SENIOR DESIGN 2018

TEMPLE UNIVERSITY

College of Engineering

FORWARD

As Dean of the College of Engineering at Temple University, I am proud to welcome you to the culmination of Engineering students' journeys through Senior Design.

Senior Design challenges students to work collaboratively on projects sponsored by a Temple faculty member, outside organization or as part of an independent project. In the past, Temple Engineers have sent high-altitude balloon 90,000 feet up during the solar eclipse, developed next generation medical devices, built tiny houses and green roofs, just to name a few.

This semester, we are proud to showcase how Senior Design continues to evolve, showing the collaborative, innovative and entrepreneurial nature of our intensive, hands-on curriculum.

A special thanks to faculty who have diligently prepared students and to the project sponsors for their critical support. Today is your chance to glimpse into the future of engineering progress, right here at 12th and Norris.

Regards,

Keya Sadeghipour
Dean
Temple College of Engineering

SENIOR DESIGN II PRESENTATIONS

All presentations will take place in Room 102 “Fishbowl”.

	MONDAY (4/23)	TUESDAY (4/24)	WEDNESDAY (4/25)	THURSDAY (4/26)
9:00 - 9:30	TEAM 29 **Rogue Irrigation Authority** Advisers: Walters, et al.	TEAM 32 **Nex Gen Efficiency** Adviser: Cohen	TEAM 21 **LiveInject** Adviser: Suh	TEAM 58 **ASME Design Competition** Adviser: Jacobs
9:30 - 10:00	TEAM 50 **BC3** Adviser: Miller	TEAM 4 **Made of Steel** Adviser: Kim	TEAM 45 **Project G-Force** Adviser: Lelkes, et al.	TEAM 46 **Conn River** Adviser: Khan
10:00 - 10:30	TEAM 28 **Mighty Ducks** Adviser: Jacobs	TEAM 49 **Better Tools Better Science** Adviser: Pleshko	TEAM 5 **De-icing Team** Adviser: Dikin	TEAM 24 **Atomos** Advisers: Har-el, et. al
10:30 - 11:00	TEAM 30 **Aerospace All-Stars** Adviser: Sadeghipour	TEAM 27 **Bridging the Future** Adviser: Kim	TEAM 25 **Owls Nest Consulting** Adviser: Khan	TEAM 35 **Seismic Design of a Steel Structure** Advisers: Coe, et al.
11:00 - 11:30	TEAM 15 **Retroactive** TEAM 19 **Southern Aero Temple** Advisers: Roberts, et al.	TEAM 43 **On Track** Adviser: Miller	TEAM 2 **HydroPhillyCity** Adviser: Dames	TEAM 10 **Run RMC** Advisers: Roberts, et al.
11:30 - 12:00	TEAM 41 **MSRR Corporation** Adviser: Ayranci	TEAM 38 **Automated Solutions** Adviser: Dames	TEAM 36 **Formula SAE Intake/ Exhaust** Adviser: Cohen	TEAM 55 **Engine Nectar** Adviser: Hamid
12:00-12:30	TEAM 3 **Urban Greenhouse Group** Adviser: Tehrani	TEAM 11 **Wave Power Tech** Adviser: Heravi	TEAM 51 **Vertical Farm System** Adviser: Ronen	TEAM 42 **Bridge Designers** Adviser: Kim
12:30 - 1:00	TEMPLE 52 **Temple Formula Racing** Adviser: Biswas	TEAM 13 **Body Savers Inc.** Adviser: Chopra	TEAM 26 **SIAA Urinalysis** Adviser: Patil, et al.	TEAM 47 **Spec** Adviser: Bai
1:00 - 1:30	TEAM 12 **Soil, Inc.** Adviser: Udoeyo	TEAM 9 **Rotarod Mod Squad** Adviser: Darvish	TEAM 39 **Tissues Engineering and Microfluids** Adviser: Pleshko	TEAM 53 **Sensory Perception Shin Sleeve** Adviser: Spence
1:30 - 2:00	TEAM 18 **ESK Environ. Consultants** Adviser: McKenzie	TEAM 33 **Accelerators** Adviser: Darvish	TEAM 44 **Advanced Chip Design for CNS-Modeling** Advisers: Ramirez, et al.	TEAM 7 **FSAE Aerodynamics** Adviser: Chen
2:00 - 2:30	TEAM 31 **Tierney & the Beach Boys** Adviser: Helferty	TEAM 48 **TU Lite Concrete** Adviser: Udoeyo	TEAM 8 **Electric Engineers** Advisers: Helferty	TEAM 17 **Mismatched Impedances** Adviser: Ahmad
2:30 - 3:00	TEAM 40 **RMC Electrical** Adviser: Helferty	TEAM 20 **Prosthetic Aesthetic, Inc.** Adviser: Ochia	TEAM 16 **Geowall 2018** Adviser: Coe	TEAM 54 **Los Angeles Re-Chargers** Adviser: Ren
3:00 - 3:30	TEAM 57 **Inertia House** Adviser: Udo-Inyang	TEAM 34 **X-Hab Sanitation Challenge** Adviser: Ronen	TEAM 1 **Five Guys Biometrics** Adviser: Lemay	TEAM 22 **On Pace to Win** Advisers: Darvish, et al.
3:30 - 4:00	TEAM 23 **MAGK Solutions** Adviser: Chopra	TEAM 14 **Noise Busters** Adviser: Silage	TEAM 56 **Three Power Inc.** Adviser: Biswas	TEAM 37 **Electro-Mechanix** Adviser: Dames

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BIOENGINEERING

TEAM 1 - FIVE GUYS BIOMETRICS

Chinmay Chafale
Kyle Greenzweig
Liam Kelly
Thomas Murphy
Eshan Patel

ADVISER

Michel Lemay

DYNAMIC MEDICAL REHABILITATION BOOT

Our design takes a common orthopedic boot, used by patients following a lower leg injury or surgery, and adapts it to further facilitate patient recovery. The common orthotic device has been retrofitted with various sensors and custom designed circuits to enable a user to, in real time, track unilateral weight bearing of an injured leg during their recovery process.

This data is processed by a common Raspberry Pi, decoding the information and pushing the data to a mobile application for the end user to track and monitor. By tracking this data, our device will enable patients to more closely follow their prescribed recovery plan and allow for both a faster and complete recovery.

MECHANICAL ENGINEERING

TEAM 2

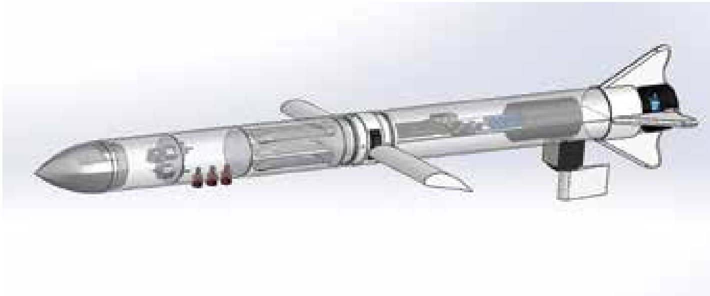
Adam Chrisman
Yuxiang Zhang
Leonardo Flores
Samuel Joseph

ADVISER

Philip Dames

HYDROPHILLYCITY

Unmanned underwater vehicle for water sample collection.



UUV SolidWorks final assembly.

MECHANICAL ENGINEERING

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 3

Maryam Almesfer
Gianna Makler
Brett Riley
Kamila Florczak

ADVISER

Rouzbeh Tehrani

URBAN GREENHOUSE GROUP

Sponsor: FNC

Our team is working with the North Philadelphia non-profit Federation of Neighborhood Centers (FNC) to refurbish a high-tunnel greenhouse which will extend their growing season to year-round. The greenhouse grows low cost vegetables for weekly farmer's markets serving the North Philadelphia community and also serves as an educational tool for local high schools and volunteer programs. The original greenhouse lacked ventilation, insulation, and a sustainable water source. We replaced the cover, insulated the west wall with plywood and insulation foam board, and installed a passive ventilation system capable of automatically opening vents using a temperature controlled mineral wax cylinder.

8th and Poplar Street Greenhouse prior to our team's renovations.

Covering the structure and providing ventilation stabilized the temperature and humidity within the greenhouse. We installed a rainwater catchment system consisting of 96 feet of gutter and 1,050 gallons of water storage to eliminate FNC's reliance on municipal water to irrigate crops. The water will be distributed through a drip irrigation system using a solar powered pump. We designed and implemented a solar powered system to power all electrical components.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 4 - MADE OF STEEL

Chanel Mack
Ladan Abbasi
Halyna Pylypchuk
Jean Lafleur
Illya Trofymenko

ADVISER

Sanghun Kim

2018 NATIONAL STEEL BRIDGE COMPETITION

The 2018 Student Steel Bridge Competition challenges students to conduct a project that goes from design, to testing, and into the erection of a competitive bridge. Our team, along with teams 27 and 42, has managed to come up with a final bridge design that meets and exceeds all the challenges put forth by the competition rules.

The final design came out to be 17 feet long, 1'- 8" tall, and 3' - 2" wide. Design and testing was done through RAM Elements, and verified in Staad.PRO. Fabrication was outsourced to Emtech Metal Products due to time concerns, the reliability of professional fabrication, as well as their competitively low pricing. The resulting bridge was tested on categories based on the competition rules. Namely, constructibility time, as well as deflection due to vertical and lateral loading. Our results for construction time were 39 minutes, and our vertical deflection from 2600 lb load over two 3 foot spans along the span of the bridge came out to 1.56 and 2.25 inches.

The bridge was left as an example for future Temple students who will be entering the competition in subsequent years.

MECHANICAL ENGINEERING

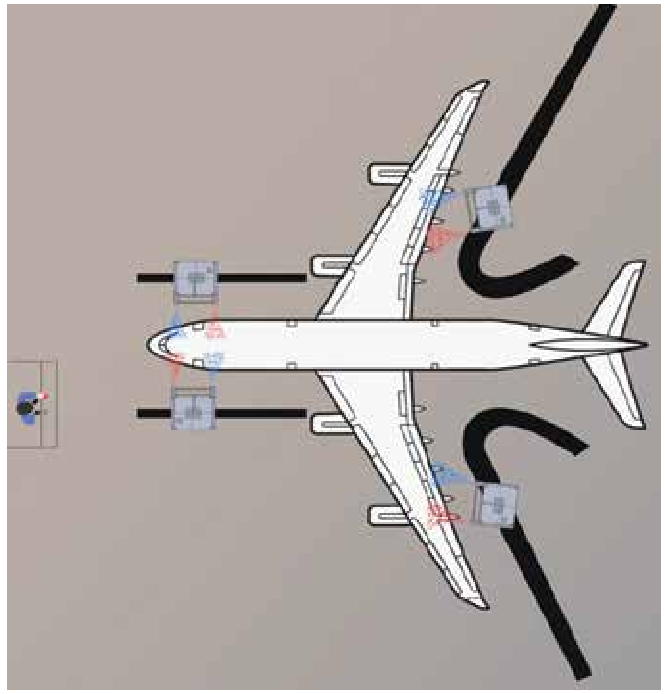
TEAM 5 - DE-ICING TEAM

Abdalrahman Alotaibi
Mohammad Ashkanani
Nam Le
Haidar Morad

ADVISER

Dimitry Dikin

SEMI-AUTOMATED DE-ICING AND ANTI-ICING SYSTEM



Aircraft's wings and rear tail are engineered with a very specific shape in order to provide proper lift for flight, any change in their shape can result in serious safety issues during take-off. Therefore, deicing and anti-icing are required to prepare the aircraft for a safe flight. Deicing is done to remove any snow or ice contamination on the aircraft's body, and anti-icing is done to delay ice formation on the aircraft's body.

