The University of Toledo
College of Engineering

UNDERGRADUATE RESEARCH AND SENIOR DESIGN ENGINEERING PROJECT EXPOSITION

THE UNIVERSITY OF TOLEDO
COLLEGE OF ENGINEERING
NITSCHKE HALL
FRIDAY, APRIL 28, 2017

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NITSCHKE HALL
DESIGN EXPO NOON - 3 P.M.

Featuring undergraduate research and senior design projects from the departments of:

Bioengineering

Civil and Environmental Engineering

Electrical Engineering and Computer Science

Engineering Technology

Mechanical, Industrial and Manufacturing Engineering

For more information on the exposition call 419.530.8014 or email sandra.stewart@utoledo.edu.

For more information on undergraduate programs, please call 419.530.8045 or email jon.pawlecki@utoledo.edu.

Please contact the individual departments regarding formal presentation times.

Chemical Engineering projects will be displayed at the Fall Semester Exposition in December 2017.

THE UNIVERSITY OF TOLEDO

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Associate Professor, Associate Chair and Instructor of Senior Design

Motion-activated vacuum pump for lower limb prosthetics

FACULTY ADVISER: RONALD L. FOURNIER, PHD

Client Advisers/Sponsors: Zach Weber, Prosthetist, Amputee Associates, LLC

Design Team: Jenna Lykins, Kimberly Macenczak, Alex Stasuk and Kayla Winters

In this design for a motion-activated vacuum pump for a lower limb prosthetic, the flexion of the prosthetic foot will create a vacuum within an apparatus that is connected to the socket for the residual limb, allowing for a tighter fit during motion. The vacuum will be an attachment for an existing socket and for the Fillauer All Pro prosthetic foot. This foot is suited for many types of motion on all different surfaces, which allows the user to live an active lifestyle. The motion-activated vacuum pump addresses the need for an effective, quiet and lightweight vacuum.

Baluspine

FACULTY ADVISER: RONALD L. FOURNIER, PHD

Client Advisers/Sponsors: Vijay Goel, PhD; Sarit Bhaduri, PhD; and Aisling Coughlin, PhD

Design Team: Samantha Benton, Hannah Birchall, Nicholas Bozovich, Jessica Kwong and Ryan Wiant

The Baluspine is a polymeric spinal fusion cage. The Baluspine cage will target the damaged area of the spine and allow for a speedy recovery at a lower cost to the customer than its metal competitors. The subtle intricacies of the plate's shape will allow for level-by-level spinal fusions while fixating the cage and spine in place. This design will save time and money in the operating room by avoiding issues that could complicate surgeries and requiring the surgeon to match the plate-to-cage sizes.

EpiPatch by PatchMed

FACULTY ADVISER: RONALD L. FOURNIER, PHD

Design Team: Mackenzie Bowman, Omar Gad, Joshua Kinn and Natalie Mason

Current treatments for life-threatening allergies are expensive and not suitable for patients with needle-phobia. Every person with life-threatening allergies should have the appropriate means and affordable care to treat anaphylactic shock. The EpiPatch will be the first-ever transdermal delivery solution that incorporates hollow, microneedle technology to rapidly administer epinephrine to the bloodstream in order to attenuate symptoms of anaphylaxis. Creating a novel, alternative solution will provide a more safe, effective and affordable product for patients.

SpecuLIFT

FACULTY ADVISER: RONALD L. FOURNIER, PHD

Design Team: Melissa Brodsky, Mark Caris, Andrew Oerhtman, Michael Peachock and Rachel Wagner

The SpecuLIFT is a novel improvement to the modern vaginal speculum used during pelvic exams in emergency room settings on patients experiencing abdominal distress. SpecuLIFT incorporates extending blades, which conform to the patient's anatomy and aims to reduce discomfort and residual pain during a trauma evaluation.

Right-Cycle Aromatic Alarm Clock

FACULTY ADVISER: RONALD L. FOURNIER, PHD

Client Advisers/Sponsors: Brent Cameron, PhD; Andre Aguillon, MD; and Mahmoud Eladawi

Design Team: Akhil Gangisetty, Carolyn Grobbel, Josh Maurer, Lauren Spyker and Lindsay Wilkerson

The Right-Cycle Aromatic Alarm Clock seeks to create an innovative approach to waking up in the morning. The product is a wearable, biotechnology device used during sleep that continuously monitors users' sleep cycles and releases an olfactory-stimulating fragrance to wake them up in their lightest stages of sleep during a desired time range. The product aims to avoid users' heavy sleep stages, which are associated with morning grogginess, to leave them feeling refreshed, energetic and ready to start the day.

A unique design for the central-line syringe to prevent multiple insertion attempts

FACULTY ADVISERS: RONALD L. FOURNIER, PHD; AND MS. TAMARA PHARES

Design Team: Robert Ariss, Rajit Banerjee, Mahbod Pourriahi and Ken Vuong

The central-line procedure is often used in emergency situations for the quick, systematic delivery of medications. The proposed device works to prevent multiple insertion attempts by simplifying the needs of the practitioner finding the vein. This new method does not require the practitioner to retract the plunger, but to depress it. This technique yields less resistance, allowing the practitioner to more finely control the syringe. Further, the aspiration may be stopped and continued as needed, given the proposed method's unique design. The simplicity of this new design is a preferred alternative, as it will work to reduce multiple insertion attempts, ultimately mitigating complications during the central-line procedure.

