor Hava Health LLC. has found an alternative that is safer. The main smart feature in this device is automatic activation when the measured air quality is low.



BIOENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM C2

Luke Weida
Mariam Alqatan
Tegan Durishin
Frank Kakos
Marissa Pirritano

ADVISOR

Tozuda

HEAD IMPACT SENSOR

Sponsor: Tozuda

The goal of this project is to fully assess if Tozuda's current head impact sensor design is ready for head impact military use or if a re-design is needed to meet/exceed US military standards. Moreover, to determine if the device as patented, is capable of predicting IED blast exposures.

Tozuda's Head Impact Sensor

CIVIL ENGINEERING
MECHANICAL ENGINEERING

TEAM C3

Weston Doutrich
Ben Harris
Josh Fieseher
Riley Edwards
Rebecca Crispin

ADVISOR

Prof. Lawrence Gelburd

SUSTAINABILITY PROJECTS AT URBAN FARM

Sponsor: Marta Lynch

Our team is designing and building an on-site walk-in cooler for the local farm at 8th and Poplar, so they can store greater amounts of produce with ease, and increase pro tability. In addition, we are completing the previous senior design team's work, by implementing the recommended air circulation fans in the farm's high tunnel.

View of FNC Community Learning Farm on 8th and Poplar

MECHANICAL ENGINEERING

TEAM C4

Rowen Martin
Joseph Schade
Michael Croke
Jonothan Deardorff

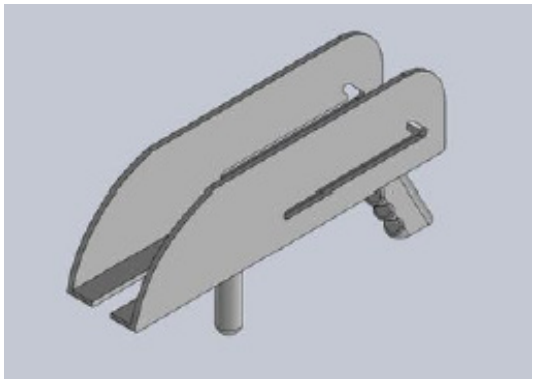
ADVISOR

Justin Jacobs

YOUTH HANDHELD CRICKET BOWLING MACHINE

Sponsor: Freebowler

The industry partners of Freebowler have a demand for a small "throw down" machine that can be used by coaches and parents with ease to throw cricket balls to the young athletes.



Solidworks Model

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM C5

Anthony Cotto
Jeremy Maher
Georgios Michalopoulos

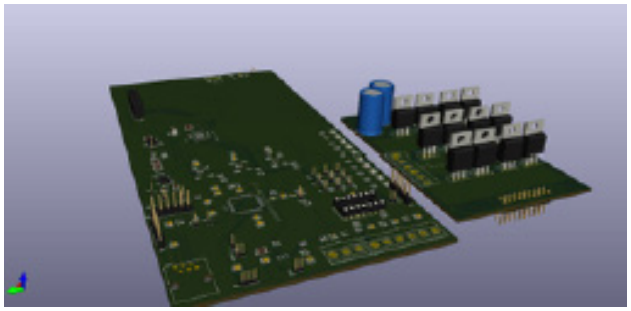
ADVISOR

Prof. Brian Thomson

BRUSHLESS DC MOTOR CONTROL

Sponsor: ASI Drives

This project envisions the design, prototyping, and testing of a power controller that switches power on and off to the electromagnetic windings of a dc motor.



3D model of controller

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM C6

Francesca Henrichs
Geoffrey Milord
Lauren DuBose
Chad Vanterpool
Moodi Aldharman
Alex Fuentes

ADVISOR

Adam Salamon

LIGHTWEIGHT PNEUMATIC ACTUATION SYSTEM

Sponsor: Pression LLC

A wearable device that promotes rapid recovery, which includes stabilizing heart rate and increasing blood ow, directly after extraneous exercise.

