ANNUAL ENGINEERING DESIGN EXPO

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Welcome to the 2025 Annual Engineering Design Expo!

Today we proudly spotlight the ingenuity and hard work of our students as they take on real-world engineering challenges. This Senior Design Expo is your chance to witness firsthand how passion, creativity, and technical expertise come together to drive innovation.

This year, 65 students from the Computer, Electrical, and Mechanical Engineering programs have joined forces on 14 ambitious projects—everything from autonomous food delivery, and off grid lighting options, to next-generation lawn care solutions. Their collaborative spirit and problem-solving prowess are on full display!

A heartfelt thank-you goes out to our generous sponsors: ELNA Magnetics, Central Hudson Gas & Electric Corporation, and The Council of Industry. Your financial support and hands-on collaboration have been instrumental in bringing these projects to life.

To our industry partners, your mentorship and real-world insight has been invaluable. By sharing your expertise and opening doors to professional networks, you've helped our students bridge the gap between the classroom and their future careers. We are grateful for your guidance.

To our dedicated faculty advisors, thank you for your unwavering commitment, wisdom, and encouragement. Your mentorship has empowered our teams to stretch their abilities, tackle complex design challenges, and achieve results they can be truly proud of.

Finally, to all of our guests - get ready to be inspired! As you tour each exhibit, chat with our students, and explore their working prototypes, we hope you'll catch a glimpse of the bright future that engineering innovation promises.

Most importantly, congratulations to our graduating seniors! May the skills, knowledge, and experiences you've gained here at SUNY New Paltz propel you toward a lifetime of discovery, problem-solving, and positive impact.

Once again, welcome to the 2025 Annual Engineering Design Expo—let the celebration of creativity, collaboration, and engineering excellence begin!

Warm regards,

Kevin T Shanley

Kevin T. Shanley, Ph.D.
Chair, Division of Engineering Programs

Table of Contents

SENIOR DESIGN II

Team 1

Guidance and Pathfinding (G.A.P.) Drone

Jordan Calhoun (CE), Glenda Giordani (ME), Tim Roach (EE),
William Huang (EE)

Advisor: Dr. Rachmadian Wulandana

Co-Advisor: Dr. Wafi Danesh

Abstract

New students entering college for the first time have a hard time getting around campus. Many of these students try to use campus maps that are hard to find and difficult to read or understand. Specifically, the campus maps are displayed in odd spots that students generally would not pass on their way between classes, additionally the online campus maps are difficult to read being a blurry pdf file in many cases. For this reason, new students often end up late to class and miss vital information during the first few weeks of school. To combat the hard to navigate campus maps and unlabeled buildings the GAP Drone was designed. The idea behind this drone is that it will guide students or other such users to the building they are looking for. This Drone is designed to fly from its home to the user and then guide the user to their destination. The drone will then return to its home and land on the charging station where it will charge until the next user needs guidance. This GAP Drone would be a very user-friendly way to provide guidance to users who are unable to find seasoned students or faculty who know their way around campus.

Team 2

Thermally Improved Battery Pack

James Pousson (ME), Anthony Ramirez Grijalba (ME),
Tenmetey Tetteh-Nartey (ME), Dean Schepisi (EE), Fetah Medunjanin (ME)

Advisor: Dr. Ping-Chuan Wang

Stakeholder: Kai Di Feng (IKM Technology)

Abstract

As world infrastructure and transportation evolves and green energy sources become more widespread, the need for reliable and efficient energy storage systems becomes greater. The goal of our project is to explore the effectiveness of cell array battery systems that are cooled internally. The most common form of large-scale battery is found in electric vehicles, where layers of battery components are folded on themselves to allow for quick charge and recharge rates with high energy capacity. This design presents two main issues, the first being that large amounts of heat can be generated near the center of the battery which can increase the rate of degradation for the battery's energy capacity. The second is that if the casing of the battery is compromised anywhere, the entire battery can fail. Both issues can be addressed when working with arrays of smaller batteries combined to match the performance of a larger battery. Cooling systems can be routed between each individual cell to allow for a more even distribution of heat and to allow for more heat to leave the system, which could allow for longer battery life spans. This design also allows for the failure of one cell without causing permanent harm to the rest of the system. In this project we explore the effectiveness and potential of internally cooled battery array systems.