Luna-Scap Implant

FACULTY ADVISERS: RONALD L. FOURNIER, PHD, AND MARGARET JAIN, MD

Client Advisers/Sponsors: Mohammad Elahinia, PhD; Eda Yildrim-Ayan, PhD; and Laura Schmelzer, PhD

Design Team: Addison Agler, Jared Bauer, Bethany Grayczyk, John Schulz and Colin Shortridge

This design project is a feasibility study for a new way to surgically correct and stabilize the carpal bones of the wrist after injury to the scapholunate interosseous ligament – the ligament connecting the scaphoid bone and the lunate bone. This ligament hosts around 80 percent of a person's grip strength. The primary method being tested involves utilizing a nickel titanium, Nitinol structure to hold the carpal bones in place while utilizing a pre-loaded cellular matrix to regrow the injured ligament. This method aims to increase the post-surgical range of motion for the patient's wrist beyond the results from the current, standard surgical procedures.

Computer-aided diagnostic instrument (CADI)

FACULTY ADVISER: BRENT CAMERON, PHD

Client Adviser/Sponsor: Scott Pappada, PhD, Assistant Professor of Anesthesiology and Bioengineering

Design Team: Brad Henderson, Chelsea Mogus, Thomas Vanasschee and Christina Winterfeld

CADI will aid in decreasing the number of misdiagnosed cases in the emergency room by targeting more commonly misdiagnosed diseases, like sepsis. CADI is a computer-aided diagnostic instrument that will allow workers in the medical field to enter the health information of emergency room patients. Once data has been entered, CADI will populate the risk analysis for the disease. This is intended to aid medical professionals in the diagnostic process.

E-Strips

FACULTY ADVISER: AISLING COUGHLIN, PHD

Design Team: Samantha Ballway, Jake Bible, Lawrence (Matt) Sanders, Navtaj Sandhu and Thomas Yakubowski

E-Strips are at-home dental strips outfitted with bioactive glass to fight hypersensitivity. The bioactive glass is used for ion release to allow hydroxyapatite to form when it interacts with saliva. In addition to other dental hygiene and wellness products, this product will target hypersensitivity by adding a protective layer on the teeth that will rebuild enamel and prevent demineralization.

Muddy Creek Bay Wetland Restoration

FACULTY ADVISERS: DOUGLAS K. NIMS, PHD, PE, AND CYNDEE GRUDEN, PHD, PE

Client Adviser/Sponsor: John Simpson, Winous Point Marsh Conservancy

Design Team: Mshari Alshammary, Nick Calmes, Casey Conine, Cole Keyner and Joseph Leech

The Winous Point Marsh Conservancy seeks to restore coastal wetland vegetation in the Muddy Creek Bay Region. The proposed Mudhole Restoration site is located in the western area of the bay region near the mouth of the Sandusky River. To restore the wetland vegetation, two conceptual design structures are being developed. Marsh terracing and a dike design will be utilized in an effort to restore the coastal wetlands in the bay. Restoring the wetlands will provide many benefits, including a healthy habitat for native vegetation and wildlife. The restoration effort also will result in the absorption of nutrients and sediments flowing into the bay to improve water quality.

Carter Field athletic complex

FACULTY ADVISER: DOUGLAS K. NIMS, PHD, PE

Client Advisers: Nicole Baden and Daniel Klett, The University of Toledo

Team Members: Ahmad Abdelkarim, Hilal Smidi, Brandon Smith and Taya Zoubareva

This redesign of the Carter Field athletic complex attempts to upgrade the current Carter Field and dormitories to a state-of-the-art facility. It is intended to provide effective training facilities to the varsity baseball and softball teams, while helping The University of Toledo generate revenue. A desired deliverable included in this project involves incorporating band and football practice fields, along with a redesign of the roadways around the area's perimeter. This project also aims to improve the student experience on UT's Main Campus. An effective and aesthetically pleasing design also could generate funds to help accommodate athletic events and training programs.

City of Luna Pier Venice Canal access point

FACULTY ADVISER: DOUGLAS K. NIMS, PHD, PE

Client Advisers: John Zarb, Chairman, Guardians of Luna Pier Waterways, and John Wakeman, Guardians of Luna Pier Waterways

Design Team: Nawaf J. Alshammeri, Kyle M. Alston, Matthew A. Hebebrand and Deborah N. Mobula

The Guardians of Luna Pier Waterways seeks to restore its historical canal system and encourage community support to help maintain it. It was decided that the best way to encourage this support would be to create a new entry point to the canal system for community use. The project team designed options for new access points to help with the restoration of the historic canal system. These designs include components suggested by the Guardians, based on current needs and wants.

Toledo Metroparks pedestrian suspension bridge

FACULTY ADVISERS: DOUGLAS K. NIMS, PHD, PE; LIANGBO HU, PHD, PE; HABIB KAAKE, PHD, PE; AND BRYAN ELLIS, PS, PE

Client Advisers: Anthony Amstutz, Park Services Supervisor, Swan Creek Preserve Metropark; Jim Cassidy, Park Services Supervisor; Joe Fausnaugh, Chief of Operations, and Jon Zvanovec, Project Manager, Toledo Metroparks

Design Team: Yousef Alfaedi, Mingfei Hao, Edgar Moreno, Casey Vinings and Bangyu Wang

A design for a pedestrian, tension ribbon bridge will allow visitors to cross Swan Creek from the Belt House property owned by the Toledo Metroparks to the floodplain recently donated by The Andersons, Inc. The bridge design involves crossing the creek at a span of 200 feet, and overcomes an elevation difference of 20-25 feet. It will include a design for a tower in the floodplain, as well as the bank by the Belt House. The project also includes the design of a feasible foundation and walkway for both sides of the bridge.

