

Senior Design Day:
Final Presentations, Posters and Demonstrations

April 12, 2011

 

***Welcome to Senior Design Day, Spring 2011***

On behalf of the Temple College of Engineering and the Senior Design Coordinating Committee, it is our pleasure to welcome you to Senior Design Day for Spring 2011.

Senior design is an important capstone design experience for undergraduate engineers. At Temple University’s College of Engineering, we offer a multidisciplinary senior design experience. Students across the college participate in a college-wide design experience. Design teams are encouraged to include members from other departments so that our students learn how to collaborate with the different disciplines. Engineering today is a highly multidisciplinary field, and Temple emphasizes this throughout our undergraduate curriculum.

Senior design students participate in a two-semester design course. Projects are selected and approved by faculty before they enter Senior Design. The first semester consists of design and simulation of a project. The major deliverable for this course is a final presentation that describes and justifies the proposed design. Projects identify 10 major design constraints and must convince the review panel that the proposed design meets these constraints.

The second semester typically involves implementation and testing of the proposed project. A major deliverable for this portion of the course is a final presentation and poster that analyzes the project with respect to the major design constraints established in the first semester. Students are expected to demonstrate their projects on Senior Design Day.

Projects must address technical issues, such as performance and function, and practical issues such as cost and sustainability. Engineering systems to simultaneously satisfy these often competing concerns is an important part of modern engineering. At Temple, we emphasize a design process that integrates all such concerns into a single unified framework. We encourage industry involvement and are always interested in collaborating with industry on these projects.

This semester, for the first time, we have students from our honors section of Introduction to Engineering presenting their projects. These students participated in Senior Design I as first-year students and followed a design paradigm very similar to what we use in Senior Design.

We hope you will enjoy the presentations and posters today. For further information on how you can get involved in senior design, please contact Joseph Picone (tel: 215-204-4841; email: picone@temple.edu).

Best regards,

The Senior Design Coordinating Committee:

Richard Cohen

Frank Higgins

Joseph Picone

Robert Ryan

**Presentation Schedule**

|  |  |  |  |
| --- | --- | --- | --- |
| **Day** | **Time** | **Room** |  |
| **Dr. Cohen** | **Dr. Ryan** | **Dr. Higgins** | **Dr. Picone** | **Posters** |
| **EA 126** | **EA 304** | **EA 305** | **EA 308** | **SEAL** |
| **04/12/11** | **12:00 PM** | SD2-33 | SD1-02 | SD2-10 | IE-01 | **ALLGROUPS** |
| **04/12/11** | **12:20 PM** | SD2-32 | SD1-03 | SD2-12 | IE-02 |
| **04/12/11** | **12:40 PM** | SD2-26 | SD1-07 | SD2-35 | SD2-01 |
| **04/12/11** | **1:00 PM** | SD1-04 | SD2-29 | SD2-36 | SD2-04 |
| **04/12/11** | **1:20 PM** | SD1-05 | SD2-09 | SD2-06 | SD2-23 |
| **04/12/11** | **1:40 PM** | SD1-06 | SD2-05 | SD2-31 | SD2-11 |
| **04/12/11** | **2:00 PM** | **BREAK** |
| **04/12/11** | **2:20 PM** |
| **04/12/11** | **2:40 PM** | SD2-24 | SD2-16 | SD2-28 | SD1-01 |
| **04/12/11** | **3:00 PM** | SD2-15 | SD2-03 | SD2-27 | SD2-08 |
| **04/12/11** | **3:20 PM** | SD2-14 | SD2-17 | SD2-22 | SD2-02 |
| **04/12/11** | **3:40 PM** | SD2-13 | SD2-30 | SD2-21 | SD2-34 |
| **04/12/11** | **4:00 PM** | SD2-19 | SD2-18 | SD2-20 | SD2-07 |
| **04/12/11** | **4:20 PM** | **BREAK** |   |
| **04/12/11** | **4:40 PM** |   |
| **04/12/11** | **4:40 PM** |   |
| **04/12/11** | **5:00 PM** | **INDUSTRIAL ADVISORY BOARD(DIAMOND CLUB: RHOADES ROOM)** |   |
| **04/12/11** | **5:20 PM** |   |
| **04/12/11** | **5:40 PM** |   |
| **04/12/11** | **6:00 PM** |   |

Note: Presentations designated with an and IE, SD1, SD2 are Introduction to Engineering (Honors), Senior Design I and Senior Design II presentations respectively.

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**Introduction to Engineering (Honors):**

**… To experience the engineering disciplines …**

**“All our knowledge has its origins in our perceptions.”**

**Leonardo da Vinci, circa 1480**

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| **Team IE-01** | **Skyland McNuggets** | **EA 308 12:00 PM** |
| **Team Members** | Dylan Connelly, Barbara Cushing, Perry Orthey, John Shaw, James Swieson |
| **Advisor(s)** | Joseph Picone |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Civil and Environmental Engineering, Mechanical Engineering |
| **Project Title** | SoundSync: A Better Way to Groove |
| **Abstract** | The sound syncing system will be able to detect a walking or running pace, and match it to a song at a similar tempo. This will be useful to athletes as well as casual exercisers, helping them to properly time their music to their stride. This will be accomplished with sensors contained in the runner’s shoes. Some of the technical challenges will be processing the audio to determine the tempo, and designing the sensors and interface to the media player. The sensors will most likely utilize accelerometers and use Arduino integrated circuits to parse and relay the information to an Apple iPod/iPad/iPhone. The device will be programmed to match the pace to a song’s tempo. One of the main technical challenges will be finding a way to detect the tempo of songs. Another will be the construction of the sensors, finding a way to balance portability and sensitivity. The device will be able to match a song to a pace nearly the same as the stride, taking into consideration double and half time. |
| **URL** | https://sites.google.com/a/temple.edu/skyland-mcnuggets/ |
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| **Team IE-02** | **Cherry & Goldberg** | **EA 308 12:20 PM** |
| **Team Members** | Mary Hassan, Andrew Park, Matt Rieger and Lorraine Sybrandy |
| **Advisor(s)** | Joseph Picone |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Civil and Environmental Engineering, Mechanical Engineering |
| **Project Title** | The Goldberg Water Dispenser – A Self-Propelled, SequentialMulti-Component Water Dispenser |
| **Abstract** | Although the final application of a Rube Goldberg project may be a menial and everyday task, the process and design of the project itself provides a unique application of physics and engineering principles. The design we have created involves a series of travelling objects, simultaneous moving systems, and possible pyrotechnics. Through all of this, we hope to create a working water dispenser. While the result is simplistic, our hope is to make a workable, yet inventive procedure. While dispensing water is usually accomplished by simply turning on a faucet or garden hose, our project takes that process from a simple, somewhat boring task to a fun, interesting way to view physics. While our design is still preliminary, we hope to use gravity to begin the motion downwards and somehow use energy harnessed from other movements to build momentum upwards and power the water to dispense. Physics equations will play a vital role in our design, especially when building tracks for moving objects and the angles at which they are situated. That being said, the greater momentum we achieve at the start, the better it will be to power the dispenser at the end. |
| **URL** | https://sites.google.com/a/temple.edu/temple-university-s-cherry-and-goldberg/ |

