

Bright Future Engineering Talent Hub
STEM Challenge – Suggested Project Themes 2024

Department	Code	Project Theme	Description
Architecture and Civil Engineering 建築學及土木工程學系	ACE-C1	Towards Carbon Neutrality 通過綠色校園實現碳中和	Students will propose design ideas for achieving the goal of carbon neutrality in Hong Kong. Students can create a greener and more sustainable campus by modifying existing spaces and adding some green features or smart devices. The team demonstrates innovative ideas and feasible solutions for reducing the overall carbon emission in Hong Kong. 學生將提出設計構想，以實現香港的碳中和目標。學生可以通過改造現有空間並添加一些環保功能或智能設備來創建一個更綠色、更可持續發展的校園。團隊最終能展示減少香港整體碳排放的創新想法和可行的解決方案。
	ACE-C2	Smart Energy Management for Homes 智慧家居能源管理	Smart energy management is one efficient way to reduce the energy use of residential buildings as well as the monthly bills. Students are encouraged to develop practical strategies and tools that could be installed at home to monitor and manage electricity use of different devices (such as air-conditioners, lighting, fans, etc) so as to reduce electricity waste. Simple calculations or experiments could be used to demonstrate the design performance. 智慧能源管理是減少住宅建築能源使用以及每月帳單的一種有效方法。鼓勵學生開發實用的策略和工具來監測和管理住宅建築中不同設備（如空調、照明、風扇等）的用電情況，減少電力浪費，並使用簡單的計算或實驗來驗證所開發的策略和工具的性能。
Biomedical Engineering 生物醫學工程	BME-C1	How to Protect Against UV Exposure? 探索有效防護紫	Understanding the science behind UV-induced damage and UV protection is important for overall health. This project provides a great opportunity for students to learn about chemistry, biology, and experimental design. The students will first learn the

學系		<p>外線的方法</p>	<p>principles of various UV protection methods. They will then conduct tests to compare the effectiveness of these measures. For instance, they will evaluate different sunscreens and measure their efficacy in protecting against UV radiation.</p> <p>理解紫外線引起的生物損傷及紫外線防護的科學原理對於我們的健康非常重要。這個項目將為學生提供學習化學、生物，和實驗設計的機會。學生們將首先了解各種紫外線防護方法的原理。其次，他們將對這些防護方式進行測試，比較這些方法的有效性。例如，他們可以評估不同防曬霜的效果，測量它們防護紫外線輻射的功效。</p>
	BME-C2	<p>Building a Small Portable Microscope</p> <p>搭建一台小型顯微鏡</p>	<p>Optical microscopy allows us to visualize features beyond the capability of our natural eyes. In this project, students will design and build a small, portable microscope. Using this microscope, students will demonstrate its performance by imaging structures of their interest. This project provides a fantastic opportunity for students to explore optics, engineering, and biology, involving hands-on building and understanding the principles of microscopy.</p> <p>光學顯微鏡使我們能夠看到超出自然視覺分辨力的微小結構。在這個項目中，學生將設計，並搭建一台小型、便攜式顯微鏡。在顯微鏡搭建成功後，學生們可以對他們感興趣的結構進行成像，來展示其性能。這個項目將為學生提供一個探索光學、工程學、和生物學的機會，讓他們可以通過實踐，更深入地理解顯微鏡原理及應用。</p>
	BME-C3	<p>Developing an Electronic Device for Blood Processing</p> <p>構建血液處理的</p>	<p>Students will learn the basics of a well-known programmable electronic platform called Arduino. They will be guided to build hardware connecting with Arduino for controlling flows of liquids with a small volume (<1 nano-liter). Students can then apply this liquid control system to implement some blood</p>

		電子設備	<p>processing operations, eg extracting white blood cells.</p> <p>學生將學習著名可編程電子平台 Arduino 的基礎知識，在導師指導下構建與 Arduino 連接的硬件，以控制液體 (<1 納升) 的流動，並利用這種液體控制系統來進行一些血液處理操作，例如提取白細胞。</p>
	BME-C4	<p>Developing Wristband for Heart Rate Monitoring</p> <p>組建心跳監控腕帶</p>	<p>Students will learn the basics of a well-known programmable electronic platform called Arduino. They will be guided to build a wristband connecting with Arduino for monitoring heartbeat. Student can also integrate the measurement to other effector such as lighting and sound for other creative projects.</p> <p>學生將學習著名可編程電子平台 Arduino 的基礎知識，在導師指導下構建與 Arduino 連接的腕帶以監控心跳。學生也可進一步結合量測結果與其他效果裝置例如光或聲音來進行創意專案。</p>
Computer Science 電腦科學系	CS-C1	<p>Prompt Engineering with Large Language Models (LLMs)</p> <p>大型語言模型提示工程(LLMs)</p>	<p>Students will be given tasks to customize chatbots for conversations in different scenarios (e.g., psychological consultation, customer service, surveying, translation). They will learn about the strengths and limitations of the most advanced large language models and how we could better leverage these models to provide support in daily life.</p> <p>學生們將被分配任務來定制聊天機器人，以便在不同的場景下進行對話(例如，心理諮詢、客戶服務、調查、翻譯)。他們將了解最先進的大型語言模型的優勢和局限性，以及我們如何更好地利用這些模型在日常生活中提供支持。</p>
	CS-C2	<p>Building a Digital Twin of Your School Campus</p> <p>建立你校園的數位分身</p>	<p>Students will explore 3D scanning techniques (photogrammetry or LiDAR) to scan their school campus (the environment with possible iconic objects). They will also explore 3D modeling tools to produce and revise the resulting 3D models that can be opened in a 3D model viewer showing its geometry</p>