Simply Walk: A Tolkien-themed fitness application

FACULTY ADVISER: LAWRENCE THOMAS, PHD

Design Team: Arshiya Anand, Francesca J. Bailer and Alexander Carson

The "Walking to Mordor Challenge" is a web-based fitness challenge that currently has a very low-tech solution for tracking one's progress. Our "Simply Walk" project aims to build a more accessible version of the challenge for mobile phone users. With a built-in map function to automatically track a person's progress, as well as progress-marking notifications, our application version is easy to use and motivational, inspiring users to get outside and walk more frequently.

Virtual-reality controller and concept application

FACULTY ADVISER: LAWRENCE THOMAS, PHD

Design Team: Michael Gerdes, Matthew Kilgore, Eric Klostermeyer and Zachary Webb

With an increased public interest in virtual reality, the technology sector has seen a rise in startups and businesses releasing their own implementations of virtual reality hardware. However, the adoption rate among the general public has been unimpressive due to the high entry-level cost. The aim of this project is to design an affordable virtual-reality controller with an imbedded game application.

Top-down guidance system for autonomous machines

FACULTY ADVISER: PROF. BRENT NOWLIN

Design Team: Abd-Al-Menem Aburidi, Robert Jansen, Daniel Kinsley and Connor Messerly

The top-down guidance system project attempts to create a proof-of-concept prototype for an experimental and innovative technology that will provide "smart" navigational capabilities for autonomous machines at a micro level. Primarily focusing on concept, this project will encompass a more simplified version of the technology that could later be put to commercial use.

Long-term multiple temperature recording device

FACULTY ADVISERS: GLENN LIPSCOMB, PHD, AND RICHARD G. MOLYET, PHD

Client Advisers/Sponsors: The University of Toledo and NASA GLOBE

Design Team: Tristan Boudrie, Kenneth Emerson and Tyler Schmidt

This project involves designing a device to acquire three types of temperatures data: surface, soil and air, over an extended period of time. A Sparkfun Redboard, built from an Arduino Uno, will be used to control the various temperature sensors and store data on a MicroSD card. The product will be used in K-12 schools as a low-cost, data-recording device to facilitate the growth of the GLOBE environmental database.

Affordable sun photometer

FACULTY ADVISERS: GLENN LIPSCOMB, PHD; KEVIN CZAJKOWSKI, PHD; AND RICHARD G. MOLYET, PHD

Client Advisers/Sponsors: The University of Toledo and NASA GLOBE

Design Team: Dingtao Cao, Roger Fracalossi, Jacob Mozdzierz and Devon Wuerfel

This project involves the design of a sun photometer to be used for NASA's GLOBE program. It will be used by students and civilians to measure aerosol optical thickness in the atmosphere. The photometer will measure three wavelengths of light and capture values when pointed directly at the sun.

Wireless portable charger

FACULTY ADVISER: RICHARD G. MOLYET, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Ryan Korte, Karl Schmidt, Michael Schuster and Jon Siebert

This project involves the design of a mobile charging device that can be attached to the phone for quick and easy use while on the go. The design allows users to easily snap their phones onto the chargers. It utilizes a magnetic attachment case, Li ion batteries and the Qi wireless standard.

Smart Trash Bin

FACULTY ADVISER: GERALD HEURING, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Mustafa Alhashem, Min Dong, Michael Herman, Wenbin Lu and Muath Zakri

The design for Smart Trash Bin involves mounting network-connected (cellular or Wi-Fi) sensors on fixed trash cans located in parks, schools and hospitals to report when the can becomes full. This product could help reduce costs for clients by allowing waste removal crews to visit and empty only full cans, rather than checking each one.

Laser measurement system

FACULTY ADVISER: RICHARD G. MOLYET, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Branden Austin, William Benedict, Ben Lewandowski and Yousef Zakri

This project involves a laser system for accurately measuring the thickness of a piece of metal strip. The system will reduce the need to hand-measure the piece of strip, giving more accurate and precise results of the gauge of the metal. This data will give feedback to machines, letting the operators know if the material being produced is within the allowed tolerance.

Smart attendance system

FACULTY ADVISER: AHMAD JAVAID, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Ryan Jewell, Max Kolomiyets, Robert Longfield and Caleb Simmons

This project utilizes RFID technology to track a student's attendance in a classroom setting. The RFID readers are placed in doorways to classrooms, and monitor the student's traffic using his or her student ID. All information is stored in a database accessible through a website for students and faculty to review attendance. The Smart Attendance System can be implemented to save time and money, and can result in better record keeping.

Home efficiency and controls system

FACULTY ADVISER: RICHARD G. MOLYET, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Conner Boggess, Joseph Guyer, Tianyu Liu and Patrick Loar

This system creates an economical and efficient environment for residential power usage. It encourages owners of a household to utilize their power outlets more efficiently and maintain consistent control over each individual outlet. This control will be enabled through a series of adapters placed on wall outlets, as well as a central server connected to a phone app, to display all relevant information.

Smart Car Plug-In

ADVISORS: HENRY LEDGARD, PH.D., RAGHAV KHANNA, PH.D.

Client Advisor/Sponsor: The University of Toledo

Design Team: Jamel Ahmed, Dylan Benedict, Jace Fugate and Kyle Kissner

This project creates a user-friendly module/device that gives older vehicles newer technology. The smart car plug-in will display data from the car's onboard computer onto an IOS phone app. The plug-in also will allow more sensors to be added to the vehicle, such as a backup sensor.

