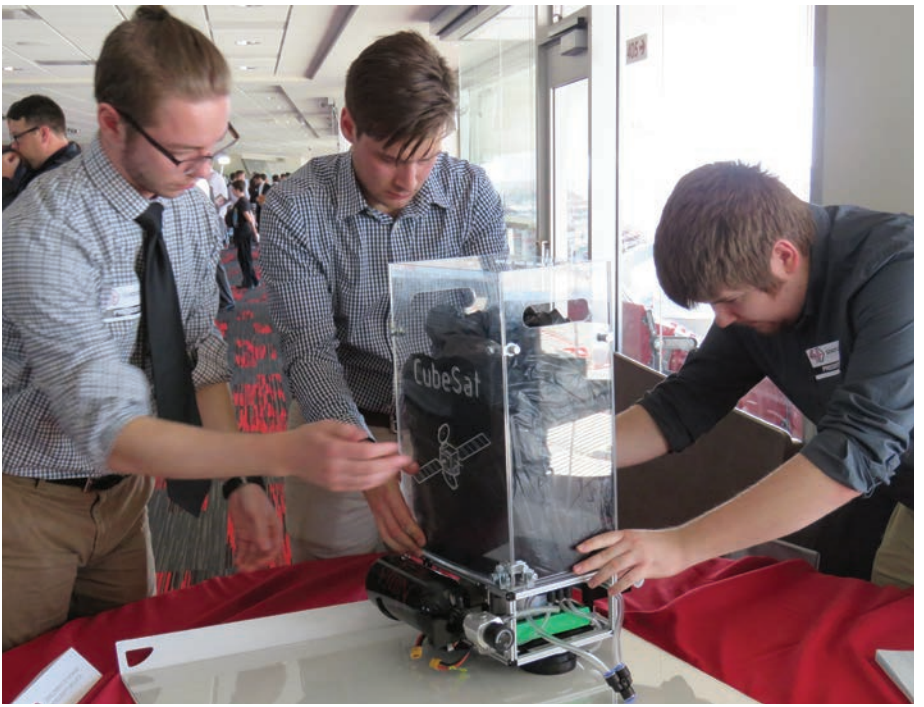
MEMORIAL STADIUM • APRIL 26, 2019

NEBRASKA ENGINEERING SENIOR DESIGN SHOWCASE

WELCOME

Welcome to the University of Nebraska–Lincoln College of Engineering's premier undergraduate senior engineering design showcase. These capstone projects are the culmination of many hours of research, creativity and effort and are designed to make a positive and lasting impact.

2018 Showcase participants



The 2018 People's Choice Award winner was the Planar Microgravity Simulator. The device was designed and built by Ben Bradley, Rachael Wagner, Nathan Jensen, Nathan Borcyk and Katie Johnson. It allows researchers to test their small satellite systems on Earth.

SENIOR DESIGN SHOWCASE

NEBRASKA ENGINEERING

TABLE OF CONTENTS

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GUIDED TOURS

MEMORIAL STADIUM TOURS

1:15 p.m. 2:15 p.m.

A tour of Memorial Stadium will be available at the times above. Tours are limited to no more than 30 guests and are on a first-come, first-served basis.

NEBRASKA ATHLETIC PERFORMANCE LAB

1:45 p.m. 2:45 p.m.

Tours are on a first-come, first-served basis.

THE PEOPLE'S CHOICE AWARD

Vote for your favorite senior design. Using your own criteria, vote for your favorite project. Only one vote per guest, please. You can pick up and drop off your ballot at the People's Choice Award Table, located near the center of the showcase floor.

CELEBRATING SUCCESS, RECOGNIZING 110 YEARS OF NEBRASKA ENGINEERING

Following the showcase, we invite you to attend an informal reception in honor of the seniors and the college's 110th anniversary.

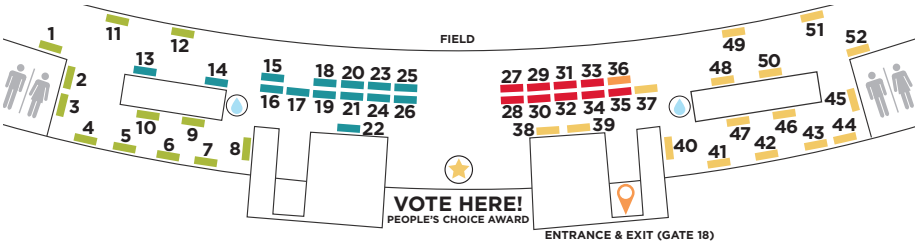
Van Brunt Visitors Center
313 N. 13 Street, Lincoln
5–7 p.m.

Hosted by Dean Lance C. Pérez,
the event will feature hors d'oeuvres and beverages.

110

COLLEGE *of* ENGINEERING

MAP/BOOTHS



MECHANICAL ENGINEERING

1 Design and Development of a Canine Mobility Wheelchair
2 Bi-Directional Motorized Conveyor Belt
3 Assistive Tremor Correcting Pen Holder
4 Rotor Placement Automation
5 Development of a Manufacturing Method for Super-Coiled Polymer Actuators
6 Design and Development of a Torsional Fatigue Tester
7 The SnowBot
8 Balance Training Platform
9 Teletrax Track Propulsion System
10 Teletrax Telehandler Superstructure
11 Mini Enemeez Dispenser
12 Self Folding Snow Blanket
13 Biofilm Application System

BIOLOGICAL SYSTEMS ENGINEERING

14 M.M.A.D. for Water Quality
15 Swine Mortality Removal Apparatus
16 JP Lord Basketball Launcher
17 Fountain Wars
18 Stormwater Drainage Assessment for Douglas County Environmental Services
19 Smart Shoe Sole
20 Dental Device to Aid in Full Arch Restoration Implant Fabrication Process
21 Amber Flashing Warning Light System Redesign for CLAAS Combine Headers
22 Small Scale Food Extrusion Device
23 Skin Temperature Detecting System for Prosthetic Users
24 Stream Bank Erosion Sensor
25 1/4-Scale Tractor Suspension
26 Dairy Plant Relocation

