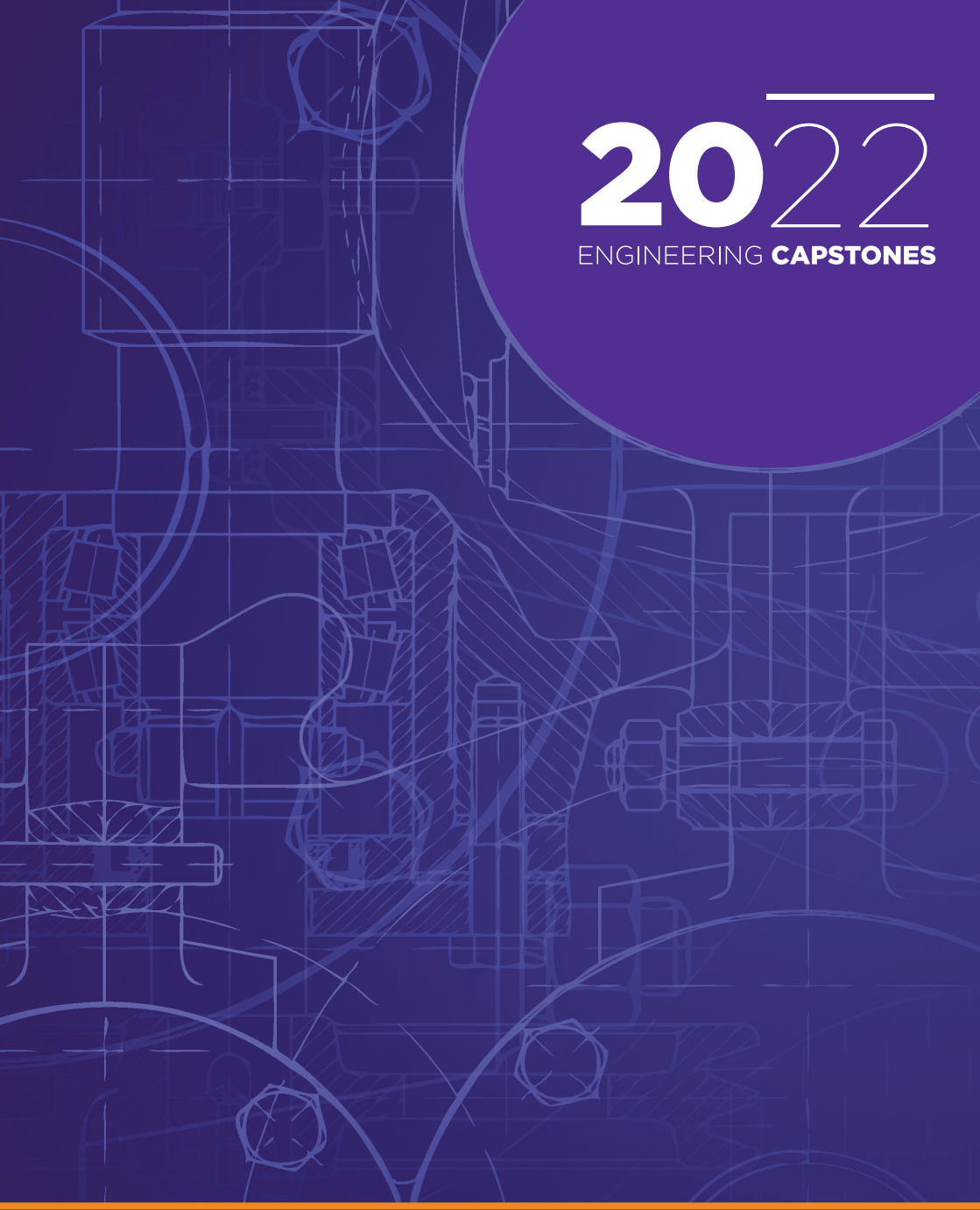

2022

ENGINEERING **CAPSTONES**

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MESSAGE FROM OUR DEAN

The Engineering Capstone is a major design course structured to immerse students in the process of developing engineering and technology solutions. It is a defining feature of the Engineering undergraduate experience that also provides the opportunity to integrate technical, human, aesthetic and business concerns with applied design solutions. The mission to create a design through imagination and innovation is leveraged from the knowledge and skills acquired throughout the four-year curriculum, together with the culmination of ideas from the Junior year and hard work throughout 2021-22.

This year's projects align with today's Engineering advances as well as our institutional research priorities of biomedical and health systems; robotics; cybersecurity; environmental sustainability; and urban systems. For the first time in two years, our Seniors were able to showcase their Capstone Projects incorporating design solutions to solve real world problems. Fifteen projects were presented by the Class of 2022 and are highlighted in this booklet. Each represents the highest aspirations of undergraduate intellectual development, creativity, and engagement with original creative work.

To the Class of 2022, you made it! This is testament to the incredible resilience and resolve you have shown throughout this pandemic and the support and dedication of our faculty.

With offers to join top international graduate schools, take up positions in large corporations, enjoy gap years, or explore opportunities in the UAE, we wholeheartedly congratulate all of you for your wonderful academic achievements.

On behalf of the Engineering Division, our best wishes for a successful future ahead and please keep in touch!