The main purpose of the semi-automated deicing and anti-icing system is to improve the current practice of deicing and anti-icing an aircraft in which in severe conditions a re-application of deicing is required.

The proposed solution is to design a system that can perform both operations concurrently as such it can deliver the goal of the process in less time and lower chemical consumption.

MECHANICAL ENGINEERING

TEAM 7

Kyle Appel
Jesse Yoder
Igor Smola
Shoultes Tyler

ADVISER

Jim Chen

FSAE AERODYNAMICS

3-D rendering of the 2018 TFR car with Complete Aerodynamic Package.

The Temple Formula Racing team (TFR) set out on shortening their lap times this year by introducing aerodynamic devices on the car to increase normal forces on the tires, increasing traction forces, yielding better cornering speeds, improved control, and ultimately faster lap times.

Aerodynamic devices are mainly used for two reasons, to increase the down-force applied to the car and to direct airflow around the car resulting in less drag on the vehicle.

Team 7 / FSAE Aerodynamics set out on adding a full aerodynamic package for the 2017 and 2018 TFR cars. This package will include a front wing, a rear wing, and an under-tray with diffuser. The aerodynamic package should produce at least 500 pounds of down-force without restricting top-end acceleration or adding over 30lbs to the vehicle. Wings and under-tray were modeled in a 3D CAD software then analyzed with a Computational Fluid Dynamics (CFD) solver / visualizer to determine how the aerodynamic package will perform under various speeds and configurations to find a satisfactory design that produced the required amount of down-force. Theoretical CFD simulations predict 629 pounds of combined down-force applied upon the completion of fabrication and testing, exceeding the set goal of 500 pounds.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 8 - ELECTRIC ENGINEERS

David Arnott
James Riley McHugh
Jessica Cohen
Jonathan Szynal

ADVISER

John Helferty

TU TOUR DRONE

The goal of this senior design project is to create an autonomous drone that can be used to guide visitors, new students, or anyone lost on Temple University's campus from their current location to any destination of their choice. The user communicates with the drone through a web application hosted on an AWS (Amazon Web Services) server to supply the drone with their location and desired destination.

In order to get to the user and fly around campus, the drone utilizes GPS for marking an overall path. Since GPS in a city environment is inaccurate due to other signal interference and tall buildings, another form of navigation is necessary to keep the drone on this path. An imitation learning algorithm called the DAgger algorithm (Dataset Aggregation) is used to keep the drone from veering off sidewalks into the street and to avoid obstacles that might be present in the path.

The inspiration for this project came from the need for a more reliable and interactive way of navigating and showing the university's campus and also from the desire to contribute to the new and up-and-coming field of urban drone autonomy.

MECHANICAL ENGINEERING

TEAM 9 - ROTAROD MOD SQUAD

Liqaa Alotair
Mable Bakali
Scott Alvarez
Emma Mae Veloso

ADVISER

Kurosh Darvish

ROTAROD

Team 9 is building a custom Rotarod machine for Dr. Darvish's Biomechanics Lab to test the motor skills of mice and rats. The Rotarod uses an elevated, rotating rod that acts as a treadmill for the animals. The team added features including an adjustable RPM dial and LCD RPM output screen.

The machine is scaled to comfortably fit the large Sprague Dawley rats used in the lab. Three lanes allow multiple tests to be The housing is made of a transparent acrylic sheet so the rats can be viewed from all angles. Opaque walls separate the lanes so the rats do not see each other during the test, reducing the rats' stress.

The rats walk on an innovative 3D printed drum. The drum is printed in two halves and is clamped to the metal shaft. Using 3D printing, new drums can be created quickly and cheaply, allowing researchers to print drums of different diameters to scale it perfectly for different species. New drums could also include different textures on the outer surface, giving the animals a new obstacle to navigate. The rotating rod is driven by a DC motor and Arduino.

MECHANICAL ENGINEERING

TEAM 10

Jason Begley
Jonathon Hill
Katie Nguyen
Joseph Teitelman

ADVISER

Shriram Pillapakkam
Dustyn Roberts

RUN RMC

Run RMC is a team of mechanical engineers working in conjunction with electrical engineers and the Temple Robotics Club to produce a mining robot for this year's NASA Robotic Mining Competition (RMC). We are responsible for creating the mining system for the robot, which includes an auger, ball screw linear guide system, and four bar linkage system to raise and lower the auger. The main objective of the annual NASA Robotic Mining Competition, held at Kennedy Space Center, is to design and develop a robot that can traverse a simulated Martian terrain and collect samples from the ground.

Shown is the 2016 Temple RMC robot in competition at Kennedy Space Center. This year's RMC team iterated upon this particular design for their upcoming competition in May.

The robot should be able to mine both a top layer of BP-1, a fabricated material developed by NASA that is intended to simulate what would be encountered on Mars, as well as the icy regolith deep below the surface; which is simulated with gravel in competition. Completed robots typically consist of a frame, depositing system, mining system, wheels/tracks, and an electrical configuration that powers the robot (either autonomously or by human control). Once the robot has been fully constructed, the team will submit their design into competition where it will be judged on a variety of different criteria.

MECHANICAL ENGINEERING

ELECTRICAL & COMPUTER ENGINEERING

TEAM 11

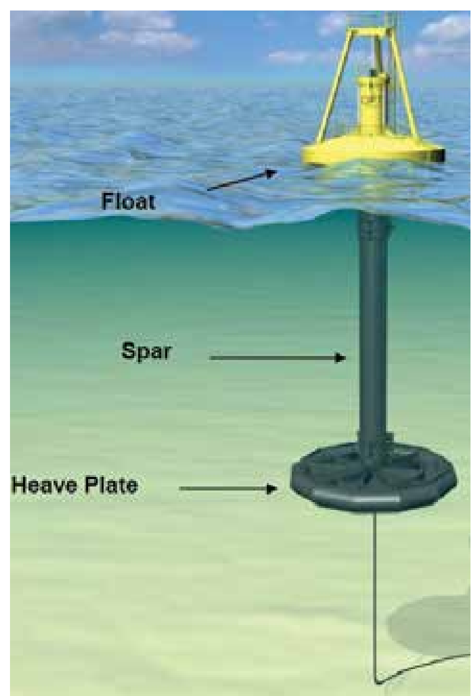
Matthew Beu
Nichole Humbrecht
Sujoy Talukder

ADVISER

Hamid Heravi

WAVE POWER TECHNOLOGY

Sponsor: Ocean Power Technology



Team 11 designed a device to capture the mechanical energy that is naturally available in the waves of the ocean. Ocean waves are the result of winds blowing across the surface of the water causing agitation that propagates due to the conservation of momentum. This propagating wave stores energy in the form of potential and kinetic energy until it is either absorbed by structures at sea or crashes into land.

There are many designs that have been developed to harness this energy, each with its own set of pros and cons. Within the scope of this project, Team 11 looked to validate the point absorber design as a method of wave energy recovery. A point absorber is small when compared to the length of the wave, typically is floating freely, and generates electricity by using the relative motion between the waves and the still surface typically being restricted to movement along 1-degree of freedom only.

Our design is a permanent magnet linear generator. As the name implies the motion that is being harnessed is along one central axis between two independent buoys in a linear fashion that generates emf from the oscillation of permeant magnets relative to cooper coils.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 12

Cory Bogas
Nick Green
Jodie Hyland

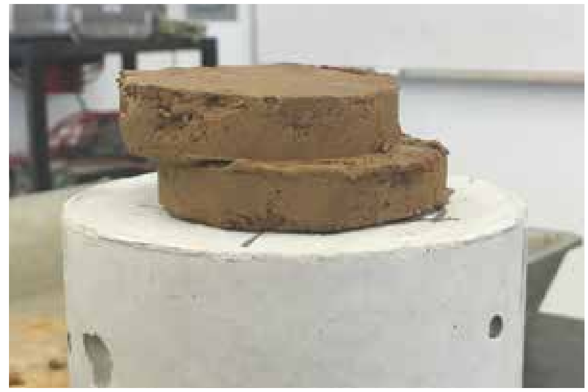
ADVISER

Felix Udoeyo

SOIL, INC.

This research was performed to analyze the effects of adding Cement Kiln Dust (CKD), Ground Granulated Blast Furnace Slag (GGBFS) and nanosilica to a clayey soil and deduce which mixture yields the strongest soil.

Each mixture had various percentages of each additive and underwent three tests: Atterberg limits, direct shear test, and the standard proctor test.



Sheared soil sample.

MECHANICAL ENGINEERING

TEAM 13 - BODY SAVERS INC.

Joseph Albanese
Fatemah Alqallaf
Austin Brownell
Juan Munoz

ADVISER

Harsh Deep Chopra

EMERGENCY AMPUTATION CONTAINER

This project addresses the issue of accidental extremity amputations in the workplace. The motivation in the pursuit of designing and building the Emergency Amputation Container (EAC) is for affected patrons to not only conserve but to facilitate the reattachment of a severed limb. Although the Occupational Safety and Health Administration (OSHA) has protocols and regulations for the use of heavy machinery, there are still cases of workers permanently losing limbs by these very same machines due to inadequate care of their amputations.

The approach to this solution is simple: create a container that will house limbs long enough for reattachment at a later time. The design parameters come down to thermal properties of material selections and geometric constraints. The EAC must be able to accommodate practical amputation sizes and cool amputated extremities for an extended amount of time. The success of the EAC will be seen in fewer workers losing their limbs due to improper protocol when handling amputations.

EAC conceptual CAD model.

ELECTRICAL & COMPUTER ENGINEERING

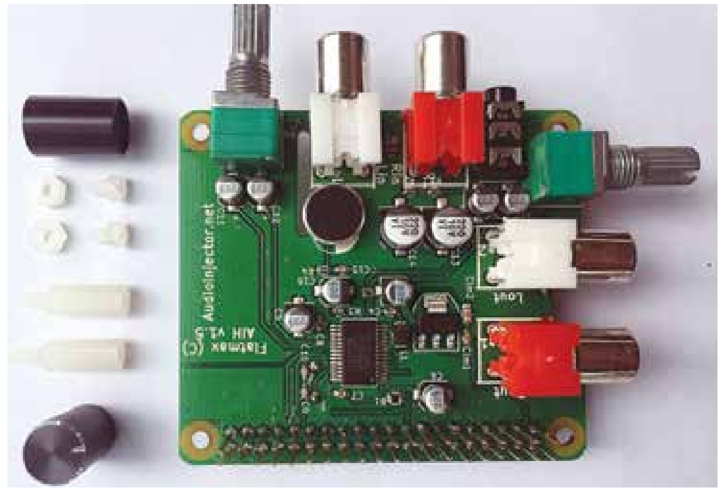
TEAM 14

Minteng Chen
Fanny Brahima
Andy Lamani
Sanders Legendre

ADVISER

Dennis Silage

NOISE BUSTERS



The main objective of this project is to create a digital signal processor using a Raspberry Pi. Our digital signal processor will be fully integrated with a 7-inch touch screen user interface as a method of controlling the different modes and options that our DSP will provide. Our DSP will eliminate noise and heterodynes notch depth to 70 decibels and include common DSP features such as bandpass filtering, notch filtering, and automatic gain control.

