Book of Abstracts

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Understanding of Aerosol Transmission of COVID 19 in Indoor Environment - Part 2: Approaches to Mitigation

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The challenge we face in implementing solutions for new HVAC ventilation and filtration design, is to effectively improve air quality for virus mitigation without losing performance efficiency. The purpose of this improvement is to decontaminate the occupied enclosed areas, reducing the transmission of the corona virus aerosol transmission. Our research seeks reliable approaches to mitigate the further spread of aerosol transmission in indoor spaces. The methodology is to examine innovative HVAC engineering solutions that combat epidemiological problems of Covid-19 for the post-pandemic era, by researching scholarly articles and ASHRAE journals. We are achieving the goal of finding highly efficient resolutions by examining technologies such as displacement ventilation systems, installing MERV-13 to MERV-16 rated filters, wall mounted or portable HEPA filtration systems, needlepoint bipolar ionization, and ultraviolet germicidal irradiation (UVGI). These solutions are effective because they greatly reduce aerosol droplet nuclei and disease transmission in commercial and residential buildings. (Our key findings of these solutions will help in improving and integrating new and existing technologies in upgrading HVAC-R systems). By better understanding the benefits and disadvantages of these HVAC structural improvements, future innovations and research will require exploration of new ways to retrofit and correct existing design flaws. This will technologically advance ventilation and filtration systems, which will in turn overcome engineering design limitations, by efficiently reducing the risk of infections and destroying airborne pathogens.

Covid-19 Impact on Radiology Students' Distance Learning

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Radiological Technology students are well into a full year of distance learning. The Juniors are utilizing a hybrid mode, where they continue to have laboratory classes on campus at half capacity and every other week. The Senior students are completely learning through distance learning and focusing their efforts on reviewing for their licensing exams. Both cohorts are in clinical rotation with COVID-19, a smaller threat to their schooling, but still a hazard that can impact their personal and educational lives. With the use of surveys that are distributed during online classes, we hope to evaluate how a full semester of distance learning impacted students. We also hope to evaluate Juniors on their clinical rotation experience and the Seniors that had to resume after a break from cancelled clinical rotations. Other factors we will measure include whether access to the COVID-19 vaccine will lessen the student's fear of becoming infected or does the continued threat change their minds about entering a health care field. We will continue to compare the emotional, mental, and physical well-being of the students over the course of the current school year. Changes in motivation, engagement and perceptions of success are critical changes with online instructional learning (Daniels, 2021). With the distribution of online surveys, we are continuing to evaluate the effects that distance learning has on both the first- and second-year students and compare how they are coping with distance learning, in addition to domestic and familial responsibilities of the students outside the classroom walls.

Daniels, L.M., Goegan, L.D. & Parker, P.C. The impact of COVID-19 triggered changes to instruction and assessment on university students' self-reported motivation, engagement and perceptions. Soc Psychol Educ 24, 299–318 (2021). https://doi.org/10.1007/s11218-021-09612-3

Face Detection with Deep Learning

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The project involves the use of a Haar-cascade set of frontal faces to train a machine learning model, CascadeClassifier, to detect single face or multi-faces in a still photo or detecting face(s) on a streaming video. The model is trained with a dataset that contains 393,703 of frontal-facing images of persons. Afterwards, it is tested to detect frontal face of a single person or a multi-person image. The program tested with success in detecting faces in still photos.

Application of Internet of Things in Online Robotics Class

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Prof. Zhou Zhang

Distance/online learning is becoming an important form at academic institutions and the growth in distance/online learning has been outpacing the growth of enrollment. At present, the pandemic has been even further pushing distance/online learning to the peak based on the census from the United States Census Bureau. According to the data of EducationData.org, 98% of the institutions have moved most of the in-person classes to the online sections. The online robotics classes are also currently provided online across the country. Because the robotics class is a kind of intensive hands-on class, the online class prevents the students from implementing various