**Senior Design I:**

**… To design, simulate and prototype …**

**“Simplicity is the ultimate sophistication.”**

**Leonardo da Vinci, circa 1475**

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| **Team SD1-01** | **Perfect Pitch** | **EA 308 2:40 PM** |
| **Team Members** | Amber Moscato, Rechab Gray, Michael Leonetti and Adam Sworob |
| **Advisor(s)** | Joseph Picone |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Electrical and Computer Engineering, Mechanical Engineering |
| **Project Title** | Automatic Guitar Tuning with Improved Accuracy Using FFT’s and Harmonic Addition to Detect Fundamental Frequencies |
| **Abstract** | Guitar tuners allow musicians to accurately tune their instrument with an instantaneous response time. Tuning is crucial, but is also difficult and time consuming. The Perfect Pitch Automatic Guitar Tuner bypasses the need for manual tuning by a musician, utilizing a DC servo motor that applies torque to a clamp and turns the guitar peg in the direction of the required correction in frequency. The result allows quick, accurate tuning for beginners and advanced guitarists. The automatic tuner scans frequencies ranging chromatically from 55 Hz to 1406 Hz, covering all possible notes, and has an error tolerance of 0.3 Hz based on the change in pitch recognizable by musicians. Fast Fourier Transforms and Digital Signal Processing provide highly accurate frequency resolution. A closed-loop feedback control system continually monitors the frequency emitted by the vibrating string until the pitch is within the specified tolerance. The torque applied by the motor to the tuning peg does not exceed the tensile breaking point of the guitar string. The motor operates between 2.5 and 4 (lbs)(inch) at a maximum of 1 revolution per second to prevent breakage. |
| **URL** | https://sites.google.com/a/temple.edu/science-of-sounds/ |
|  |  |
| **Team SD1-02** | **Earth Engineering** | **EA 304 12:00 PM** |
| **Team Members** | Jason Eng, Monique Forrest, Sade Goldson and Robert Magee |
| **Advisor(s)** | Felix Udoeyo |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Strength and Leachability of Slag-Cement Bypass Monolith for Utility Trenches |
| **Abstract** | With the growth of modern society, utility trenches are needed to install underground utility lines and other underground infrastructure. Utility trenches create a vast need for suitable backfill, hence the need to develop a controlled low-cost material. Fly ash is typically the only supplementary cementitious material (SCM) used in the backfill, controlled low-strength material (CLSM). This SCM will be replaced with slag, silica fume, and cement kiln dust-industrial by-products from cement and iron-smelting factories. In this work, slag-cement bypass monolith will be designed and tested for compressive and split tensile strengths, and batch or column contaminant leachability. The obtained results will be compared with ASTM strength standards and EPA’s acceptable contaminant level limits. These standards include the compressive strength, flow consistency, permeability, unit weight, yield, air content, air, whether if it can withstand required loads, and its readiness in the field. Meeting these standards will ascertain the applicability of the new controlled low-cost strength material. |
| **URL** | https://sites.google.com/a/temple.edu/strength-and-leachability-of-slag-cement-bypass-monolith-for-utility-trenches/ |

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| **Team SD1-03** | **Preemptive Bridge Design, Inc.** | **EA 304 12:20 PM** |
| **Team Members** | Joseph Hanna, Haitham Mohammad, Brian Petrun and Eric Scalgione |
| **Advisor(s)** | Bill Zhang |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Elevated Pedestrian Interchange on Temple University’s Campus |
| **Abstract** | Since its founding in 1888, Temple University has experienced a boom in population growth as the University becomes more prestigious. This growth carries a corresponding necessity of expansion and improvement of campus facilities. In 2009, Temple released its 20/20 plan including details of its $1.2 billion expansion. Temple’s President Ann Weaver Hart announced the expansion will develop the Broad Street corridor. Developing the Broad corridor of Temple’s campus will indubitably increase both foot and vehicle traffic of an already congested area. An area of interest is the Broad and Cecil B. Moore corridor including a new 1,500-bed residence hall, other existing residence buildings and a retail complex. Preemptive Bridge Design, Inc. will design the structural system to elevate a pedestrian interchange that will span the four corners of the Broad and C.B.Moore intersection increasing the safety and experience of pedestrians. This project will utilize Revit (Autodesk) to create a 3-D model of the structure. The proposed project will be specified to the standards on the International Building code and ADA, while under strict supervision of professional advisors. The completed project will develop a functional method addressing congestion concerns while leaving behind a digital legacy and a prototype. |
| **URL** | https://sites.google.com/a/temple.edu/elevated-pedestrian-footbridge/ |
|  |  |
| **Team SD1-04** | [Hydromat, Inc.](https://sites.google.com/a/temple.edu/hydromat/) | **EA 126 1:00 PM** |
| **Team Members** | Leigh Cignavitch, Ryan Cras, Christopher Sennott and Michael Stanoch |
| **Advisor(s)** | Oleksandr Diloyan |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Electrical and Computer Engineering, Mechanical Engineering |
| **Project Title** | Generation of Electricity from a Moving Vehicle Utilizing a Flexible Kinetic Energy Collecting Element |
| **Abstract** | In order to decrease the amount of energy wasted by a car’s engine, a mechanical speed bump is designed to capture energy lost through braking in traffic areas where speed regulation is necessary. The design is based on two previous Senior Design projects (ME-7 April 2010, ME-4 April 2009) that captured kinetic energy when vehicles rolled over a spring-loaded, mechanical speed bump at low (5-10 mph) speeds. The new, more efficient design uses a fluid-filled Flexible Kinetic Energy Collecting Element (FKECE) to transfer energy instead of a rack and pinion. Pressure increases in the FKECE as cars drive over and fluid is forced out and directed through tubes to a centrifugal pump that drives a generator. The electricity is then stored for use in various applications. The system was tailored specifically for the energy and dimensional needs of a toll booth. The FKECE design will allow for higher passing velocity, while also maintaining reliability. This will significantly lower the maintenance and cost of the system. |
| **URL** | https://sites.google.com/a/temple.edu/hydromat/ |

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| **Team SD1-05** | **Chaos** | **EA 126 1:20 PM** |
| **Team Members** | Alexey Bachmanov, Patrick Henry and Daniel Kim |
| **Advisor(s)** | Dmitri Vainchtein |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Improving the Efficiency of Viscous Mixing Utilizing Chaotic Laminar Flow |
| **Abstract** | Studies of chaotic advection are essential in the understanding of the dynamics of homogeneous mixing of fluids dominated by viscous forces, where standard turbulent-based mixing is unachievable. Studies in this field are of great importance to food and chemical processes that involve the batch mixing of viscous fluids. In such cases, achieving uniformity represents a problem of considerable practical interest.Team Chaos will investigate the behavior of viscous mixing in a two-cylinder system where the rotation of the cylinders varies with time. The magnitude and the rate of the variations will lead to drastically different mixing behavior. Although previous experiments have given us an empirical understanding of how the quality of mixing changes with different parameters, there is no good theoretical model explaining why this happens. Our project will aim to develop a computational model and an experimental apparatus to test our predictions, with the eventual goal of establishing a basic theoretical framework that explains the viscous mixing process. Ultimately, we will use this insight for the purposes of improving the efficiency of viscous mixing.  |
| **URL** | https://sites.google.com/a/temple.edu/team-chaos/ |
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| **Team SD1-06** | **Jounce** | **EA 126 1:40 PM** |
| **Team Members** | Robert Baker, Conor Shannon and Steve Teterus |
| **Advisor(s)** | Vallorie Peridier |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Inertial Suspension System to Minimize Tire Load Variation on a Formula SAE Racecar |
| **Abstract** | In the world of road racing, mechanical grip is one of the most important elements of race car design. Road Race cars must be able to maintain high top speeds while being able to quickly change directions. In order to design a car that fits these requirements suspension components must limit the load variation across the tire contact patch, thus maintaining high levels of mechanical grip. To achieve this, we are collaborating with Penske Racing Shocks to develop an inerter for the FSAE racecar. An inerter uses a flywheel to store and release kinetic energy. One inerter will be placed on each side of the front suspension to increase the mechanical grip of the front wheels. We must use the natural frequencies of the FSAE car’s suspension system to determine how the inerter will be tuned. To test the inerters’ affect on performance we will be using dynamometers as well as track testing the FSAE car with and without the inerters. We are interested in seeing how the inerters affect the FSAE car. It is expected that the inerter will decrease lap times by 10% due to the increase in mechanical grip. |
| **URL** | https://sites.google.com/a/temple.edu/j-damper/ |