CHEMICAL ENGINEERING

27 Electrochemical Reduction of Aqueous-Based Carbonates to Fuel Ethanol and Other Industrial Chemicals
28 Energy Efficient Production of Gasoline Grade Biofuels from Corn Stover using a Novel Zeolite Catalyst
29 Dimethyl Ether and Methanol Production from Biomass
30 Non-Catalytic Production of Biodiesel using Dimethyl Carbonate under Supercritical Flow Conditions
31 Membrane Integrated Continuous Fermentation for the Production of Monosodium Glutamate
32 The Production of Acetic Acid and Methanol from Corn Stover Biomass
33 Exploring Cellulosic Ethanol Production from Corn Stover Using a Theoretical Strain of Clostridium Thermocellum
34 Olefin Production via Biodiesel-Derived Glycerol
35 Production of Terephthalic Acid Using a Spray Reactor to Reduce Environmental Concerns

CIVIL ENGINEERING

36 Boy Scouts of America Outdoor Education Center Concept Site Master Plan

ELECTRICAL ENGINEERING

37 goBilda Power Distribution and Control System
38 DMX Lighting Controller
39 Energy and Water Data Streamer
40 Coaxial Magnetic Gear
41 Plant Computer
42 Glacier Creek Sensor Network Redesign
43 GARDENBOT: A Semi-Automated Gardening System
44 Apartment Moisture Monitoring
45 Kool Shield Controller
46 T.E.A.M. Display
47 Automatic Pet Feeder
48 Tri-renewable
49 iMobile Platform
50 Self Balancing Cube
51 Acoustic Sensor Mesh
52 Musical Synthesizer

STUDENT LIST/BOOTHS

Abbenhaus, Kasi 35
Adams, Janelle 23
Adams, Josh 32
Al Nuumani, Khawla 29
Al Sabahi, Musab 34
Al-Badry, Shanon 36
Al-Mughairi, Mohamed 31
Al-Sabahi, Mohammed 28
Alhabsi, Taher 12
Alhamy, Sherevan 8
Almaqbali, Khalid 2
Alsiyabi, Mahdi 12
Anderson, Samuel 48
Arens, Kristin 33
Astorino, Gabe 34
Bacho, Ahmad 29
Baker, Michael 42
Bao, Xinyue 43
Barnes, Paul 28
Barnum, Lindsay 5
Bartels, Adam 8
Bauer, Josh 17
Bauman, Nathaniel 42
Beaber, David 10
Bendix, Keith 21
Bevins, Alisha 7
Biegert, Meghan 16
Blankenau, Connor 20
Blayney, Ethan 7
Bohling, Kelsey 13
Bolin, Jonah 25
Bolin, Noah 25
Brinkman, Justin 26
Brossart, Garrett 17
Browning, Megan 31
Buckley, Allison 39
Burbach, Eric 30
Burbach, Luke 26
Cao, Eric 52
Carle, Jonathan 44
Carter, Jozzy 20
Chao, Byron 42
Chekal, Jacob 36
Chok, James 10
Christensen, Sam 52
Clark, Mitchell 51
Cole, Anna 36
Conley, Jarrod 11
Connolly, David 46
Cook, Hunter 15
Cottrell, Kara 30
Cowles, Nick 36
Curry, Tyler 1
D'Amato, Anthony 7
Dahal, Rupak 45
Darveau, Ryan 12
DeJonge, Kevin 5
Dempsey, Cole 7
Deng, Alex 31
Dittmar, Sam 48
Dolph, Erica 20
Donoghue, Jared 15
Dozier, Dalton 13
Durham, Parker 2
Eddins, Reece 1
Eidem, Austin 33
Elge, Isaac 4
England, Alexis 1
Eskens, Olivia 34
Favazza, Alex 23
Fiedler, Jack 6
Fitz, Jeremy 50
Forsyth, David 13
Foster, Justin 37
Fox, Hannah 27
Frenzel, Jared 39
Frerichs, Isaac 21
Friedman, Brandon 17
Gabler, Joseph 8
Gebers, Nathan 9
George, Ben 49
Gerdes, Sam 24
Gilinsky, Cameron 45
Gilmore, Caleb 5
Goloja, Landin 6
Goodman, Noah 40
Gottberg, Jacob 4
Haas, Tanner 34
Haase, Isiah 42
Hackett, Caleb 46
Harding, Karl 49
Harmon, Wyatt 1
Harney, Robin 27
Hauger, Alli 14
Heck, Andrew 39
Heimes, Michaela 8
Herr, Eric 22
Hill, Garrett 38
Hoge, Brittlin 27
Hohensee, Walker 13
Hruby, Alex 19
Huntwork, Baron 14
Jiang, Han 5
Johnson, Aaron 51
Johnson, Daniel 28
Johnson, Josiah 18
Johnson, Maddie 24
Johnson, Meredith 26
Jones, Jarod 1
Jonseth, Viktor 40
Kaufman, Graham 50
Keith, Brad 47
Keyser, Clay 3
King, Grant 1
Klaasmeyer, Lauren 35
Klawitter, Rylee 47
Klinkebiel, Ben 4
Komla-Ebri, Joel 50
Kracl, Marek 39
Kunikeeva, Aliya 23
Kurkowski, Zak 25
Lane, Merrett 18
Lehr, Brenden 51
Li, Yulong 12
Lindbald, Sam 23
Lindgren, Julia 18
Linnemeyer, Travis 21
Liu, Siqu 10
Loong, Kam Yong 10
Lopez, Nestor 48
Lunn, Conner 22
Margritz, Dillon 9
Massey, John 4
McIntyre, Logan 49
McKinney, Alex 33
McManigal, Matt 16
Meeks, Katrina 14
Merrill, Connor 15
Meusch, Tony 24
Meyers, Andrew 6
Miller, David 22
Miller, Gary 44
Miller, Kale 28
Mohamed, Ahmed 48
Mullen, Rodney 32
Mullin, Logan 11
Nasimov, Firdavs 32
Nelson, Pete 44
Ninh, Phuong 19
Novosad, Isaac 50
Nyberg, Alex 3
O'Grady, Shane 8
O'Connell, Claire 46
Ohlman, Jeremiah 45
Oltman, Adam 9
Ong, Jing 52
Osman, Isra 52
Pachl, Justin 45
Pales, Jacob 11
Pamperin, Megan 24
Pan, Zhili 41
Penington, Evan 3
Penne, Matthew 40
Pepin, Mason 6
Perry, Adam 33
Piening, Logan 19
Pinkman, Noah 46
Pivovar, Thomas 2
Po, TunJie 31
Porter, Isaac 44
Powers, Jared 6
Pua, Cheng Zhi 10
Rennau, Matthew 17
Robins, Kaylee 29
Romer, Matthew 40
Rosser, Darik 29
Royse, Maddy 35
Ryan, Jordan 4
Sabata, Nicholas 47
Salber, Trevor 51
Salitros, Ben 43
Sand, Trevor 7
Sauls, Chrystal 41
Schellpeper, Emma 35
Schlotthauer, Adam 38
Schubert, Eric 3
Scobey, Mark 43
Seeger, Billy 36
Shaffer, Karl 39
Shuldes, Benjamin 27
Smith, Kasey 2
Smith, Lucas 37
Smith, Paul 21
Somer, Madalyn 30
Sorensen, Joshua 9
Spence, Madison 19
Steffes, TJ 37
Steinman, Loren 26
Stokey, Megan 38
Strahl, Mason 12
Stutzman, Ryan 16
Svoboda, Cameron 2
Swenson, Joe 3
Tierra, Jacob 31
Tokoudagba, Katadaki 43
Uhing, Bryce 14
Urrutia, Alex 12
Van Heuveln, Drew 38
Vancura, Devon 25
VanDrie, Luke 39
Vanie, Yannick 6
Vu Tran, Trinh 28
Wagner, Emily 39
Wagner, Reid 30
Wangler, Sarah 11
Wankum, Ben 22
Warren, Brandon 5
Weller, Dillon 11
Wemhoff, Lydia 41
Wetovick, Seth 15
Wicks, Jacob 9
Williams, Tyrell 16
Wilson, Jena 18
Wilson, Renick 5
Woodward, Alex 49
Yang, Kate 20
Young, Wesley 21
Youngquist, Sarah 27
Zimmerman, Derek 11
Zunaiba, Jasa 32

