LETOURNEAU UNIVERSITY

ENGINEERING & ENGINEERING TECHNOLOGY

2019—2020 Senior Design Projects

At LeTourneau University, we implement engineering design and project-based learning throughout our entire curriculum. During the senior year, engineering students participate in a year-long capstone project as part of a multi-disciplinary teams. LETU students complete a wide variety of projects that involve collegiate competition, applied research, industry skills and humanitarian service. These team projects embody the learn-by-doing philosophy for which LETU is known.

LeTourneau University Nexus for Amateur Rocketry

FACULTY ADVISOR: DR. CHAD FILE

For the past 60 years, space has relentlessly proven to be the final frontier of our universe and the undiscovered country that continues to challenge and amaze scientists. While few space missions are attempted today, most rocket projects are maintained by civilian rocket enthusiasts aiming to study the upper regions of our atmosphere and to gain experience in amateur rocketry. This year LeTourneau University joins thousands of others across the country to study, design, and construct their own high-powered rocket. This project will need to consider structural and fluid mechanics, aerodynamics, and the culmination of these fields pertaining to a launch vehicle system and a payload system.

Prosthetic Energy Return Knee

FACULTY ADVISOR: DR. KO SASAKI

Transfemoral amputees are prone to falling and/or have fear of falling during walking, because the prosthetic knee joint may not be stable enough during the stance phase when body weight is placed on the prosthetic leg. Stance-control prosthetic knees stabilize the joint during stance to prevent falling but sacrifice natural knee motion by completely locking the knee joint. This project aims to develop a new stance-control prosthetic knee joint that allows more natural knee motion during stance, with a mechanism to enhance elastic-energy storage and return to facilitate smooth and more efficient gait.

Putter Pal Electromechanical Golf Aid

FACULTY ADVISOR: PROF. JOHN TIXIER

Putter Pal is an Electromechanical golf putting target. It receives accurate and errant balls and returns them to the user, along with a session report that visually depicts the putter's accuracy and logs the data. The goal of this Sr Design project is to develop the Putter Pal into a multi-feature tool that can be used by recreational, aspiring, or professional golfers, as well as instructors and coaches. Features to be incorporated into the prototype this year include self-mobility, ball velocity and projected final location, ball collection and controlled discharge, and a session report and logging of results. A Raspberry Pi micro controller and a variety of sensors and motors are being incorporated into a compact and appealing form factor. The ultimate goal is a commercial product to be finalized and marketed by an industry sponsor.

TATO: Vehicle Mobility Assist Device

FACULTY ADVISOR: DR. GITOGO CHURU

Persons with physical disability face a difficult time getting in and out of vehicles. The main objective of this Senior Design Project is to design, build and test a device that can effectively help a disabled person get in and out of the vehicle safely and with ease. The device must be safe to operate and cheap to produce so that it can be mass produced.

Additive Construction Materials Experimentation

FACULTY ADVISOR: DR. KRAIG WARNEMUENDE

The purpose of this project is for the Senior Design team under Dr. Kraig Warnemuende to develop a 3D tool carrier as the central module of an additive construction platform designed to be a test bed for advancement in additive construction techniques and materials. The tool carrier module is being designed to be adaptable in both load and path to meet the multiple needs desired. This project will enable the PI to research and develop materials and processes adaptable to additive construction.

BADGER Robotic Bird Control

FACULTY ADVISOR: DR. HOO KIM

BADGER Robotic Bird Control is a second year project sponsored by A&K Systems. We are creating an autonomous and amphibious robot designed to chase Canadian Geese off of golf courses. Our goal is to build a manufacturable prototype of the autonomous and amphibious robot that was designed and built last year. We are using the latest robotics technology in conjunction with GPS that is accurate to a few centimeters to create a robot that is incredibly smart without the need for a host of external sensors. We are also employing cutting edge Convolutional Neural Network (CNN) image recognition to detect the Canadian Geese so that we can chase them away from golf courses. All of these things put together will allow us to create the Big Amphibious Durable Goose Remover, also called the BADGER.

Eschatos: Sustainable Missions Motorcycle

FACULTY ADVISOR: DR. JESSE FRENCH

The least reached places on Earth, the Eschatos, the most extreme, farthest, and last to receive the gospel, are within the capability of modern off-road motorcycles. Using solar, wind, and fuel cell technology, the range of the missions motorcycle can be extended to far beyond the limits of the existing gasoline supply routes. The focus of the project will be to convert an existing Dual Sport motorcycle to run on sustainable fuel (electric, fuel cell, Hydrogen, or other) and design, build, and test the support trailer (which contains Fuel generation, self-recovery, and repair equipment).