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| **Team SD1-07** | **GEO-NOVA** | **EA 304 12:40 PM** |
| **Team Members** | Mark Calloway, Eric Francis-Wright, Jon Lester and Khadija Tadmi |
| **Advisor(s)** | Michel Boufadel and Shih-Jiun Chen |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering, Electrical and Computer Engineering,Mechanical Engineering |
| **Project Title** | Wastewater Heat Extraction for Commercial HVAC Applications |
| **Abstract** | Our project consists of the demonstration of the potential for a new technology developed by NovaThermal that uses wastewater to heat and/or cool large scale urban buildings. A useful characteristic of wastewater is its predictable temperature relative to outdoor temperature. In the winter, the warm wastewater is transported to the wastewater heat pump, which absorbs its heat and transfers it to the building’s clean water circulation loop providing heat to the building. Our team will be monitoring the design parameters, such as the water flow rate and temperature of the sewage side and the building side, and coefficient of performance for the heating mode during its winter use. We will also be monitoring the water quality of the wastewater’s total suspended solids before and after filtration. Filtration of the wastewater will protect the pipes from clogging and damage, but it will also lead to a decrease in temperature of the sewage water since the microbial activity that contributes to the production of heat in the sewage will be filtered out.  Our design is to maximize the efficiency of the wastewater heat pump system by designing a filtration system that will collaborate with NovaThermal’s heat pump to increase its performance. We will construct an algebraic relationship between the performance of the heat pump and the filtration of the sewage water. The equation will allow us to predict the performance of the heat pump based on the characteristics and extent of filtration of the sewage water being used.After collecting field and laboratory data, we will assemble a model of a geothermal heat pump to compare its performance and efficiency to help determine the feasibility of wastewater heat extraction as a source of energy for commercial HVAC systems in urban centers with well-developed sewage systems. |
| **URL** | https://sites.google.com/a/temple.edu/geo-nova/ |

**Senior Design II:**

**…To fabricate, test, and optimize …**

**“Everything should be made as simple as possible,
but no simpler.”**

**Albert Einstein, *On the Method of Theoretical Physics* (1933)**

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| **Team SD2-01** | **Victory Amplification** | **EA 308 12:40 PM** |
| **Team Members** | George Fava, Jeff Gregorio, Jessica Jackson and Dennis McGovern |
| **Advisor(s)** | Joseph Picone |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Hybrid DSP/Vacuum Tube Amplifier |
| **Abstract** | Vacuum tube guitar amplifiers provide tonal characteristics desirable to musicians, yet can be rather limited in flexibility. The Hybrid DSP/Vacuum Tube Guitar Amplifier offers an uncommon combination of a preamp that utilizes DSP algorithms with a vacuum tube power amplifier. The result will be a much more versatile amplifier, offering the best of the analog and digital worlds.Our DSP modeling-based preamp will receive a high impedance signal from a guitar pickup and replicate the harmonics and non-linearities generated by a vacuum tube preamplifier. A gain control will allow Total Harmonic Distortion increasing upwards from 2%. A three-band equalizer will provide tonal flexibility over the typical frequency range of an electric guitar amplifier (about 20 Hz to 20 kHz).Our vacuum tube-based power amplifier will be designed as a class AB amplifier with a linear gain response and will operate at a minimum worst-case efficiency of 50%. It will receive a line-level signal and have an output current sufficient to drive an external speaker enclosure with an RMS rating of up to 50 Watts at an output impedance of 4, 8, or 16Ω.  |
| **URL** | http://sites.google.com/a/temple.edu/dspamp/ |
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| **Team SD2-02** | **Above Level** | **EA 308 1:20 PM** |
| **Team Members** | Ali Atif, Alixandria Lane, Enoque Panzo, Megan Swartwood and Brian Worthington |
| **Advisor(s)** | William C. Miller and Xiaofeng Zhang |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | ASCE 2011Concrete Canoe Competition |
| **Abstract** | The ASCE Concrete Canoe Competition requires students to design and construct a canoe that meets the rules and regulations mandated by the NCCC optimizing a standardized hull design with concrete and reinforcement that must meet the following requirements: a water-cement ratio of 0.40, an air-entrained mix of at least 6%, use two recycled aggregates that comprise at least 50% of the aggregates by mass, and utilize reinforcement that do not exceed a 30% POA determined by the thickness of the structural elements. The team optimized the hull design by making the thickness 1 inch all around, so that the canoe does not gain extra weight. The use of lightweight material for our concrete mix was a crucial component to produce a buoyant canoe. Research has proven that materials such as glass microspheres, crushed recycled glass, and blast slag provided environmentally friendly and cost effective alternatives without compromising the structure or integrity of the canoe. Various methods of fabrication, including the creation of two forms for the erection of the concrete canoe to create a uniform shape are utilized. The Above Level Team’s designs and innovations will be studied and served as a benchmark for future generations of any other Temple University Concrete Canoe Team. |
| **URL** | http://sites.google.com/a/temple.edu/acse-concrete-canoe-competition-2011/ |

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| **Team SD2-03** | **Team GeoPavement** | **EA 304 3:00 PM** |
| **Team Members** | Stephen Dobron, Corben Fuentespina, Parin Patel and Chinhang So |
| **Advisor(s)** | Naji Khoury |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Maximizing the Performance of a Pervious Pavement System |
| **Abstract** | The implementation of Pervious Pavement Systems (PPS) is crucial in urban society due to the effects of stormwater runoff. However, heavy metal contamination of the subsurface, sediment accumulation in the PPS, along with cost of pollutant retention methods and required maintenance procedures limit the feasibility of the PPS.To address issues with current PPS technology, we will utilize a porous plastic-based cementitious (P-PBC) material previously developed by Dr. Naji Khoury at Temple University. Various mixes of P-PBC specimens will be prepared and tested against the performance of a typical pervious concrete specimen, a previously recognized Best Management Practice. P-PBC test results must yield an unclogged hydraulic conductivity value of at least 0.20 cm/s; while removing approximately 75% of urban heavy metal such as zinc, lead, copper, and cadmium. After the application of clogging material, P-PBC specimens must meet a minimum hydraulic conductivity of 0.007 cm/s.This study will determine effluent pollutant concentrations and verify that P-PBC leachate is compliant with EPA standards. Finally, the P-PBC specimens will be tested for compressive strength to determine applicability for pedestrian and vehicular traffic. Our team will select an optimal mix that meets compressive strength requirements while balancing permeability and contaminant removal. |
| **URL** | https://sites.google.com/a/temple.edu/geopavement/ |
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| **Team SD2-04** | **TerraThermal Technologies, Inc.**  | **EA 308 1:00 PM** |
| **Team Members** | Ryan Burke, Steven Demmer, Kamil Nuzha and Kevin Ravasio |
| **Advisor(s)** | Michel Boufadel, Robert Ryan, Naji Khoury and Joseph Picone |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Civil and Environmental Engineering, Mechanical Engineering |
| **Project Title** | Efficient Energy Using a Submersed Closed-Loop Geothermal System |
| **Abstract** | Traditional energy resources that rely on gas, oil, and coal are rapidly depleting fossil fuels. For this reason, a major thrust is being placed on renewable energy resources. TerraThermal Technologies will contribute to the transition to renewable energy by designing a closed-loop, pond integrated geothermal heating and cooling system. The system will provide for a housing development in Pittsgrove, New Jersey, which consists of 60 semi-detached units with average volumes of 14,800 ft3. Using pond water as the heat exchange medium will result in a faster and more efficient heat exchange rate throughout the coils of our system. In an attempt to maximize efficiency and cost expenses we examine whether or not the high water table in the New Jersey area will promote significant enough heat exchange between the pond water and the higher temperature ground water to achieve higher system efficiencies. This operation will result in 50% less energy consumption than conventional HVAC systems, which will also help to leave a much smaller carbon footprint. A feasibility study will be performed to determine the effectiveness and possibility of this system succeeding based on the cost, life cycle, and performance advantages of this system, and a pond simulation will be tested to compare results with that of the feasibility study. |
| **URL** | http://sites.google.com/a/temple.edu/ghcs/ |