The main motivation driving this project is to decrease the barrier of entry for people hoping to become involved in amateur radio. If our project is successful we hope to have our results published in a journal so that other amateur radio enthusiasts can see our results. Our project was divided up into two phases, a simulation phase and a testing phase. In the simulation phase we used MATLAB to simulate the feature set of our DSP. We used MATLAB to determine the coefficients of our filter and other important parameters. The next section of the project which we have not started is the testing part. In the testing part we will verify all the results we produced in our simulation. We hope that by the end of this project we will have a fully functional DSP that can be used for providing a better communication experience.

MECHANICAL ENGINEERING

TEAM 15 - RETROACTIVE

Joshua Frye
Zachary Scannapieco
Daymon Delbridge
Auston Buchanan

ADVISER

Shriram Pillapakkam

SAE AERO DESIGN COMPETITION

To design and manufacture a radio-controlled aircraft capable of competing in the annual SAE aero design competition.

The aircraft was to be designed around two main design constraints. Those constraints being a 1000-watt limiter for the entire aircraft as well as a power to weight ratio of 60-watts per 1-pound.

The goal of the competition is to carry as many passengers (tennis balls) and luggage (0.5-0.75 pounds weights) as possible. This year's aircraft was built to carry a maximum of 14-passengers and 10.5-pounds of luggage.

SolidWorks rendering of the final design iteration for the aircraft.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 16 - GEOWALL 2018

Victoria Dutille
Coleman Cosby
Brendon Creed

ADVISER

Joseph Coe

MID ATLANTIC REGIONAL GEOWALL COMPETITION

In the last 40 years or so, mechanically stabilized earth walls have gained wide acceptance within the public and private sectors, and have become the standard of practice for slope stability projects. The progression from the traditional concrete cantilever wall has occurred primarily because MSE walls are less expensive to construct and easier to design and build.

The Geo Institute of the American Society of Civil Engineers puts on the GeoWall Competition every year to give students the opportunity to develop the skill sets needed to tackle real world projects. Per the competition specifications, our team has designed and tested a model mechanically stabilized earth (MSE) retaining wall.

The goal of the GeoWall Competition is to optimize the design of our wall by using the least amount of reinforcement necessary to support not only the retained soil, but also additional vertical and horizontal surcharge loads.

Model mechanically stabilized earth retaining wall.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 17 - MISMATCHED IMPEDANCES

Kyle Clark
Sivan Zlotnikov
Matthew Thiess
Reed Esquirell

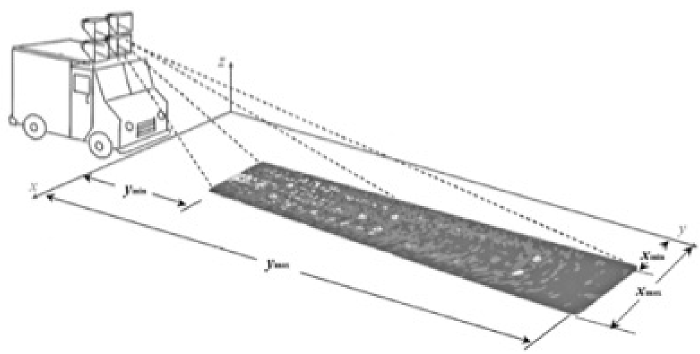
ADVISER

Fauzia Ahmad

FORWARD LOOKING GROUND PENETRATING RADAR (FL-GPR) TEST BED

Forward Looking Ground Penetrating Radar (FL-GPR) systems allow users to perform subsurface scans of various 'scenes' with the goal of detecting and locating buried objects. With military applications in detection of unexploded ordnance (UXO), improvements made to this technology will increase the accuracy and reliability of target detection.

A Forward-Looking Ground Penetrating Radar test bed was developed for Temple University's College of Engineering Multimodal Sensing and Imaging (MSI) Lab. We created this functional platform on which data collection and processing can take place so that future groups/ students can work to develop more sophisticated systems, using ours as a foundation.



Forward looking ground penetrating radar (FL-GPR) test bed.

CIVIL & ENVIRONMENTAL ENGINEERING

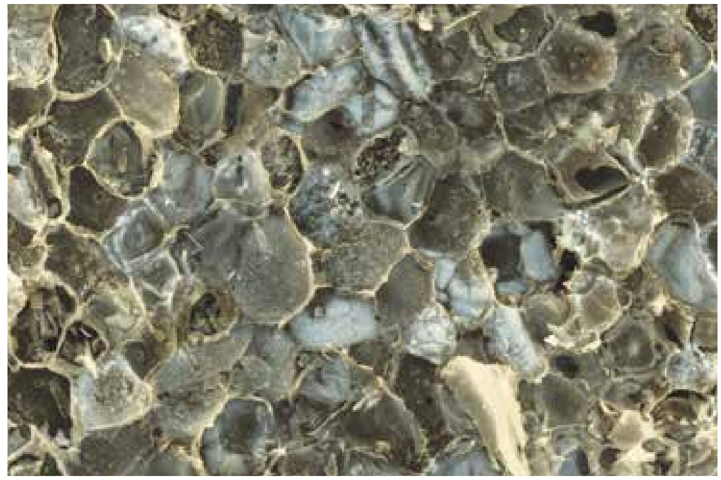
TEAM 18 - ESK ENVIRON. CONSULTANTS

Michael Evenson
Ken Sanborn
Jeff Botula
Adama Kamagate

ADVISER

Erica McKenzie

FE BIOCHAR



Iron-amended biochar sorbent.

A variety of sorbents exist that have been shown to remove select heavy metals from stormwater runoff. A previous study (Hu, 2015) has shown an iron-impregnated biochar sorbent has been successful at removing arsenic from an aqueous solution during laboratory testing.

This project further explores the functionality of this sorbent, testing the viability of both an iron impregnated biochar sorbent and a granular activated carbon sorbent. These two sorbents are compared to their pristine counterparts. The results indicate that the iron-amended sorbents were more successful at removing cations (antimony, arsenic, and selenium), and less effective at removing the anions (lead and cadmium) from aqueous solution, compared to their pristine sorbent counterparts. In addition, the effect of pH and phosphate levels on the sorption capacity of these four sorbents were examined. The influence of these two factors on the sorption capacity varied. The data was ultimately used to create a publicly available decision tool that helps planners/designers make an informed decision about the implementation of sorbents as a stormwater treatment system.

MECHANICAL ENGINEERING

TEAM 19

Lisa Dam
Brian Flynn
James McLeod
Tanvir Saurav

ADVISER

Shriram Pillapakkam

SAE AERO DESIGN COMPETITION

SolidWorks rendering of final aircraft design.

To design and manufacture a radio-controlled aircraft capable of competing in the annual SAE aero design competition.

The aircraft was to be designed around two main design constraints. Those constraints being a 1000-watt limiter for the entire aircraft as well as a power to weight ratio of 60-watts per 1-pound.

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BIOENGINEERING

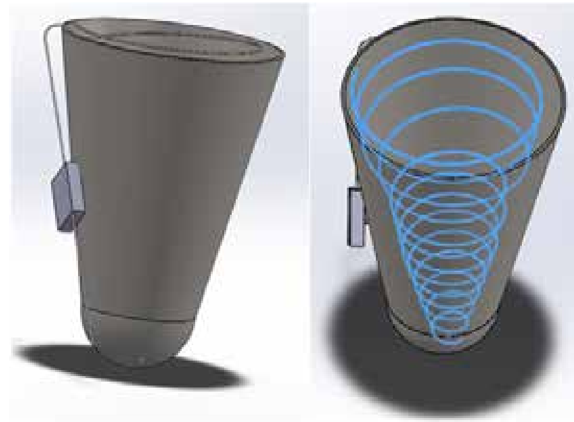
TEAM 20 - PROSTHETIC AESTHETIC, INC.

Anastasia Georges
James Hartman
Danielle Humber
Jailiene Miranda

ADVISERS

Ruth Ochia
James Furmato

THERMAL MANAGEMENT SYSTEM FOR TRANSFEMORAL PROSTHESIS



The image represents the spiraling of the tubing throughout the silicone gel liner of a transfemoral prosthetic device. The lateral placement of the pump will minimally effect the user's gait.

Thermal management system for transfemoral prosthesis implements an active cooling system into a transfemoral prosthetic device, improving the comfort and functionality of the user. Transfemoral amputees are those suffering from above-the-knee lower limb loss. Motion and friction while wearing the assistive device cause an accumulation of heat within the system, leading to discomfort, sweating, skin irritation, and skin abrasion.

Since the interface between the silicone gel liner and residual limb is an important component, the thermal management system integrates flexible silicone tubing within the silicone gel liner. To initiate heat exchange, a centrifugal pump is connected to the tubing to actively flow coolant throughout the system. Water is used as coolant because of its heat capacity, cooling properties, and biocompatibility with the skin.

Validation methods to ensure that the system efficiently regulates the surface temperature of the residual limb include complex fluidic and thermodynamic calculations in addition to materials and thermal distribution testing.

BIOENGINEERING

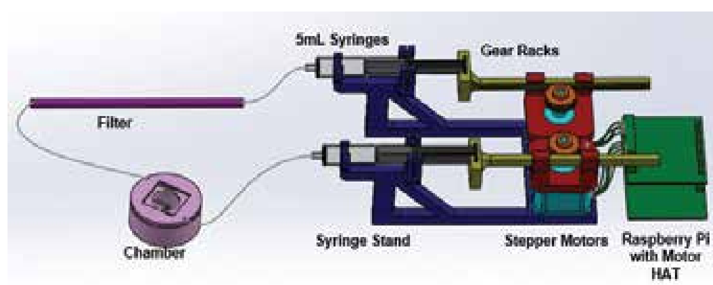
TEAM 21 - LIVEINJECT

Michael Palizkar
Cynthia Gilbert
Zachary Trego
Rachel McDonald

ADVISER

Won Suh

AUTOMATED MEDIA EXCHANGE SYSTEM



Current cell culture research requires cells to be removed from their optimal conditions of the incubator for media exchanges.

The development of this project paired with a stage top incubator will allow cell research and imaging to occur over significantly longer periods without interruption to the cells' environments, improving research quality.