experiments. The student will suffer difficulties in the deeper understanding of the advanced concepts and theories. Therefore, it is necessary to let the students have similar chances to practice via the hands-on projects. To realize the objective mentioned above, the internet of things (IoT) based projects are devised and implemented in the Department of MET. These projects are characterized by the usage of the internet, wireless sensor networks, remote control systems, remote collaboration among group members, modular design (modularity), and remote data exchanging protocols. The structures of the robots are designed by computer-aided design software based on modularity, and the designed modules are shared in class among different groups. The remote communication software and apps are provided to the students to facilitate their collaborations. The robots are equipped with sensors that are integrated into the wireless network to enable remote data exchanging. Then, the members of a group can work on the control theories and algorithms remotely. To introduce the proposed practice in detail, a project of a smart robot car is taken as an instance. In this project, data processing, noisy control, and robust optimization are practiced remotely. During the implementation of this project, an IoT-ready wireless sensor and actuator framework which integrates the smart controller is developed and given to the students. Then, by the employment of this framework, the students can collaborate remotely, familiarize themselves with the principal concepts of robotics, practice the application of hardware and software, create their innovative project, and prepare themselves for their entry into the job market, thus supporting the central educational goal of cultivating technologists in MET. After the implementation of the projects, the students can increase the immersive feeling in the remote classes, and then, help them to master the theories, know the usage of the hardware and software, and gain rich experience in robotics.

Deep Lens Based American Sign Language Translation

Jakob Horowitz
Prof. Xiaohai Li

This project aims to utilize machine learning technology to enable real time translation of American Sign Language into written English text. This would not be feasible without cloud computing and AI technology as image classification is very difficult through standard programming techniques. We are using an Amazon cloud service called SageMaker to build, train and deploy machine learning models, as well as a fully programmable Amazon Web Service (AWS) DeepLens camera that is fully integrated with SageMaker and other AWS services. All of the code we develop for setting up, training, and running the machine learning model is done using Python. We have done research on other machine learning platforms, most notably Tensorflow which also uses Python, however because of the benefits of cloud computing, and the more comprehensive toolset, we decided to use AWS.

The DeepLens camera will be used to take images to generate the dataset needed to train the deep learning model. The code execution is handled through AWS Lambda functions, and all necessary files will be accessed via cloud storage.

Chemical Exposure from Manufactured Gas Plants: Public Health Risks?

Aneeza Hussain
Prof. Nora Almeida

This project aims at identifying the chemicals and their risk factors to the public health, which were found underneath the Gowanus Green. The ground beneath Public Place, a brownfield next to the Gowanus Canal, is heavily contaminated with coal tar — a toxic chemical by-product of gas manufacturing, which happened at the site for 100 years until the gas plant closed down in the 1960s and the land was seized by the city. Recently, the city has planned to develop Public Place into "Gowanus Green" and place a school and low-income housing units on this site. The aim of this research is to find out what kind of health issues can result from chemical exposure to naphthalene, benzene, toluene, ethylbenzene, and xylene pollutants on former Manufactured Gas Plant (MGP) sites when developed. For the first stage of this project, we will conduct medical research on chemicals and cancer to determine health impacts. In addition, we will examine historical environmental justice struggles to determine what kind of data collection and documentation is needed to support a public health claim; second part of this research focuses on demographics and government.

COVID-19 Prediction Algorithm

Brian Jerez
Prof. Marcos Pinto

As coronavirus disease (COVID-19) continues to be a threat to people globally, it is important to come up with ways to predict the outcomes of the spread of the disease. Using algorithms, we can predict the diagnosis of a patient based on medical information given by a patient. The algorithm predicts the diagnosis of COVID-19 by using a portion of the dataset of patients' medical informationAs coronavirus disease (COVID-19) continues to be a threat to people globally, it is important to come up with ways to predict the outcomes of the spread of the disease. Using Machine Learning (ML) algorithms, we can predict the diagnosis of COVID19 on a patient based on medical information on patients suffering similar health problems. The dataset was preprocessed by combining data from COVID-19 cases and influenza cases (H1N1) into a single matrix, followed by removal of any clinical variables that were not present in both the COVID-19 dataset and the influenza dataset. The algorithm is firstly trained on a portion of the dataset (80%) and afterwards it is put to test on the remaining dataset (20%). Finally, the algorithm is used to predict the diagnosis of any patient with related health issues. The ML models used are decision tree and k-Neighbors Network. The primer resulted in a more accurate prediction. and can accurately predict the remaining diagnosis. This algorithm can be used in the future to diagnose patients faster based on their medical conditions and information.

Visual Communication Design for Assistive Technology

Gui Jing Jiang
Prof. Farrukh Zia

Communication Design utilizes creativity and technology to design rich multi-media for public and professional communication. Recent advances in Computer Technology have made it possible to use low cost computer hardware and open source software tools to create visual communication media such as

pictures and videos. This research project will explore the use of low-cost computer hardware and open source computer software in creating multimedia visual communication for designing and creating assistive technology devices.