Samer Madanat
Dean of Engineering

LETTER FROM THE COORDINATORS

Pradeep George

Ramesh Jagannathan

The real world engineering problems are cross-disciplinary in nature with diffuse boundaries between them. The strength of our undergraduate engineering programs (Civil Engineering, Mechanical Engineering, Electrical Engineering, Computer Engineering, Bioengineering and General Engineering) is in developing engineers to solve such real world problems. The capstone coordinators, Pradeep George and Ramesh Jagannathan, have designed a unique, cross-disciplinary capstone experience for the senior engineering students at New York University Abu Dhabi (NYUAD). This is different from the traditional capstone courses found in most of the global engineering offerings which focus on fulfilling the degree requirements for a specific engineering program/major. At NYUAD, the capstone courses, namely, Senior Design Capstone Project I (ENGR-UH-4011) and Senior Design Capstone Project II (ENGR-UH-4020), are structured to fulfill the requirements of all engineering programs/majors simultaneously. The capstone experience aims at solving a cross-disciplinary challenge for a team of seniors drawn from each of these programs/majors. The scope of the challenge is defined and the execution process is structured such that each team member satisfies the requirements of their individual program.

The capstone program experience is designed to educate the students on the core principles of the staged gate process of project management, an established industry standard. Capstone coordinators and faculty advisors collectively work together to manage expectations and set challenging yet realistic project goals to enhance the quality of the program. Program content and processes are developed to ensure that capstone requirements are fulfilled to meet the ABET and Commission for Academic Accreditation (CAA) standards.

The goal of the Capstone Design Project is to provide students with a major design experience that leverages the knowledge and skills acquired through their undergraduate studies and co-curricular experiences. Its staged gate process structure includes a process of design with measurable metrics, and incorporation of appropriate engineering standards and multiple realistic constraints. Emphasis is placed on clearly framing the design problem and following the design process to result in an optimized design solution. Students are encouraged to build prototypes of their designs and seek validation of their solutions through simulations and experiments, as appropriate.

The Capstone Project aims to be collaborative and cross-disciplinary across several engineering streams. The emphasis is on students applying the design process to solve real-world problems in a 21st century, global context. The projects address engineering and technology topics that overlap with the sciences, social sciences, liberal arts or business. The Capstone provides an opportunity to integrate technical, human, aesthetic, business and ethical concerns with engineering design. Students practice critical skills in communication, team-building, and project management. There is a mid-semester review of the projects. Students complete their design and build/test their prototypes, if applicable, during the spring semester. The senior year culminates in a comprehensive project report.

Senior Design Capstone Project I (ENGR-UH-4011) and Senior Design Capstone Project II (ENGR-UH-4020) collectively offer the engineering capstone experience to seniors. Senior Design Capstone Project I is two credits which runs for the whole of fall semester. Senior Design Capstone Project I focus on different aspects of the capstone project such as problem definition and creating the design solution. Senior Design Capstone Project II in spring consists of two, seven week modules. The design solution proposed in Senior Design Capstone Project I is implemented in the first module. It is tested and validated in Module II.

This year there are 41 senior students in 15 interdisciplinary capstone projects. The titles of the projects are listed below:

- Design & Manufacture of a Kresling Origami Rotational Atherectomy System (KORAS)
- Design of Smart Chair of Smart Chair Non–Contact Respiration and Heartbeat Rate Monitoring
- Artificial Defects for improved economy and performance of Fiber-Reinforced Concrete with Limestone Calcined Clay Cement (LC^3)
- Design of a Microwave Induced Plasma Gasifier for Waste to Hydrogen Conversion
- Design of Soft-Haptics Dental Training Simulation
- Design of a 100 Gbit/S Optical Communication Link
- Designing an Energy-Efficient Personalized Driver Assistance System using Smart Mobile Phones
- Micropump design for High Pressure, Low Flow Rate
- Design and Control of a Hybrid Drone/Car/Vessel
- Design of an Autonomous Robotic Construction System with Interlocking Bricks
- Hardware Design and Side-Channel Power Analysis Attack of the Advanced Encryption Standard (AES) Cryptographic System
- The design of Engineered Cementitious Composites with Limestone Calcined Clay Cement and Artificial Defects and possible applications in the design of Wave Breakers
- Solar-Powered Vacuum Pump Refrigeration
- Design of a Universal Mechanical Door-Opening Assistance Device
- Designing an Integrated DNN Optimization Framework for EdgeAI in Healthcare

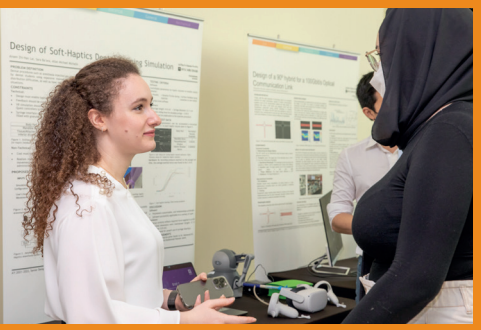
We take this opportunity to congratulate all the teams on their successful completion of the capstone projects and wish them all the best in their future endeavors.

Sincerely

Pradeep George, PhD
Senior Lecturer and Coordinator of Engineering Capstones
NYU Abu Dhabi.

Ramesh Jagannathan, PhD
Research Professor of Engineering
Managing Director, startAD
NYU Abu Dhabi.