BIOENGINEERING

TEAM 22 - ON PACE TO WIN

Thomas Gillin
Leah Evanik
Omar Mustafa

ADVISER

Michel Lemay

ENERGY HARVESTING PIEZO CANTILEVER BEAM FOR LEADLESS PACEMAKERS

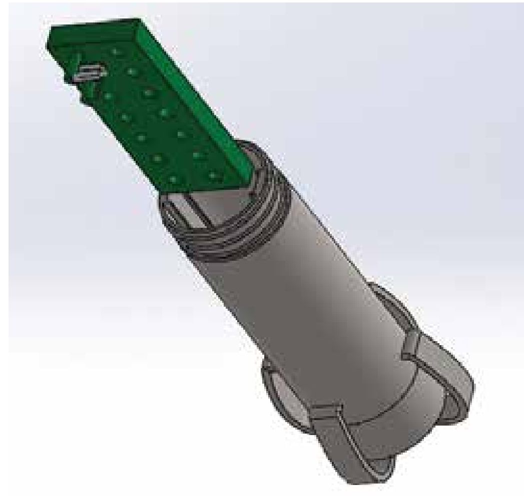


Figure shows the beam connected to the circuit board, which is placed inside a replica structure of the MICRA pacemaker.

Two of the major problems with today's pacemakers are infections due to the leads and the relatively short battery life. Moreover, these two problems result in a high percentage of replacement surgeries, as roughly 50% of patients undergo at least one replacement surgery, while 11-16% need multiple surgeries. Intracardiac leadless pacemakers will replace the standard lead wafer pacemakers, resolving the issue of infections. However, the battery life remains a problem, only lasting between 7 to 10 years.

Propitiously, these devices open the door to energy harvesting systems; the pacemaker's adherence with the beating heart can convert the heart's vibrational energy to electrical energy.

This project will address the issue of the short battery lifespan in leadless pacemakers by designing and optimizing an energy harvesting circuit powered by piezoelectric cantilever beams. Moreover, it encompasses a feasible integratable PCB with piezoelectric cantilever and circuit design into the MICRA pacemaker without a battery. A simulation and optimization study has been conducted to determine the maximum surface area and beam dimensions for maximum power output given the size and force constraints.

CIVIL & ENVIRONMENTAL ENGINEERING

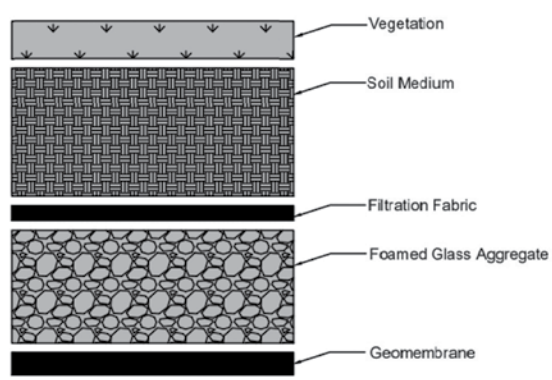
TEAM 23 - MAGK SOLUTIONS

Garrett Graf
Zachary Paris
Anthony Rosanio
Mohammad Hammoudeh

ADVISER

Harsh Chopra

SMART AQUA MANAGEMENT SYSTEMS



Over the last decade, Philadelphia has seen a steady rate in population growth which has resulted in an increase of impervious material. Philadelphia uses a combined sewer system where both the storm water runoff and septic runoff use the same piping system. During heavy rainfall events the water treatment plants cannot keep up, then discharging the untreated water through a combined sewer overflow (CSO) into the local aquatic ecosystem.

Within the last five years Philadelphia has implemented the Clean City Green Waters program to reduce the amount of storm water runoff. An extensive green roof system has been designed to be retrofitted onto the College of Engineering.

Two types of grasses were selected, Andropogon Gerardii (big bluestem grass) and Andropogon Virginicus (broom sedge), to be grown within 3.4 inches of soil medium. The soil medium consists of volcanic ash, and other organic compounds to reduce weight as well as unbalanced nutrient levels. Structural analysis was performed using RAM. Elements and found that an added load of 20.17 psf would be added to the top of the College of Engineering. Storm Water Management Modeling (SWMM) found that the peak flow rate would be 0.31 ft3/s and the maximum velocity through the open channel conduit would be 3.93 ft/s.

BIOENGINEERING

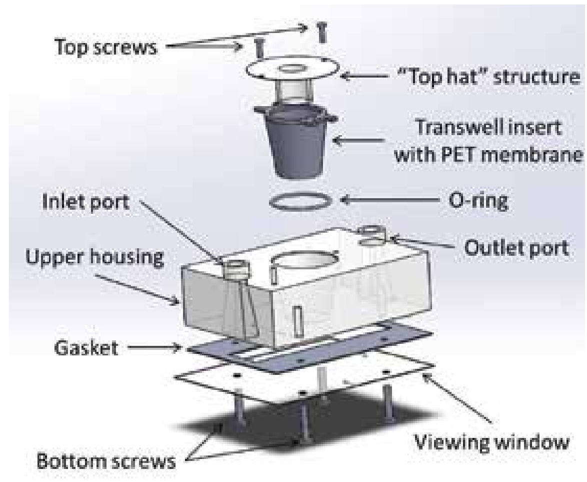
TEAM 24 - ATOMOS

Alexander Getka
Richard Hoff
Pavithra Kavitha
Dave Akande

ADVISERS

Peter Lelkes
Yah-el Har-el

A BLOOD-BRAIN BARRIER MODEL: THE PARALLEL-PLATE FLOW CHAMBER



Labeled exploded view of the parallel-plate flow chamber prototype.

The blood-brain barrier (BBB) is a highly selectively permeable interface between the blood and neural tissue that only allows specific molecules to pass through and protects the neural tissue from infection. Within modern research there is a strong desire to model the blood-brain barrier within a laboratory setting in order to gain insight about its behavior under certain conditions. Current models of interest do not incorporate fluid flow, which is an essential component for recreating the blood-brain barrier due to blood flow's influence on endothelial cell behavior.

More ambitious models that incorporate microfluidics possess many limitations in fabrication as well as the ability to make quantitative measurements; the need for a high level of training to use these devices and the expenses associated with their fabrication and use are also important problems experienced by laboratories with limited funding and resources. The goal of this project was to develop a parallel-plate flow chamber that could serve as a less expensive, reusable blood-brain barrier model and provide crucial insight into BBB function to laboratories with limited funding.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 25 - OWLS NEST CONSULTING

Timothy Long
Kyle Kegarise
Anthony Moffa
Mathew Gyerman

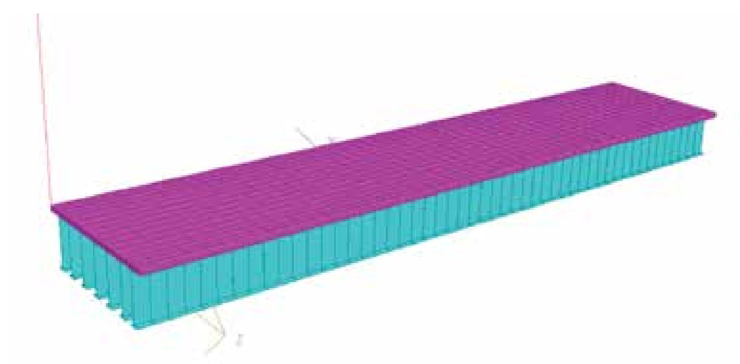
ADVISER

Ali Khan

SUSQUEHANNA RIVER RAIL BRIDGE DESIGN

Design of a simply supported bridge span of 150 feet long with freight loading consideration.

Several designs are to be compared and the most feasible superstructure design will be completed.



3-D rendering of our designed span including steel girders and concrete deck.

BIOENGINEERING

MECHANICAL ENGINEERING

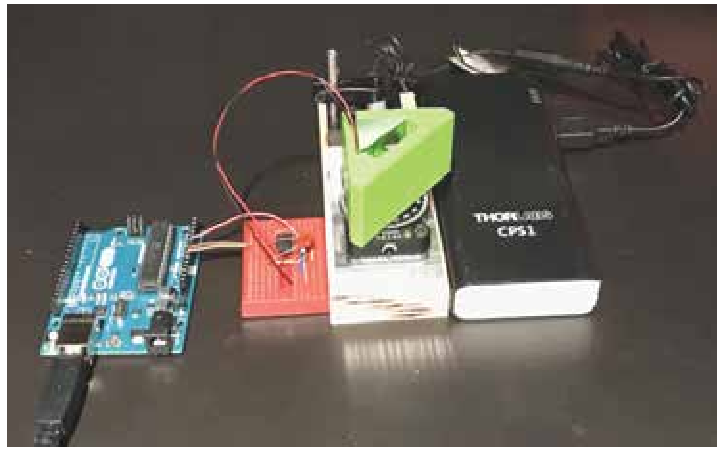
TEAM 26 - SIAA URINALYSIS

Shree Batish, Arooj Khan, Steven Wood, Irem Asci

ADVISER

Chetan Patil

URINALYSIS WITH SURFACE PLASMON RESONANCE (SPR) DEVICE TO DIAGNOSE & MONITOR ACUTE KIDNEY FAILURE/ACUTE KIDNEY INJURY (AKI)



Current blood and urine tests used to evaluate the health of the kidneys via creatinine detection in hospitalized Acute Kidney Injury (AKI) patients produce delayed results, which are not representative of the current condition of the patient. This causes delayed diagnosis and delayed administration of treatment, ultimately leading to compromised outcomes such as delayed recovery, worsening of condition, or death. Late diagnosis and late treatment also results in an extended length of stay at hospitals by an addition of 11 days on average, significantly increasing hospital costs.

Current state-of-the-art SPR devices cost over $10,000 and are very bulky, sometimes weighing over 132 pounds. Using urinalysis with cutting edge Surface Plasmon Resonance (SPR) technology, which excels in accuracy and simplicity, we propose a non-invasive, label-free, creatinine-specific (renal-clearance protein), fast, inexpensive, and portable device for diagnosing and monitoring AKI in clinical & intraoperative settings in real-time.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 27 - BRIDGING THE FUTURE

Faisal Alzaid, El Batina Bokhoum, Alexander Corialos, David Lee Ping, Betsy Batista

ADVISER

Sanghun Kim

2018 ASCE STEEL BRIDGE COMPETITION

Sponsor: Emtec Metal Products Inc. & Steel Tech Services Inc.

For this year's competition, we were put to the task of designing and fabricating a 17' long steel bridge strong enough to support a live load of 2600lbs. There were many categories to the competition such as construction speed, aesthetics, strength and construction economy. Deflection is measured by penalties which is marked as 3,000,000 per inch. Weight is penalized as 25,000 per pound. For our bridge, the combined weight and deflection was measured as 238lbs and 1.5" of deflection.

Our well built bridge, strong enough to support 2600lbs!

There was a total of 11 teams with bridges, and only 5 bridges passed the vertical loading. Some big-name schools we beat were University of Maryland, Morgan State and Lehigh University! Overall, we were ranked 5th out of 11 teams.

Considering the competition, we were facing, we considered this a big win for Temple. We hope that we can pave the way for a consistent Temple team for the many years to come.