#1 Design and Development of a Canine Mobility Wheelchair

Alexis England, Tyler Curry, Reece Eddins, Wyatt Harmon, Jarod Jones, Grant King

FACULTY ADVISOR: RYAN PEDRIGI, MECHANICAL AND MATERIALS ENGINEERING

The objective of this project was to design, build, and test a wheelchair that allows a canine to sit and lie down while harnessed without requiring extensive training or human intervention.

#2 Bi-Directional Motorized Conveyor Belt

Kasey Smith, Parker Durham, Cameron Svoboda, Thomas Pivovar, Khalid Almaqbali

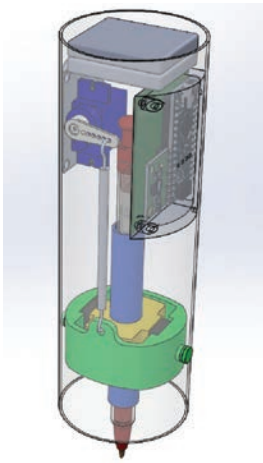
FACULTY ADVISOR: ERIC MARKVICKA, MECHANICAL AND MATERIALS ENGINEERING

This project features bi-directional motorized conveyor belt to be used for transporting cargo.

#3 Assistive Tremor Correcting Pen Holder

Evan Penington, Clay Keyser, Joe Swenson, Eric Schubert, Alek Nyberg

FACULTY ADVISOR: ALI TAMAYOL, MECHANICAL AND MATERIALS ENGINEERING

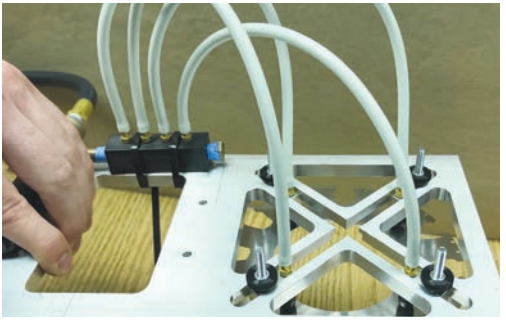


We developed a device that improves writing legibility for people experiencing essential tremors or Parkinson's disease. These uncontrollable tremors in the extremities make it difficult for patients to perform tasks that use fine motor skills, such as writing. The team's solution is design of a writing-assisting pen holder that contains a proprietary control system. By integrating an active control system, the device is able to react to and correct tremors instantaneously. An accelerometer transmits real-time movement data to the microcontroller, which moves the motor in the opposite direction of the tremor. These components together make writing smoother and easier to read.

SENIOR DESIGN PROJECTS

#4 Rotor Placement Automation

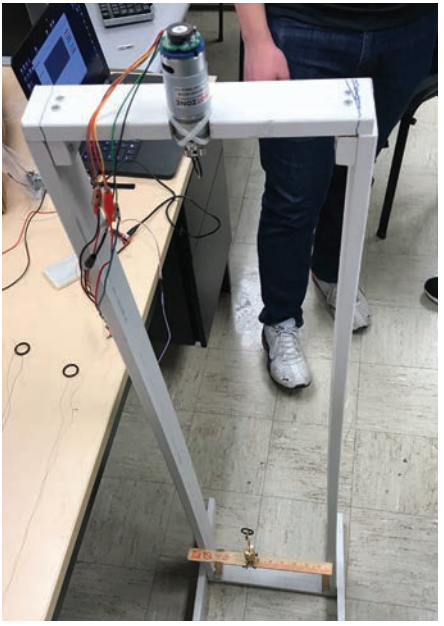
John Massey, Isaac Elge, Jordan Ryan, Ben Klinkebiel, Jacob Gottberg
FACULTY ADVISOR: MICHAEL SEALY,
MECHANICAL AND MATERIALS ENGINEERING



This project is an effort to automate the placement of electrical generator rotor laminations on a slow-moving conveyor belt. A vacuum-operated mechanism is used to pick up the rotors, while a simple vertical and horizontal linear motion system is used to position the rotors.