Site layout of COE campus

FACULTY ADVISER: PROF. LINDA S. BEALL

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Aurora J. Biggs, Brandon T. LaPoint, Wesley R. Machaterre and Brandon P. Tafelski

The University of Toledo is considering adding another research and classroom facility, "R-3," on the engineering campus. This project proposes a new design and layout for this section of campus. The redesign would improve several aspects of the engineering campus, such as traffic flow, drainage, parking, green space, study spaces and overall aesthetics. Assuming Palmer Hall has been removed and the new "R-3" building has been constructed, a new site layout was developed. A Rails-to-Trails path and maintenance building will be reflected on the layout. The goal is to achieve a better-functioning engineering campus for students, faculty and visitors. Flexible pavement design calculations will be included in the submittal, which will incorporate an updated drainage plan.

Electric vehicle conversion

FACULTY ADVISER: PROF. WILLIAM A. MUGGE

Client Adviser/Sponsor: Steven Wise, The University of Toledo Transit Services

Design Team: Scott R. Champion, Alex J. Grieshop, Adam M. Reichert and Aaron W. Voisard

The University of Toledo is always seeking to become a greener campus. This project provides a budget-friendly way to work toward that goal. New electric vehicle costs can be extremely high; thus, the next-best solution is to convert gas vehicles the University already owns to electric vehicles. This project converts a Ford Ranger into a fully-electric vehicle to be used for day-to-day operations. This will set an example for more conversions to be done on campus vehicles in the future.

Hospital patient transport

FACULTY ADVISER: PROF. WILLIAM A. MUGGE

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Michael T. Arnold, Rebecca M. Molyet, Kristopher B. Teague and Monty P. Weltman

The project team MAWT Engineering, LLC designed a safe and efficient way to transfer physically disabled patients from a stretcher to a surgical table. Patient safety, transfer time and required manpower were the design criteria steering the MAWT team's design.

Scalpel handle redesign

FACULTY ADVISER: PROF. WILLIAM A. MUGGE

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Sara A. Bowles and Allen J. Eakins

Scalpel blades have been loaded and changed in a similar fashion for several decades. With a more modern approach to how they are changed, it is possible to attain higher levels of cleanliness, faster surgical procedures and a safer work environment for doctors and nursing staff.

Flow visualization bench test

FACULTY ADVISER: CARMEN CIOC, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Yousef H. Alzahrani, Muneeb Cheema, Hussain J. Hussain, Yonghee Lee and Mohsen H. Rajhi

The goal of this project is to design and construct an economical and easy-to-reproduce water tunnel for research and educational purposes. The water tunnel design will provide a uniform flow for a wide range of Reynolds numbers. It also will be transparent so every step of the process can be observed. A testing solution is necessary for a variety of practical, fluid-flow engineering problems. An economical design solution allows the tunnel to be reproduced and used in classrooms, labs and even at home. The design can compete with the more expensive or complex options, such as wind tunnels and/or industrial water tunnels by providing comparable results in flow visualization.

Safe-Keepings

FACULTY ADVISER: W. TED EVANS, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Chad O. Barnes, Belgacem Ghmougui, Garnett L. Hegeman and Sean T. Morris

Safe-Keepings is a personal security system for a home or business owner who is away and wishes to be notified of unusual activity occurring in the home or business. Most break-ins occur while the owner is away, and by the time the break-in is known, the intruder is long gone. To provide more security awareness, the Safe-Keepings system will notify the user when motion is detected. It will allow the user to see who or what tripped the alarm by recording a video and taking still images that will be accessible on a cell phone from the Safe-Keepings cloud server.

Logistics robotic arm

FACULTY ADVISER: HONG WANG, PHD

Client Adviser/Sponsor: Merl Creps, College of Engineering Department of Engineering Technology

Design Team: Alan R. Murphy and Zachary S. Sullivan

The goal of this project is to minimize the amount of manpower a small business requires when shipping and organizing its outgoing packages on palettes with the help of a robotic arm. The robotic arm will keep a running tab of shipping costs while separating packages into their respective stacks on palettes based on box size.

Micro hydropower system

FACULTY ADVISER: ERIC W. SANDT, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Hytham H. Alharbi, Mohammed K. Almoqbel, Abdulaziz N. Alnaim, Abdulrahman S. Alsaleem and Abdulkarim Alsalman

This project demonstrates the generation of electrical power that comes from the energy force of moving water by using a water turbine. There are many forms of energy that can be produced by water; this project will focus on the kinetic energy that comes from the movement of water.

Batching system

FACULTY ADVISER: W. TED EVANS, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Mohammed H. Aljafar, Fahad S. Almshabab, Abdulmohsin F. Almudarra and Ahmed M. Alqudaihi

The purpose of this project is to help customers choose and mix specified ingredients into one mixed solution. The batching system design involves three containers that have different liquids. Based on signals received from a PLC, the system will produce and release the desired mix. All liquid will be collected in a small tank that will allow the mix to be dispensed into cups.

Concrete Impact Analysis (C.I.A.)

FACULTY ADVISERS: LUIS A. MATA, PHD, AND ZACHARY D. LINKOUS

Client Advisers/Sponsors: Stan Radabaugh, Kuhlman Corporation, and Mitch Forst, CCT

Design Team: Joshua A. Brann, Ryan Gehret, Garret S. Loeffler, Dakota M. Soviar and David A. Strauch

The current testing equipment to determine the resonance frequency for concrete is expensive. The Concrete Impact Analysis (C.I.A.) will evaluate a more economical alternative to expensive equipment that operates by discovering the resonance frequency of concrete to determine the damage to test samples. This alternate option utilizes a microphone instead of an accelerometer to accumulate data and pass that information to a computer.