Team 3

Adjustable Height Bed Lift

Ryan Cairns (ME), Nathaniel Cosentino (ME), Peter Hade (ME), Antonio Gonzalez (ME)

Advisor: Dr. Ping-Chuan Wang

Co-Advisor: Graham Werner

Stakeholder: Dana Jones (Accessadoor)

Abstract

This project introduces an innovative adjustable height bed lift mechanism designed to enhance the comfort and independence of disabled individuals. Our objective was to create a practical, concealed lift solution that departs from the traditional, often dehumanizing appearance of hospital beds, while also remaining cost-effective in comparison. The system is engineered to elevate users by up to 23 inches, thereby facilitating easier transitions into and out of bed either by the help of an aid or by additional transfer mechanisms. It operates on a standard 110 Volt wall outlet and can be controlled via a remote or a smartphone app, offering both convenience and accessibility. Additionally, the design is available in a portable version for on-the-go use. Throughout the project, we conducted comprehensive research, iterative prototyping, and rigorous testing to address critical challenges including user safety, discreet aesthetics, and robust functionality. Our design integrates seamlessly into home environments without the clinical look of conventional medical devices. The outcomes of our work indicate that the mechanism not only meets essential functional requirements but also significantly improves user dignity and quality of life by eliminating the stigmatization associated with hospital-style equipment. This information is vital for advancing assistive technology in residential settings, offering a new paradigm in mobility aids. Future efforts will focus on refining the system based on real-world user feedback, exploring enhanced connectivity options, and optimizing the design for mass production. Ultimately, this project paves the way for more inclusive and human-centered design in assistive devices, ensuring that technology truly serves its users with both empathy and efficiency.

Team 4

Development and Testing of New Sensors to Detect Ice Accumulation on Aircraft Wings

Derreck Suhul-Torres (ME), Kevin Lopez (CE),
John Urban Quezada (EE), Simon Maranga (EE)

Advisor: Graham Werner

Stakeholder: Simon Clement (PYTHEAS Technology)

Abstract

Aircrafts experience very harsh conditions when in operation. The freezing temperatures along with water vapor in the air can cause ice to accumulate over time. This accumulation can harm the plane's ability to operate correctly, which is dangerous for passengers and pilots. While planes do have deicing techniques used to help with this, there isn't any consistent way to detect ice before it becomes an issue. This project seeks to amend this problem by identifying ice accumulation in real time which will help pilots immensely and keep passengers safe. The goal of this project is to implement an icing detection system using a piezo electronic sensor and actuator placed on the wings of an aircraft. A piezo can output a signal when it undergoes physical forces such as pressing, pushing, or change in temperature, and is read as a voltage. This was used to create a piezoelectric vibration sensor to measure the changes in dynamic behavior caused by ice accumulation on an aircraft wing. This was tested by attaching piezo electronics to an aluminum beam. The effect of ice was simulated using mass weights and melted sugar on the plate to observe the resulting changes in voltage from the piezo. From this experiment, the relationship between the plate's resonant frequency and the thickness of ice was correlated. The presence of ice shifted the resonance which decreased the voltage reading from the piezo. By determining the resonance frequency through voltage peaks, shifts in the frequency and voltage allowed for effective ice detection. A Fast Fourier Transform (FFT) was used over a repeating time cycle to find the resonance frequency. Through this, current spikes through a resistor were used to observe the thickness of the ice on the metal plate. In addition to this, ANSYS was used to observe how ice thickness correlates to the resonance frequency. The analysis matched up with the physical tests conducted which verified the functioning of the project design.

Team 5

Development of Off-Grid Lighting Product

Shelly Yousoufov (EE)

Advisor: Dr. Kevin Shanley

Stakeholder: Selux Corp.

Abstract

This project presents the design and development of an off-grid solar-powered street lighting system aimed at delivering a reliable and sustainable lighting solution for areas with limited access to the electrical grid. The system integrates photovoltaic (PV) panels for energy harvesting, a lithium iron phosphate ($LiFePO_4$) battery system for energy storage, and a motion-activated 24V LED luminaire to optimize energy efficiency. Key engineering principles applied include PV system design with maximum power point tracking (MPPT), low-voltage battery chemistry selection, voltage regulation for LED dimming, and sensor integration for adaptive lighting control. The project evolved from initial NiMH battery storage to $LiFePO_4$ to enhance system compatibility with the charge controller and improve storage reliability. Through iterative prototyping and testing for solar panel output, battery discharge cycles, and light performance, the system demonstrated autonomy for up to three days and compliance with UL low-voltage safety standards. This solution offers a scalable and efficient alternative to grid-tied lighting systems, with potential applications in both urban infrastructure and remote communities.