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| **Team SD2-05** | **The Green Team**  | **EA 304 1:40 PM** |
| **Team Members** | Peter Attalla, Justin Barta, Nana Boateng and Harsh Patel |
| **Advisor(s)** | Alex Pillapakkam |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Pure Energy |
| **Abstract** | The earth is covered with about two-thirds of water yet the availability of clean drinking water is limited. According to UNICEF, about a billion people still use unsafe drinking water sources. Even though there are various distillation methods in the market today, the desire for utilizing the sun’s energy to provide essential clean drinking water continues to pose a challenge to our world. The goal of our project is to efficiently produce clean drinking water from solar energy that will provide at least 4 liters of clean water per day. In order to achieve this goal, our solar distillation system will consist of a parabolic trough coupled with a custom distillation mechanism. The parabolic trough, with its focus along the pipe containing impure water, will focus incoming solar radiation from the sun. The evaporated water in the tray will be condensed and collected as clean drinking water. This project will include thermodynamic and heat transfer analysis, fabrication as well as testing. |
| **URL** | http://sites.google.com/a/temple.edu/pureenergy/ |
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| **Team SD2-06** | **Lunar Solutions I**  | **EA 305 1:20 PM** |
| **Team Members** | Rodney Nash, Thien Nguyen, Cara Santin and Ahmed Youssef  |
| **Advisor(s)** | John Helferty |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | NASA Lunabotics Mining Competition |
| **Abstract** | In May 2011, NASA hosted the second annual Lunabotics Mining Competition. The goal of the competition is to design and build the robot that can most effectively excavate simulated lunar regolith. Each team is given 15 minutes to excavate and transport as much lunar regolith simulant as possible. The team that excavates the most material more than the minimum of 10 kg wins the competition. The finished robot will also meet physical constraints outlined by NASA. The total weight of the empty robot must be less than 80 kg and no more than 2 m tall. The design is modeled after a design taken from a snow blower with front loader. We used tracks instead of wheels to improve maneuverability and speed. The excavation system utilizes two linear actuators to move an arm with a scooper which will collect the lunar material. The system is controlled by an Arduino Mega board with an Ethernet shield. Linksys routers are used to provide the wireless connectivity to the robot. In a competition setting, our robot will be able to mine and transport 30 Kg of regolith within a 15 minute time period. |
| **URL** | https://sites.google.com/a/temple.edu/lunabotics/ |

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| **Team SD2-07** | **Visionary Energy Solutions, Inc.**  | **EA 308 4:00 PM** |
| **Team Members** | Rebecca Hagel, Shawn Meyer, Amar Patel and Daniel Reo |
| **Advisor(s)** | Steve Ridenour |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Energy Modeling to Reduce Energy Consumption |
| **Abstract** | On Temple’s campus, the Biology Life Sciences Building (BLSB) is the leading energy consumer using 830,117 BTU/gsf-yr. This energy usage is six times greater than the Engineering Building, which has similar square footage.  The BLSB has 4 floors consisting of 50 laboratories and 40 classrooms for a total of 168,651 square feet and occupancy of 800 people. Over 65% of the total energy used is consumed by the heating, ventilating, and air conditioning (HVAC) system and 20% is consumed by lighting demands. By modeling the building's energy usage in Trane software and simulating energy reduction methods, we will reduce the energy usage of the Biology Life Sciences Building.  By implementing energy reduction techniques in our software model we will reduce energy consumption by twenty percent. One energy reduction technique is to use a Coil Energy Recovery Loop (CERL), which will recover up to 30% of otherwise lost energy from the exhaust air. Light emitting diodes are also used to save up to 40% per bulb. The attractiveness of this plan relies on its return on investment (ROI). The ROI for this energy reduction plan occurs within 10 years. |
| **URL** | http://sites.google.com/a/temple.edu/ves/ |
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| **Team SD2-08** | **MindGames** | **EA 308 3:00 PM** |
| **Team Members** | Yuliy Balter, Jason Buranich, Joe Gro and Ilyana Mushaeva |
| **Advisor(s)** | Iyad Obeid |
| **Coordinator** | Joseph Picone |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | A Non-invasive Brain to Computer Interface System for Video Gaming |
| **Abstract** | We are analyzing beta and mu waves of the brain that are interpreted to represent users’ intent. Beta and mu waves are associated with the alert/work state of the brain. We are using these waves as the The brain has neurons which fire off every time we think of doing a movement or when we move. The voltages supplied by the neurons are in the microvolt (or μV) range.These voltages will be read by an electrode cap and then passed through an electroencephalography machine. By monitoring the voltages between 8-30 Hz, and sending the voltages through the filtering processwe create control signals based upon the user’s thought patterns. To demonstrate our ability to manipulate brain waves, we implement a dodge ball game.The system utilizes a C++ interface with software called BCI2000. BCI2000 is an open source brain to computer interface system used for data acquisition. We will also incorporate a feedback system in which the user will sense the ball getting closer as they visually see it moving closer. We will accomplish this by using a vibration system that will intensify as the ball moves closer. |
| **URL** | http://sites.google.com/a/temple.edu/mindgames |

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| **Team SD2-09** | **Apollo Alternative Heating**  | **EA 304 1:20 PM** |
| **Team Members** | Ashleigh Baxter, Amanda Branco, Josh Laskin and Laura Solomon |
| **Advisor(s)** | Robert Ryan |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Design and Construction of a Solar Powered Space Heater |
| **Abstract** | The average household emits 11,330 pounds of CO2 each year due to electric and gas heating. These resources are harmful to the environment and cannot be renewed. The depletion of these resources and resulting impact on global climate change are of great concern. Apollo Alternative Heating is designing and constructing a heater which will be powered by solar energy.  The design consists of a solar collector placed in a window to power a heater connected to a storage tank. The collector must fit into a standard household window and will be able to function without using more than 1kW of electric power. This heater will allow consumers to lower their current heating bill by up to 10% and reduce their CO2 emissions by 836 pounds per year. The heater must be comparable in size, cost, and performance to an electric powered heater used for a 12 ft. by 10 ft. bedroom. To achieve this, the design is based on sunlight conditions for a Northeast latitude location in a south facing direction. This design is different from other solar heating systems because it is able to be used for 8 hours overnight and can be used for one room. |
| **URL** | http://sites.google.com/a/temple.edu/apollo-alternative-heating/ |
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| **Team SD2-10** | **Control Systems, Inc.**  | **EA 305 12:00 PM** |
| **Team Members** | Timothy Boger, Sadarshan Kandi and Ross Keyes |
| **Advisor(s)** | Chang-Hee Won and Saroj Biswas |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Nonlinear Control of Laser Targeting System |
| **Abstract** | For decades proportional, integral, and derivative (PID) controllers have been the industry standard for the majority of control applications. In this time PID has become very robust; however it is not particularly sophisticated. While the constants of a PID controller can be re-tuned to maintain performance, the act of tuning does not consider the dynamic environment. Recently, control systems engineers have devised a theoretical control method called stochastic control that addresses this issue. Stochastic control theory stems from the H2 and H∞ control methods. Our group intends to implement a stochastic control algorithm in hardware using satellite attitude control as the test case. We will create a hardware test bench for implementing control algorithms and compare the performance of a PID to a stochastic controller. We expect the stochastic controller to outperform the PID controller, as various theoretical approaches have shown in the past. The satellite system simulation consists of a laser mounted on a two-axis gimbal aimed at a target. The performance of the two systems will be gauged by their ability to keep the laser dot pointed in a target area while a vibration table induces the disturbance. |
| **URL** | http://sites.google.com/a/temple.edu/nonlinear-control-of-laser-targeting-system/ |