MECHANICAL ENGINEERING

TEAM 28 - MIGHTY DUCKS

Christian Chiarulli
Anthony Mack
Mark Donaghey
Shaine Quigley

ADVISER

Daniel Jacobs

ROBOTIC LIFEGUARD

Our project tackled the issue of accidental drowning. Our goal was to reduce the time it takes to provide lifesaving aid to a swimmer in distress, by replacing the lifeguard with a remotely piloted water craft.

The water craft is remotely guided up to the victim, and safely provides a handhold for the swimmer to grab onto. The water craft then serves as a flotation device until proper aid can be brought out to the swimmer.

Our design requirements for the water craft included a top speed of 10 mph, a buoyancy rating for an adult male with a factor of safety of 2, and the ability to be safely piloted to a victim without endangering them further.

Our boat prototype, before electronics were installed and fiberglass wrapped.

CIVIL & ENVIRONMENTAL ENGINEERING

MECHANICAL ENGINEERING

TEAM 29

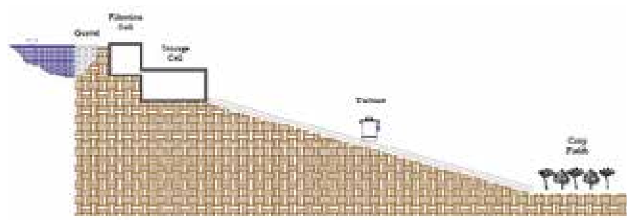
Angelo Algeri
Michael Mahoney
Zachary Klee
Claire Marshall

ADVISERS

Tony Ferrar
Evelyn Walters

THE ROGUE IRRIGATION AUTHORITY

In the developing world, many communities suffer from polluted irrigation water and lack of access to electricity. The objective of this project was to create an integrated engineering solution to heavy metal pollution in irrigation water and lack of electricity in small, rural, developing communities.



Overview of the designed filtration and micro hydro-power system.

The project addresses these issues in an existing Peruvian community, Saccha, which was selected due to the prevalence of mercury-polluted waterways in the area and the community's need for a power source. Designing for a specific community provides quantifiable parameters to inform the design.

The team designed a system that will provide electrical power and contaminant-free irrigation water through integrated micro hydro-power and heavy metal filtration. The designed filter utilizes sustainable biochar material to decrease mercury concentration to meet the World Health Organization standard of 1 μg/L. The designed in-line Francis turbine extracts 367 kWh of energy per month, enough electricity for the community to charge one cell phone and three standard, 60-Watt light bulbs per home.

The system provides reliable clean water and electricity while utilizing materials that are affordable and readily accessible in rural and impoverished areas.

MECHANICAL ENGINEERING

TEAM 30 - AEROSPACE ALL-STARS

Joseph Vespaziani
Joshua McKee
Elizabeth Hibbert
Matthew Eagan

ADVISER

Keya Sadeghipour

INTELLISENSE DRILL TESTING DEVICE

Sponsor: McGinley Orthopedics

McGinley Orthopedic Innovations is a company founded by Dr. Joseph McGinley that works to improve the technology associated in orthopedic surgery. Dr. Joseph McGinley created the IntelliSense Drill.

The drill is currently in use at Shriner's Hospital for Children in Philadelphia, along with nearly 30 hospitals across the country. The drill auto-stops when it penetrates through the second bone cortex. The drill has a built in depth gauge that eliminates manual measuring.

The drill saves in the cost of wasted screws due to incorrect size or misplacement and decreases the need for x-rays to confirm screw placement. Other products are currently in development to assist in the advancement of orthopedic technology. Currently, the CEO tests each drill by hand. This is a time consuming procedure that needs improvement. The fatigue testing device will automate the process of orthopedic surgery.

Once the machine is initialized, it will run through its program loop without any further interaction.

IntelliSense drill testing device.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 31 - TIERNEY & THE BEACH BOYS

Christos Yiantsos
Colin Campbell
John Do
Tierney Mellen
Lane Sandler

ADVISER

John Helferty

ROCKSAT-X 2018

RockSat-X is a rocket payload design program that is part of a partnership between Colorado Space Consortium and NASA. A payload is a containment structure that holds the project students create and is restricted to a size of 12 inches in diameter and 10.75 inches in height.

Students from various universities will be participating and designing payloads that will be sent to the edge of space, about 170km into the atmosphere. Our payload design will consist of a muon detection system. Muons are particles created from high energy particles from space called cosmic rays. These muons are particles that can be detrimental to electrical equipment and humans. Muons can pass through almost any material, making them a potential danger to electrical components.

Machining aluminum heat shield.

Our team will be looking to capture these muons during the flight of our payload on the NASA sounding rocket which will be in flight for about twelve minutes.

MECHANICAL ENGINEERING

TEAM 32 - NEX GEN EFFICIENCY

Bordain Smith
James Stellato
Henry Ortiz
Ryan McKee

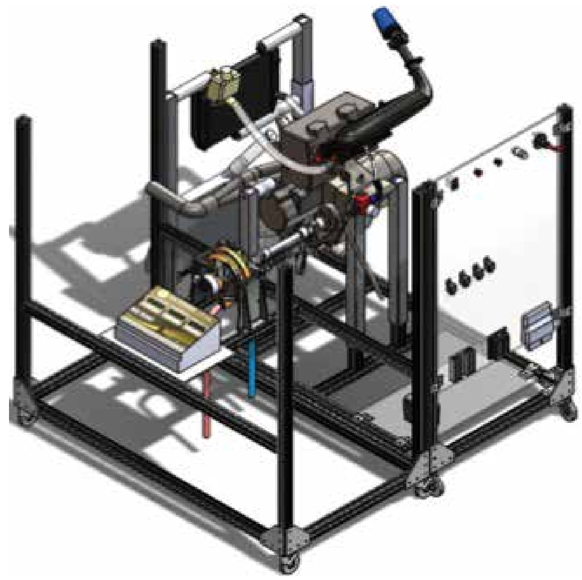
ADVISER

Richard Cohen

TEMPLE FORMULA RACING: ENGINE TESTING STATION

Temple Formula Racing (TFR) is a team of students simulating real world challenges while designing, manufacturing, and racing a high-performance formula style car for the Formula Society of Automotive Engineers (FSAE) collegiate design competition. The FSAE competition exhibits the necessity of innovation and development to effectively increase vehicle performance year after year. The objective of this project is to implement an in-house performance testing facility to allow for ease of diagnostic tuning and engine performance modification for current and future TFR teams.

Over the years, the TFR team has encountered difficulty testing engine parameters necessary to optimize engine performance, due to the lack of an in-house engine testing station. Current diagnostic tuning involves transporting the race car to and from an outsourced test facility, which introduces strict budget and deadline restrictions. By implementing an in-house, out-of-vehicle engine testing station, the TFR team will be able to test critical-performance components, such as air-intake and exhaust systems, during preliminary design stages prior to project completion. Intermittent testing will allow for subsystem design reiterations necessary for maximizing engine performance.



This image displays two detachable test stands. The left stand features an EDP-100 water-brake dynamometer capable of measuring 100 horsepower and 60 lb-ft torque values. The right stand contains all components necessary to mount and run a 600cc engine safely.

MECHANICAL ENGINEERING

ELECTRICAL & COMPUTER ENGINEERING

TEAM 33 - ACCELERATORS

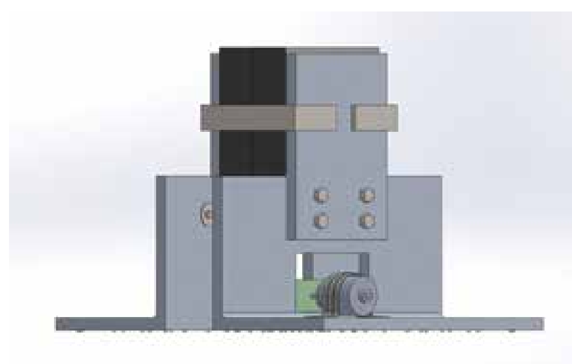
Nawaf Murad
Reem Alarbeed
Karan Puri
Sodiq Adebiyi

ADVISER

Kurosh Darvish

LINEAR AND ROTATIONAL ACCELERATION DURING TBI

Replicate the linear and rotational motion of the head in a rat model for automotive-related TBI.



Control mechanism of the head.

CIVIL & ENVIRONMENTAL ENGINEERING
ELECTRICAL & COMPUTER ENGINEERING
MECHANICAL ENGINEERING

TEAM 34 - X-HAB SANITATION CHALLENGE

Austin Nolt, Damien Gordon, Christian Hofmeister, Mauricio Mendez

ADVISER

Avner Ronen

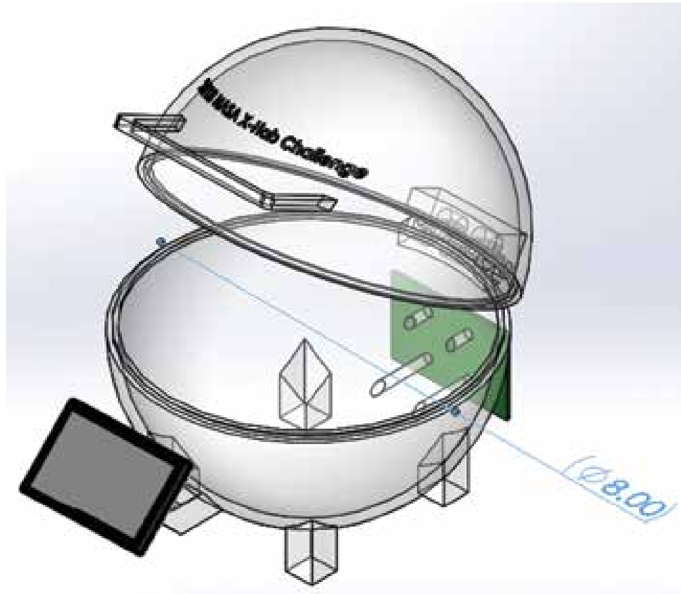
FRESH PRODUCE SANITATION DEVICE FOR USE IN MICROGRAVITY

Sponsor: NASA

Our project is a part of the NASA X-Hab competition. The objective is to design a device to sanitize fresh produce in microgravity, to potentially be used on the International Space Station (ISS). Our design is to use a 3-D printed sphere lined with UV-C LEDs. The produce can then be suspended in an anti-microbial net in the center of the device.

The UV-C LEDs provide a low power and zero waste solution to sanitize the produce. The user interface will be a Raspberry Pi touchscreen, which will offer the user produce options to select. The device will then operate a sufficient amount of time to ensure the produce is safe to consume.

Through proper testing and thermal management, our design ensures sanitary and unspoiled produce with each use.



This is a SolidWorks model of our design. It is a sphere lined with UV-C LEDs designed to sanitize fresh produce.