Team 6

Advanced Solar Tracking

Marco Hermida (ME), Kyle Leon (EE), Markus Meyer-Pflug (EE), Aboud Abbas (ME)

Advisor: Dr. Mohammad Zunoubi

Abstract

This research project explores a cost-effective, hybrid solar tracking system that combines both active and passive mechanisms to enhance photovoltaic (PV) efficiency. Traditional dual-axis tracking systems, while effective in maximizing solar energy capture, are often cost-prohibitive, limiting their widespread adoption—particularly in areas distant from the equator where solar angles vary more dramatically. To address this, our interdisciplinary team of electrical and mechanical engineering students designed a low-cost alternative that retains the efficiency benefits of dual axis tracking while reducing complexity and power consumption. The system features motorized east-west tracking controlled by a microcontroller, combined with a manual north-south adjustment for seasonal repositioning. The mechanical structure, developed in SolidWorks, includes a custom H-bar frame constructed from 5052 aluminum, assembled with 1/4” 18-8 stainless steel bolts for corrosion resistance and structural integrity. This frame distributes force evenly and supports approximately 70 pounds of vertical load. A gear system and shaft were designed alongside a 3D-printed motor mount and gear, providing a lightweight and adaptable drive interface. The electrical research focused on optimizing tracking algorithms and minimizing actuator power usage, while the mechanical team prioritized weatherproofing and durability. Critical components are housed in enclosures rated IP65 or IP66, protecting against dust and water jets. Testing involves seasonal simulations to measure energy capture efficiency, comparing fixed-tilt, active-only, and hybrid configurations. We aim for a 35–40% energy gain over stationary panels. This project represents a meaningful step toward affordability and sustainable solar tracking systems that are adaptable to various climates and have widespread implementation.

Team 7

LUROX 26 Bi-Pedal Droid

Taheemuddin Ahmed (EE), Brianna DiBianco (ME), Venn Engstrom (ME), Juan Franco Guzman (ME), Andrew Keefe (EE), Brian Ordonez (CE)

Advisor: Dr. Julio Gonzalez

Co-Advisor: Dr. Mahdi Farahikia

Abstract

Project LUROX 26 focused on the design and construction of an affordable, modular bipedal robot intended for educational and experimental use. Starting in August, the project encompassed the full development cycle—from 3D modeling and high-speed PLA printing of structural components to custom electronics and embedded programming. Key design features include a distributed control system using ESP32-S3 microcontrollers on custom PCBs for each limb, as well as a centralized power distribution board supporting lithium-ion battery operation. A simulated environment and URDF model were developed to test and refine locomotion strategies, comparing reinforcement learning methods in NVIDIA Isaac Lab with traditional hardcoded gaits and calculations. LUROX 26 showcases how advancements in additive manufacturing and accessible AI tools make it feasible for undergraduates to develop sophisticated robotic systems. The project's modular and low-cost framework serves as a platform for further development in robotics education, with future work aimed at improving gait stability, integrating real-time sensor feedback, and expanding autonomous behavior capabilities.

Team 8

Magnetic Charging Table

Noah Silman (ME), Lucas Douglas (EE), Julia Bossonis (EE),
Steven Kumas (CE)

Advisor: Dr. Mohammad R. Zunoubi

Abstract

This project presents the development of a wireless charging table that autonomously aligns a power transmission coil with the position of a Qi-enabled mobile device. A key challenge in magnetic charging is ensuring precise coil alignment, as even slight misalignments can significantly reduce power transfer efficiency and increase heat generation. The system integrates a dual-axis XY tracking platform utilizing belt-driven linear rails actuated by 42HBRC0001Y-24B stepper motors and TB6600 stepper drivers. KY-008 650 nm laser modules and photodiode receivers mounted on the upper carriage scan the table surface in both X and Y directions. The software logs each scanning cycle and records the coordinates where beam interruptions occur. The collected data is processed using a centroid-based location algorithm to estimate the coordinates of the coil inside the device. These coordinates are interpreted by a custom plotting algorithm, which directs the lower carriage to align the charging coil with the phone's position. The system is powered by a 48 W AC adapter, with a variable-output buck converter regulating voltage for the microcontroller and motor drivers. High-side switching is implemented using DMG2305UX (P-CH) and IRLZ34NPBF (N-CH) power MOSFETs to isolate the high-power wireless charging circuitry from the low-power control logic. The wireless charging module operates at approximately 150 kHz with a nominal 12 V, 1.5 A input and includes integrated overcurrent protection that disables transmission at ~2 A.
This proof-of-concept demonstrates the feasibility of precision coil positioning through low-cost optical sensing and motion control. Future improvements include minimizing power loss by eliminating breadboards and optimizing vertical coil-to-device spacing.