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| **Team SD2-11** | **GHV Engineers**  | **EA 308 1:40 PM** |
| **Team Members** | Thomas Gallen, Jennifer Huber and Paloma Vila |
| **Advisor(s)** | Robert Ryan |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Harvesting Stormwater Runoff for Urban Farm Irrigation |
| **Abstract** | Rainwater control and reuse contributes to a healthier environment, especially in urban regions. A rainwater harvesting system is being designed for an urban farm located in the Germantown section of Philadelphia, Pennsylvania. This design includes a means of transporting captured rainwater from the roughly 2350 ft2 roof to a constructed wetland, where it will be treated. The water, treated to EPA non-potable reuse standards, must then be stored and transported to the adjacent half-acre farm to irrigate the crops. Should the system fill, overflow must be controlled and directed to a nearby combined sewer. A constructed wetland was chosen to treat the roof runoff, which research has shown may contain traces of heavy metals (specifically zinc, copper, and lead) and hydrocarbons. Heavy metal and hydrocarbon concentrations can be reduced substantially through treatment in a constructed wetland. This onsite treatment of rainwater alleviates dependency on public water resources and reduces water usage costs. Additional benefits of this system are reduction of peak volumetric loading and water quality improvement of runoff from the property into Philadelphia’s combined sewer system.  |
| **URL** | http://sites.google.com/a/temple.edu/ghv-engineers/ |
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| **Team SD2-12** | **Car Diagnostics, Inc.**  | **EA 305 12:20 PM** |
| **Team Members** | Tomilade Adeyemi-Wilson, Ahmed Attalla, Gleb Danilchenko and Christopher Tufts |
| **Advisor(s)** | Dennis Silage |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Multi-Function Touch Screen Display Using Vehicle On-Board-Diagnostics |
| **Abstract** | The concept for the project is to analyze, design and fabricate a portable, handheld embedded processing system which serves as a diagnostics tool for automotive performance. The system will utilize an interactive user display with touch screen navigation for convenience. The device will display processed information from the standard automotive On-Board-Diagnostics (OBD-II) port. Available functions will include Miles-Per-Gallon (MPG), real-time service monitors for automotive performance and analysis, an aberrant error emissions/safety Diagnostic Trouble Codes (DTC) display with data logging capabilities of past DTCs. The internal combustion or hybrid engine sensor data is available from the OBD-II port as the standardized SAE J1979 protocol using the ISO 15765 Controller Area network (CAN) data bus of the vehicle. Sensor information will be requested by the device from the OBD-II port and processed for display on a touch screen LCD. The proposed system will consist of a digital communication link between a transceiver attached to the inconvenient OBD-II port (under the dashboard) and the interactive user interface with touch screen display. |
| **URL** | http://sites.google.com/a/temple.edu/multifunction-obd/ |

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| **Team SD2-13** | **HEATT** | **EA 126 3:40 PM** |
| **Team Members** | Stephen Barrett, Jonathan Childs, Dean Cun and Emmy Messina |
| **Advisor(s)** | Parsaoran Hutapea |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Electrical and Computer Engineering, Mechanical Engineering |
| **Project Title** | Development of a Hybrid Fuel Cell Electric Powertrain |
| **Abstract** | The auto industry has no alternative fuel source with the efficiency and practicality necessary to lower oil usage. To transition forward, this project bridges the gap between gasoline and fuel cell technology. The power train for this project features a 324V battery system charged by either an ICE generator or hydrogen PEM fuel cell. The fuel cell and generator have not been connected, therefore cannot currently charge the batteries. The rate at which the batteries discharge, charge and the voltage level are controlled by the Battery Management System (BMS). However, the BMS suffers from interference, which inhibits its ability to accurately read the batteries voltage level and makes charging dangerous during operation. This team's main focus is the vehicle's control system enabling the driver to select the main power supply. This provides a choice of the most favorable power source for specific driving conditions. Our goal is to design and implement a LabVIEW program that communicates with a Compact Reconfigurable Input-Ouput (cRIO) device that issues commands to control each power sources operation. After future BMS work, the fully functional vehicle will model the practicality of a combined gasoline/fuel cell powered system for transitioning from fossil fuels to emerging fuel technologies. |
| **URL** | http://sites.google.com/a/temple.edu/fuelcell/ |
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| **Team SD2-14** | **Biosims Technology, LLC**  | **EA 126 3:20 PM** |
| **Team Members** | Nadia Elkaddi, Thomas Heffernan, Jiacheng Li and David Lin |
| **Advisor(s)** | Nancy Pleshko and Alireza Hoseini |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | An Apparatus to Study the Effects of Mechanical Input on Articular Cartilage Growth |
| **Abstract** | Articular cartilage is made up of chondrocytes and an extracellular matrix composed primarily of water, collagen and proteoglycans.  Since cartilage is largely avascular, chondrocytes rely on the extracellular matrix around it for nutrients.  In normal joints, load-bearing areas, in comparison to non-load bearing regions are: thicker, have a higher proteoglycan concentration, contain larger cells, have a greater volume of organelles, and mechanically stronger.This design project will consist of building a loading system for cartilage explants in order to study the mechanical effects of pressure on articular cartilage cells.  For the system to be sufficient, it must incorporate an input of 0.5-1 Mpa, fit in an incubator 345mm high, 535mm wide, and 535mm deep, and utilize LabView to control air pressure.  In order to increase the accuracy of lab results, a confined loading system will be used, which will allow the cell explant to be restricted when the loading force is present.  A loading system such as this can be used to further cartilage growth using mechano-stimulation research, thereby helping the 20 million people per year inflicted with osteoarthritis. |
| **URL** | http://sites.google.com/a/temple.edu/developing-an-ultrasound-machine-with-variable-intensities/ |

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| **Team SD2-15** | **Team STV**  | **EA 126 3:00 PM** |
| **Team Members** | Michael Lukas, Noel Prodigalidad |
| **Advisor(s)** | Alex Diloyan, Kevin Carmody and Christopher Holliday |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Diesel Propulsion Drone |
| **Abstract** | During off peak hours, the New Jersey Transit agency has a demand to operate smaller trains consisting of two to three passenger cars. To fulfill this need, our team will design the foundation for a scaled down diesel propulsion unit using the locomotive shell of a Comet V Multiple Unit. Since it will be remotely controlled from either end of the train, we can classify the unit as a drone. It will provide nearly the same capabilities of a conventional locomotive: energy output for passenger luxuries and comforts, and enough tractive effort to drive the train and its load. It will be comprised of service proven components to cut costs and increase part reliability. Currently, regional rail systems operate light passenger demand trains with multiple unit propulsion systems, MU’s, and inefficient methods involving full-scale locomotives. Our Propulsion Drone will be a smaller and more cost effective alternative while complying with Federal Regulations and Environmental Protection Agency (EPA) Tier IV emissions standards. Some constraints that we will analyze include tractive effort, braking power, and cost efficiency according to a realistic passenger demand. STV Incorporated, an Engineering Consulting firm that works closely with New Jersey Transit, will be providing their information databases for our research and simulation programs in order to develop and test our design. |
| **URL** | http://sites.google.com/site/sdmetrain/ |
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| **Team SD2-16** | **I-LED, Inc.**  | **EA 304 2:40 PM** |
| **Team Members** | Brian Angelina, Benjamin Bruening, Christopher Eckert and Ercan Kibaroglu |
| **Advisor(s)** | Bill Zhang |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Adaptive Structural Retrofits Using Building Information Modeling |
| **Abstract** | Since its founding in 1970, the Temple University College of Engineering has grown from 250 students to over 1,000 graduates and undergraduates. This growth carries a corresponding need for expanded and improved facilities. The renovation of existing buildings extends capacity without the capital outlay required for new construction. I-LED, Inc. has designed the structural system to add a tenth floor to the existing Engineering Building, increasing the area of the building by approximately 13,000 ft2. This project employs the latest in Building Information Modeling (BIM) technology to create a spatially conscious 3-D model of the existing structure that serves as a repository for interlinked detail and specification storage. The structure has been designed and analyzed as per requirements published by the American Institute of Steel Construction. The proposed addition will be specified to the standards of the International Building Code, and will be carefully vetted by professional advisers for constructability and economy. Our design will increase the structural capability of the building to enable the design and construction of an additional typical floor and intensive green roof. The completed project will increase the building’s functional and environmental capacity and leave a BIM model as its digital legacy for future developments. |
| **URL** | http://sites.google.com/a/temple.edu/bim/ |