A Low-cost SLAM RC Car with RPLIDAR

Najwan Kased
Prof. Zhou Zhang

Remote control(RC) car used to do simultaneous localization and mapping (SLAM), is becoming popular in the mission of rescue. Besides, the function of remote collaboration is also important for the serious applications. Unfortunately, the commercial product is usually expensive. So, how to realize low-cost design is a challengeable topic. To solve the problem, the Arduino single-board microcontroller and IoT board are employed to implement the control and collaborating task. The sensor used to acquire the data of environment is 2D laser scanner RPLIDAR. RPLIDAR is a low-cost 'Light Detection and Ranging sensor' suitable for indoor robotic SLAM application: (1) It is crucial to balance the data acquire speed and the hardware processing speed since Arduino's baud rate is limited to 115200 baud; (2) The mapping work should keep a specific accuracy of 0.6 cm to make the generating map sense; (3) How to display the final results should be taken into account. To solve the above problems, the discrete sample method is used. With this method, the sampling frequency is under control in order to balance the data acquire speed and the hardware processing speed. After that, maximum likelihood method is used to optimized the acquired data and to improve the accuracy of the mapping work. During the implementation of this project, an IoT-ready wireless sensor and actuator framework which integrates the smart controller is developed. Then, the acquired data can be processed via the cloud. The success of this project will enable the safe landing of robotic and manned vehicles with a high degree of precision with relative low investment.

Smart IoT Car Seat Alarm System for Preventing Hot Car Death

Fahmeda Khanom
Touheda Khanom

Prof. Xiaohai Li

Hot-Car death of children due to lack of attention from parents is not a rare tragedy in recent years. The objective of the research project is to research and design a compact and low-cost smart IoT device that can help to prevent such tragedies. In this project, we will build a prototype system that can detect if a child is left alone in a closed vehicle. When such an event is detected, the device will send alerts to the child's parents or caregiver through multiple means. If the parents or caregiver do not provide any response after a short period, the device will alert the first responder for immediate action. We will use a Particle Photon which is a compact physical computing platform that will connect to a Cloud that will not require active management of users and reach remote parents, caregivers, or first responders. By the research done so far, we created a preliminary system design that includes multiple channels of sensors. These sensors are used to detect the presence of adults, children, and temperature conditions inside the vehicle. In the next step of this research project, we will develop, implement, and test our system. We will also further add more features to our system and implement them.

Perpetual Time Machine

Joan Beatrice Ladaban
Prof. Farrukh Zia

Physical computing and machine learning are important areas of research. This project involves the use of physical computing (in phase one) and machine learning (in phase two), to control an autonomous robotic time machine. Physical computing refers to writing code to interact with the physical environment by using physical components and devices. This is a topic related to Hardware Engineering, where one can use open-source hardware such as Arduino and Raspberry Pi. Machine Learning refers to writing code that learns from data and improves its performance and is a topic related to Software Engineering. This research project combines the Software and Hardware aspects into one working system.

Interfacial Dynamics and Ionic Transport of Radiologic Contrast Media in Carbohydrate Matrix: Utility and Limits of X-Ray Imaging

Lin Mousa
Hayley Sanchez

Prof. Subhendra Sarkar
Prof. Zoya Vinokur

Carbohydrate matrix in model fruits and vegetables like apples and sweet potatoes that are also mineral rich were mildly treated with a microwave heat source and radiologic contrast media (Gadolinium based Gadovist, K-edge 50 keV and Iodine based Omnipaque , k-edge 33 keV) that are strong absorbers of x-rays. Soft x-rays from a clinical radiographic system were used at mid keV range to identify diffusing patterns of contrast nano-complexes in the heat treated and untreated carbohydrate matrix and test for transmetallation (exchange of biometals, particularly alkaline earth Ca2+, Mg2+ and transition metals Cu2+, Fe2+/3+, Mn2+ from biochemical pools with Gd3+ of the infused media). X-ray attenuation surrounding the infusion points using regions of interests (ROI) analysis showed the diffusion of contrast media away from infusion points stopped after 24-48 hours while build up of x-ray absorbing material continued in the nearby regions demonstrating recruitment of native biometals from the bulk regions of the mineral rich fruit and vegetable, hence transmetallation (commonly observed by ion mass spectrometry). This effect seems to be more prominent in the heat shock matrix. Our work seems to be the first demonstration of such metal exchange in carbohydrate matrix using direct imaging technique and may add biomedical insight for metal toxicity and effects of heat waves during climate change in plants and vegetables.