RecruitMe

FACULTY ADVISER: JARED O. OLUOCH, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Shawn D. Campbell, Taylor M. Hunt, Artie E. Mitchell and Austin L. Sargent

RecruitMe is a web application geared toward connecting companies directly with student talent. RecruitMe allows both students and companies to create profiles to showcase what they can offer. Each student profile includes a biography, resume information and previous awards or projects significant to his or her career. RecruitMe caters to both undergraduate and graduate students. Each company profile includes a description of the company and its mission, job opportunities within the company, and a simple way to get in touch with the company if a student would like to apply for a position. The main purpose of the website is to simplify the process of companies acquiring talent and students finding future careers.

Smart Assistant Mirror (SAM)

FACULTY ADVISER: HONG WANG, PHD

Client Advisers/Sponsors: Gregory Gaustad and Zachary Linkous, The University of Toledo College of Engineering

Design Team: Thom A. Coehrs, Roger M. Cornell, Phouthasak J. Douanglee and Jose M. Ruiz

SAM is a customizable smart mirror that combines the power of a microcomputer with an everyday, household mirror. Using two-way mirror technology, SAM can display a dashboard interface through a reflective mirror, presenting users with useful information and widgets, such as weather information, calendar appointments and more. It features a user-friendly configuration system, as well as Wi-Fi connectivity for up-to-date information.

Biscuit pull-bar

FACULTY ADVISER: PROF. WILLIAM A. MUGGE

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Jameson C. Faller, Jonathan T. King and Kayleigh J. Smith

The goal of this project is to design a biscuit pull-bar that is cost effective, easy to maintain and performs outstandingly. The biscuit pull-bar will help racecar drivers overcome the common problem of traction-limited acceleration by improving traction during acceleration, maintaining traction down straightaways and absorbing shock from imperfections in the track. This pull-bar design utilizes four polyurethane biscuits, a self-contained, bronze, linear bearing, and SAE 1018 steel rods and plates.

Fluid forces test bench

FACULTY ADVISER: CARMEN CIOC, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Yousef A. Alsaud, Kyle R. Mohr and Brett Rife

A newly designed and built fluid forces test bench will be used in fluid mechanics labs. The current model has several broken pieces, as well as elements that need to be improved or updated. The new fluid forces test bench improves upon areas that were lacking in the previous test bench. The new bench benefits future students of The University of Toledo, while serving as an example of student workmanship. The bench will provide future students with a visualization of fluid forces and processes. Students in the MET 2050 Fluid and Hydraulic Mechanics Lab will use the apparatus to test and demonstrate their working knowledge of fluid forces.

Perpetual motion

FACULTY ADVISER: CARMEN CIOC, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Trevor J. Coopersmith, Gabriel J. Hughes, Ahmad Neeme and Jason A. Perse

This project utilizes the properties of magnets to create motion and generate electricity. This is accomplished by placing magnets on a rotating wheel while a surrounding cage of magnets encloses the wheel. The magnets in the enclosure will have the same polarity as the magnets on the wheel, thus using the repulsion effect to keep the wheel spinning after an initial push.

Manual can crusher and recycling device

FACULTY ADVISER: PROF. RICHARD A. SPRINGMAN

Client Advisor/Sponsor: College of Engineering, Department of Engineering Technology

Design Team: Hussam A. Alhussain, Abdulrahman Alolayan, Ahmed F. Alshammari, Ali A. Alshuaibi and Aron M. Jarvis

This device is a tool for effective waste management through the use of recycling and economical use of space. A manual can crusher was ergonomically designed to require a minimal amount of force to activate, thereby making it user-friendly and child-friendly. The device is mounted on a cart, making it mobile. The can crusher is of aluminum construction and was designed to hold around four aluminum cans in its basket. It has the capacity to crush more than one can at a time. This cost-efficient device uses a lever system to initialize the crushing feature.

Monitoring system for unoccupied buildings

FACULTY ADVISER: JARED O. OLUOCH, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Client Adviser/Sponsor: Mark A. Smith, SSOE Group

Design Team: Chelsea O. Kania, Tyler J. Martin, Nathan P. Matheny, Linzy Packard and Corey E. Pollauf

This system was created using Raspberry Pi and IP cameras to develop an open-source solution for monitoring unoccupied structures. It provides alerts to an offsite user including, but not limited to, banks holding foreclosure properties, municipalities monitoring properties under their control, property managers waiting to lease a property, or owners of seasonal properties. Video and/or still images are sent to a cloud provider, allowing clients to view the cause of the alert and determine the proper response.

Rudolph Libbe office renovation

FACULTY ADVISER: PROF. LINDA S. BEALL

Client Adviser/Sponsor: Mike Mutscheller, Rudolph Libbe, Inc.

Design Team: John D. Burrow, Benjamin J. Edwards, Seth C. Morrison and Johnathan J. Runion

This project focuses on the renovation of 15,000 square feet of existing office space at the corporate headquarters of Rudolph Libbe, Inc. in Walbridge, Ohio. The current layout of the office includes many private offices, which does not promote collaboration among employees. The goal of this renovation plan is to update the current space and create a more open office layout. This, in turn, will promote more collaboration and better communication among employees.

The University of Toledo parking analytics

FACULTY ADVISER: JARED O. OLUOCH, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Amir H. Horani and Yulexis D. Pacheco Monasterios

Continuous expansion at The University of Toledo has made parking on campus more difficult, and there are few resources available to address this problem. A demonstration prototype utilizing sensors and a real-time web application provides information about available parking spaces for a specific parking lot on campus. The application displays the details needed for the user to make a parking decision on campus.