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| **Team SD2-17** | **Enviroland Engineering**  | **EA 304 3:20 PM** |
| **Team Members** | Tugba Akgun, Daniel Kapral and Rory Sgarlat |
| **Advisor(s)** | Robert Ryan |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | The Performance of an Engineered Wetland to Control Eutrophication |
| **Abstract** | Constructed wetlands may be utilized for wastewater treatment by using a combination of physical, chemical, and biological processes. At EnviroLand, we specialize in the treatment of agricultural runoff waters that contain excessive amounts of nutrients by way of engineering wetlands. When deposited into local waters, these excess nutrients may trigger the process of eutrophication which causes algal blooms and contributes to oxygen depletion of marine habitat. An agricultural operation may contribute up to 3 kilograms per hectre of phosphates and 13 kilograms per hectre of nitrates during a storm event. Our team proposes an engineered wetland as the most economical way to remedy excess nutrients in order to increase the fertilizer application efficiency in agricultural operations. A scale wetland will be constructed to operate in an indoor laboratory facility with plants and soils indigenous to the Delaware Valley. The nutrient contaminated wetland will be monitored for the uptake of nitrogen and phosphorus to observe an at least 30 percent reduction through plant consumption and sorption processes. |
| **URL** | http://sites.google.com/a/temple.edu/enviroland-engineering/ |
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| **Team SD2-18** | **Test Rigs, LLC**  | **EA 304 4:00 PM** |
| **Team Members** | Abdul Muneem, Matthew Burns, Euill Long and Funmi Ogunlokun |
| **Advisor(s)** | Robert Ryan |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Improved Free-Flow Hydroturbine Performance Using a Ducted Design |
| **Abstract** | In recent years, scientists have become concerned with Global Warming. Experts agree that increased emissions of greenhouse gases are the catalyst to this volatile situation. Thus, recent interest in environmentally friendly forms of energy has skyrocketed. Obviously, the solution to this global problem will be multi-faceted, but we believe free-flow hydro turbines are a step in the right direction. Our design will incorporate a floating platform to harness the hydro-kinetic power potential of rivers. Attached to the bottom of the platform and submerged in the river will be an environmentally friendly free- flow hydro turbine. Unlike dams, free-flow hydro turbines do not hamper fish migration or contribute to sediment build up. Currently, free-flow hydro turbines are primarily limited to rural locations where access to the power grid is unavailable and power demand is low. Our aim is to improve on the power output of such turbines by designing a ducted system to increase the velocity of the water going through the turbine. Our ultimate goal is to improve the performance of the non-ducted turbine by at least ten percent, thus making the technology more feasible for small scale power production. |
| **URL** | http://sites.google.com/a/temple.edu/testing-rig/ |

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| **Team SD2-19** | **Fluent Engineering**  | **EA 126 4:00 PM** |
| **Team Members** | Anthony Gland, Matthew Judge and Lucas Orner |
| **Advisor(s)** | Srikanth Bontha, |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Effect of Coolant Passage Design Parameters on Fluid Pressure and Velocity Distribution |
| **Abstract** | In machining operations, cutting fluids are used for improving cutting performance. The four basic methods for applying cutting fluids in machining operations are: flooding, mist, high-pressure systems and through the cutting tool systems. Cutting fluids increase lubrication, minimize chip breakage, and aid in the removal of heat from the cutting zone. The cutting fluid can perform these functions only if it actually reaches the cutting zone. This study is an attempt to study the effect of coolant passage design parameters such as shape, diameter and angular bends on fluid pressure and velocity distribution at the exit cross-section of the passage. The objectives will be to design a passage that will deliver coolant to the cutting in the most effective way possible. This means a design that will use minimal amount of coolant and achieve maximum cooling results. This will be accomplished using a combination of computational fluid dynamics (CFD) techniques and experiments. Computational work will be carried out by using the fluid dynamics software package Fluent. The numerical results will then be verified with experiments.  |
| **URL** | http://sites.google.com/a/temple.edu/fluent-engineering/ |
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| **Team SD2-20** | **Smart Power, Inc.**  | **EA 305 4:00 PM** |
| **Team Members** | Tsuefeng Moua, Yina Shi and Kenny Te  |
| **Advisor(s)** | Saroj Biswas and Frank Ferrese |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Intelligent Reconfigurable Power Grid |
| **Abstract** | Power Grids deliver electricity from supplier to consumers from various power sources. As technology advances, there tends to be excess strain within the grid due to increase in power demand. Nearly 70% of faults within the grid are transient type, these faults often self-heal themselves. The remaining faults are due to problems within the components in the grid itself. An intelligent reconfigurable power grid has the ability to reconfigure itself in the event of a failure in order to maximize the reliability and efficiency of the power supply while minimizing cost of components. Diverse consumer load consumptions that will closely mirror consumer power usages will be modeled in order to emulate real world circumstances. Multiple alternate reconfigurations will be designed, implemented and tested to determine the best reconfiguration method. With multiple reconfigurations, we can obtain accurate results while determining the most appropriate method that will ultimately meet our goal. The resulting methodology can be applied to larger scaled power systems. |
| **URL** | http://sites.google.com/a/temple.edu/smart-power-grid/ |

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| **Team SD2-21** | **EIA, Inc.**  | **EA 305 3:40 PM** |
| **Team Members** | Kenneth Carter, Ryan Hughes and Keyur Vekaria |
| **Advisor(s)** | Saroj Biswas and Jim Chen |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering, Mechanical Engineering |
| **Project Title** | Engine Heat Power Recovery From Thermoelectric Generation |
| **Abstract** | It is a known fact that in most cars only 15 percent of the energy created by a combustion engine is actually used toward powering the vehicle, while the other 85 percent is lost, mostly through heat. Out of this 85 percent, close to half of the energy loss occurs in the radiator of the car. We propose to design a new radiator which utilizes thermoelectric generators (TEGs), which recovers waste heat energy into usable electric energy. TEGs will allow the heat from the engine to be converted into electrical power that will be used to charge the car battery. Our design goals include maximizing the electrical output by increasing the temperature gradient between the two sides of the thermoelectric generator. The larger the temperature gradient, the more energy we can produce. We will also need to maximize the surface area of the generator, find material that can withstand the heat of the radiator, and create a unit that fits into all cars. The Electrical Engineering component of the project will include design of electrical circuit for the thermoelectric modules along with the charging circuit of the battery and power flow analysis. |
| **URL** | https://sites.google.com/a/temple.edu/eia-inc/ |
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| **Team SD2-22** | **Bumblebee** | **EA 305 3:20 PM** |
| **Team Members** | Mubin Ahmed, Yue Liu, Hai Nguyen and Sahaskumar Patel |
| **Advisor(s)** | Chang-Hee Won |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Indoor Aerial Autonomous Coaxial Rotorcraft |
| **Abstract** | One of the most exciting events of the year called Indoor Aerial Robotic Competition (IARC) sponsored by Drexel Autonomous Systems Lab (DASL). Our senior design project is based on this event, we will be programming a autonomous rotorcraft and compete in 2011’s tournament. The goal of the project will be to follow a black line with of 8 inch wide. We will need the rotorcraft to maneuver through a pathway with obstacles such as model trees and poles and building. There are low speed fans setups at the end of pathway, so we will calculate the wind resistance against the rotorcraft. Our final goal of the competition is to mark the location of victims and transmit a live video feed to receiver’s laptop. In order to make the location with accuracy of 100% we will be implanting an image processing technology. The video camera will be coded to recognize a human victim and give an exact location. Based on how accurately we provide the location we will be awarded point thus wining the competition. We can consider our design as a prototype for a search and rescue mission, it can be used for military purposes. |
| **URL** | http://sites.google.com/a/temple.edu/autonomous-blimp/ |

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| **Team SD2-23** | **Medical Devices, Inc.**  | **EA 308 3:20 PM** |
| **Team Members** | Jon Lester, Enea Mile and Syed Fehr |
| **Advisor(s)** | Zdenka Delalic |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Implantable Blood Pressure Monitor |
| **Abstract** | The goal of this project is to develop a convenient and more effective way of monitoring blood pressure for extended periods of time. Current ambulatory home monitors are cumbersome and are conspicuous. They offer limited memory storage, require lots of power, and can be uncomfortable as it employs the oscillometric method, which has the user wear an inflatable cuff around the arm. This makes sleeping especially difficult for users who need to be monitored overnight, due to their constricting setup. An implantable blood pressure monitor would eliminate many of these common issues, as well as allow for a more efficient way for cardiologists, or general practitioners to better monitor patients' hypertension. Implanting the device would require only a minimally intrusive surgery, placing the device in an artery such as the femoral, or subclavicular arteries. Fabrication of such BioMEMS based sensors is complex and very expensive. As such, for this project, we will only present design work for the sensor, discussing its theory of operation and presenting limited simulation that demonstrates getting a pressure reading from the sensor to the transceiver. A hardware simulation will also be produced to demonstrate the wireless transmission of data from the implant to a receiver. |
| **URL** | http://sites.google.com/a/temple.edu/design-project/ |
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| **Team SD2-24** | **Second Generation Systems**  | **EA 126 2:40 PM** |
| **Team Members** | Dat Duong, Jennifer Bullock, Ishmael Kamara and Douglas Johnson |
| **Advisor(s)** | Alex Dlioyan |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Enhanced Wind Turbine Performance using Compliant Rotor Technology |
| **Abstract** | R2 Engineering will execute a series of trade off studies to design a wind turbine from basic principles. The predicted stress levels and performance of the turbine will be validated through fabrication and testing. The performance of the turbine will then be compared to that of the Air X Marine 400 design. This comparison ensures that the interests of the Piasecki’s low speed wind turbine program are served. Designed to work well in low wind environments, our rotor specifications would increase Annual Energy Production by 20%, and reduce average blade root bending stress by 15%. The design path that R2 Engineering Team has followed emphasizes the freedom of the rotor to teeter while running. The simulation that R2 Engineering Team has chosen allows the rotor to be attached to the tower during high winds. These two techniques make it possible for the rotor to avoid both the most frequent running loads and the rare load spikes which currently limit rotor design. From these load reduction techniques, we can tolerate a significantly larger rotor diameter without a significant increase in cost, allowing an increase in production and decreases intermittency. |
| **URL** | http://sites.google.com/a/temple.edu/windturbineretrofitproject/ |