BIOENGINEERING
ELECTRICAL ENGINEERING

TEAM C8

Caitlin Jugler
Evan Kemmerer
Kane O'Connor
Jack Oswald
Michael Partington

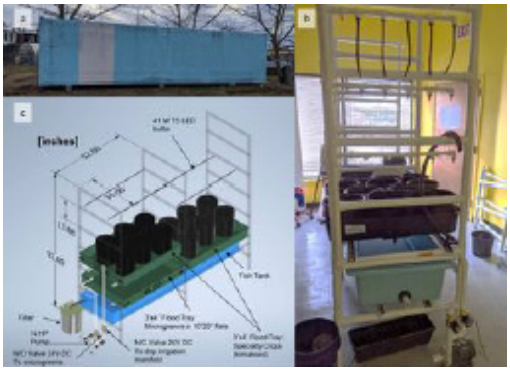
ADVISOR

Jamie Bracey-Green

ENGINEERING URBAN SUSTAINABILITY

Sponsor: Center for Inclusive Competitiveness

The prevalence of urban food deserts has motivated localized methods of growing food that can be sustained by community members. Farmers in Philadelphia in partnership with Temple CoE's Center for Inclusive Competitiveness, are proposing using controlled environment agriculture to teach the community to use STEM to solve urgent food problems. Team C08 was enlisted to redesign a 40' shipping container to enable aquaponic cultivation of cat sh and tomatoes in a closed loop of nutrient cycling.



a) CEA shipping container facility at One Art Community Center in W. Philly b) Modular aquaponic unit build in progress c) CAD model of modular aquaponic unit

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM C9

Dean Cavaliere
Samantha Schafer
Joseph DiFeo
Kevin Paris

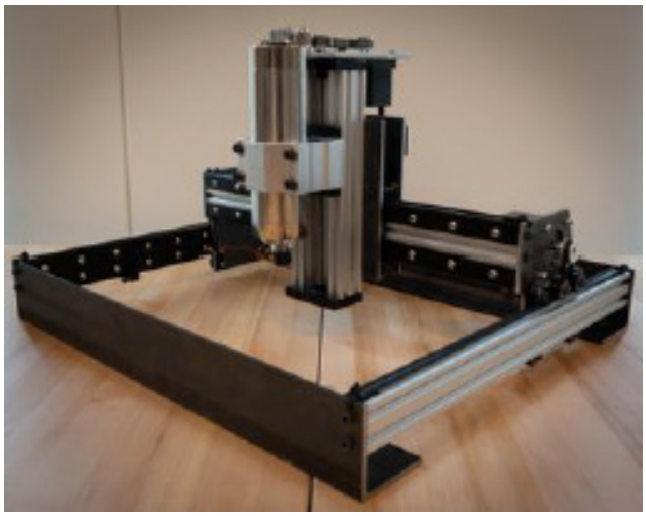
ADVISOR

Prof. Laura Riggio

DESKTOP 3-AXIS CNC MILL

Sponsor: Jim Gannon & John Jemison

We aim to design a Desktop 3-Axis CNC mill targeted towards hobbyists, educators, and small businesses while exceeding the capabilities of existing market solutions at a competitive price. Our machine will use a precision grade spindle, standard collets, and software-controlled spindle speeds; combining features not found on existing solutions. Components of the mill will use standard hardware and software, allowing the user to customize and scale their machine to accommodate any personal needs.



Complete mechanical assembly of the Desktop 3-Axis CNC Mill.

ELECTRICAL ENGINEERING

TEAM C10

Brian Abraham
Khoa Nguyen
Joe Long

ADVISOR

Prof. Lawrence Gelburd

URBAN AQUAPONICS

Sponsor: Anna Herman

Aquaponics is a system of agriculture that combines both aquaculture and hydroponics. The goal of this project is to develop a easy-to-assemble kit that contains the documentation and hardware necessary for aquaponics owners to create a smart, WiFi-connected aquaponics system. This allows for remote access of real-time system measurements such as temperature and pH. The initial target audience of this kit are biology high-school teachers to use as a teaching tool and low-scale urban farmers.