Engineering World Health Competition

FACULTY ADVISOR: DR. PAUL LEIFFER

LeTourneau Engineering World Health is a design competition team dedicated to making an impact in the global healthcare system. This year LETU EWH is partnering with Samaritan's Purse to develop a portable surgical table. Samaritan's Purse is a nondenominational evangelical Christian organization providing spiritual and physical aid to hurting people around the world. Samaritan's Purse sends out an Emergency Field Hospital whenever disaster strikes. The goal of the EWH team is to design a lightweight, portable, and durable surgical table for use in a Samaritan's Purse Emergency Field Hospital. The purpose is to reduce cost so that the ministry may spend their resources providing aid to more locations.

Frontier Wheelchairs

FACULTY ADVISOR: PROF. NORMAN REESE

In the developing world, powered wheelchairs are too expensive for most people who need them. Meanwhile, battery-powered wheels are decreasing in cost due to their prevalence in powered scooters and bicycles. Beeline wheelchairs, an organization in Guatemala, has asked LeTourneau engineering students to design an attachment using an electric wheel that can help wheelchair riders travel up to 12 miles over semi-rugged roads at 10 mph. In this application, the device needs to require little maintenance and cost less than $200. This year, the students will design, build, and test an attachable accessory that provides powered propulsion for a manual wheelchair. A prototype must be built in time for the team to travel to Guatemala over Christmas break for testing and customer feedback.

Hydrologic Budget

FACULTY ADVISOR: DR. YUNUS SALAMI

A team of civil engineering students are applying skillsets in surveying, hydraulics, and watershed analysis as well as in situ data from an onsite hydrometeorological station to identify and quantify all water inputs and outputs associated with LeTourneau University's retention pond - a Low Impact Development feature. A robust model will then be developed to simulate the system's behavior and a hydrologic budget created for multi-seasonal, multi-scenario planning and management purposes. Benefits include prescribing optimum storage-consumption-release policies, improving sustainability practices, providing foundational water quantity information for use by other researchers, furnishing students with real-world experience in watershed modeling, and fulfilling the objectives of the research grant awarded for the project.

Lazy Rivers

FACULTY ADVISOR: DR. DARRYL LOW

Lazy Rivers are a common feature at large recreational water parks, but the mechanisms affecting flow and required energy input are poorly understood. In the second year of this project, the team will initially focus on experimental testing of a previously built physical model, then design, build, and test their own small-scale lazy river models. These constructed systems will be interchangeable, modular channels that will allow for analysis of flow components and aid in assessing flow behavior for the development of lazy river design tools. This project is supported by Bryan Ziegler, P.E. (Aqueous Engineering) and other aquatic engineers at Aqueous Engineering in Tyler, TX.

LeTourneau Emulated GPS Range

FACULTY ADVISOR: DR. NATHAN GREEN

LEGRange is a 3-year GPS-centered project being funded by Sandia National Labs. The goal of the project is to create a GPS Constellation and place it on campus for the purpose of running over-the-air testing and evaluation of adversarial signals. Furthermore, there are yearly milestones to be met. In the first year, the team will construct the GPS constellation, consisting of four modified transmitters and one receiver. Each device will leverage mature code provided through UT Austin's Radionavigation Lab in order to process signals. The team will use the second and third year to develop an adversarial GPS device, detector, and finally a device used for localizing adversarial devices. LEGRange is a highly anticipated project that will advance our research efforts in the field of defense.

LeTourneau Lullaby Pacifier

FACULTY ADVISOR: DR. HOO KIM & DR. JOONWAN KIM

The goal of the LELP team is to develop a prototype of the Lullaby Pacifier: a smart pacifier that plays music, takes temperature readings, vibrates to soothe teething babies, and turns itself off when not in use. An app for iPhone and Android is being developed to control the pacifier and report its status. With this app and the Lullaby Pacifier, parents will be able to monitor their baby's temperature, comfort their baby's teething pain, and soothe them with music without having to be right next to them. This project involves students from four different departments on campus: engineering, computer science, business, and psychology.

LETSAT

FACULTY ADVISOR: DR. BYRON LICHTENBERG

LetSat is a follow-on project from 2017-2018 to develop a small satellite known as a CubeSat. This year's team has been focusing on development of an AI to provide hazard identification using a neural network to identify possible landing hazards for science missions needing to land on Lunar or Martian surfaces . In addition to AI development, the team has continued development of the required support systems (hardware and software) for the AI. This year's goal is to produce an integrated system capable of being launched and recovered on a reusable suborbital rocket (80 km or higher) by May 2020. This development system will allow the team to recover data from the mission and analyze the data to optimize the AI for segmentation accuracy.