CAPSTONE PROJECTS

Design & Manufacture of a Kresling Origami Rotational Atherectomy System (KORAS)

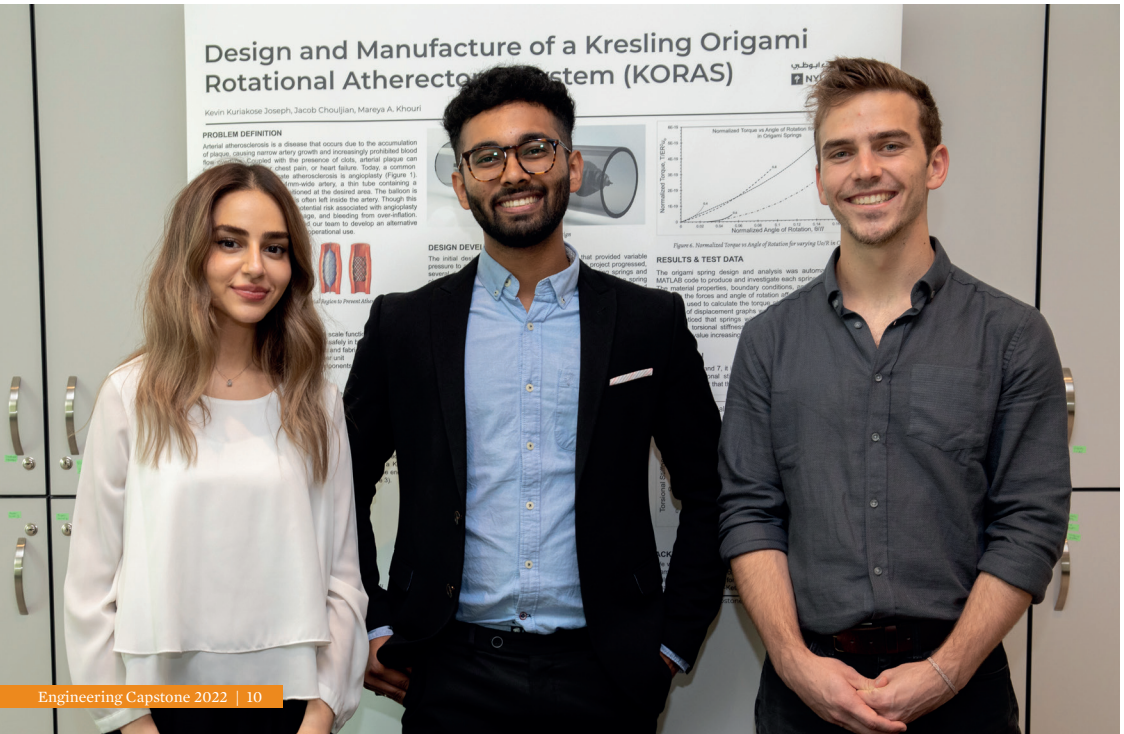
STUDENTS

Jake Chouljian (Mechanical Engineering), Kevin Kuriakose Joseph (Mechanical Engineering), Mareya A. Khouri (Mechanical Engineering)

ADVISOR

Mohammed Daqaq, Professor of Mechanical Engineering; Associate Dean for Undergraduate Programs

The purpose of this capstone project is to design and manufacture a Kresling pattern Origami Rotational Atherectomy System (KORAS) to ablate calcified lesions and atherosclerotic plaque. Our design project is driven by the current limitations of existing products and procedures of arterial plaque removal which cause severe adverse side effects including embolism, infection, myocardial infarction, and death.



Using a mechanism that converts 0.5 N of linear force to rotational motion, our design project aims to remove such lesions through an abrasive rotary drill mounted onto the spring. The design consists of three main systems: a mechanism that allows a surgeon to change the pressure of a closed volume to produce an applied linear force, a Kresling pattern origami spring that acts as an actuator to convert this force into rotational force, and a drill bit that can harness this energy in the form of torque and ablates the unwanted plaque in the artery. The entire system will be designed to fit in a 4 mm diameter artery and 3D printers will be utilized to create models on such small scales, using materials with variable stiffness such as Vero and TangoBlackPlus.

Design of Smart Chair for Non-Contact Respiration and Heartbeat Rate Monitoring

STUDENTS

Martyna Piasek (Electrical Engineering), Tintié Ahmed Koné (Electrical Engineering)

ADVISOR

Sohmyung Ha, Assistant Professor of Electrical Engineering and Bioengineering

An ECG is considered a critical health indicator that directly benefits from long-term monitoring as many CVDs - including arrhythmias and blocked or narrowed arteries - can be diagnosed long before an onset event. Unfortunately, despite many advancements in wireless technology, the use of home ECG is still very limited mainly due to discomfort associated with wet, contact electrodes.

Hence, in our Capstone Design Project we focus on developing a Smart Chair mounted with an ECG that will ensure non-contact respiration and continuous heart rate monitoring (for 8-12 hours per day) for mid/high-risk CVD patients while ensuring their comfort. Two textile capacitive coupling electrodes will be incorporated into the backrest of the chair in order to obtain signals corresponding to RA (right arm) and LA (left arm). An extra electrode providing a reference point and enabling DRL (driven right leg) circuit will be used to reduce the signal interference. It will be placed in the seat of the chair. The data collected will be processed in real-time using an ADS1294 ECG IC and its development board software -ADS129xECG-FE. An accurate electrocardiograph will be developed allowing an analysis of P, T waves and QRS complex with the goal of improving early detection of common CVDs and enabling a potential rapid intervention in the event of a crisis to decrease the mortality rates of CVDs.

Artificial Defects for improved economy and performance of Fiber-Reinforced Concrete with Limestone Calcined Clay Cement (LC^3)

STUDENTS

Najila Al Qubaisi (Civil Engineering), Cornelius Otchere (Civil Engineering), Fatima Redha (Civil Engineering), Hessa Alabbas (Civil Engineering)

ADVISOR

Kemal Celik, Assistant Professor of Civil and Urban Engineering

Concrete is used for a wide range of applications due to its strength and durability, as well as its monolithic characteristics. However, it has its drawbacks: low tensile strength, and low ductility. This limits the applications in which concrete could be used.