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| **Team SD2-26** | C.U.R.V. Engineering | **EA 126 12:40 PM** |
| **Team Members** | Pamela Kobylkevich, Karl Lewis and Edward Wienckoski |
| **Advisor(s)** | Vallorie Peridier |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Optimizing Damper Stiffness in Formula Racecars Using MR Fluid |
| **Abstract** | The primary objective of this research is to design, implement, and test a semi-active suspension control system for a Formula Racecar. The proposed system will actively monitor the pitch and lateral acceleration of the racecar and respond by dynamically adjusting the viscosity of the dampers so as to maintain stability and provide a smooth ride. The dampers will incorporate a magneto-rheological (MR) fluid, whose viscosity can be almost instantly varied by varying the applied voltage. The lateral accelerations of the car will be measured using an accelerometer, filtered using digital signaling processing techniques, and then used to adjust the viscosity of the MR damper. The control system will be programmed to increase damping with increasing lateral and pitch accelerations. The complete suspension control system will be implemented using an on board microprocessor. We will be using a Formula SAE car to test the performance of the proposed dampers. By comparing lap times on test tracks (autocross, skid pad, and acceleration/breaking test) we will be able to quantify the improvement due to the MR fluid dampers over conventional dampers with the goal of decreasing lap times by 2-5%. |
| **URL** | http://sites.google.com/a/temple.edu/semi-active-dampers/ |
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| **Team SD2-27** | **RF Locators** | **EA 305 3:00 PM** |
| **Team Members** | Safiyah Abdul-Malik, Clarence Augustin, Michael McCollum and William Maignam |
| **Advisor(s)** | Zdenka Delalic and Fatehy El-Turky |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Universal Remote Locator Device Using an RF Transmitter and Receivers |
| **Abstract** | Misplacing important day-to-day items is very inconvenient, and it is even more frustrating to frantically search for these items at a time when you need them immediately. At one point or another, we all fall victim to being disorganized and misplacing our personal belongings (wallets, car keys, TV remote, etc.), but it should not negatively impact our daily routine by making us late for work or other appointments. We propose to address this problem by designing a universal remote locator device. This wireless device will consist of a radio frequency (RF) transmitter with multiple receivers that can be attached to your personal belongings which may become misplaced. Pushing a particular button on the transmitter will send a signal to a corresponding receiver causing it to beep for a period of time so that the user can locate it. This is similar to how the alarm for a household cordless phone works, except this device will be applicable to almost any item within your household. This system will be wireless and battery powered, as well as being compact enough to conveniently fit onto your items. |
| **URL** | http://sites.google.com/a/temple.edu/remote-location-detection-device/ |

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| **Team SD2-28** | **Advance AR**  | **EA 305 2:40 PM** |
| **Team Members** | Thomas Driscoll, Fei Lin, Viral Patel and Thuan Nguyen |
| **Advisor(s)** | Fatehy El-Turky |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Data Glove Gesture Recognition for Augmented Reality Applications |
| **Abstract** | Data gloves are designed to track 3-D hand motions made by the user wearing the glove. In a training mode, specific hand motions, or gestures, will be recorded to represent certain functions desired by the user. Then in an operational mode, by detecting these gestures, users can control applications interfaced to the glove. The data glove created in the project will use several triple-axis MEMS analog accelerometers attached to the glove on the fingers and the back of the hand. The outputs of each accelerometer will interface to a microcontroller built into the glove. It will sample the data and transmit it wirelessly through Bluetooth to a host computer. To account for variations in the user's hand motions such as duration of of the gestures and intensity of the gestures, all incoming signals will first pass through a normalization algorithm. The data will then be processed by a gesture detection algorithm measuring similarity between the incoming signals with a template of programmed gestures from the training operation. The resultant output will be available to control a particular user's application. Possible applications include robotic control, gaming control, use as a computer peripheral device, and electronic communication. We will demonstrate the data glove through detection of the sign-language representation of the 26 letters of the alphabet. |
| **URL** | https://sites.google.com/a/temple.edu/dataglove/ |
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| **Team SD2-29** | **SCC, Inc.**  | **EA 304 1:00 PM** |
| **Team Members** | Breanna Kovach, Grant Leonhard, Fabrice Benoit and Ahmadi Khalil |
| **Advisor(s)** | Felix Udoeyo |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Predicting Moment and Shear Capacities of SCC Using Dimensional Analysis |
| **Abstract** | Self-consolidating concrete (SCC) is a new concrete whose application is expected to grow rapidly in the future because of its reduction in labor cost, construction time, and noise level on the construction site. The use of cement kiln dust (CKD) as a replacement for Ordinary Portland Cement (OPC) reduces the material cost since the CKD is a waste material. The objective of this research is to develop a predictive model for the moment and shear capacity of SCC made with CKD.A control mixture composed of 100% OPC will be used in order to compare the strength of the mixtures. Three other mixtures will be produced ranging in increments of 10% from 10-30% CKD with 90-70% OPC. Testing of these samples will involve the use of a universal strength testing machine as well as slump flow, L-Box, V-funnel, U-Box, J-Ring, and static segregation tests. Ideally the strength requirement of 3500 psi should be met while using the highest percent of CKD as to reduce cost.Using our research results, practicing engineers and construction professionals will be able to easily determine the most cost effective mix design in terms of the percentage of CKD that is needed for their application. |
| **URL** | http://sites.google.com/a/temple.edu/self-consolidating-concrete/ |

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| **Team SD2-30** | **Concrete, Inc.**  | **EA 304 3:40 PM** |
| **Team Members** | Haitham Mohammad, Priyank Patel, Evan Shepard and Stuart Shepard |
| **Advisor(s)** | Felix Udoeyo |
| **Coordinator** | Robert Ryan |
| **Department(s)** | Civil and Environmental Engineering |
| **Project Title** | Evaluating CKD in Self-Consolidating Concrete Mixtures |
| **Abstract** | Cement kiln dust (CKD) is a waste removed from cement kiln exhaust. Cement industries generate between 13 and 17 million tons of CKD per year, of that, around 1.5 million tons of CKD are disposed of into landfills every year. There has been limited research performed on this waste product and its practical engineering uses. This project will further our understanding of the effects of cement kiln dust in light-weight self consolidating concrete (SCC) mixes. For our research we will design one control mix with 0% CKD/Slag and 100% Original Portland Cement (OPC), and then 5 more mixes consisting of 80% OPC with varying CKD to Slag Cement ratios: 0%;20%, 5%;15%, 10%;10%, 15%;5%, and 20%;0%. We will prepare 6”x12” and 4”x8” cylinders to perform 5 ASTM tests to determine the compressive/ split tensile strengths, sorptivity, porosity, and water absorption. We will use 3 specimens per test for all 6 mixes plus testing on the 1st, 3rd, 7th, and 28th day of curing for strength tests giving a total of 198 specimens. All mixes will be designed for a minimum compressive strength of 3500psi. |
| **URL** | http://sites.google.com/a/temple.edu/strength-porosity-and-corrosion-of-self-compacting-lightweight-concrete-containing-ternary-blended-binders/home |
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| **Team SD2-31** | **Tesla** | **EA 305 1:40 PM** |
| **Team Members** | Yauheni Haluza, Maninder Sehgal, Gregory Tedesco and Robert Komulainen |
| **Advisor(s)** | Thomas Sullivan |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Vehicle Magnetic Field Reduction for Mine Protection |
| **Abstract** | Degaussing is a process which is used in order to reduce a known, unwanted magnetic field. For the purposes of our design, we wish to apply this technique to counter explosive mines, which utilize electromagnetic distortion sensors to detect unsuspecting military tanks and vehicles.  Our main objective is to design a degaussing mechanism that will generate a counter-magnetic field to offset the natural field created by a tank, as the tank is composed of highly ferromagnetic materials.  Doing so will conceal the tank’s magnetic presence from the mine’s sensors.  We will develop a prototype degaussing mechanism based on a scale-size model of a ferromagnetic vehicle.  The model device will have to fit within a volume of .5 cubic feet and consist primarily of a battery power source and current-carrying coils oriented accordingly as to generate the necessary counter magnetic-field.  The battery will be rated at 18 volts and 2.5 amp-hours.  A possible expansion to this problem would be to design a circuit that can compensate both the amount and direction of the current through the coils, for situations where the surrounding environment invokes EM interference. |
| **URL** | http://sites.google.com/site/vehicledegaussing/ |