CIVIL & ENVIRONMENTAL ENGINEERING

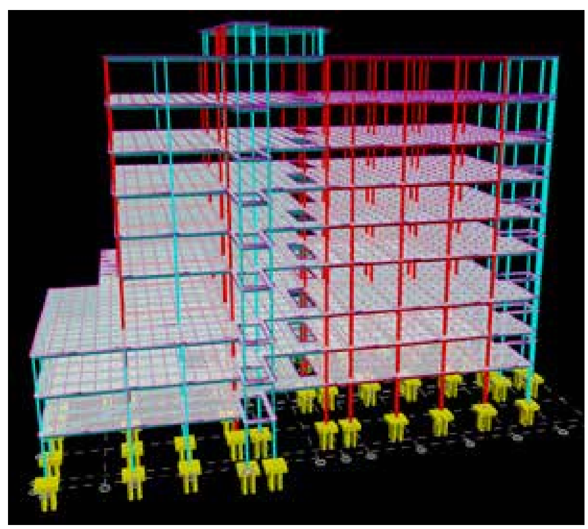
TEAM 35

Michael Berry, Jack O'Connell, John McCormich, Alex Schaal

ADVISERS

Joseph Coe
Sanghun Kim

SEISMIC DESIGN OF A STEEL STRUCTURE



The purpose of this senior design project is to identify a potential solution to the outdated lateral design of Temple University's Engineering Building. The building was constructed in 1975 under the 7th Edition AISC Steel Construction Codes and ANSI 58.1-1972 that are now more than forty years old. New codes and standards are released annually, and each edition has considerable revisions and additions to the minimum requirements for seismic and wind resistance. It is the goal of our project to update and retrofit the building to satisfy the current requirements. We designed the structure in RAM Modeler using the structural as-built drawings to analyze the existing conditions of the building.

By making the beam sizes, spacing, and configurations identical to the as-built drawings, we simulated the behavior of the building. We tested different bracing arrangements in RAM Structural System to determine the most effective retrofit method. We performed comprehensive gravity and lateral analysis, testing for deflection and drift. Our team determined that horizontal angle bracing in the stairwells most effectively minimized drift. This method was also the most feasible in terms of constructibility.

MECHANICAL ENGINEERING

ELECTRICAL & COMPUTER ENGINEERING

TEAM 36

Aaron Giaco
Connor O'Rourke
Nicolas Patterson
Jahad Khoudari

ADVISER

Richard Cohen

FORMULA SAE INTAKE / EXHAUST OPTIMIZATION

The problem this project addresses is the low horsepower produced by Temple Formula racing car. The last design of the exhaust and Intake system contributed to the production of 60 horsepower. Therefore, this project aims to improve the volumetric efficiency of the intake system by optimizing runners' length, plenum geometry, and plenum volume.

Manipulating the intake components leads to equal airflow and pressure distribution through all runners. This helps increase the volumetric efficiency of the design and so the aim of increasing horsepower to 72hp is achieved.

The approach to achieve our goal is to apply experimental and simulation testing on the old intake. This provides us with a diagnosis of the design issues, horsepower curve, and torque curve of the design. The next step is to theoretically calculate the optimal intake dimensions and 3D print the new design. The new design is tested to evaluate the improvements of overall output by comparing it to the output of the old design. Sound pressure level and pressure drop testing were performed on new different muffler designs to evaluate the noise level and pressure loss. Based on the results, a muffler design with accepted noise level and lowest pressure drop is picked.

MECHANICAL ENGINEERING

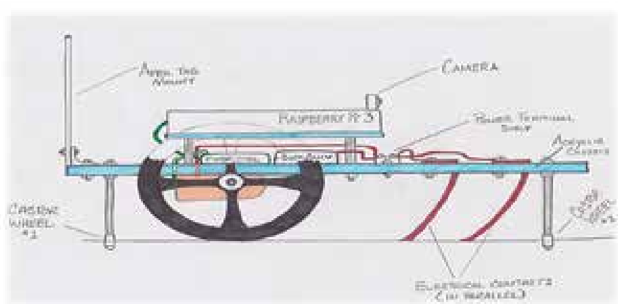
TEAM 37 - ELECTRO-MECHANIX

Makhail Parchment
Dan Poiesz
Antoine Mauldin

ADVISER

Philip Dames

THE AUTONOMOUS VEHICLE MODELING PROJECT: A 1:20 SCALE MODEL FOR TRAFFIC DELAY WAVE DAMPING RESEARCH



A small scale robotic vehicle to reproduce traffic experiments performed with actual automobiles.

The purpose of our project was to develop a small scale robotic model to reproduce traffic experiments performed with actual automobiles. Traffic researchers have proven the concept that one autonomous vehicle can dampen a traffic wave that develops from congestion. Each of their experiments required approximately 500-man hours to perform, cost thousands of dollars, and can only run at 10-minute intervals for safety; thus, a robotic model will advance their research at a quicker pace and save money.

We designed a track that provides power to the vehicles enabling a continuous runtime, no batteries or charging is required. The circular track reproduces the original test course and simplifies our design by removing the need for steering control. Inexpensive cameras and open-sourced image processing software provide relative speed and distance information. Wheel encoders in our motors provide necessary velocity measurements. Using this sensor data our control software implements algorithms from traffic data to adjust the vehicles speed in a similar manner to human drivers.

ELECTRICAL & COMPUTER ENGINEERING

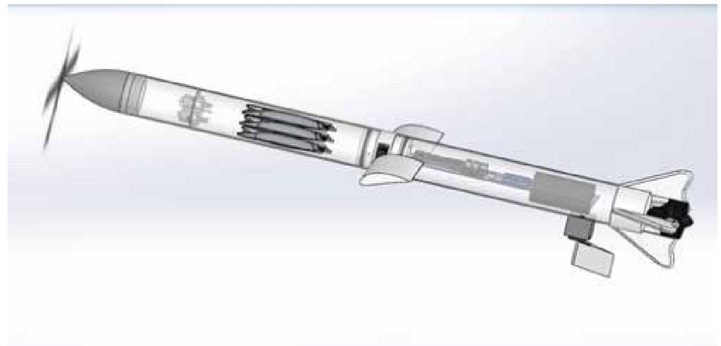
TEAM 38

Eronsele O. Eboda
Sean Perry
Issac Provenza
Sharon Obiefuna

ADVISER

Philip Dames

AUTOMATED SOLUTIONS



The Lower Schuylkill River Corps. (LSRC) is an organization which aims to preserve the quality of the Schuylkill River. Working with the Penn Program in Environmental Humanities (PPEH), they are hoping to research the environmental characteristics of the river and its surrounding area. One method of research involves collecting water samples from the river at various depths to observe the pollutants present in the water at these depths.

Performing this manually would be inefficient, costly, and ultimately unreliable, so we are proposing a semi-autonomous submersible vehicle with a water collection system to gather samples from the river. The submarine will be controlled remotely when navigating the surface of the water and will be capable of diving autonomously while simultaneously collecting water samples at specific depths.

Our team has designed the various electrical systems for the vehicle, which include a propulsion system, water capture system, active fin system, wireless communication system, and integrated sensor control system.

BIOENGINEERING

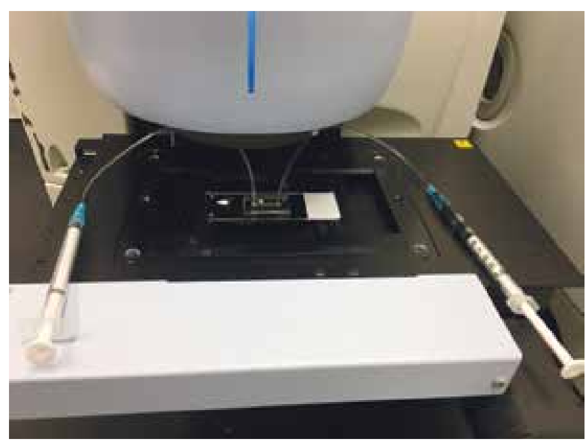
TEAM 39 - TISSUES ENGINEERING & MICROFLUIDS

Winston Colburn
Kenneth Hy
James Karchner
Daniel Reiners

ADVISER

Nancy Pleshko

SHEAR GENIUS



FT-IR imaging spectrometer that is being utilized in Dr. Pleshko's lab, and our microfluidic device that fits on the stage of the spectrometer without interference. Tubing shows where media flows into and out of the device.

Osteoarthritis is a joint disease that affects ~20% of the population and occurs due to age or the degeneration of AC focal defects following injury. AC is an avascular material that lines the ends of long bones and is unable to repair itself upon injury, leading to the rise of tissue engineering (TE) as a possible solution. TE is expensive and time consuming, which has led to the use of rapid and inexpensive microfluidic devices.

Microfluidics allows for the evaluation of TE parameters in a scaled-down environment, which aids in decreasing costs. Infrared (IR) spectroscopy is a technique that utilizes non-ionizing IR radiation to non-destructively assess tissue properties over time without the need for expensive dyes, while also minimizing sample number. We developed a microfluidic device for spectroscopic evaluation of chondrocyte-mediated matrix production over time for TE applications.

The device is designed to fit within a FT-IR imaging spectrometer and constructed utilizing IR transmissible material, such that IR imaging spectroscopy can be performed over time without destruction of the sample. We envision that this device will be applicable to numerous TE fields in the future, as the microfluidic channels are customizable for cell type and experimental requirements.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 40 - RMC ELECTRICAL

Sean Martin
Nicholas
Nathan Groblewski
Benjamin Gross

ADVISER

John Helferty

ROBOTIC MINING COMPETITION ELECTRICAL

Sponsor: NASA, PA Space Grant Consortium

The Robotic Mining Competition is a NASA sponsored event held annually at the Kennedy Space Center. The objective is to design a robot capable of traversing a simulated Martian terrain, mining a sample and returning it to a collection bin. The robot will be allowed two 10-minute runs in the arena to complete this task, with more points awarded for the more regolith mined.

2017 RMC competition robot, upon which the 2018 robot improves.

This team is responsible for the electrical design of the mining robot. The electrical design has been broken into 3 subsystems, the Drivetrain, the MAST, and the Digging/Dumping systems.

A successful design of the robot is dependent on obeying the competition rules, which introduce design constraints. For our Drivetrain subsystem, the functionality is to move the robot at the desired speed and direction within the arena. The MAST subsystem will be responsible for the localization of the robot with respect to the dumping bin. Lastly, the Digging/Dumping subsystem will be responsible for the robot's ability to dig up the desired regolith and dump it into the collection bin.

A successful design for each of these subsystems will allow the robot to perform all of these actions efficiently and within the rules of the competition.

MECHANICAL ENGINEERING

TEAM 41 - MSRR CORPORATION

Joshua Robison
Timothy McMullen
Frank Smith
Paul Romeo

ADVISER

Berk Ayranci

2018 ASHRAE STUDENT DESIGN COMPETITION: HVAC DESIGN CALCULATIONS

The purpose of this competition is to properly size a heating, ventilation, and air conditioning (HVAC) system, specifically requiring variable air volume (VAV) air handling units (AHUs) while complying with the 2010 Editions of specific ASHRAE.

Standards per the competition website description. The team employed techniques and software used by industry professionals to design a modern and efficient HVAC system for competition and student design submissions.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 42 - BRIDGE DESIGNERS

Thomas Benek
Thomas Maria
Daniel Rotondo
Joshua Sanders

ADVISER

Sanghun Kim

NATIONAL STUDENT STEEL BRIDGE COMPETITION

Sponsor: Emtec Fabrication

The objective of the 2018 National Student Steel Bridge Competition is to design, optimize, and analyze a 1:10 scale model of Portland's Bridge of the People. It opened in 2015 and is the first major bridge in the U.S. to prohibit private motor vehicles, while allowing mass transit, bicycles, pedestrians, and emergency vehicles.