BIOENGINEERING
CIVIL ENGINEERING
ELECTRICAL ENGINEERING

TEAM C11

Don Webster
Sello Bodibe
Vibol Nhek
Aidan Coyle

ADVISOR

Prof. Lawrence Gelburd

ENVIRONMENTAL JUSTICE TRACKING

An Arduino-based sensor for collecting environmental data that can be used by local high school students to gather data about their neighborhood.

BIOENGINEERING
CIVIL ENGINEERING
MECHANICAL ENGINEERING

TEAM C12

Nicholas Seiberlich
Matthew McLaughlin
Baran Arig
Hamad Alown

ADVISOR

NewAge Industries

QUALIFICATION OF AN OFFLINE TUBING CUTTER

Sponsor: NewAge Industries

NewAge Industries invested in an offline tubing cutter which requires a validation protocol to be developed and executed. The purpose of our project is to develop an Installation Qualification (IQ), Operational Qualification (OQ), and a Procedural Qualification (PQ) for the offline cutter system as well as maintenance and operation instructions. Our project will also include a cost benefit model along with a workflow analysis to ensure that the new process is cost-effective and resourceful.

Diagram of the Offline Tubing Cutter which requires validation

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ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM D1

Cole Supplee
Matthew Ward
Mohammad Albahri

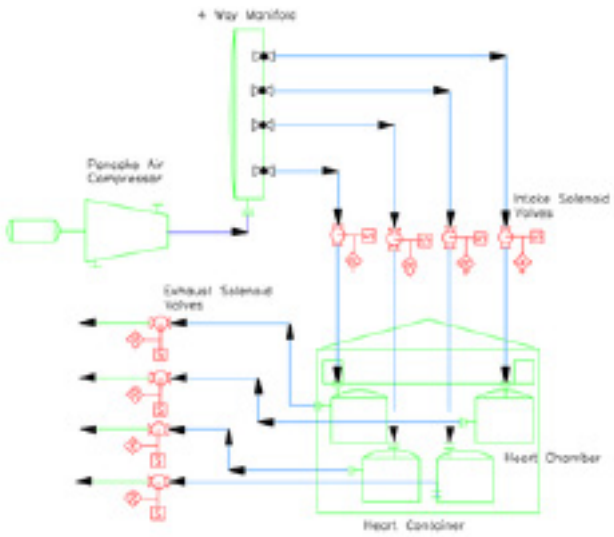
ADVISOR

Prof. Yah-el Har-El

CHAMBER SPECIFIC PACEMAKER

Sponsor: Dr. James Furmato

The overall objective is to design a comprehensive pacemaker that is not only able to increase the heart rate of a patient with bradycardia, but also to include potential treatment of other cardiac diseases. This design can detect signals more accurately than current devices that are available. With more electrodes, the device will be able to better distinguish the signals from the heart from signals from other organs in the body or outside noise than other pacemakers.



P&ID of mechanical heart model. Pacemaker to be connected directly to solenoids & pressure sensor (not shown) in heart chamber.

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM D2

Aly Ahmed
Ivy Nuo Chen
Kevin Kauermann
Ethan Musser
Michael Reynolds

ADVISOR

Prof. Hamid Heravi

DATA ACQUISITION FOR A FORMULA SAE RACECAR

Sponsor: Dr. Brian Thomson

Temple Formula Racing (TFR) is a student organization that annually participates in the Formula SAE Michigan event. This project aims to provide design validation and performance quantification for the TFR vehicle suspension system through a comprehensive data acquisition system. The system will measure five components of vehicle dynamics: wheel speeds, loads, and displacements, steering angle, and chassis motion. Further, selected information will be displayed in real-time to the driver.

A rendering of the TFR 2020 vehicle with data acquisition system.