Team 9

Voice-Controlled Boom-Box

Oliver Trzcinski (ME), Korey Barber (EE), Brian Lopez (EE),
Sabina Sobhy (EE), Uriel Cruz (CE), David Lin (CE)

Advisor: Dr. Vincent Liao

Co-Advisor: Graham Werner

Abstract

The issue of modern smart sound systems is that they rely on using their own services to benefit from the consumers of using their data. With the lack of boomboxes that have the sound quality of expensive brands and have features such as voice commands. Therefore, we wanted to help design a quality boom box using parts that can be bought relatively easily, make it portable and have it display information while using our Stakeholder's guidance on how to implement the design. We will use code that is used through the community such as OVOS, which is an Open Voice OS that helps create/use a custom voiced controlled interface with our device. This also allows the user to store the data locally and not share it through the internet. We would then have a screen to go along with it and have a separate demonstration of how the GUI would work on our system. This can be a few buttons such as pause/play, stop and next and previous track. As for the enclosure, we want to make sure that we get the best sound quality possible so we will follow the recommended specs of our speakers to take advantage of it. We hope that this design will serve as a DIY option for people to build their own voice-controlled boom-box and help maintain the software.

Team 10

Wrist Mounted Grappling Hook

Marcus A. Pena (ME), Montana Prais (ME), Matthew Selvaggio (ME),
Jean Merejildo Diaz (ME), Omri Downes (ME), Jacobus Hockx (EE)

Advisor: Dr. Mahdi Farahikia

Abstract

Our project is a wrist mounted grappling hook for professional and recreational use, such as for wall traversal and item retrieval. We designed a fluid pneumatic propulsion system using carbon dioxide and incorporated a reel-back system to retract the cable and hook after use. The motivation behind our project was to attempt to tackle a unique and fun project. It allowed us to connect theory with real world applications while also pushing our creative and engineering skills by creating a device that's thrilling, unique and awesome to experience. We learned the application of pneumatic principles, fluid analysis, projectile kinematics analysis, and pressurized system design. Our team implemented 3D design, welding, fundamentals of coding, and circuit design to achieve our project goals. We also learned the value of having a cohesive team, helping each other to strengthen our individual skills and learn new ones. We strengthened our time management skills, held each other accountable for our individual tasks, and effectively communicated to ensure a successful project outcome. As engineers, we face different kinds of challenges and tasks while out in the field. In our project, we each demonstrated how interdisciplinary engineering can be leveraged to bring imaginative ideas to life. We'll use this experience as a foundation towards approaching engineering challenges with confidence. Additionally, we plan to refine our grappling hook design further, potentially exploring advanced materials, automation enhancements, and broader real-world applications.

Team 11

Wind Power on The Go

Justin Wagner (ME), Alban Kalaj (ME), Alenton Findley (ME), Puneet Mangat (EE)
Advisor: Dr. Kevin Shanley

Abstract

Kamituga is a small mining town located in the Democratic Republic of Congo. While this town is essential to the country for obtaining valuable resources, its electricity needs remain limited, where they rely on gas generators as the state's electrical grid is underdeveloped. There are many areas around the world that may not have access to clean energy, and many more that have no access at all, even to power a simple lightbulb. What our project aims to do is to provide a small source of clean, reusable energy that can be used to power lights or small appliances and act as a secondary power source. Our project is a portable wind turbine designed to be relatively easy to disassemble and reassemble with basic tools and replace broken parts without much hassle. To account for varying wind conditions, we based our design off of a vertical axis wind turbine, so orientation doesn't affect power generation. Through our simulations, we discovered how the tip-to-speed ratio can affect the efficiency and how friction from the gear train, generator, etc. can compound onto itself and negatively affect the efficiency. What we learned during this project aided in understanding how wind turbines are designed and what not to do during the designing and manufacturing phase. In the future, we will take what made our design fail and improve on those factors to deliver a viable product.

Team 12

LawnPilot: Robotic Lawnmower

Kimani Frankson (ME), Jonathan Mitchell (CE), Faith Apostolides (ME), Pavan Kang (ME), David Candia-Domingo (ME)

Advisor: Dr. Heather Lai

Co-Advisor: Kerry Ford

Abstract

The LawnPilot showcases a remote-controlled, electrically powered robotic lawnmower designed to offer homeowners a safe, quiet, quality, green and user-friendly solution for lawn care. By integrating advanced electronics with robust mechanical engineering, the robotic system provides a strong alternative to traditional mowers.