Graphene Coated Laminated Composite on Carbon Fiber Reinforced Plastic for Light Striking Prevention

Aaryan Nair
Prof. Akm S Rahman

Lightning strike protection (LSP) of aerospace structures have become a growing concern when air travel has been significantly increasing, particularly in the post-Pandemic era. Graphene thin film is an emerging material that can be integrated into carbon fiber composite structures to address this issue. This

technology may have widespread applications in airplanes, wind turbines, and other instruments which are susceptible to frequent lightning strikes. Electrical discharge of the instrument in a safe manner is vital for the safety of the passengers (in the case of flights) as well as the integrity of the aircraft structures because of their specific mechanical and structural properties, which are essential for their functioning. The purpose of this project is to fabricate graphene thin film coated carbon fiber composite structures for the assessment with simulated lightning strikes.

This study will look at different methods for incorporating GTF (graphene thin film) into Carbon Fiber Reinforced Plastic and assess the electrical conductivity through methods such as compressive molding, Resin Transfer molding fabrication to achieve highly conductive functionalized nanosized GTFs, integrated with carbon nanotubes (CNTs) and graphene nanoplatelets (GNPs). The method developed must reduce the resistivity of the CFRP and provide a safe discharge outlet for the lightning strikes.

As an extension of the current methods developed, the plan is to gain an understanding on how resistivity varies between blends of pristine graphene, against blends comprising of CNTs and GNPs. Successful development of highly conductive blends could result in increased safety standards of aircrafts, reduced maintenance costs for wind turbines, and increased usage of wind energy.

In the current study we will develop GTF using GNP impregnated polymers. Electrospinning process will be implemented to develop the GTF. The project is expected to develop viable methods for the fabrication of graphene thin film material, and a standard for simulated lightning striking test.

Low-Cost 3D Exploration Robot

Erik E. Peregrina
Prof. Andy Zhang

The current Covid-19 pandemic has put a massive strain on our health care system and our health care workers. During the New York shut down, health care workers ran out of Personal Protection Equipment (PPE) and began to ration them. Using robotics, we can help reduce healthcare workers direct interaction with highly infectious diseases and patients, through the use of robotic arms. For a rapid developing situation, the robotic arms can be assembled and installed quickly to cope with a sudden influx of patients or lack of PPE supplies.

Recovered Energy Solutions from Urban Wastewater

Itay Rubin
Prof. Masato R. Nakamura

Project Background
Cities, by virtue of being the densest areas of human concentration, are the largest consumers of water and producers of wastewater. Water treatment plants inside urban areas address this by treating polluted water, gray water and sewage. However, ordinary biological systems for sewage treatment require enormous energy resources.
Research Goals
This research will attempt to identify new ways to harvest energy resources derived from recovered waste outputs, known as waste to energy (WtE). More specifically, it will explain how cities can use

mechanical engineering technologies to uncover potential energy sources which are hidden within the city infrastructure, but currently wasted. By doing so, we can offset the environmental impact and costs of energy at sewage treatment plants to meet urban energy needs. Two types of energies are widely available in the city: (1) potential energy (from mass) and (2) heat energy. By using the WtE potential mass and heat energy sources, we reduce overall new energy production needs.

Potential Energy (from mass): High-rise buildings use energy to distribute clean water for household use. Once used, that water goes down the drains, along with potential mass energy. This energy can be harvested and either stored or sent to the grid before it is sent to wastewater treatment plants.
Heat Energy: Buildings emit heat that can be recovered. Wastewater from kitchens and bathrooms retain heat when going down drain. By using heat exchangers, they can transfer some of this heat to the inlet line of the boilers before the wastewater proceeds to the treatment plant.
Solar and wind energy have been recognized as a viable alternative energy source. However, recovered waste energy sources have been overlooked. This presentation will highlight wastewater as an inexpensive, available, and sustainable alternative energy source.

Moore Graphs and the Degree-Diameter Problem

Luc Telemaque
Prof. Nadia Benakli

The Degree/Diameter problem is a famous problem in combinatorics. Given two positive integers and , the problem consists of finding a graph with the largest possible number of vertices, , that has maximum degree , and diameter . An upper bound for is called the Moore bound. Graphs for which is equal to the Moore bound are called Moore graphs. The Degree/Diameter problem has several applications such as the construction of large interconnection or microprocessor networks. In this project, we explore the existence problem and construction of the Diameter 2 Moore graphs. $GuvGwGuwvwvuwuvwWGuvGwW$