The development of high-performance fiber-reinforced concrete with the use of Limestone Calcined Element (LC^3) requires a great understanding of the composite behavior of the material, including the interaction between the fibers and the interface properties. As known generally, concrete is characterized as a brittle material. Adding fibers improves the toughness of the matrix and controls crack propagation. However, the addition of fibers significantly increases the cost. This cost inhibits the use of fibers in concrete despite its superior properties.

In this project, we aim to design and optimize a mix that will use fewer fibers but achieve a similar performance as conventional fiber reinforced concrete. This will allow for high performance concrete to be achieved at a lower cost, paving the way for fiber reinforced concrete to become mainstream. The design will be achieved by varying the proportion of artificial defects and fiber volume fraction of the mix. It is hypothesized that introducing artificial defects to the concrete matrix and harnessing its ability to cause saturated cracking will help to reduce the amount of fiber needed to achieve similar performance as a mix without artificial defects. The performance of the resulting mix will be evaluated by considering the compressive strength (>=40MPa at 28 days), flexural strength (>=6.5MPa at 28 days), reaction kinetics (similar reaction mechanism as conventional LC^3) and the workability. The findings from this study will be reported through a written report and a poster.

Design of a Microwave Induced Plasma Gasifier for Waste to Hydrogen Conversion

STUDENTS

Yehowahi Nii Tetteh Boye Sekan (Mechanical Engineering), Steffanie Dias (Mechanical Engineering), Vera Petrova (Mechanical Engineering)

ADVISOR

Vijayavenkataraman Samjairaj, Assistant Professor of Mechanical Engineering and Bioengineering

UAE generates approximately 4200 tonnes of municipal solid waste (MSW) per day with the majority of the MSW and sewage being sent to landfills with very little of the waste being recycled. The UAE has a target of reaching zero landfill by 2050 and they also plan on increasing their use of renewable energy by 35% by 2030.

This report proposes a design project: the use of microwave induced plasma gasification as a means of converting municipal solid waste to hydrogen gas. This technology is timely as it could potentially contribute to the efforts of the UAE in achieving one of its goals of becoming a global leader in the supply of hydrogen. Hydrogen is vital to the petrochemical industry as a coolant and for hydrogenation which is a key component of many chemical processes. It is also set to be the clean and sustainable fuel of the future of transportation. The microwave gasifier designed in this proposal makes use of a standard household microwave oven that will generate plasma and cause temperatures to reach as high as 1500°C and operate at atmospheric pressure with a maximum pressure of 2atm. This causes the waste sample present in the reactor to gasify and form syngas, a combination of carbon monoxide and hydrogen. The sample size will be approximately 10g in mass and will be placed in the sapphire glass reactor that can withstand high temperatures. The syngas collected shall be measured and then analyzed using gas chromatography.

Design of Soft-Haptics Dental Training Simulation

STUDENTS

Allan Michelin (Computer Engineering), Sara H. Ba'ara (Computer Engineering), Zhi-Han Ansen Lai (Bioengineering)

ADVISOR

Mohamad Eid, Assistant Professor of Electrical Engineering

The proficiency and skills of dentists today are heavily reliant on their practical, tactile sensation experiences. Traditionally, these abilities are acquired in dental school through training tasks such as probing and scaling on artificial dental mannequins in the laboratory. However, the usage of artificial teeth in training brings about several limitations such as the inability for the live creation of different dental conditions on the mannequin, as well as higher costs.

Although computer-based dental simulations have attempted to solve these limitations, drawbacks in making these simulations fully realistic and haptically-accurate still exist. In an effort towards creating a more realistic dental simulation, this paper investigates the use of soft haptics as a system to replicate the visual-haptic perception involved in basic dental procedures. In particular, the soft haptics-based system will offer instantaneous customization and alteration of periodontal pocket depths, tissue hardness, and gingival conditions. To facilitate this development, this project proposes the fabrication of skin-like soft materials able to adjust shape and structure through pneumatic internal granular particle jamming. Through adjusting the internal air pressure of granular particles and pneumatic chambers, the surface of the soft material will respond in a predictable manner, akin to the real-life variability in dental conditions. Together, the systems will generate pockets of depths ranging from 2 to 10 mm through applying air pressure from 0 to 0.1 MPa. In addition, the artificial gingiva's Young's Modulus will range from 20 to 50 MPa. Such a system will enable effective reproduction of human gingiva, which is more realistic, customizable, and low-cost than current artificial mannequins.

Design of a 100 Gbit/S Optical Communication Link

STUDENTS

Raushan Khullar (Computer Engineering), Salama Al Zaabi (Computer Engineering), Saoud Al Mansoori (Computer Engineering)

ADVISOR

Mahmoud Rasras, Associate Professor of Electrical Engineering

Due to the ever-increasing demand for higher communication bandwidth, higher data transfer rates is a fundamental technological development challenge. Scientists have continuously looked for ways to improve data transfer speeds moving from copper wires to optical fibers, and thus significantly increasing the data transfer efficiency.

New technologies allow for further increase in transfer rates by encoding more information in a pulse of light over the same fixed period using a technique called phase-shift keying (QPSK). This capstone project aims to design a compact and low loss component referred to as a 90o optical hybrid demultiplexer which is a key building block in implementing a QPSK receiver. The latter is an advanced optical modulation technique used in modern communication systems. The goal is to fabricate a design for the 90-degree hybrid, which will operate at a wavelength of 1550nm. In addition to that, the target insertion loss is <8dB along with a target bit error rate of 10-3, which is 1 bit error per 1000 bits transmitted, lastly the target uniform axis loss is <0.5dB. Algorithms will be developed to design and prototype this component, Furthermore, hardware will be built based on this design and used to demonstrate a 100Gb/s optical QPSK transmission link.

