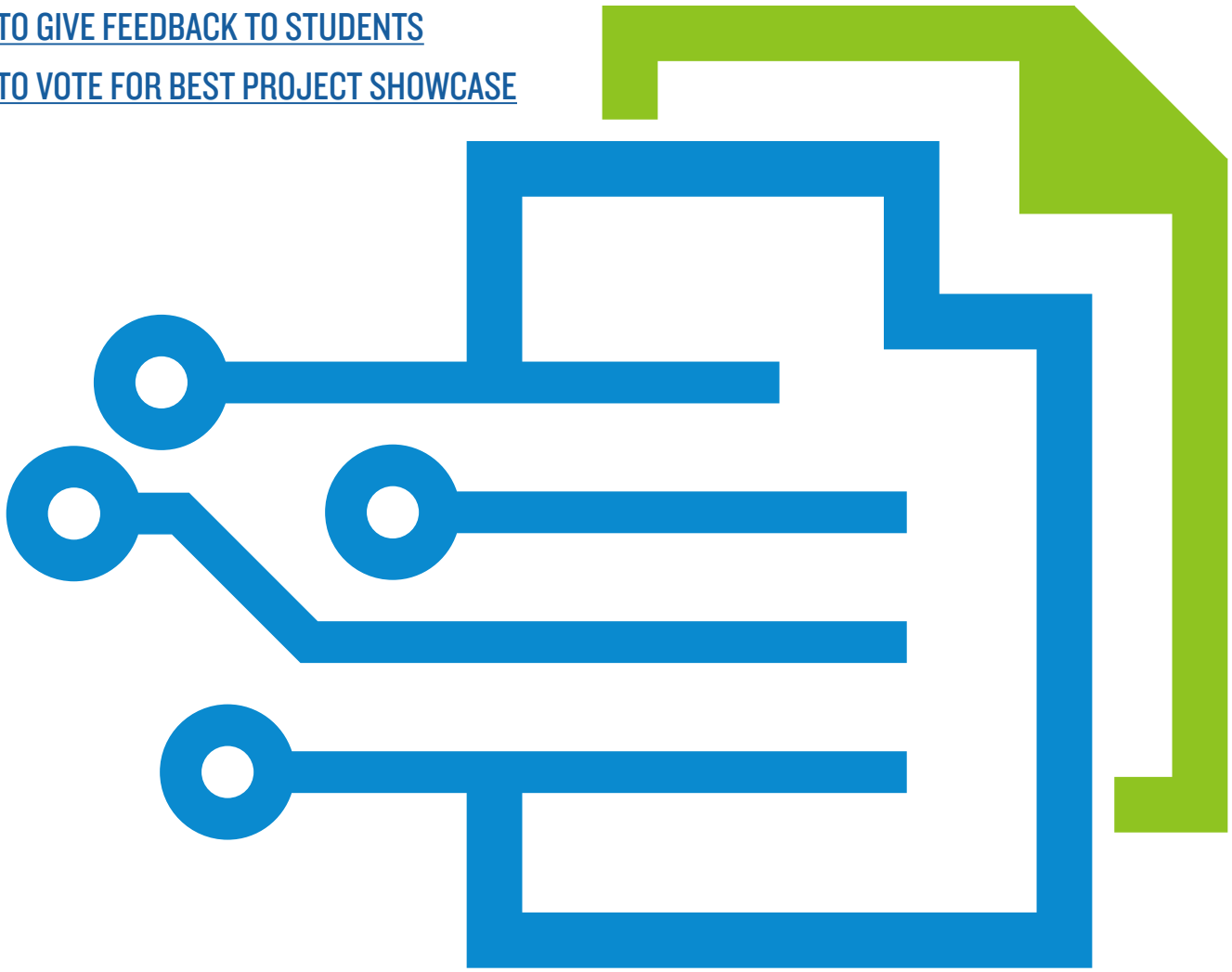
CLICK TO GIVE FEEDBACK TO STUDENTS

CLICK TO VOTE FOR BEST PROJECT SHOWCASE



VIRTUAL SHOWCASE SPRING'20

ME Capstone Senior Projects

CARBON FIBER COMPRESSION MOLDING

Dean Chan
Raymond Choi
Connor Lowry

ADVISED BY PROFESSORS DAVID WOOTTON AND SVEN HAVERKAMP

VIRTUAL SHOWCASE SPRING'20

The Cooper Motorsports team seeks to reduce the weight of their 2020 racecar by 20 lbs. Manufactured aluminum components like suspension uprights, the differential mount, and pedals contribute significant weight. These components have undergone constant refinement, thus it is difficult to further reduce weight without sacrificing stiffness. We propose carbon fiber bulk molding compound [CFBMC] as an alternative to aluminum. As opposed to purchasing expensive commercially made CFBMC, we developed an in-house manufacturing method. Testing rigs were made to characterize its material properties and validate our process by redesigning and manufacturing a suspension upright. Preliminary tests show that in-house CFBMC samples are 50% of the weight of aluminum, 50% of the strength, and 200% of the stiffness in tension, which achieves our minimum requirements. We expect to save at least 5 lbs overall by applying this material to aluminum components on the car.