#5 Development of a Manufacturing Method for Super-Coiled Polymer Actuators

Renick Wilson, Brandon Warren, Han Jiang, Caleb Gilmore, Lindsay Barnum, Kevin DeJonge
FACULTY ADVISOR: TIMOTHY WEI,
MECHANICAL AND MATERIALS ENGINEERING



Applying a current to a super-coiled polymer actuator, one type of solid-state actuator, thread will cause it to heat up and contract, resulting in a method of actuation. This system has been shown to rival the performance of biological muscles, and can be manufactured with cheap, off-the-shelf components. This team developed a manufacturing method for producing super-coiled polymer actuators that will reliably and quickly create accurate actuators.

#6 Design and Development of a Torsional Fatigue Tester

Jack Fiedler, Mason Pepin, Landin Goloja, Yannick Vanie, Andrew Meyers, Jared Powers

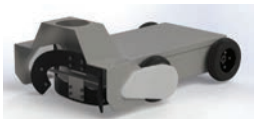
FACULTY ADVISOR: MICHAEL SEALY,
MECHANICAL AND MATERIALS ENGINEERING

The goal of this project was to create a torsional fatigue tester for a larger-sized U-Joint assembly than NEAPCO currently has the ability to test. The machine is able to deliver 200,000 pounds of force inch of torque to the U-Joint repeatedly until failure of the specimen. It is important that the machine is able to withstand both the high torque as well as resisting fatigue damage.

#7 The SnowBot

Ethan Blayney, Anthony D'Amato, Alisha Bevins, Trevor Sand, Cole Dempsey

FACULTY ADVISOR: CARL NELSON,
MECHANICAL AND MATERIALS ENGINEERING



The SnowBot is an autonomous snow blower made to clear driveways with ease. Its goal is to save users from the time and physical strain of scooping heavy snow and prevent injuries that the rigorous effort may cause. Battery-operated, the robot will navigate driveways of various sizes and clear up to 3 inches of light packed snow or 1 inch of dense snow.

#8 Balance Training Platform

Sherevan Alhamy, Adam Bartels, Joseph Gabler, Shane O'Grady, Michaela Heimes

FACULTY ADVISOR: CARL NELSON,
MECHANICAL AND MATERIALS ENGINEERING

The purpose of this project is to improve on an existing balance training platform for rehabilitation purposes and to design a machine that is feasible for both home use and rehabilitation centers. This new machine needs to be cheaper and lighter for commercial use. In the new design, the center of the platform supports 400 pounds, which is greater than the average human weight. The device will also allow a tilt angle of 14 degrees with a speed of 6-60 degrees per second.

SENIOR DESIGN PROJECTS

#9 Teletrax Track Propulsion System

Nathan Gebers, Jacob Wicks, Joshua Sorensen, Adam Oltman, Dillon Margritz
FACULTY ADVISOR: MICHAEL SEALY, MECHANICAL AND MATERIALS ENGINEERING

Current Telehandlers on the market are unable to operate in muddy and tough work conditions. Teletrax has asked us to design a track system that is able to operate in deep mud and also climb 18-inch obstacles.

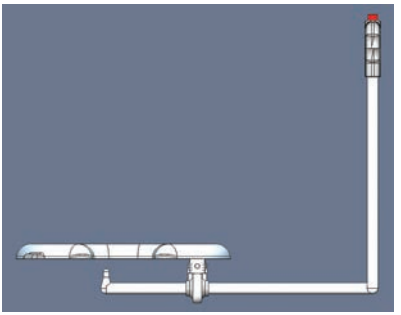
#10 Teletrax Telehandler Superstructure

Siqu Liu, Cheng Zhi Pua, David Beaber, James Chok, Loong Kam Yong
FACULTY ADVISOR: MICHEAL SEALY, MECHANICAL AND MATERIALS ENGINEERING

Teletrax wants to build a new-design telehandler. Our project is to design the front superstructure that has the capability to support a telescopic boom and 12,000 pounds of point load at the extendable telescopic fork in both static and dynamic condition.

#11 Mini Enemeez Dispenser

Dillon Weller, Sarah Wangler, Logan Mullin, Derek Zimmerman, Jarrod Conley, Jacob Pales
FACULTY ADVISOR: CHASE PFIEFER, MECHANICAL AND MATERIALS ENGINEERING, (MADONNA REHABILITATION HOSPITAL)



Many rehabilitation patients have health complications that require the use of an Enemeez mini, a self-deployed, medication-based enema. A number of those patients also have tenodesis hand grasp – a condition in which the patient has no active grip – and are unable to properly disperse this medication, requiring assistance from a clinician or caregiver. This dispenser allows someone with tenodesis hand grasp the ability to dispense an Enemeez mini with adequate force to fully dispense the medication while seated on a rehab shower commode chair or lying in bed on their left side.

#12 Self Folding Snow Blanket

Mason Strahl, Ryan Darveau, Alex Urrutia, Yulong Li, Mahdi Alsiyabi, Taher Alhabsi
FACULTY ADVISOR: MICHAEL SEALY, MECHANICAL AND MATERIALS ENGINEERING

This self-folding and portable snow blanket leaves all the hassle of shoveling in the past. This heated snow blanket deploys over a driveway, deck or sidewalk and can be retracted into its holding box at the push of a button and then carried away.

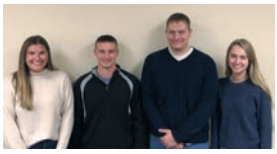
#13 Biofilm Application System

Dalton Dozier, Walker Hohensee, David Forsyth, Kelsey Bohling
FACULTY ADVISOR: DEEPAK KESHWANI, BIOLOGICAL SYSTEMS ENGINEERING

In his research, Dr. Sam Wortman of the Department of Agronomy and Horticulture has found that the application of biofilms, fluids made up of various biological materials which form a film when sprayed onto soil, to different test plots has presented several challenges. This is because the fluids are highly viscous and some contain non-soluble ingredients, and the current system can pump when at least 77 percent of the solution is water. We were asked to design an application system for these fluids to reduce the percentage of water needed to dilute the solution so it can be pumped and to reduce the probability of the system clogging.

#14 M.M.A.D. for Water Quality

Alli Hauger, Bryce Uhing, Katrina Meeks, Baron Huntwork
FACULTY ADVISOR: TIFFANY MESSER, BIOLOGICAL SYSTEMS ENGINEERING



Innovative sensor technologies for water quality monitoring, which can detect pollution hotspots, are being researched to ensure clean water for everyone. However, there are many barriers to this research. One is the current apparatus that holds the sensor during data collection also disrupts the testing process. Our team re-engineered the current device to ensure that the water quality tests can be collected properly and efficiently. The new design – the EXO 2 Messo Measurement Assistance Device (M.M.A.D.) for water quality sensing – will allow for the user to easily collect the water quality data at varying depths in the water.