The intention of this concept is to not overwhelm outdated road infrastructure in the former industrial districts on the river's banks. Engineering students are challenged to compete in a student driven project experience from conception, design, fabrication, and testing.

The design and construction requirements for the competition emphasize the real world engineering issues, including spatial constraints, material properties, strength, serviceability, fabrication, and safety. Success in this project will further our understanding of these important engineering principals, as well as bring positive recognition to Temple University at the intercollegiate competition.

MECHANICAL ENGINEERING

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 43

Mohamed Bah
Justin Goldman
Junqiang Liu
Tyler Myles

ADVISER

William Miller

ON TRACK

Launch roller coasters are a very common style of roller coaster in new amusement parks today. The launch systems on this style of roller coaster often utilizes either hydraulic or electromagnetic systems, both of which are expensive due to their unique designed parts and complicated to incorporate due to their complex design. To save amusement parks money in construction and maintenance, an alternative catapult launch system can be utilized. This type of mechanism transforms potential energy into kinetic energy by means of a dropped mass in order to provide an acceleration to a cart containing the riders.

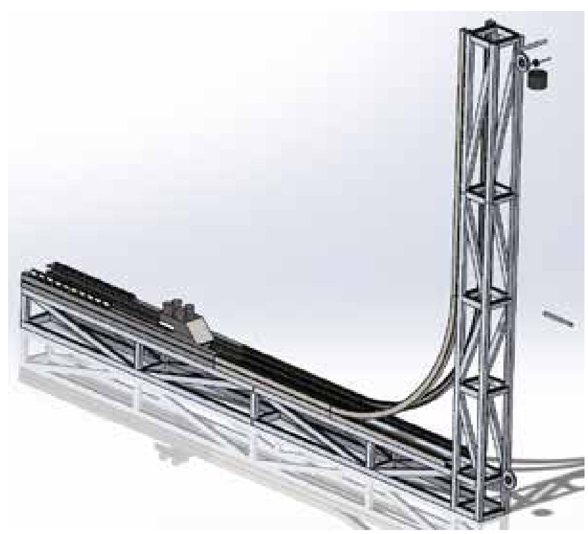


Illustration of the finalized design of the track, space frame, and launch system of the roller coaster to be constructed.

The catapult system is relatively cheap, compared to previously mentioned systems, due to its simple parts and purely mechanical design, which in turn also makes the maintenance easier since the most expensive repairs would be simple mechanical part replacements, such as new pulleys or ball bearings. Keeping in mind ideas such as ASTM Standards, material selection, durability, manufacturability, and safety, a final roller coaster was constructed using computer aided design and then a physical model was to be built at a 40:1 scale. This model will allow for the testing of the design in the physical world, assuring that is could work at full scale.

BIOENGINEERING

TEAM 44 - ADVANCED CHIP DESIGN FOR CNS-MODELING

Rogena Azer
Vanja Nikolic
Timothy Sullivan

ADVISER

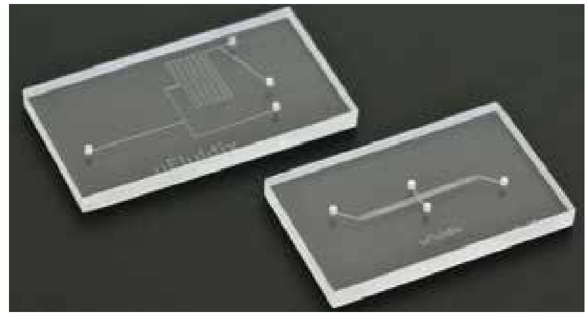
Evangelia Bellas

DEVELOPMENT OF AN IN-VITRO NEUROVASCULAR UNIT USING MICROFLUIDIC CHIP TECHNOLOGY

Sponsor: Servio Ramirez, PhD

Development of microfluidic chip sustaining an in-vitro model of the Blood Brain Barrier (BBB). This engineered solution provides an understanding pathophysiology of the BBB which can be applied to research and other medical concepts.

This novel design consists of a double compartment system: the central, tubular compartment represents the capillary with a porous wall, while the surrounding secondary compartment mimics neuronal tissue.



Example of uFluidix chip with bifurcating channels.

BIOENGINEERING

TEAM 45

Bhautik Amin
Anthony Richards
Matthew Short
Helen Van Natta

ADVISER

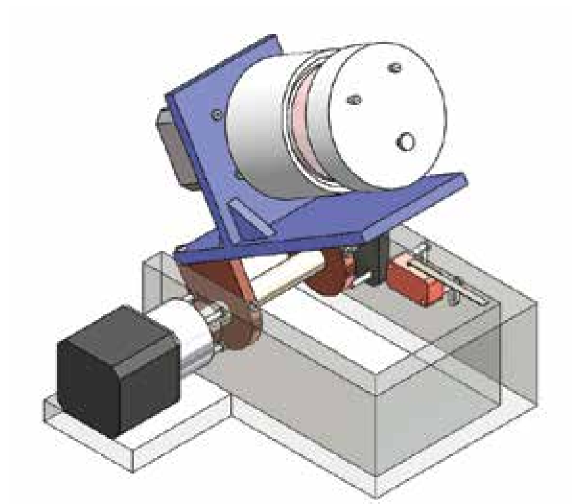
Peter Lelkes

PROJECT G-FORCE

Cell culture devices such as the rotating wall vessel (RWV) bioreactor surpass the limitations of 2D culture techniques (e.g. petri dish) by simulating the effects of microgravity in a 3D chamber, facilitating conditions that more closely resemble how cells behave in vivo. Furthermore, simulated microgravity, and, more generally, any degree of reduced gravity, provides insight into the impact of space exploration and extraterrestrial settlement on biological life.

In regards to the phenomena of partial gravity loading (any fraction of the gravitational acceleration experienced on Earth), an RWV can be modified through angular adaption to simulate gravity conditions in the range of 0 to 1 g.

This project involves the development of a low-cost, robotic modification kit to be used in conjunction with RWV technologies, allowing for the fine-tunable simulation of simulated partial gravity environments for cell culture applications.



Mechanical schematic of final design.

This will be accomplished with a electromechanical pitch system, capable of precisely altering the angular position of a culture vessel, and, in turn, changing the fluid forces acting on particles within the vessel. The proposed device is designed for safe use inside a laboratory incubator, operable for the duration of typical cell culture experiments.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 46 - CONN RIVER

Corey Smithfield, Denman Studdy, Dillon Potts, Anthony Dornes, Matthew Hilken

ADVISER

Mohiuddin Khan

CONNECTICUT RIVER BRIDGE REPLACEMENT

Team 46 has developed a conceptual design report and a preliminary design for the replacement of the Connecticut River Bridge.

The existing bridge is a rolling bascule movable bridge that is located between Old Lyme and Old Saybrook, CT.

The team looked a several alternative designs before creating a preliminary design drawing set for the proposed bridge.

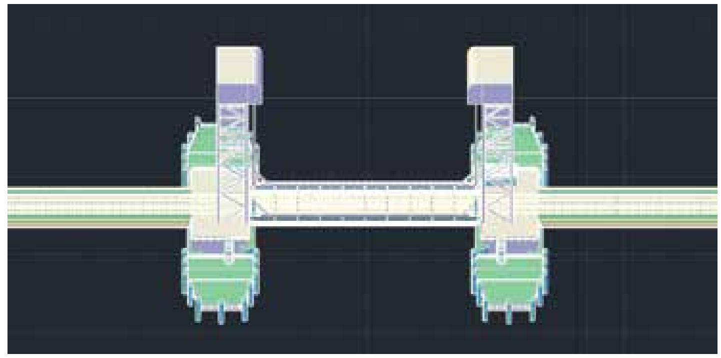


Image shows a 3-D Model of the proposed design of the replacement of the bridge.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 47 - SPEC

Alexander Soussan, Audie Ni, Davy Duong, Mohammad Tishad

ADVISER

Li Bai

AUTONOMOUS NAUTICAL SURFACE VEHICLE: ROBOBOAT 2018

Sponsor: Viking Yachts

Roboboat is a competition sponsored by AUVSI (Association for Unmanned Vehicle Systems International) in which teams design autonomous, robotic boats to navigate and race through an aquatic obstacle course.

The goal of this project is to use ROS, an already existing framework for robotics, to allow communication across multiple sensors for navigation. The central computing node is an Nvidia Jetson TX2 embedded system - which minimizes both weight and power consumption.

Our team has implemented a computer vision system for the detection of several different color buoys. The software will detect buoys, infer the color at a certain level of confidence, and output the pixel coordinate bounding box in reference to the camera frame. A laser range finder mounted on a pan tilt servo will run an algorithm in order to publish the distance of an obstacle within 180° field of view. The laser scan data will be used as input to a SLAM (simultaneous localization and mapping) algorithm in order to navigate in real-time.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 48 - TU LITE CONCRETE

Michael Delaney
Yazan Eid
Michael Petrole
Dennis Brusilovskiy

ADVISER

Felix Udoeyo

STUDENT CONCRETE BEAM COMPETITION

As team 48 in for Senior Design II we are competing in the Student Concrete Beam Competition. Each team will be constructing a concrete beam, no more than 50 pounds, which will be tested to failure by applying a force at the midspan.

There are two goals in this competition: constructing the beam that can withstand the highest ultimate load, and most accurately predicting the loads on the beam.

Aside from the competition, we also were looking to test two other variables to determine how they affect the strength. These variables consist of different size rebar and different anchorage lengths. Rebar can vary by its diameter which directly correlates to the number that corresponds with it. Given the size constraints of the beam, we decided to test beams with number three, four and five rebars.

The next variable that we will be testing is the anchorage length. This is excess rebar on either side of the three-foot span that will be bent at a 90-degree angle to prevent bond failure; it will prevent the rebar from slipping when the beam is placed in tension. The different anchorage lengths will directly correlate to the rebar diameter.

BIOENGINEERING

TEAM 49 - BETTER TOOLS BETTER SCIENCE

David Gansen
Obiora Ufondu
Monica Parameswaran
Jerry So

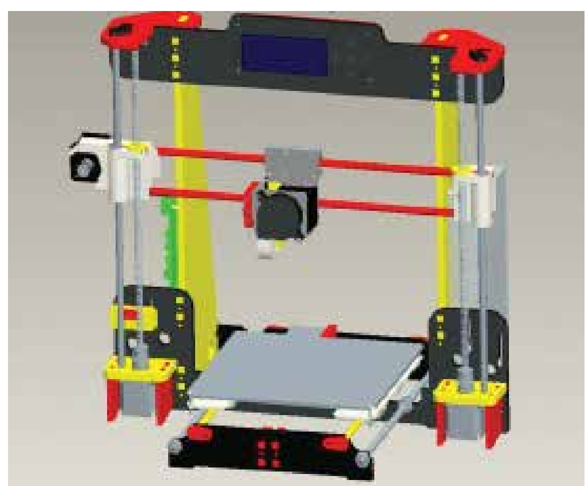
ADVISER

Nancy Pleshko

AUTOMATED FORCE-ADAPTIVE SPECTRAL ACQUISITION USING A FIBER OPTIC PROBE

A handheld fiber optic probe is necessary to perform Attenuated Total Reflectance (ATR) spectroscopy on certain biological tissue samples. However, using a handheld probe can result in inconsistent force application at the contact point with the sample due not only to unsteadiness of hands and different users, but also to mechanical relaxation of biological tissue samples.