LINK TO CONTENT

VIRTUAL SHOWCASE SPRING'20

SHAPE-LOCKING CATHETER

Gregoire Caubel
John Nguyen

ADVISED BY PROFESSOR ERIC LIMA, DR. ANTHONY COSTA, AND ALEXIS BRUHAT

80% of strokes every year are ischemic in nature, meaning a physical clot blocks blood flow to a certain region of the brain. Physicians only have 4.5 hours to intervene after a stroke event, and commonly use neurovascular support catheters to physically remove the blockage. These catheters need to be flexible enough to maneuver around complex vasculature, but rigid enough to hold their position during an operation. Instability of these support catheters caused by buckling can lead to longer surgical intervention times and greater risk for the patient. The aim of this project is to develop a computer simulation to better understand the dynamics of a catheter within the aortic arch and to use the simulation to determine the feasibility of a variable stiffness mechanism for improving the operational stability of support catheters. LINK TO CONTENT

REFLECTIVE SOLAR CONCENTRATORS FOR CUBESATS

William Morris
Brian Lee
Aqib Sadique

ADVISED BY PROFESSOR DAVID WOOTTON

VIRTUAL SHOWCASE SPRING'20

CubeSats are small, modular satellites that are popular for commercial, scientific, and educational use due to their low cost and ease of manufacturing compared to traditional satellites. However, their power systems are still costly and limited in power generation capacity due to their small surface area. A power system utilizing a deployable reflective solar concentrator would mitigate these problems; a large reflector would increase the amount of sunlight collected, thereby increasing the power generation. Additionally, the concentrator would only require solar cells along the focus of each reflector, which would decrease costs compared to a traditional solar array of comparable size. LINK TO CONTENT

SMART RESIDENTIAL HYDROPONIC GARDENS

Tae Hyun Koh
Sophie Schneider
Aidan Smolar

ADVISED BY PROFESSORS DAVID WOOTTON AND ROBERT DELL

CO-ADVISED BY PROFESSORS NAVEEN SHLAYAN (EE DEPARTMENT) AND AUSTIN WADE (SCHOOL OF ARCHITECTURE)

VIRTUAL SHOWCASE SPRING'20

With increased urban development, we are living further away from nature than ever before. We aim to bring green spaces to urban residents by utilizing hydroponic technology—a technology that provides the essential needs to a plant using an artificial environment. The industrial scale of existing hydroponic technologies are out of reach to most consumers. We aim to create a personal hydroponic system that increases green spaces in small scale urban residential environments through a product that is both functional and aesthetic. We hope to challenge the current standard for where and how natural ecology can exist in an urban residential area. LINK TO CONTENT

FIGHTING THE OPIOID EPIDEMIC: A DRUG INJECTION SYSTEM

Gertrude Dabo

Naomi Javitt

ADVISED BY PROFESSOR ERIC LIMA

VIRTUAL SHOWCASE SPRING'20

According to the U.S Department of Health and Human Services (HHS), over 130 people died each day from opioid related overdoses from 2017-2018. Fortunately, there is a drug called naloxone or Narcan, which can reverse an overdose within minutes. The biggest challenge in saving an individual from an overdose is timely access to Narcan and a bystander to administer it. To combat this problem, we have created a novel device that can detect an opioid overdose, and inject the individual with the correct dose of Narcan.The device is low profile and wearable, so it will always be on hand. It consists of an accordion shell with a needle and medicine reservoir, which when compressed, can inject an individual, and then retract the needle when it is released. LINK TO CONTENT

AIR HANDLING UNIT ANALYTICS FOR BUILDING EFFICIENCY

Jung Hwan Lim
Kevin Mao
Dilara Seyman
Nick Triano

ADVISED BY PROFESSOR MELODY BAGLIONE

VIRTUAL SHOWCASE SPRING'20

Cooper Union aims to reduce its greenhouse gas emissions intensity by 40% from 2014 levels by 2030 to meet the NYC Carbon Challenge. About 50% of its energy consumption derives from heating ventilation, and air conditioning (HVAC) systems. In 41 Cooper Square (41CS), the largest consumer of energy on campus, the facilities staff uses the Building Management System (BMS) to monitor and control the HVAC systems. However, the BMS lacks metrics tailored to optimizing energy performance and is an overwhelming display of information. Since there has been little past optimization work on this component, we are focusing on an Air Handling Unit (AHU) in 41CS, which ventilates and conditions building spaces. Our solution provides a simplified, user-friendly interface incorporating energy metrics and utilizes data analysis to identify ways to reduce AHU power consumption. LINK TO CONTENT