#15 Swine Mortality Removal Apparatus

Hunter Cook, Connor Merrill, Seth Wetovick, Jared Donoghue
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

The Swine Mortality Removal Apparatus is designed for transporting deceased hogs. Hog farms have very tight corridors and corners, making it necessary that our apparatus have a high degree of mobility to navigate out while carrying several hundred pounds. The old-fashioned method of physically pulling the carcasses causes a harmful amount of physical stress on a person's back, especially over time. Our design will greatly reduce the manual labor required. Because the deceased hog only comes into contact with the apparatus, disease exposure to the surrounding population is also reduced.

#16 JP Lord Basketball Launcher

Matt McManigal, Meghan Biegert, Ryan Stutzman, Tyrell Williams
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

This project focuses on assisting students, ages 5-21, with physical limitations. JP Lord School, an Omaha Public Schools facility that serves young students with multiple disabilities, asked our team to create a basketball launcher to enhance the school's physical education program. Many of these students have very limited mobility, preventing them from physically handling and shooting basketballs without an assistant's help. In some cases, students are only capable of pushing a ball from their lap or pressing a button. Interaction with the surrounding environment is a key factor in learning and development for young students, and this limitation can prevent these students from understanding how the world around them works. Our team has created a standalone basketball launcher capable of shooting a small basketball into a hoop with the simple touch of a button.

#17 Fountain Wars

Matthew Rennau, Garrett Brossart, Josh Bauer, Brandon Friedman
FACULTY ADVISOR: JEYAMKONDON SUBBIAH,
BIOLOGICAL SYSTEMS ENGINEERING

Our project is to design an apparatus that we can use to compete in the American Society of Agricultural and Biological Engineers (ASABE) Fountain Wars event. This is a hands-on, real-time competition that takes place each year and involves students working in teams to create an engineering design that matches the given challenge of that year. Our job was to evaluate the competition challenge problem and criteria, then design and fabricate the apparatus.

#18 Stormwater Drainage Assessment for Douglas County Environmental Services

Merrett Lane, Jena Wilson, Julia Lindgren, Josiah Johnson
FACULTY ADVISOR: TIFFANY MESSER,
BIOLOGICAL SYSTEMS ENGINEERING

The Douglas County Environmental Services office is relocating from its current office to a 35-acre parcel of land on the southeast corner of 156th Street and West Maple Road. That site is home to multiple county facilities, including a 911 dispatch center and the Sheriff's Office. An assessment was performed at the new site by locating and cataloging inlets and drains, analyzing discharge evaluation methods, and quantifying the amount of stormwater leaving the site. Best management practices, including filters and pumps, were recommended to reduce the amount of pollutants entering the stormwater collection system, and bioretention cells were designed to collect and treat stormwater.

SENIOR DESIGN PROJECTS

#19 Smart Shoe Sole

Alex Hruby, Logan Piening, Madison Spence, Phuong Ninh
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

Studies have found that decreased shoe sole stiffness during normal walking and increased stiffness during fast walking, jogging, and running is a key factor in reducing the metabolic cost of human locomotion. Current designs of shoes are not energy efficient when it comes to changing stiffness between running and walking. Our team designed a shoe insole with the purpose of alleviating metabolic dissipation at different locomotion speeds. It incorporates carbon fiber and elastic bands to affect the mechanical advantage and gearing ratio of the foot and ankle during movement.

#20 Dental Device to Aid in Full Arch Restoration Implant Fabrication Process

Jozzy Carter, Erica Dolph, Connor Blankenau, Kate Yang
FACULTY ADVISORS: TERRY STENTZ AND KELLI HERSTEIN,
CONSTRUCTION ENGINEERING AND MANAGEMENT

Dr. David Rallis hopes to remove three of the steps in the iterative process of permanent full-arch restoration in dentureless patients by using an intraoral iTero 3D scanner to directly scan a patient's gingiva. However, the gingiva does not have many distinguishing marks that are necessary for the iTero to piece the image together. Dr. Rallis asked us to design a device or process that will aid the iTero in the 3D scanning procedure. It must be accurate, adaptable, flexible, post-op compatible, and user-friendly. We designed and fabricated a flexible chain with letters on the front face of the links that can be placed over posts screwed into the implants.

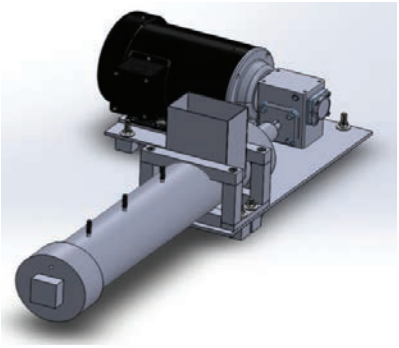
#21 Amber Flashing Warning Light System Redesign for CLAAS Combine Headers

Keith Bendix, Isaac Frerichs, Travis Linnemeyer, Paul Smith, Wesley Young
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

Our project is to redesign the current AWFL mounting bracket in order to address the problems that CLAAS's customers are experiencing, such as the mount breaking off when being hit by an obstacle from either the front or rear. We designed a new system that would break away when struck instead of the mount breaking off.

#22 Small Scale Food Extrusion Device

Conner Lunn, David Miller, Eric Herr, Ben Wankum
FACULTY ADVISOR: JEYAMKONDAN SUBBIAH,
BIOLOGICAL SYSTEMS ENGINEERING



Our goal is to measure temperature and pressure inside a small-scale extrusion device. Extrusion is a process that is used to create products such as pastas, pet foods, and cereals. This process uses a screw to feed product through a barrel and out of a die in the shape of the desired product by creates high pressure at the die. By sensing the temperature and pressure along the barrel, researchers can validate characteristics of the extruded product, such as whether pathogens have been killed and proper gelatinization of the product has been achieved.