Mechanical relaxation occurs through minute displacement of water, or creep phenomenon. Greater forces applied to samples result in greater absorbances in the spectra generated. Because absorbance is related to concentration, as described by Beer's Law, greater absorbances in spectra cannot necessarily be ascribed to greater concentrations. Consequently, the absorbances cannot be used to calculate concentrations of tissue components.



A 3D printer was reprogrammed to regulate the amount of force applied to biological tissue samples through a fiber optic probe.

Mechanically automating force application during sampling eliminates inconsistent force. A robotic arm that can adapt to small changes in contact force can remove this inconsistency. A 3D printer outfitted with a custom probe gripper and force sensor is being reprogrammed for control via Arduino and Matlab.

CIVIL & ENVIRONMENTAL ENGINEERING

MECHANICAL ENGINEERING

TEAM 50 - BC3

Dampalou Sambiani
Dimitrios Stoupakis
Charles Unrath

ADVISER

William Miller

FRESNEL LENS WATER PURIFICATION SYSTEM

The Fresnel Lens Water Purification System is a device that will allow clean water to be brought to areas of the world that have access to a water source, but that water source is untreated and may be contaminated with pathogens and/or disease. This system will allow for purification using only the sunlight. This system will utilize the energy of sunlight using a series of Fresnel lenses.

The design of this system is to ensure an all-in-one design concept that will optimize the space to be occupied. This all-in-one design concept will incorporate the use of 3 fresnel lenses where each lens will be independently able to tilt, rotate, and lift ensuring movement within the x, y, and z-axis. This type of movement will ensure that the focal point of the direct sunlight will be optimized among the evacuated tube where evaporation will take place.

Amongst completion of the product, the Fresnel lens Water Purification System will be able to generate temperatures in excess of 100º C in order to induce water vaporization.

Fresnel lens water purification system.

CIVIL & ENVIRONMENTAL ENGINEERING

TEAM 51

Kevin Bosco
Andrew Phelan
Trumar Wagner

ADVISER

Avner Ronen

VERTICAL FARM SYSTEM

As the world population continues to rise, clean water, land, and food become increasingly scarce. Conventional farming places a significant strain on these vital resources. Large volumes of water are wasted in runoff which then carries pollutants into nearby rivers, lakes, and oceans.

Traditional agriculture also requires a large amount of land that may otherwise be used for recreation, housing, or conservation. Furthermore, conventional farming is not feasible for year-round growth in most regions of the world and is subject to disease, pests, and harsh weather. To combat these issues associated with rising population levels and conventional farming, Team 51 has designed and constructed an aeroponics system that offers a more sustainable approach to food production.

The product has been designed with several consumer goals in mind, including ease of use, maintainability, and ease of assembly. This system consists of a dome shell to support plants, a misting system to provide nutrients, and greenhouse panels to maintain temperature and humidity. This eliminates the need for pesticides, eliminates runoff, reduces energy usage by 90%, reduces land usage by 30%, and allows for year-round growth.

ELECTRICAL & COMPUTER ENGINEERING

MECHANICAL ENGINEERING

TEAM 52 - TEMPLE FORMULA RACING

Jonathan Wommer
Christopher Pegram
Kelly Piecyk
Michael Simonson

ADVISER

Saroj Biswas

FORMULA STUDENT ACTIVE AERODYNAMICS

Team 52's project is a drag reduction system for the Temple Formula Racing racecar to improve vehicle aerodynamics and performance in the May 2018 Formula Student SAE competition. The system acts on the rear wing of the car to alter the angle of the secondary and tertiary wing elements when certain conditions are met.

Temple Formula Racing's 2018 racecar design displaying rear wings which will be actuated with Team 52's Drag Reduction System.

The desirable scenario for wing actuation would be during straight-line speed, when down-force is not required for vehicle control therefore the drag induced is wasting energy. An electrical data acquisition system determines the state of the car by collecting the vehicle dynamics of acceleration, steering angle, speed, and suspension loading. This is accomplished through the Arduino Mega microcontroller with an accelerometer, gyroscope, load cells, rheostat, and a two channel DC to DC solid state relay for transmitting the control signals between the Arduino and the pneumatic linear actuator.

Finally, when the optimal conditions for wing actuation are met and the signal is received from the Arduino, the pneumatic actuator rotates two of the three wing elements changing the airflow properties of the airfoil system. This modification improves the vehicle's high-speed acceleration and increases its overall top speed while maintaining low-speed handling gains.

BIOENGINEERING

TEAM 53 - SENSORY PERCEPTION SHIN SLEEVE

Vienna Blow
Rachel Makar
Devrissa Knowles
Stacey Plasencia

ADVISER

Andrew Spence

ELECTRICAL STIMULATION SHIN SLEEVE

The purpose of this project is to develop a sleeve with electrode holes in the anatomically correct position to allow for TENS-like stimulation of sensory nerves in the shin that control proprioception and balance control.

This is the symptom (sway) that our project should hypothetically help alleviate.

MECHANICAL ENGINEERING

TEAM 54 - LOS ANGELES RE-CHARGERS

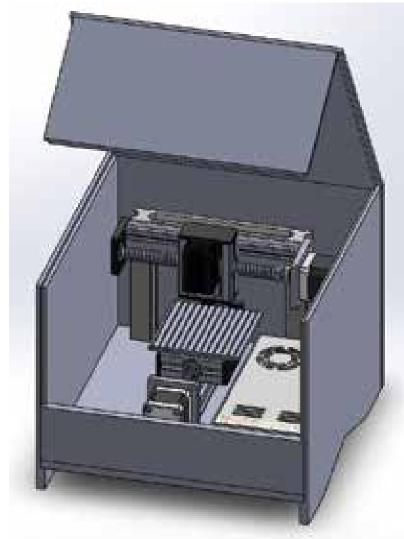
Dan Onraet
Jon Han
Andrew Scholl

ADVISER

Fei Ren

LASER INSCRIBING DEVICE FOR NEXT GENERATION ELECTRONICS

An environmentally controlled laser inscribing device for the use of Dr. Fei Ren's graduate students.



MECHANICAL ENGINEERING

TEAM 55 - ENGINE NECTAR

David Grainge
Michael John
Matthew Hayes
Lee Vona

ADVISER

Hamid Heravi

OPTIMIZED BIODIESEL FUEL PROCESSOR

A small scale biodiesel production system was developed, with an emphasis on efficiency and ease of use, being built from easily attainable materials.

The system can produce fuel using a variety of feedstocks, including different alcohols, oils, and catalysts, using the chemical reaction known as transesterification. The fuel was tested for thermo-physical characteristics to ensure quality.

Through experimentation with various feedstocks being used in the production process, a fuel with good cold weather characteristics was developed. The final production fuels were tested using a test engine, which helped to determine the fuel's combustion characteristics. The fuel was also tested for characteristics which affect cold weather performance.

ELECTRICAL & COMPUTER ENGINEERING

TEAM 56 - THREE POWER INC.

Danny Asmaro
Mamdouh Mikhail
Stepan Pylypchuk

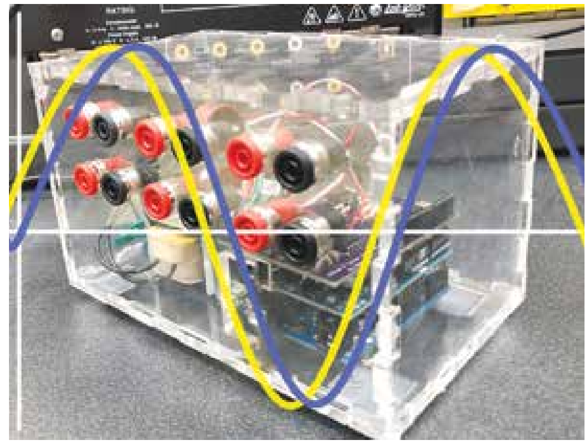
ADVISER

Saroj Biswas

AUTOMATIC POWER FACTOR CORRECTION SYSTEM

The purpose of the project is to design an Automatic Power Factor Correction System to improve power quality and reduce power loss in large inductive loads.

The system uses microelectronics and a Microcontroller to measure and correct the power factor. This system uses a Triac to switch the correct capacitive values from a single capacitor.



Automatic power factor correction system.

CIVIL & ENVIRONMENTAL ENGINEERING
ELECTRICAL & COMPUTER ENGINEERING
MECHANICAL ENGINEERING

TEAM 57 - INERTIA HOUSE

Nour Alwazee
Mamadou Diallo
Ahmed Althbati
Veronica Knell
Ethan Gage

ADVISER

Philip Udo-Inyang

RACE TO ZERO DESIGN COMPETITION

The object of this project is to design a house in the greater Philadelphia area that can heat and cool itself with minimal reliance on fuel and electricity.

Our goal will be associated with the Home Energy Rating System index. A score of zero on this index represents that the design produces as much energy as it consumes on an annual basis. This “net zero” goal will be achieved by using alternative building techniques, coordinating plans, and relying on renewable energy sources.

At the conclusion of our process, we plan on entering our design in the Race to Zero Competition.

AutoCAD model of our design.

TEAM 58 - ASME DESIGN COMPETITION

A. Kader Ousseini Moussa
Abdulaziz Alotaibi
Christopher Smith
Majed Abdullah Alnaimi

ADVISER

Shriram Pillapakkam

THE ROBOT PENTATHLON

The 2017 ASME Student Design Competition, consists of five events- the lift, throw, sprint, hit, and climb. These events model functional mechanical tasks that humans perform via a robotic and electrical application.

The competition took place November 5, 2017 at the ASME International Mechanical Engineering Congress and Exposition in Tampa, Florida. We began working on the project in 2018, and although we did not participate in the competition we have followed the rules and guidelines to judge our device.

Due to time constraints three events were selected for design: lift, throw, and sprint. For the lift we have designed a scissor jack that will be controlled by a linear servo to regulate the up and down motion. The device we used for the throw is based off of a tennis ball machine, using two vertically aligned wheels attached to two motors in order to launch the ball forward. Both items have been fabricated and assembled by the team at the Temple University Machine Shop, and will be controlled by an Arduino Uno Rev3 and Adafruit Motorshield.

Lastly, for the sprint we purchased a Hercules 4WD chassis and encoded a separate Arduino and Motorshield to sync with the motors of the robot. All of the components will be controlled by a GoolRC GC6 transmitter. Our hope is that a future team at Temple University may be able to continue our research and optimize our design to accomplish all five events.

SENIOR DESIGN DAY

APRIL 27 2018

SERC LOBBY / 3-5 PM

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