BIOENGINEERING
ELECTRICAL ENGINEERING

TEAM D3

Thao Vo
Rutwika Anumula
Noelle Lewandowski
Casey Bruno

ADVISOR

Prof. Iyad Obeid

HEADS UP DRIVING

Drowsy driving causes many accidents every year. To tackle this, the team designed a steering wheel cover that detects changes in heart rate that can indicate drowsiness and microsleep. Arduino Pulse Sensors in the cover detect heart activity, which is sent to a microprocessor that calculates heart rate, and then to a smartphone app that computes heart rate variability (HRV). If the HRV indicates microsleep, an alarm will sound.

CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING

TEAM D4

Leah Martino
Justin Dinardo
Nicholas Cutrone
Eric Cruz
Patrick Danas

ADVISOR

Prof. Ahmed Faheem

SUSTAINABLE ROADWAYS

Sponsor: Dr. Faheem

Microplastics are becoming a bigger global-scale problem every day. Our project aims to reroute microplastics from waterways and landfills by implementing them in asphalt binders. We chose three different types of plastics to add to a binder and will measure the feasibility of adding microplastics to asphalt binders through a number of tests that simulate strength, aging, and chemical leaching. We hope this will improve asphalt quality while alleviating large-scale pollution/landfill issues.

MECHANICAL ENGINEERING

TEAM D5

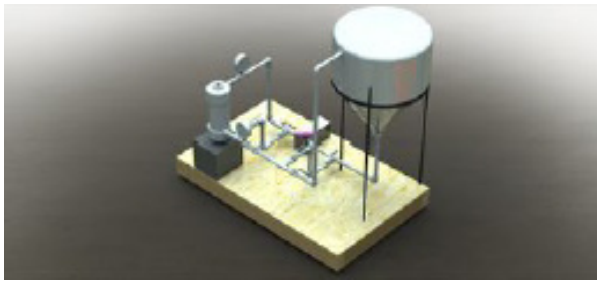
Adam Brock
Mary Qin Hassig
Gordon Walbert
Ryan Probasco
Connor Maynard
Benjamin Ryherd

ADVISOR

Prof. Dmitriy Dikin

HIGH-SHEAR HYDRODYNAMIC REACTOR

The goal of this project is to design and optimize a small shear-rate reactor for graphene exfoliation and other hydrodynamic processes. Motivation for this project stems from research needs in the study of graphene synthesis and other 2D materials. Our system is designed to achieve liquid exfoliation of graphite into graphene through the use of a rotary reactor with Couette ow between two concentric cylinders. The proposed prototype consists of a transportable, closed uidic system.



ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM D6

Mike D'Argenio
Arthur Heng
Nick Gonzalez
Kevin Jackson
Kyle Gerrity

ADVISOR

Prof. Philip Dames

SEARCH AND RESCUE UAV

The goal of our project is to create a quadcopter designed for search and rescue applications. To achieve this, we used an open-source ight planning software for ight control paired with a thermal imaging camera for human detection. Our project is aimed at search and rescue applications in large open areas such as missing hikers or lost mountain climbers.

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING

TEAM D7

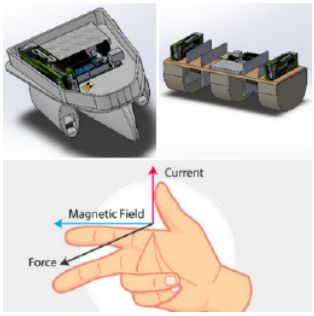
Jurges Tahiraj
Stephen Kovacic
Nuri Sivri
Emily Lofing

ADVISOR

Prof. Harsh Deep Chopra

MAGNETO HYDRODYNAMIC PROPULSION

Magnetohydrodynamic Propulsion (MHD for short) is a type of propulsion that this senior design team is currently researching and testing. It will be used to propel aquatic vessels without any moving parts. Through the use of magnetic and electrical forces a force will be induced in salt water to propel the vessel forward.