SENIOR DESIGN PROJECTS

#23 Skin Temperature Detecting System for Prosthetic Users

Sam Lindbald, Janelle Adams, Alex Favazza, Aliya Kunikeeva
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

Our project proposes a new concept for detecting skin temperature inside of lower-limb prosthetics. A large proportion of amputations are accompanied by sensory impairments like nerve damage, which limits ability of user feedback on the temperature or pain of the limb. We have modified a skin temperature sensor that has the potential to increase the health, happiness, and safety of lower-limb prosthetic users by detecting and alerting overheating within the prosthetic, preventing tissue break-down. We modified a baby fever sensor that notifies users by means of a rechargeable sensor that live-time Bluetooth transmits skin surface temperature to the FeverFrida app installed on any smartphone platform.

#24 Stream Bank Erosion Sensor

Maddie Johnson, Megan Pamperin, Tony Meusch, Sam Gerdes
FACULTY ADVISOR: DEEPAK KESHWANI,
BIOLOGICAL SYSTEMS ENGINEERING

Typically, stream bank erosion is monitored with bank pins, which is a cumbersome way to retrieve data. The purpose of our stream bank erosion sensor is to ease the data retrieval process and acquire more accurate data about bank erosion over longer periods of time. The ultrasonic sensor allows for high resolution erosion data. This sensor will be helpful for hydrologists and staff members wanting more information on the bank erosion and when the most erosion occurs.

#25 1/4-Scale Tractor Suspension

Jonah Bolin, Zak Kurkowski, Devon Vancura, Noah Bolin
FACULTY ADVISORS: ROGER HOY AND JOE LUCK, BIOLOGICAL SYSTEMS ENGINEERING

Our project focuses on a new suspension for the ASABE 1/4-Scale Tractor Team. The goal is to allow the tractor to navigate the challenging durability course at the ASABE Competition. Due to continual changes and updates to the course, we had to account for variability in track configurations and conditions. This year's design features suspensions systems in three locations: the front axle, the mid-frame, and the seat. With the addition of suspension locks, maximum flexibility can be utilized for rough terrain, or set rigid to attain maximum pulling performance.

#26 Dairy Plant Relocation

Meredith Johnson, Loren Steinman, Justin Brinkman, Luke Burbach
FACULTY ADVISOR: DEEPAK KESHWANI, BIOLOGICAL SYSTEMS ENGINEERING

Our team is working to relocate the Dairy Plant from East Campus to the Food Processing Center on Nebraska Innovation Campus. We created equipment layouts for several product lines, like cheese and ice cream, to optimize efficiency. We are also creating a techno-economic analysis to produce a price point for a new fortified milk product line that Husker Athletics will purchase for their athletes.

#27 Electrochemical Reduction of Aqueous-Based Carbonates to Fuel Ethanol and Other Industrial Chemicals

Hannah Fox, Sarah Youngquist, Brittlin Hoge, Robin Harney, Benjamin Shuldes
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

To minimize CO2 in the atmosphere, it was proposed to convert greenhouse gas into fuel ethanol and industrial chemicals. The carbon dioxide will be harvested from seawater utilizing a system containing electrolytic cation exchange module that converts the carbonates in seawater to carbon dioxide through the addition of hydrogen ions. This removal of CO2 from the ocean will indirectly decrease the amount of CO2 in the air. Using two reactors and several separation units, harvested carbon dioxide will be converted to fuel-ethanol, ethylene, and hydrogen gas.

#28 Energy Efficient Production of Gasoline Grade Biofuels from Corn Stover using a Novel Zeolite Catalyst

Daniel Johnson, Kale Miller, Paul Barnes, Trinh Vu Tran, Mohammed Al-Sabahi
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

We are examining the economic and technical feasibility of the production of gasoline-grade biofuel using corn stover as a feedstock. The project will also consider the utilization of waste products as a heat source, as well as the inclusion of a novel zeolite catalyst to decrease the plant's environmental impact.

#29 Dimethyl Ether and Methanol Production from Biomass

Darik Rosser, Ahmad Bacho, Khawla Al Nuumani, Kaylee Robins
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

The goal of this project was to design a more environmentally friendly synthesis route for the production of dimethyl ether. This was achieved by altering the process of methanol production, which traditionally uses fossil fuels as the main source of carbon during production. Our project uses readily available biomass from corn stover. This biomass can be easily converted into syngas and then to methanol through a series of high-temperature reactions. Then, methanol can be made into dimethyl ether through another reaction.

#30 Non-Catalytic Production of Biodiesel using Dimethyl Carbonate under Supercritical Flow Conditions

Kara Cottrell, Eric Burbach, Madalyn Somer, Reid Wagner
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

Biodiesel is a renewable fuel replacement to current fossil fuel-based diesel and may be derived from plant oil sources such as soybeans. Our project was to seek a renewable alternative to methanol in order to obtain more valuable by-products while also making the process safer and more sustainable. Our solution is to use super critical dimethyl carbonate in place of methanol. Dimethyl carbonate is considered by the EPA to be environmentally benign, renewably sourced and it creates more valuable by-products when reacted with the triglycerides in soybean oil.

#31 Membrane Integrated Continuous Fermentation for the Production of Monosodium Glutamate

Jacob Tierra, Alex Deng, Mohamed Al-Mughairi, TunJie Po, Megan Browning
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

Monosodium glutamate, or MSG, is a flavor enhancer that is mainly produced and consumed in Southeastern Asia. Our goal is to produce MSG for the U.S. market using a continuous, membrane-integrated fermentation process, utilizing Ammoniagenes brevibacterium. The wastewater from MSG production is often very toxic and harmful to the environment and can be incredibly costly to process due to the high alkali consumption. To reduce the COD concentration and neutralize the wastewater in a more cost-effective way, we will implement a new wastewater treatment system with both a yeast reactor and an activated sludge reactor.

#32 The Production of Acetic Acid and Methanol from Corn Stover Biomass

Josh Adams, Rodney Mullen, Firdavs Nasimov, Jasa Zunaiba
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

Currently, nonrenewable resources are used in the production process of acetic acid from methanol carbonylation. These nonrenewable resources release large amounts of greenhouse gases. This project aims to produce a comparable volume of acetic acid and methanol as current methods and to decrease greenhouse gas emissions through the use of the renewable biomass feed, corn stover.