CLASS OF 2022

جامعة نيويورك أبوظبي

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ENGINEERING DIVISION

Designing an Energy-Efficient Personalized Driver Assistance System using Smart Mobile Phones

STUDENTS

Mohamed Al Hosani (Computer Engineering), Hazem Lashen (Computer Engineering), Dhvani Khakhar (Computer Engineering)

ADVISOR

Muhammad Shafique, Associate Professor of Computer Engineering

Advanced driver assistance systems (ADAS) are increasingly becoming a staple in today's modern automotive industry. A growing number of manufacturers are starting to incorporate them into expanding segments of their car offerings. There is a wide variety of ADAS features that happen to be extremely attractive to consumers as they provide both convenience and

safety for drivers. A common feature, collision avoidance, has been found to reduce the potential for accidents by a measure of 37%, up to 65% depending on the scenario. The problem herein lies in the fact that ADAS features are often times not available to some segments of the public, as they are considered premium features and are sold with higher end models. This results in lower socioeconomic status groups lacking access to these potentially life-saving features. This is a problem as, ideally, safety should be provided to all members of society regardless of wealth. This project seeks to remedy this problem by providing users access to ADAS features through their smartphones that are widespread. With many developing countries now reporting smartphone adoption levels above 50% [2], there is an opportunity to increase safety in those countries by leveraging people's access to smartphones. This would subsequently allow them access to the ADAS features which would make the greatest impact in terms of reducing the potential of an accident as well as improve the quality of driving and general public safety. The purpose of this work is the design and development of an Android mobile application that utilizes a smartphone's onboard cameras to facilitate a number of ADAS features.

Micropump design for High Pressure, Low Flow Rate

STUDENTS

Ahmed El Ashwah (Mechanical Engineering), Ayesha Sameer (Bioengineering), Mariano Utrera (Bioengineering), Sofia Chavele-Dastamani (General Engineering)

ADVISOR

Khalil Ramadi, Assistant Professor of Bioengineering

In both clinical and research settings, delivering pharmaceuticals to the brain is crucial for pathological treatment, for protecting recording implants from natural body responses, or for studying behaviorally relevant neural activity. Brain drug delivery often requires pumping fluid through a catheter inserted into the tissue for controlled, local infusion.

The major challenge in this delivery strategy is infusing at flow rates of 100 nl/min - 10 ×L/min to prevent tissue damage while generating the required pressure to pump through these catheters. The currently available pumps capable of low infusion rates cannot meet the high pressure requirements. To address this gap in the existing technology, we propose the development of a functional prototype for an implantable, remote-controlled micropump capable of pumping at 100 nl/min - 10 ×L/min with pressures of 55 Pa - 5.5 kPa for use in humans. After thorough analysis, we have selected two solutions that show significant potential: Archimedes screw pump and hydrogel. The prototype will be created through theoretical and computational analysis. The final design will be evaluated based on efficiency, accuracy, volume capacity, and cost. Due to its medical relevance in both patient treatment and neuroscience research, this prototype holds great potential for future development and could provide a significant contribution to the field of neuroengineering.

Design and Control of a Hybrid Drone/Car/Vessel

STUDENTS

Adam Ali Hassan (Computer Engineering), Yara Massoud (Computer Engineering), Ahmad Almuhtadi (Electrical Engineering), Ziad Elkammah (Electrical Engineering)

ADVISOR

Antonios Tzes, Professor of Electrical Engineering; Program Head of Electrical Engineering

With global warming posing a greater threat on humanity and on our Earth than ever, data collection, research, and development in this field has seen great advancement. However, when it comes to the topic of data collection, it often poses a risk to the people set out to collect the data. This project will propose a more efficient and safer alternative, which does not require people to be in the field. A vehicle will be designed and created that will help in data collections of all kinds, namely sea floor level measurement or coral reef data collection.

The report will discuss and expand on the problem statement by analyzing the problem and visualizing it using black box modeling. After that, the problem statement is developed. Next, the technical and non-technical design constraints of the project are explored. Technical constraints such as the environment, power consumption, maximum speed, and weight are discussed in relation to how they would affect the design of the project. Non-technical constraints, such as budget and safety constraints are also explored in a similar nature. The criteria for design evaluation are then defined. In this section of the report, the use of simulations and field testing as evaluative methods are discussed. Extensive background research was undergone from which Morphological charts and Pugh charts were used for concept selection and generation. Four major sub problems were established, choice of computer, thrust propulsion, wheels, and rotors. The modeling of the aerial, ground, and surface vehicle are discussed independently, as well as the simulation plan. A plan for optimization is also in place in order to manage the constraints discussed previously. The final design expected due to the design process that was followed is detailed as well as certain ethical dilemmas the project might face. Finally, the bill of materials and project management visual aids represent the process in which the design of the project took place. The vehicle will be able to drive or fly to the shoreline, and float as well as move and propel on the water surface. This unmanned vehicle will be a hybrid drone, car, and vessel, and will eliminate the risk of human life while also being able to access a variety of locations.