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| **Team SD2-32** | **Yager Motor Company**  | **EA 126 12:20 PM** |
| **Team Members** | Robert Nazian, Kyle Parkins, Robert Pennock and Sean Selkregg |
| **Advisor(s)** | Richard Cohen |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Testing of Yamaha Genesis 80FI Engine for the Formula SAE Racecar |
| **Abstract** | The main objective of this project is to successfully tune the Yamaha Genesis 80FI engine and its components for Temple's FSAE race car. Our main goal is to maximize torque output of the engine without compromising the safety of both the engine and the driver. In order to maximize torque, we plan on using a turbocharged system which will deliver more air to the engine. However, this can lead to a problem that many other FSAE teams experience when using turbochargers called detonation. To overcome this, we chose to run our engine using high octane racing gasoline which burns slower than low octane gasoline and will reduce the chance of engine detonation. Also, our engine is unique in that it has a continuously variable transmission. This type of transmission was chosen because it does not require manual shifting and will improve the car’s acceleration. The transmission will be coupled to the rear differential by connecting the belt drive to a secondary shaft. From here, a roller chain will be linked to the final drive which will transmit the torque to the rear differential. We are also incorporating a MicroSquirt Engine Management system and dynamometer testing to increase the car’s performance. |
| **URL** | http://sites.google.com/a/temple.edu/engine-application-for-formula-sae-vehicle/ |
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| **Team SD2-33** | **Shockwaves, Inc.**  | **EA 126 12:00 PM** |
| **Team Members** | Francis Bolger, Raymond Cornely and Benjamin Sauers |
| **Advisor(s)** | Kurosh Darvish |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Development of a Shock Tube for Research in Traumatic Brain Injuries |
| **Abstract** | Researchers have studied the potential effects blast waves have on human brain tissue. They found that blast waves do have the ability to cause traumatic brain injury (TBI) but are still searching for the mechanism that triggers it. The Bioengineering Department at Temple University will begin studying this area of research by conducting their own experiments using blast waves. Our project entailed building a shock tube capable of producing a shock wave with a dynamic pressure between 22 and 35 psig at the specimen; the range at which TBI occurs in the experiment specimen. The shock wave is delivered to the head of an anesthetized rat in order to determine how it affects the brain tissue. Soundproofing was required to reduce the noise vibrations produced by the system so it did not interfere with other experiments within the immediate area. The requirements of the system and the constraints of the building required us to apply our knowledge of machine design, finite element analysis, and acoustics to develop a safe and operational product capable of producing the desired results. Success of the system allowed for the expansion of research in this particular field at Temple University. |
| **URL** | http://sites.google.com/a/temple.edu/shockwave-formation/ |

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| **Team SD2-34** | **Rodent Exercise Inc.**  | **EA 308 3:40 PM** |
| **Team Members** | Heera Jose, Tanya Singh, Tim Starosta and Angela Thomas |
| **Advisor(s)** | Mohammad Kiani and Bin Wang |
| **Coordinator** | Richard Cohen |
| **Department(s)** | Mechanical Engineering |
| **Project Title** | Low Cost Device for Testing Aerobic Performance in Rodents |
| **Abstract** | Myocardial Infarction is a major health concern in industrialized countries. Rodents are often used to test various treatments for myocardial infarction. A known method for testing their recovery is by monitoring the rodents’ heart functioning before, after, and during aerobic exercise which is performed with a treadmill and monitoring equipment. We will be designing a model for a one lane rodent treadmill which will assist in the aerobic exercise and monitoring recovery from myocardial infarction. Existing market treadmill machines range from approximately $5,000 to $10,000. One of our goals is to decrease the price of this otherwise significantly expensive equipment by altering the design and materials, keeping it under $1,000. We will create the ability to monitor speed of movement, angle of inclination, length of time exercising, and a hook-up capability for EKG and heart rate monitoring. Some goals of the project include: inclination to 30⁰, maintaining a constant speed with an error less than 5%, USB capability with data transfer to the computer, and a width adjustable lane from 3 inches to 6 inches in 1 inch increments. If our goals are reached, a more cost-efficient product will be available to researchers to further progress in current medical issues. |
| **URL** | http://sites.google.com/a/temple.edu/rat-treadmill/home |
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| **Team SD2-35** | **sketch-N-eers**  | **EA 305 12:40 PM** |
| **Team Members** | Joshua Deleon, Riaz Jabar, Tuan Phan and Bradley Williams |
| **Advisor(s)** | Seong Kong |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Biometric Detection for Improved University Attendance |
| **Abstract** | In a university setting, lecture halls are an efficient way for an institution to construct classes with a large student body. Although these facilities provide ease for the university to organize a large amount of students, there is a dilemma with attendance. Several attempts to take attendance, such as passing around a sign in sheet, physically calling out roll, or swiping an ID, result in either forged attendance, or valuable class time wasted. Our senior design team will design and fabricate a fingerprint scanner to perform better than current scanners on the market. The main goal is to have the scanner produce a lower scanning error rate than the retailed scanner. We will need to purchase a retailed scanner to compare ours with. The comparison will be done by creating two databases for each scanner; ours and the purchased. The prints on each database will then be matched with newly scanned prints using a public fingerprint matching script in MATLAB provided by Mathworks. We will then compare the error rate for both of the scanners. By creating a more accurate fingerprint sensor, we can benefit the application of using fingerprint recognition for attendance taking.  |
| **URL** | http://sites.google.com/a/temple.edu/sketch-n-eers/home |

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| **Team SD2-36** | **SAVSS**  | **EA 305 1:00 PM** |
| **Team Members** | Greg Wells, John Zebly, Donovan Bolger and Xuhui Liu |
| **Advisor(s)** | John Helferty |
| **Coordinator** | Frank Higgins |
| **Department(s)** | Electrical and Computer Engineering |
| **Project Title** | Suborbital Active Vibration Suppression System |
| **Abstract** | In a university setting, lecture halls are an efficient way for an institution to construct classes with a large student body. Although these facilities provide ease for the university to organize a large amount of students, there is a dilemma with attendance. Several attempts to take attendance, such as passing around a sign in sheet, physically calling out roll, or swiping an ID, result in either forged attendance, or valuable class time wasted. Our senior design team will design and fabricate a fingerprint scanner to perform better than current scanners on the market. The main goal is to have the scanner produce a lower scanning error rate than the retailed scanner. We will need to purchase a retailed scanner to compare ours with. The comparison will be done by creating two databases for each scanner; ours and the purchased. The prints on each database will then be matched with newly scanned prints using a public fingerprint matching script in MATLAB provided by Mathworks. We will then compare the error rate for both of the scanners. By creating a more accurate fingerprint sensor, we can benefit the application of using fingerprint recognition for attendance taking. |
| **URL** | https://sites.google.com/a/temple.edu/shepo |
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