ALFA UAV: AUTONOMOUS LEARNING FIRE ASSIST UNMANNED AERIAL VEHICLE

Kyungjoon Lee
Daniel Feyman
Karen Yehoshua

ADVISED BY PROFESSOR HAVERKAMP

VIRTUAL SHOWCASE SPRING'20

This past year, wildfires in California burned over 200,000 acres of land and hundreds of millions of properties. The detrimental effect of wildfires is only expected to grow. To combat the fires, we developed a system of multiple, autonomous, fixed- wing drones that assist firefighters in extinguishing wildfires by acting as their eyes in the sky. The system has three main functional requirements; the first is for the aircraft to be able to detect, image, and track the progression of a fire. Using that data, the system must generate optimal flight paths for fire suppression aircraft. Lastly, since firefighter radios are limited by line of site, the drones will act as a persistent communications node between the firefighters. The deliverables comprise the development and design of the aircraft, the configuration and prototype of the computer that is onboard the aircraft, the simulation of the UAV autopilot, the algorithm to generate flight paths for fire suppression aircraft, and the user interface for the aircraft ground operator. This project is part of the 2020 SAE Aeroconnect Challenge, a student engineering design competition. LINK TO CONTENT

MICROPHONE ARRAY FOR IMPROVED ACTIVE NOISE CONTROL

Daniel Abes
Olivia Heuiyoung Park

ADVISED BY PROFESSORS MARTIN LAWLESS AND MARK LUCHTENBURG

Active noise control (ANC) systems attenuate noise by detecting incoming sound and generating an anti-noise signal to destructively interfere with it. ANC systems are generally limited to low-frequency sounds because sensors and actuators are close together and lack sufficient time to react to high-frequency or impulsive sounds. To compensate, common applications such as noise-cancelling headphones rely on ear coverings to block out higher-frequency sound indiscriminately, which can hinder communication and situational awareness. Our system implements an external array of microphones located around the user to increase the distance between the sensors and the user. The system will determine the locations of each microphone, user, and noise source using time delay of arrival (TDOA) of sound. After relative locations of the microphones are found, the user's open-back headset and the noise source locations are monitored real-time and are forwarded to the ANC system for path estimation. LINK TO CONTENT

INTEGRATING ROBOTICS INTO COOPER UNDERGRADUATE CURRICULUM

Christopher Jeong
Haoran Wei

ADVISED BY PROFESSOR MARK LUCHTENBURG

VIRTUAL SHOWCASE SPRING'20

Cooper Union faculty are introducing cutting edge robotic technologies to undergraduate students. One of these technologies is the drone-motion capture system, which consists of open-source Crazyflie drones and a state-of-the-art Vicon motion capture system. This system demonstrates feedback controls through experiential learning, however, the system is extremely complex. In order to make this system accessible to students, this project creates simulations for presenting the system in a class environment while teaching feedback controls, as well as serves as a testbed for future drone-related projects.

LINK TO CONTENT

FSAE THROTTLE DESIGN AND CONTROL

Randall Hilston
Samuel Makarovskiy
Eric Wietschner

ADVISED BY PROFESSOR SVEN HAVERKAMP

VIRTUAL SHOWCASE SPRING'20

Cooper Union's Formula SAE racecar is designed annually to improve the performance of the vehicle for competition. The throttle body on the intake manifold of the car has not been changed since its inception. The functional requirement of the throttle is to provide the driver with control over air flow into the engine. The optimal throttle maximizes air flow and provides predictable responsiveness to the driver. Proposed design alternatives are tested through computer simulations and compared to the current throttle body. Beyond implementation in the Cooper Union's Formula SAE racecar, an innovative throttle design and control schema can inspire others to prioritize fuel economy and driver comfort for commercial automotive applications.

LINK TO CONTENT

PERFIT: IMPROVED MASK PERFORMANCE WITH ERGONOMIC STRUCTURES

Vincent Hu
Seryung Kim
Tae Kyoung Lee

ADVISED BY PROFESSOR ROBERT DELL

VIRTUAL SHOWCASE SPRING'20

The World Health Organization (WHO) states that 92% of people worldwide do not breathe safe air. Cities are more polluted than ever before; people are exposed to Particulate Matter (PM) from various sources. Although masks have long been used to protect human respiratory system from pollutants, they face a major problem of inward leakage due to air gaps. This project aims to enhance the ergonomics of the mask by designing a new geometry while remaining at low filter cost. The design targets urban population who are constantly exposed to polluted air. Mask geometry is redesigned in order to accommodate various facial sizes and thus reduce air leakage. While keeping the new mask design cost-effective, new filtration techniques are considered to enhance airflow through the filter. LINK TO CONTENT