Design of an Autonomous Robotic Construction System with Interlocking Bricks

STUDENTS

Paula Navalon (Mechanical Engineering), Amelija Ancupane (Civil Engineering), Yaman Garg (Civil Engineering)

ADVISORS

Borja García de Soto, Assistant Professor of Civil and Urban Engineering
Sunil Kumar, Professor of Mechanical Engineering; Program Head of Mechanical Engineering

The construction industry continues to fall behind other industries in terms of productivity with its relatively low level of automation and digitalization. This project aims to tackle this issue by combining interlocking mortarless brick technology with autonomous robots. The design will be a proof of concept of how using smaller and more mobile robots (in contrast to large single robots that are currently available on the market) with an interlocking brick design can be a feasible and more productive alternative to traditional construction.

The TurtleBot platform alongside a customized gripper to handle the bricks will be used. From the designs currently available, a design for the interlocking bricks which best allows for easy use with the robot, whilst satisfying the structural requirements, will be selected and optimized. An algorithm will then be developed in the Robotic Operating System (ROS) for the process of constructing a wall and tests of the final products will be performed both in simulation and in the laboratory. The results will be extrapolated and compared with the parameters such as cost and time for the construction of a traditional masonry wall. The goal is that this project will serve as a basis to scale the concept to incorporate a team of mobile robots that are more suitable for construction operations than TurtleBot.

Hardware Design and Side-Channel Power Analysis Attack of the Advanced Encryption Standard (AES) Cryptographic System

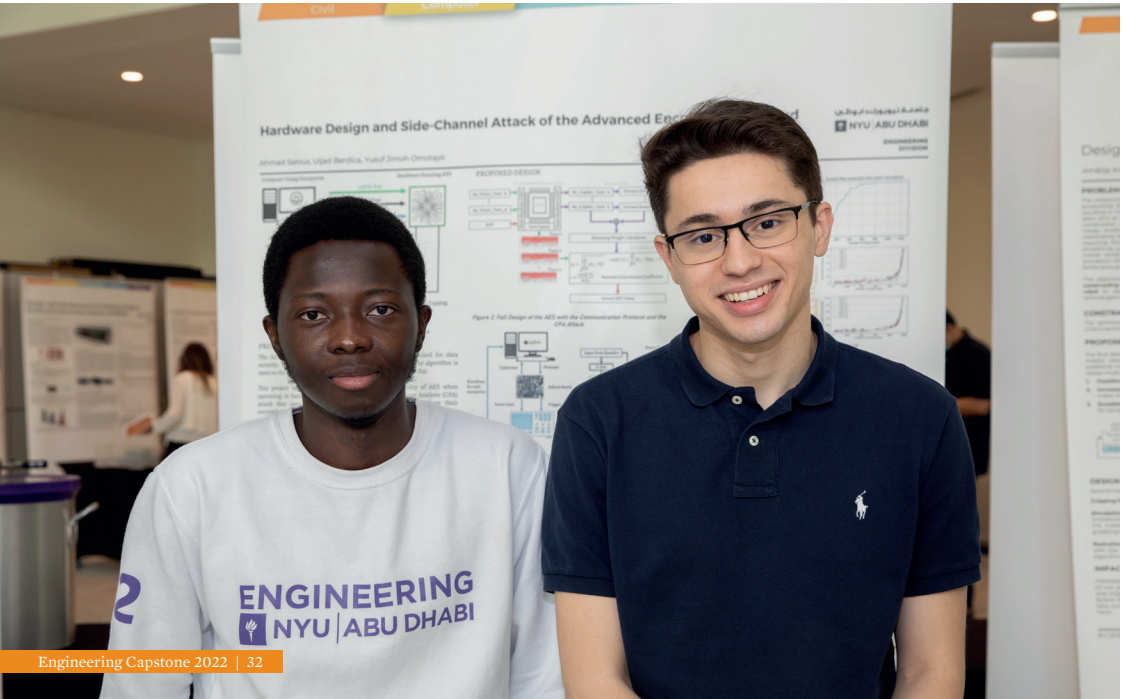
STUDENTS

Ahmad Salous (Computer Engineering), Uljad Berdica (Electrical Engineering), Yusuf Omotayo Jimoh (Electrical Engineering)

ADVISOR

Ozgur Sinanoglu, Professor of Computer Engineering; Director, Center for Cyber Security

This project seeks to break the most widely used symmetric cipher, the Advanced Encryption Standard (AES) by exploiting its side-channel vulnerability when operational in hardware, thus enabling an attacker to implement the side-channel analysis techniques like Correlation Power Analysis (CPA) attack to retrieve the key used for encryption.



A successful CPA attack can replace an exhaustive key search, which would in the worst case need 2128 computations, with an iterative key search that would run 256 times for each key byte, ultimately reducing the computationally hard problem to a trivial one.

The design of Engineered Cementitious Composites with Limestone Calcined Clay Cement and Artificial Defects and possible applications in the design of Wave Breakers