UT parking garage augmentation

FACULTY ADVISER: NICHOLAS V. KISSOFF, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Client Adviser/Sponsor: Bryan Martin, Turner Concrete Products

Design Team: Nicholas M. Hamilton, Nicholas D. Mehling, Christopher J. Perchinske, Colin P. Rininger and Alexander J. Thomas-Dull

The purpose of this project is to design a second access point for traffic entering the East Ramp Parking Garage at The University of Toledo. The design seeks to alleviate traffic congestion at the intersection of North Towerview Boulevard and East Centennial Drive. A reduction in traffic at the intersection also will result in a safer crossing point for pedestrians at North Towerview Boulevard and reduce traffic buildup on Bancroft Street.

BOV Jack-Cart

FACULTY ADVISER: CARMEN CIOC, PHD

Client Advisers/Sponsors: Steve Hutchinson and Keith Muhalik, The Andersons – Maumee Railcar Repair Shop

Design Team: Nicholas T. Keller, Andrew T. Lewallen and Lawrence M. Richardson

A Jack-Cart design for The Andersons – Maumee Railcar Repair Shop utilizes a transmission jack with a modified platform to fit an assortment of Bottom Outlet Valves (BOVs). The modified platform will be attached to a carousel so it will be able to rotate into position when lowering and raising the BOV. This design makes the process of removing and reinstalling the BOV to the tank car a safer job. Improved safety is achieved by reducing the awkward positions in which workers are placed when lifting a BOV into place – a situation that can turn hazardous with a valve weighing from 80-100 lbs. The cart also will improve the efficiency of removing and reinstalling the valves by making possible with a single person a task that currently requires 2-3 workers.

Carmel mix tank

FACULTY ADVISER: PROF. NICOLE L. WINHOVEN-KAMM

Client Adviser/Sponsor: The JDI Group, Inc.

Design Team: James A. Gonya and Dylan S. Kluczynski

This project focuses on an application of a Programmable Logic Controller (PLC). The PLC will control six ingredient tanks, one mix tank and one storage tank. Each of the eight tanks will have motors and valves, along with heating or cooling jackets. All of these components will be controlled and monitored by the PLC. The second part of the project will focus on the use of a Human Machine Interface (HMI), which will allow for a demonstration of the process without the need to build a full-scale model.

Solar power

FACULTY ADVISER: CYRUS HAGIGAT, PHD

Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Moeaid Y. Aljaber, Kamel Z. Alkhwaitim, Fadhel M. Alsada, Mohammed Y. Alyami and Abdulelah K. Safi

As the world searches for new ways to generate power without the use of fossil fuel, concentrated solar energy presents a solution. This project delivers a bench to demonstrate the basic principle of power plants and concentrated solar collection.

Mobile autonomous robotic arm

FACULTY ADVISER: HONG WANG, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Abdullah M. Alharbi, Mater M. Almutairi, Runze Guo, Derek A. LaChance, Dustin A. Reitzel and Marc L. Sonnega

The goal of this project is to produce a working, small-scale, proof-of-concept model of an autonomous pick-and-place robot for use in a warehouse or other industrial capacity. It consists of a robotic arm mounted on a four-wheeled chassis, which is capable of retrieving, storing, transporting and dispensing various materials. In addition to the model, a drawing of a full-scale, refined prototype also will be provided.

Contactless instrument/pipette dispenser

FACULTY ADVISER: PROF. WILLIAM A. MUGGE

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Christopher P. Makar, Timothy D. Miller and Benjamin M. Tamor

This device can properly adjust a single-channel, manual pipette, minimizing errors that could increase the cost of a procedure or experiment. The user will employ a keypad and screen as an interface that will send data to an Arduino. The Arduino also will receive feedback from a Raspberry Pi and ultimately decide if the pipette is properly adjusted. The design for this product limits human intervention with a pipette while it is being adjusted.

Engineering campus site design

FACULTY ADVISER: PROF. LINDA S. BEALL

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Nasser S. Almarzooq, Mustafa A. Alnasser and Yijun Zhu

A site plan was designed to align the College of Engineering campus with the Campus Master Plan. The project consists of two major elements: first, construction of a new building; and second, omitting Palmer Hall and redesigning the site of the College of Engineering. The Campus Master Plan emphasizes the preparation of the campus for the next decade, and presents The University of Toledo as modern and high-tech. The proposed building takes these goals into consideration, and provides features that are not currently available in the College of Engineering, such as private study rooms, a café and a lobby.

Simple home technology

FACULTY ADVISER: PROF. NICOLE L. WINHOVEN-KAMM

Client Adviser/Sponsor: TS Controls

Design Team: Brent C. Anderson, Nicholas R. Shaheen, Brook L. Shufelt and Bryce K. Young (CSET)

In this project, products were designed and developed to enable the safe and convenient living of individuals who prefer safety and simplicity. The prototype products include a safety outlet and a Bluetooth wireless-controlled outlet array. The safety outlet is an electrical outlet that de-energizes when human motion is detected within close proximity. This function eliminates the potential risk of arc flash and electric shock, providing safety when making connections and peace of mind in the presence of children. The Bluetooth wireless outlet is a stand-alone power outlet array that is controlled wirelessly via a software application installed on a mobile device. The software application is a single-user interface, allowing the end-user control of an array of “low tech” devices, especially those in locations with limited access.

Bancroft Hills school redevelopment

FACULTY ADVISER: NICHOLAS V. KISSOFF, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Designer: Saud F. Almutairi

Several schemes designed in this project will transform a vacant lot into a small hub of community enrichment for the surrounding area. The development will include a multi-sport surface, gazebos, playground equipment, landscaping and a small parking area.