The LawnPilot features a sharpened 12in lightweight aluminum blade powered by a 500W 24V electric motor for efficient and effective cutting. Its tracked, tank steering, differential drive train system, driven by a 250W 24V electric motor and solenoid actuated brakes ensures high offroad-maneuverability and robustness to a top speed of 6mph. The onboard computer, a Raspberry Pi 4B, and additional custom-built circuitry manages the sensors and wireless operation of the LawnPilot. Through an RC controller with joysticks and buttons that control the robot's movement and a camera on the robot live streaming its POV to any computer, the LawnPilot can be operated remotely up to 60ft away. Additionally, cut- height can be adjusted to 2in, 2.5in or 3in and it has a charging-station for the battery that has a ~2-hour-long life. Extensive analysis and testing optimized the blade, motors, drivetrain and frame for proper performance and reliable operation. While Python-based programming, carefully designed circuitry/electronics guarantee dependable functionality of the robot. Overall, the LawnPilot shows great potential as an alternative to traditional mowers. As it reduces the danger, noise, emissions and labor inherent to traditional mowers. Our findings pave the way for future upgrades, including larger size, faster speeds, better range and even full autonomy.

Team 13

Autonomous Food Delivery Car

Alexander Krupinski (ME), Owen McGarrity (ME), Mark Camitan (EE), Benjamin Weisfeld (EE), Ryan Schubert (CE), Ryan Zhang (CE)

Advisor: Dr. Wafi Danesh

Co-Advisor: Kerry Ford

Abstract

This project presents the development of a GPS-enabled vehicle designed for autonomous food delivery, and aimed at enhancing convenience and addressing time management issues for the campus community. The vehicle integrates GPS for navigation, allowing the vehicle to autonomously follow pre-programmed routes and deliver food without manual intervention. The system includes key features such as obstacle detection and avoidance ensuring safe navigation by detecting and maneuvering around obstacles on a path. Additionally, users can schedule food pickups and deliveries through a mobile app, streamlining the process and reducing the need for manual involvement. The app also allows real-time tracking of the vehicle location and the ability to manage the delivery process. Bluetooth connectivity enables manual control of the vehicle, providing users with security if needed. The primary goal of this project is to offer a time-efficient solution to food retrieval, addressing human laziness and improving campus life by automating the delivery process. This autonomous food delivery vehicle will significantly reduce the need for individuals to perform food retrieval tasks, allowing them to focus on other responsibilities. The findings of this project indicate that the integration of GPS, obstacle detection, and app-controlled functionality can effectively create an efficient and reliable food delivery system. Future developments will focus on enhancing the vehicle’s capabilities, improving its accuracy, and expanding its use in various environments.

Team 14

Convective Cooling Experiments for Thermo-Fluid Lab

Sophia Banks (ME), Adam Bass (EE), Kyra Burnside (CE),
Shahed Herzallah (ME), Roberto Sanchez (ME)

Advisor: Dr. Rachmadian Wulandana

Co-Advisor: Dr. Amr Abdo

Abstract

The project aims to improve the inadequate heat transfer lab setup at SUNY New Paltz by introducing two experimental modules to help students better understand heat dissipation principles. The primary focus is on modeling the heat transfer behavior of heating elements placed inside insulated Delrin blocks, equipped with temperature sensors, and covered by a copper plate. The setup is used to analyze temperature distribution across a copper plate, study convective cooling effects, and assess the efficiency of heat dissipation from a central heat source to the environment. Two cooling methods were tested: Model 1, featuring a Tower CPU Heat Sink with Fans, and Model 2, which employs an All-in-One Liquid Cooler. Model 1 focuses on analyzing the effects of fan velocity on convective heat transfer (h), which controls the heat transfer rate between the copper plate surface and surrounding air. Model 2 uses a liquid pump system to circulate coolant from the heatsink to the fans, testing the effect of varying convective heat transfer coefficients on the total heat transfer rate ($\dot{Q}$). Both models were designed to simulate real-world cooling systems in a controlled environment to explore heat dissipation under different cooling methods. The research aims to optimize thermal management by improving heat transfer in air- and liquid-based cooling, while also focusing on developing detailed lab manuals to provide clear instructions and effective hands-on learning. The overall goal is to enhance students' understanding of heat transfer properties while offering a more engaging and effective setup for heat transfer labs.

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