#33 Exploring Cellulosic Ethanol Production from Corn Stover Using a Theoretical Strain of Clostridium Thermocellum

Kristin Arens, Adam Perry, Austin Eidem, Alex McKinney
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

Ethanol is a much cleaner alternative to fossil fuels, with the potential for increased use in gasoline blending. Traditional starch-rich corn or pure-sugar feed stocks are in relatively low supply/high cost. Lignocellulosic biomass is in much higher supply in rural agricultural areas, for example the leftover plant material (including stalks, leaves, and cobs) from corn harvest, known as corn stover. Producing ethanol from this biomass is currently expensive and inefficient, but improvements in microorganism engineering are promising to help the industry take hold. This project utilizes these proposed modifications to model ethanol production.

#34 Olefin Production via Biodiesel-Derived Glycerol

Olivia Eskens, Tanner Haas, Gabe Astorino, Musab Al Sabahi
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

Our team's goal is to convert crude glycerol first into methanol and then into a blend of olefins. This new, greener process for the production of olefins will reduce the use of popular current methods, which require the use of environmentally harmful hydrocarbons. Due to the high market price, as well as wide consumer application, propylene was the target olefin produced. Capacity of this process was scaled down to 10 percent of a typical propylene via hydrocarbon process in order to accurately determine feasibility.

#35 Production of Terephthalic Acid Using a Spray Reactor to Reduce Environmental Concerns

Lauren Klaasmeyer, Emma Schellpeper, Maddy Royse, Kasi Abbenhaus
FACULTY ADVISOR: YASAR DEMIREL,
CHEMICAL AND BIOMOLECULAR ENGINEERING

High-purity terephthalic acid (PTA) is an important monomer in the production of polyethylene terephthalate (PET), which is the plastic used to produce bottles, synthetic fibers such as polyester, and other films and products. In 2016, 61.2 million tons of PTA were produced. This project focuses on the replacement of the continuously stirred reactor in the traditional Amoco Mid-Century (MC) process with a spray reactor that creates higher product purity of PTA, eliminating the need for the hydrogenation step of the MC process, thereby improving reaction conditions, reducing processing steps, utility and energy usage, and capital investment.

#36 Boy Scouts of America Outdoor Education Center Concept Site Master Plan

Anna Cole, Shanon Al-Badry, Jacob Chekal, Nick Cowles, Billy Seeger
FACULTY ADVISOR: CRAIG REINSCH, CIVIL ENGINEERING

We have partnered with the Boy Scouts of America to provide an update to their master plan for the Outdoor Education Center site at 600 South 120th Street in Lincoln. Our work included providing transportation solutions, drainage evaluations, investigation of geotechnical conditions, environmental evaluation and determination of permitting requirements, preparation of concept design plans for bridges, drainage, utilities, and overall site plan, and evaluation of structural elements included in the project.

SENIOR DESIGN PROJECTS

#37 goBilda Power Distribution and Control System

Justin Foster, Lucas Smith, TJ Steffes
FACULTY ADVISOR: HERBERT DETLOFF, ELECTRICAL AND COMPUTER ENGINEERING

The GPDCS is a modular power distribution and control system to improve the existing method for distributing power throughout the robotics build system GoBilda, consisting of five modules performing operations such as voltage cutoff, current limiting, voltage level changing, and distribution to all peripherals in a robotics system.

#38 DMX Lighting Controller

Megan Stokey, Drew Van Heuveln, Garrett Hill, Adam Schlotthauer
FACULTY ADVISOR: MARK BAUER, ELECTRICAL AND COMPUTER ENGINEERING

This project serves to replace an antiquated lighting controller module in the HuskerVision studio. The lighting panels surrounding the studio are controlled via DMX protocol. Our design utilizes a user-friendly Raspberry Pi-powered, touch-screen interface to customize each panel display and display the result. A microprocessor converts this input to DMX, which is exported to the studio's lighting fixtures.

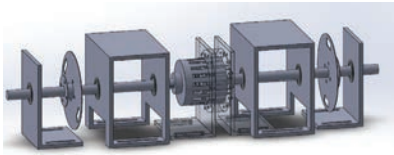
#39 Energy and Water Data Streamer

Emily Wagner, Karl Shaffer, Andrew Heck, Jared Frenzel, Allison Buckley, Marek Kracl, Luke VanDrie
FACULTY ADVISOR: MARK ANTONSON, JEFFREY S. RAIKES SCHOOL OF COMPUTER SCIENCE AND MANAGEMENT

The Daugherty Water for Food Global Institute owns many water energy meters that monitor electric irrigation pump energy usage. These meters were designed to collect and transmit data via a cellular modem. However, cellular connectivity is often poor in rural areas, and some meters are unable to establish a connection. The meters have no storage functionality, so any data that fails to send due to poor cellular connectivity is lost. To address this problem, we developed an easily reproducible hardware-software data pipeline that enables farmers to retrieve, store, and visualize water pump energy measurements without relying on cellular connections. The solution is a three-part data pipeline that transfers data from the meters to the cloud. In addition to the data pipeline, the web application provides admin functionality to manage all users, meters, and data.

#40 Coaxial Magnetic Gear

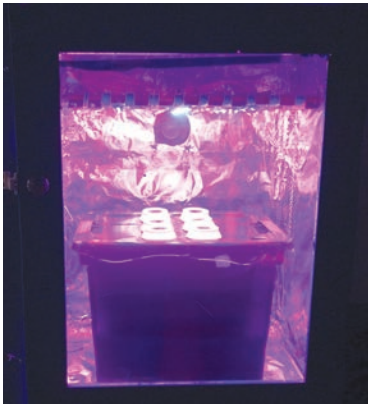
Noah Goodman, Matthew Penne, Matthew Romer, Viktor Jonseth
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING



Coaxial magnetic gears use magnetic coupling between two rotors and a stator to achieve a change in the rotational speed of a shaft. Magnetic gears produce less friction and require less maintenance than mechanical gears, making them useful for hard to reach applications like windmills and power transmission gearing. The development and testing of a working coaxial magnetic gear is the basis of this project. RPM sensors were designed and built to confirm the gear ratio and operating conditions. All data was collected using a STM32 ARM processor and displayed through a LABVIEW user interface using Bluetooth communication.