Prototype designs and the governing force

CIVIL ENGINEERING
MECHANICAL ENGINEERING

TEAM D9

Tony Dong
Aaron Zvyagelsky
Benjamin Stankovic
Justin Chan
Ahmed Amin

ADVISOR

Prof. Felix Udoeyo

HOTCRETE

With rising concerns about global warming and waste pollution in our world, developing a sustainable, environmentally friendly solution is more critical than ever before. To contribute to these sustainability goals, our solution will replace salt use with conductive concrete for deicing applications. Our project overall will seek to advance the development of innovative deicing solution to change how roads are made and maintained during winter seasons.

Photo of Conductive Concrete on Roca Bridge, Omaha Group LLC

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM D10

Gia Phan
Gavin Koma
Chau Nguyen
Yu-Jie Liao

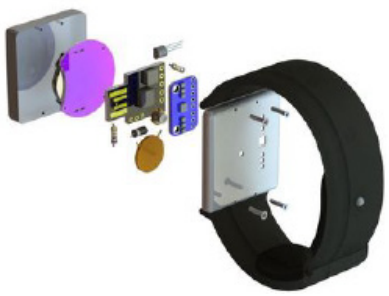
ADVISOR

Prof. Andrew Spence

TOASTÉ

"Pulse points" are also known as quick-warming spots, meaning heating up these areas causes the body core temperature to be affected accordingly.

Toasté is a wearable watch that can restore thermal comfort for users within 10 minutes by raising the perceived temperature by 5°F. By using the body's "pulse points", Toasté is the go-to solution that is highly portable and effective at warming people up.



3D CAD exploded view of Toasté

CIVIL ENGINEERING
MECHANICAL ENGINEERING

TEAM D11

Willow Jessop
Thomas Whitfield
Geno Helm
Brian Meilinger
Adam Holmes
Andrew Knezich

ADVISOR

Prof. Berk Ayranci`

SOLAR DECATHLON DESIGN CHALLENGE TEAM

Our team chose to enter the Solar Decathlon Design Challenge which is run by the US Department of Energy. Our goal is to combat the increase in fossil fuels as a result of city growth across the country by designing a single family urban home run completely off of solar energy. Our design is to be built in Durham, North Carolina, and made efficient and affordable by our use of entirely electric devices, thick insulation, a Variable Refrigerant Flow HVAC system, and a tank-less water system.

CIVIL ENGINEERING
MECHANICAL ENGINEERING

TEAM D12

Jillian Bamford
Connor Murphy
Domenico DiMatteo
Mitchell Gartner
Devin Castillo

ADVISOR

Prof. Jim Shih-Jiun Chen

THERMAL IMAGING UAV

Drone with attached thermal imaging camera to be used in the inspection of wind turbine nacelles to prevent damage and overheating of the nacelle and its components.

BIOENGINEERING
MECHANICAL ENGINEERING

TEAM E1

Deborah Wang
Franky Acosta
Michael Fazio
Kaitlyn Rauscher

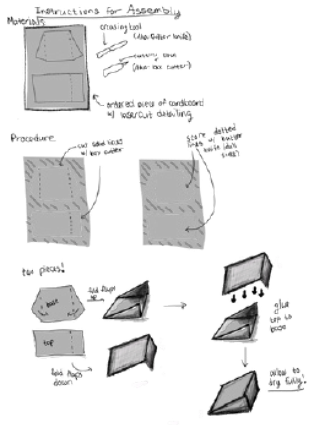
ADVISOR

Prof. Daniel Jacobs

PARAMETRIC SOLUTIONS FOR INDEPENDENCE

Sponsor: Professor Mikael Avery

Children with muscular dystrophy, cerebral palsy, and other postural conditions need adaptive equipment to fully participate in learning and play. Unlike current adaptive equipment made from triple-wall cardboard, our sturdy, lightweight, and easy-to-assemble devices will not require a trained occupational therapist (OT) to measure, cut, and assemble. Parameterized designs produce a custom-sized device with a few key body measurements, while CNC machining eliminates human error in manufacturing.



Assembly instructions for a posture wedge