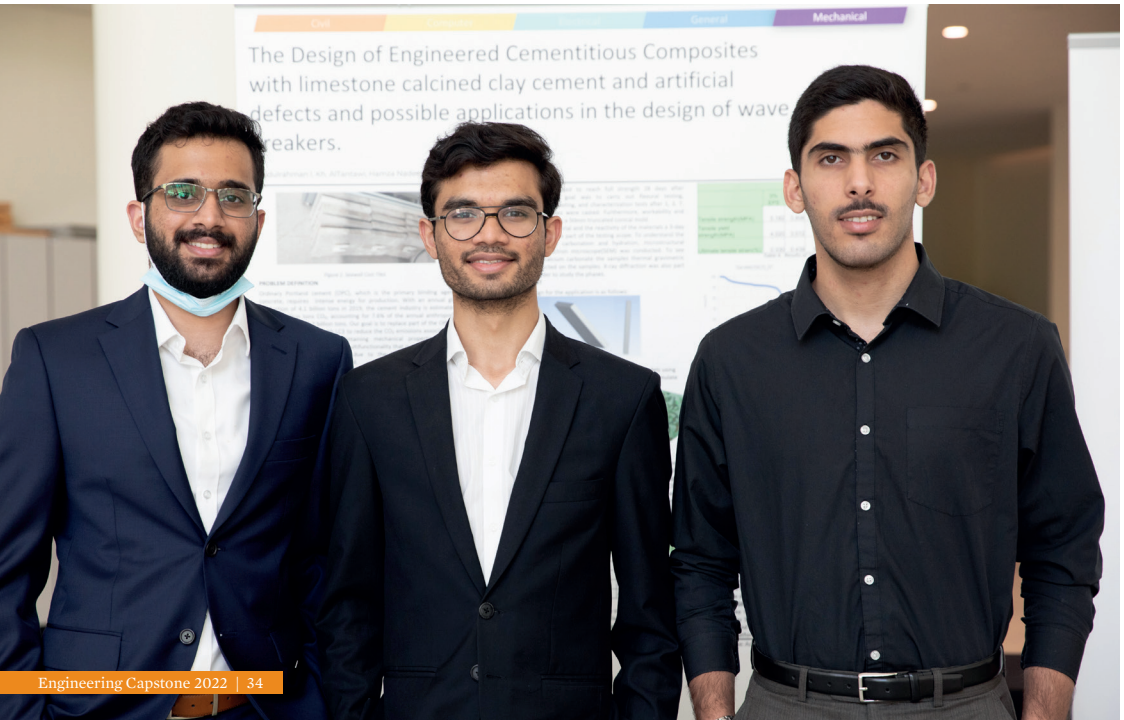
STUDENTS

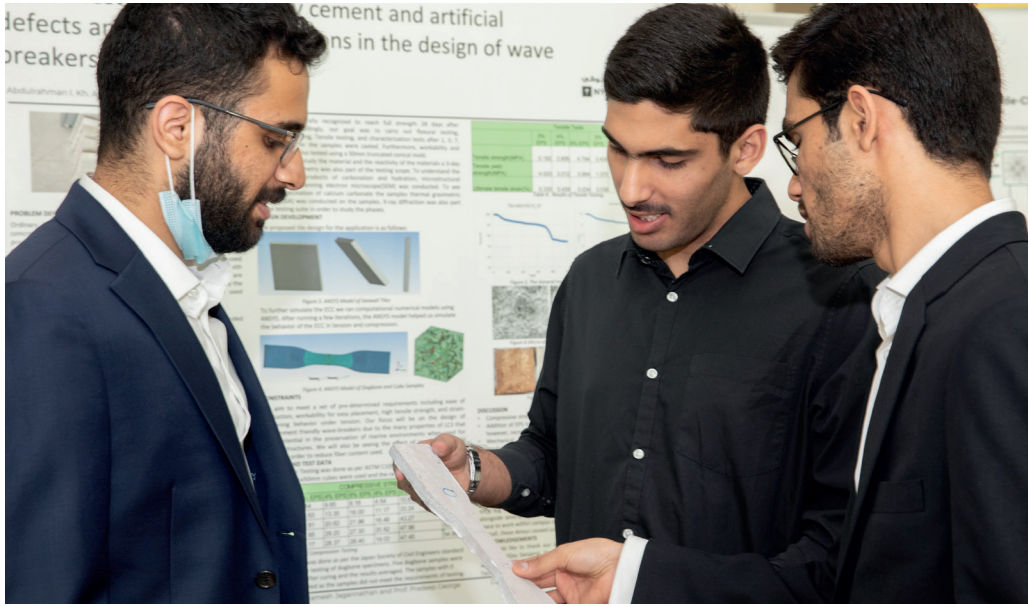
Abdulrahman I. Kh. AlTantawi (Mechanical Engineering), Hamza Nadeem Ansari (Mechanical Engineering), Shaheer Haider (Mechanical Engineering)

ADVISORS

Kemal Celik, Assistant Professor of Civil and Urban Engineering
Vijayavenkataraman Sanjairaj, Assistant Professor of Mechanical Engineering and Bioengineering

Due to the expansion of the construction industry, the durability of materials involved in construction is of immense importance. Designing new, sustainable, cost-effective, and environmentally friendly material is the need of the hour. A lesser durable concrete requires frequent maintenance and repair, which resulted in elevated economic costs and an increased carbon footprint. Besides, the humid environment of the UAE makes it more vulnerable to corrosion, particularly coastal infrastructure.





Corrosion of reinforcing bar results in rust that occupies a larger volume compared to the parent metal, causing distress, cracking, and spalling, and compromising the load-carrying capacity of the structure. In order to mitigate this effect, discontinuous fibers and artificial defects will be introduced into the matrix. The small size of fibers allows for an effective cracking control mechanism superior to conventional reinforcement. This capstone project studies the improvement of fiber-reinforced concrete through the inclusion of artificial defects or flaws in the form of expanded polystyrene into the matrix.

Solar-Powered Vacuum Pump Refrigeration

STUDENTS
Abdullah Amr Mohamed (Mechanical Engineering)

ADVISOR
Sunil Kumar, Professor of Mechanical Engineering; Program Head of Mechanical Engineering

The project aims to design a solar-powered vacuum pump-based freezer to assist street vendors and homeowners operating and living in the northern parts of the African Sahel region respectively. The product aims to operate wholly using solar power, minimize water usage, and achieve minimal costs of buying and maintaining that can be afforded by people living and operating in the region. The product is meant to allow for month-long storage of food without need for new water intake and is meant to be capable of being stacked and transported by vendors in trucks.