#41 Plant Computer

Chrystal Sauls, Lydia Wemhoff, Zhili Pan
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING



Our tabletop Plant Computer grows plants and crops of the user's choosing. The environment inside the enclosure is monitored and adjusted by a control system designed to maximize individual plant growth and deliver the proper amount of nutrients and moisture to the plants. Sensors send data to the microcontroller, which is displayed to the user via a mounted touch screen. The system makes adjustments via actuators and/or sends an alert message to the user through the touch screen. The user can also control certain components, such as the light intensity, nutrient concentration, and temperature via the user interface.

SENIOR DESIGN PROJECTS

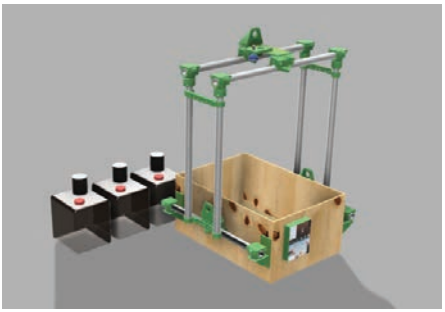
#42 Glacier Creek Sensor Network Redesign

Isiah Haase, Byron Chao, Michael Baker, Nathaniel Bauman
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

The Glacier Creek Sensor Network Redesign project is an environmental sensor network used to study microclimates.

#43 GARDENBOT: A Semi-Automated Gardening System

Ben Salitros, Xinyue Bao, Katadaki Tokoudagba, Mark Scobey
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING



The purpose of this project was to design and build a system for automating greenhouse operations by building a scalable solution that could be made from easily sourced, inexpensive materials. The system would automate watering, feeding, pesticide delivery, and temperature and light monitoring and control, by way of an easy-to-use user interface. The design resulted in a mostly 3D-printable design using common components found in any hardware store and inexpensive sensors and control systems.

#44 Apartment Moisture Monitoring

Jonathan Carle, Pete Nelson, Gary Miller, Isaac Porter
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

This project focuses on designing a wireless system that mitigates moisture threats by collecting data such as humidity, temperature, and water presence.

#45 Kool Shield Controller

Cameron Gilinsky, Jeremiah Ohlman, Justin Pachl, Rupak Dahal
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

The Kool Shield Controller is an advanced motor-control module for the Kool Shield thermal barrier system, developed by Humboldt Special Manufacturing, which helps refrigerated semi-truck trailers maintain their temperature.

#46 T.E.A.M. Display

Claire O'Connell, Caleb Hackett, David Connolly, Noah Pinkman
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

The T.E.A.M. Display is a large, wall-mounted board that displays software health statuses using LEDs and LCDs. Garmin Interfaces Department employees are updated on these statuses weekly, but the board will display more up-to-date statuses using a matrix of LEDs to show results in green (success), yellow (warning), or red (failure) and downloads the statuses over Wi-Fi. The board also has speakers and an outer LED array which serve to alert developers to new status information.

#47 Automatic Pet Feeder

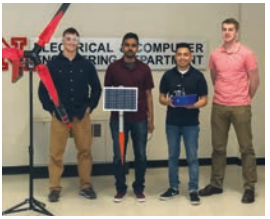
Rylee Klawitter, Nicholas Sabata, Brad Keith
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

The automatic pet feeder measures the weight of a pet, dispenses the proper amount of pet food based on the measured weight, and projects the weight data on a web application for monitoring.

SENIOR DESIGN PROJECTS

#48 Tri-renewable

Sam Dittmar, Samuel Anderson, Nestor Lopez, Ahmed Mohamed
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING



Tri-renewable is a unique power generation system that offers a broad range of off-grid power applications. The generation process is done by use of a wind turbine, a hydrogenerator and a solar panel – all of which can be disassembled and fit into a portable, compact case. The power is accessed via USB connection, which can directly charge electronic devices. An interface enables the user to accurately gauge the amount of available power with various algorithms.

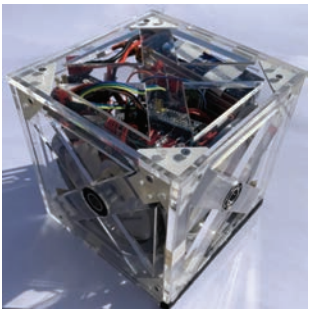
#49 iMobile Platform

Logan McIntyre, Karl Harding, Ben George, Alex Woodward
FACULTY ADVISOR: HERBERT DETLOFF,
ELECTRICAL AND COMPUTER ENGINEERING

The iMobile Platform is an autonomous robotic platform designed to transport tools throughout an office setting.

#50 Self Balancing Cube

Graham Kaufman, Isaac Novosad, Jeremy Fitz, Joel Komla-Ebri
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING



Our goal is to build a self-contained, fully automated balancing cube. All of the robot's components are housed inside the 6-inch frame. When the cube is at rest on one of its faces, it builds up momentum by accelerating one of its weighted reaction wheels. Once the robot has determined it has built up enough inertia, a brake is applied to the wheel and the angular forces from the formerly spinning wheel are translated into a torque about one of the cube's edges, causing the cube to "jump up" precisely to an edge. Once on its edge, the cube uses sensor data to detect and counteract any tipping motion by accelerating or decelerating its reaction wheel.

#51 Acoustic Sensor Mesh

Brenden Lehr, Aaron Johnson, Mitchell Clark, Trevor Salber
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING

We aim to build a system that determines the acoustic properties and dimensions of a room by playing a known sound (a sine sweep) and having multiple nodes receive the sound produced. This data (an impulse response) will be wirelessly transferred back to a laptop. After the data has been received it will be used to generate an acoustic model and dimensions of the room via a Matlab program.

#52 Musical Synthesizer

Eric Cao, Sam Christensen, Jing Ong, Isra Osman
FACULTY ADVISOR: MARK BAUER,
ELECTRICAL AND COMPUTER ENGINEERING

We combined the advantages of an analog and digital synthesizer to make a more functional and powerful sythesizer. A MIDI (Musical Instrument Digital Interface) input device is the main input, and MIDI devices are separated from the synthesizers so users can choose any MIDI devices to connect with the synthesizers to produce various sound. Our MIDI device is a keyboard. The oscillator and the filter will be fully analog and thus allow the synthesizer to produce various noise. The STM32F103 board and a single-board computer give users more control and power, such as digital precision, expanded polyphony, and complex forms of synthesis.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