Smart-mirror medicine cabinet

FACULTY ADVISER: PROF. JASON M. SLAGLE

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Design Team: Jason D. Comito and William L. Mitchell

An internet-enabled, home, smart-mirror medicine cabinet will present useful information, such as weather, traffic alerts and calendar entries to the end users as they prepare for their days. The mirror will be driven by a Raspberry Pi, single-board computer and a HDMI display hidden behind a two-way, mirrored glass or acrylic. The design includes a plan to integrate a Bluetooth scale and design software that stores weight and other health information. Using the Google Fit API, this information could be analyzed and reviewed at a later time on the mirror and on other devices. Other features for the prototype model may include a locking cabinet, medication reminder software, gesture/voice control and a speaker system and interface for playing music.

Modern CNC machine

FACULTY ADVISER: PROF. JASON M. SLAGLE
TECHNICAL ADVISER: W. TED EVANS, PHD

Client Adviser/Sponsor: College of Engineering Department of Engineering Technology

Designer: Ali Malekpour

CNC machines and 3D printers are very popular. Research and development funds available in the field have grown, and expectations for advancement remain high. This project aims to build a modern interface and an open-source platform to run CNC machines. A prototype CNC machine has been designed and is being built. A very popular Arduino board will be used to control the machine. Using the controller software, the application will be able to translate and send basic G-Code commands to the machine through a USB port. In phase one, the machine will be able to cut basic shapes and engrave on wood and nonferrous metals. Future phases will focus on the software extensibility and ability to use plug-ins to extend functionality.

Hand controls for wheelchair

FACULTY ADVISER: MEHDI POURAZADY, PHD

Client Adviser/Sponsor: Angie Goodnight, The Ability Center of Greater Toledo

Design Team: Emily Cornieles Adam Fasnacht and Michael McLaughlin

A custom hand control for a powered wheelchair was developed for a client who has limited hand/muscle control and strength.

Outdoor wheelchair for youth

FACULTY ADVISER: MEHDI POURAZADY, PHD

Client Adviser/Sponsor: Angie Goodnight, The Ability Center of Greater Toledo

Design Team: Blake Podgorski Corey Stewart and Dylan Ursem

A custom mobility solution was designed for a young girl with a disability, allowing her to more easily play outdoors with her siblings.

Toledo Zoo gorilla feeders

FACULTY ADVISER: LESLEY BERHAN, PHD

Client Adviser/Sponsor: Beth Posta, Toledo Zoo

Design Team: Caleb Allison, Thomas Gibbons, Patrick Montion and Dalen Sprunger

An enrichment feeding device was designed for gorillas at the Toledo Zoo. The extreme strength of gorillas poses an additional challenge addressed by the design team.

Toledo Zoo orangutan feeders

FACULTY ADVISER: LESLEY BERHAN, PHD

Client Adviser/Sponsor: Beth Posta, Toledo Zoo

Design Team: Alex Cusick, Dan Janek, David Scarberry and Mitchell Wiese

An enrichment feeding device was designed for orangutans at the Toledo Zoo. The design requires the orangutans to solve a reconfigurable puzzle to obtain food. Though orangutans are not as strong as other primates such as gorillas, their strength still poses a great challenge.

Dynamic ornaments and decorations

FACULTY ADVISER: MOHAMMAD ELAHINIA, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Benjamin Kinney, Emily Myers, Lindsay Revill and Zeen Zhou

Nitinol, a shape memory alloy, is commercially available as wire, and moving decorations can take advantage of Nitinol's super-elasticity and shape memory effect. This design project harnesses a shape memory alloy, like Nitinol, for use in dynamic decorations.

R4360 aircraft engine

FACULTY ADVISER: RAY HIXON, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Shaston Kazmierczak, Thomas Nichols, Matthew Stephenson and Juttenbir Tatla

A 28-cylinder, rotary-piston engine weighs several thousand pounds and is currently seized. To free it, each cylinder must be lifted off its piston. This project continues the tear-down and rehabilitation of the engine.

Training knee ankle orthosis (KAFO)

FACULTY ADVISER: MOHAMED SAMIR HEFZY, PHD

Client Adviser/Sponsor: Gregory Nemunaitis, MD, Cleveland Metro Health

Design Team: Fahad Alanazi, Kyle Bowell, Khanh Huynh and Sonali Patel

This project's goal was to design a knee ankle orthosis for rehabilitating patients that improves on the weak points of some existing designs. The design must be adaptable to people with different anthropogenic measures and allow adjustment at each joint to accommodate patients with diverse rehabilitation circumstances.

Pressure-reducing spine board

FACULTY ADVISER: MOHAMED SAMIR HEFZY, PHD

Client Adviser/Sponsor: Gregory Nemunaitis, MD, Cleveland Metro Health

Design Team: Alex Buddemeyer, Stanley Gladieux, Mary Hillegas, Gunther Ruck and Joshua Walton

When a patient is strapped to a conventional, "hard" spine board for an extended period of time, ulcers can form as a result of the high pressure. This project reduces the interface pressure between a patient and the spine board, with the goal of eliminating the onset of pressure-induced ulcers.

High-pressure gas delivery system

FACULTY ADVISER: REZA RIZVI, PHD

Client Adviser/Sponsor: Carol Wedding, Deep Springs Technology

Design Team: Jacob Janicek, Caleb Ritenour and Cole Robertson

Small, hollow microspheres are used in deep-sea buoyancy applications that experience very high pressures. A gas delivery system was designed for a high-pressure vessel that will be used to test the implosion behavior of these microspheres.