The project aims to ultimately produce a functional prototype of the product, to test the prototype to ensure it meets criteria that allow it to achieve the goals it is intended to an acceptable level, and to produce a final report documenting all the work that has been done throughout the entirety of the product development process, starting from preliminary problem analysis to the conclusions drawn from the experiments performed on the final prototype and an evaluation of what the product has been able to achieve and where further development of the product may proceed from there. Currently, the product concept is that of an insulated cylindrical stainless steel vacuum chamber connected to a rotary vane vacuum pump, powered by polycrystalline solar panels, and utilizing piezoelectric pressure sensing and thermocouple temperature sensing equipment.

Design of a Universal Mechanical Door-Opening Assistance Device

STUDENTS

Matilde Handal Rabaj (Mechanical Engineering)

ADVISOR

Mohammad A. Qasaimeh, Associate Professor of Mechanical Engineering and Bioengineering; Engineering Faculty Diversity Liaison

The proposed device is a hands-free universal door opener designed to lower the chance of pathogen propagation and increase accessibility to spaces for everyone. In light of common struggles brought by the Covid-19 pandemic, it became increasingly relevant to limit contact with public high touch surfaces. The target users of this conveys the general population, especially those in high traffic areas such as schools and universities.

The proposed design employs three sets of subsystems. Firstly, a pedal for energy application. Secondly, a pivot point that operates as a kinematic energy transfer mechanism. Finally, a lock activation mechanism that unlocks the door and opens it. Moreover, the device has been designed specifically to be modular, sleek and non-invasive to the door where it is used and can therefore easily be installed, removed or modified should that be required. In addition, it will be made from commercially available materials making it widely accessible in both price and availability.

Designing an Integrated DNN Optimization Framework for EdgeAI in Healthcare

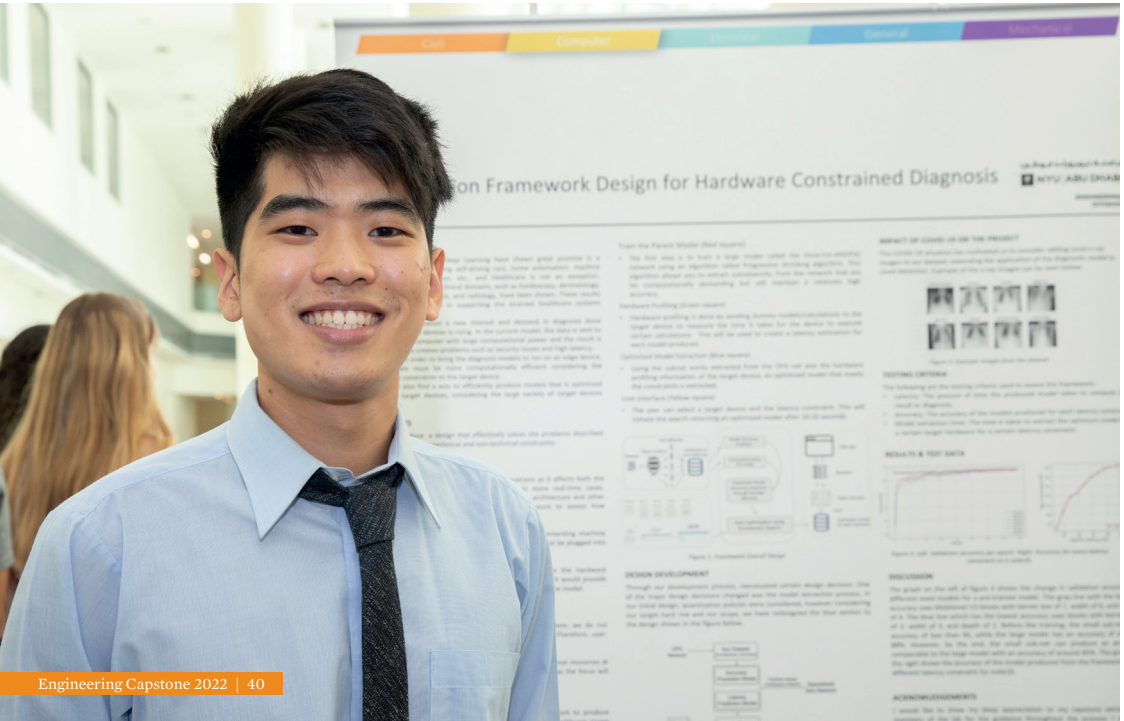
STUDENTS

Takumi Miyawaki (Computer Engineering)

ADVISOR

Muhammad Shafique, Associate Professor of Computer Engineering

The proposed system is an Integrated Deep Neural Network (DNN) Optimization Framework for Medical Diagnosis. The framework produces computationally efficient accurate prediction models for Healthcare diagnosis under hardware constraints. As a result, a diagnosis solely by the Edge-AI device becomes possible without the reliance on external high computational resources.



For the purpose of this study, the specific type of data used for the HealthCare diagnosis is covid x-ray images. Therefore the product will be an optimization framework that produces computationally efficient classification models for covid x-ray images optimized for different devices with different hardware constraints. The Optimization Framework will produce classification Models, with an AUC of above 0.85, energy consumption below 10mJ, and latency of below 20ms. The target users are resource-scarce medical professionals who are required to diagnose patients using medical images.

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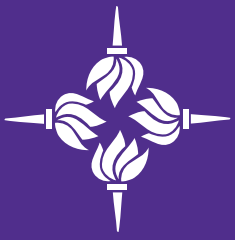

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