Pressure vessel for syntactic implosion testing

FACULTY ADVISER: REZA RIZVI, PHD

Client Adviser/Sponsor: Carol Wedding, Deep Springs Technology

Design Team: Casey Smith, Adam Snyder, Kun Yang and Liliang Zhao

Microspheres have been known to fail under high pressure, which causes surrounding microspheres to syntactically fail. The project team designed a high-pressure vessel that will be used to test the implosion behavior of small, hollow microspheres.

Multi-person, human-powered vehicle

FACULTY ADVISER: BRIAN TREASE, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Nicolas Francis, Josh Meyer, Michael Rutschilling, Trevor Sherman and Chad Winner

The design team improved an existing, three-person vehicle to hit target speeds of 40+ miles per hour. The design required both drivetrain and aerodynamic improvements.

Rough water robotics

FACULTY ADVISER: BRIAN TREASE, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Sklyer Baugher, Kevin Kraus, Robert Lagger and Jacob Price

A procedure was designed to test the static and dynamic stability of small boats. The project team designed concepts for improved stability, created small-scale prototypes and tested the prototypes in a wave tunnel.

Mechanical characterization of origami folds

FACULTY ADVISER: BRIAN TREASE, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Jakob Boss, Andrew Price, Monica Sunderhaus and Jason Wilder

Origami folding techniques have been innovatively applied to engineering problems, but data on how materials behave while being folded is sparse, at best. This team is building test fixtures based on existing fold-characterization methods and comparing the results.

Hydropower modeling

FACULTY ADVISER: SORIN CIOC, PHD

Client Adviser/Sponsor: Mark Anteau, local entrepreneur

Design Team: Tyler Brown, Nachiket Degaonkar, Thomas Parkey and Dominick Shull

This team modeled and constructed a simplified, scaled prototype of a novel idea for generating hydroelectric power.

Automotive engine plant productivity enhancement

FACULTY ADVISER: MATTHEW FRANCHETTI, PHD

Client Advisers/Sponsors: Bob Daragon and Jamie Holzhauser, Fiat Chrysler Automobiles

Design Team: Ahmed Alfadhel, Joshua Cline, Jonathon Eiden, Joel Shaffer, Heather Sunyak and Christopher Swonger

After identifying barriers to productivity at the Fiat Chrysler engine machining and assembly plant, this team developed proposals for eliminating these bottlenecks.

Dana pinion preload study

FACULTY ADVISER: ALI FATEMI, PHD

Client Adviser/Sponsor: Nathan Mandery, Dana Corporation

Design Team: Daniel Miller and Nicholas Smallman

The current method for achieving desired tension in a pinion assembly involves controlling the assembly torque, but this method is not always accurate enough. This project team investigated methods of confirming acceptable tension in a pinion assembly, which could include using a frequency analysis or laser distance sensors.

‘Monosuper’ racing motorcycle

FACULTY ADVISER: RAY HIXON, PHD

Client Adviser/Sponsor: The University of Toledo

Design Team: Roger Courtney, Chase Helmick, Joshua Hocevar, Joseph Strobbe and Joseph Wryst

A two-cylinder, 250-cc motorcycle engine was converted to a single cylinder, 125-cc engine so it may be entered in the smaller engine class for a loop race around Lake Erie.

Affiliated Companies and Sponsors

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Sylvania, Ohio
Angie Goodnight

The Andersons Rail Repair Group
Maumee, Ohio
Steve Hutchinson and Keith Muhalik

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Toledo, Ohio

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Dundee Engine Plant
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Joe Fausnaugh and Jon Zvanovec

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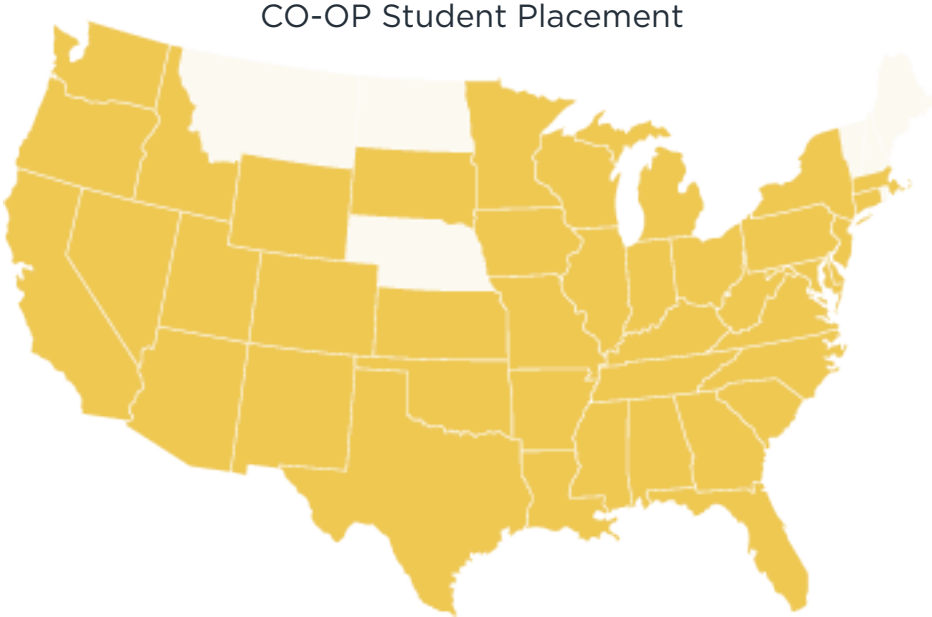

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