			<p>and texture. The goal is to build a digital twin of the secondary school campus so that visitors can view it virtually as an extension from our CityU Metaverse.</p> <p>學生將探索 3D 掃描技術（攝影測量法或激光雷達），以掃描他們的校園（包括標誌性物體）。他們還將利用 3D 建模工具進行探索，生成並修改所得到的 3D 模型，並在 3D 模型查看器中打開，以顯示其幾何和紋理。此項目的目標是建立中學校園的數位孿生，讓訪客可以將其視為城大元宇宙的虛擬延伸。</p>
<p>Electrical Engineering</p> <p>電機工程學系</p>	EE-C1	<p>ROV Robotics</p> <p>水底機械人設計</p>	<p>Students will join CityU ROV Team as junior members to gain some insight into underwater robotic development. Contestants are required to make use of their engineering and technology knowledge to design and build a robot in accordance with the competition rules. More information on the contest can be found at: https://materovcompetition.org/</p> <p>參與學生將加入城大團隊，成為少年隊員，與高年級大學生一起開發水底機械人。參賽團隊必須運用自己的工程技術知識，按照比賽規則設計和製造機械人。有關比賽詳情，請瀏覽：https://materovcompetition.org/</p>
<p>Mechanical Engineering</p> <p>機械工程學系</p>	MNE-C1	<p>Sumo Robot</p> <p>相撲機器人</p>	<p>Sumo wrestling is the Japanese traditional competitive wrestling in which a wrestler attempts to force an opponent out of the ring or to make contact with the ground with any part of his body other than the soles of his feet (usually by throwing, shoving or pushing). The Sumo robot tries to mimic the Japanese traditional competition. Participants will use a Lego Mindstorms set to design, build and program a Sumo robot to push another Sumo robot out of the activity zone or flip the opponent over. Students will need to design a mobile robot with some basic mechanical principles to make it difficult for opponent to flip over or push out of the activity zone. Students also need to design a mechanical mechanism to flip over the opponent or push it out of</p>

			<p>the activity zone. In addition, students will learn how to use Scratch programming language to develop an intelligent sumo robot through the integration of sensors, actuators and software program.</p> <p>It is recommended to divide into two teams, and each team designs its own sumo robot. A competition could be organized at the end of the event to compare their performance.</p> <p>相撲是日本傳統的競技摔跤，摔跤手試圖將對手逼出擂台或用除腳底以外的身體任何部位與地面接觸（通常通過投擲、推或強推）。相撲機器人試圖模仿日本的傳統比賽。參與者將使用 Lego Mindstorms 套裝來設計、構建和編程相撲機器人，以將另一個相撲機器人推出活動區或翻轉對手。學生需要根據一些基本的機械原理設計一個移動機器人，使對手難以翻身或推出活動區。學生還需要設計一個機械裝置來翻轉對手或將其推出活動區。此外，學生還將學習如何使用 Scratch 編程語言通過集成傳感器、執行器和軟件程序來開發智能相撲機器人。</p> <p>建議分兩隊，每隊設計自己的相撲機器人。活動結束時可以組織一場比賽來比較他們的表現。</p>
<p>Materials Science and Engineering</p> <p>材料科學及工程學系</p>	MSE-C1	<p>Develop a New Waterproof Surface Treatment Methods for Shoes</p> <p>開發鞋材防水表面處理新方法</p>	<p>Students will research and develop new, cheap, and durable treatment methods to make shoes waterproof.</p> <p>學生將研究和開發新的、廉價的、耐用的處理方法來使鞋子防水。</p>
	MSE-C2	<p>Develop a Solar Energy-powered Electric Wheelchair</p>	<p>Students will develop a solar energy system for an electric wheelchair.</p> <p>學生將為電動輪椅開發太陽能系統。</p>

		開發太陽能電動輪椅	
	MSE-C3	<p>Develop a New Material that is Stronger than Steel but Lighter than Aluminum</p> <p>開發一種比鋼更強但比鋁更輕的新材料</p>	<p>Students will research and develop new, lightweight, and durable materials better than current popular alloys.</p> <p>學生將研究和開發比目前流行合金更好的新型、輕質且耐用的材料。</p>
Systems Engineering 系統工程學系	SYE-C1	<p>Smart Transport and Logistics</p> <p>智能交通與物流</p>	<p>The emerging Internet of Things (IoT) technologies has enabled collection of transportation data, exchange of information, and implementation of traffic control actions via the internet or various vehicle-to-infrastructure (V2I) / vehicle-to-vehicle (V2V) communication networks. Students will design and develop various prototypes for intelligent traffic control framework that can fully incorporate the capability of the emerging IoT-based sensing, computing, and control technologies. Examples include intelligent traffic lights, autonomous vehicles, smart parking, inventory control and logistic systems.</p> <p>新興的物聯網 (IoT) 技術使我們可以通過互聯網或各種車輛對設施 (V2I) / 車輛對車輛 (V2V) 通信網絡收集 2 交通數據、交換信息和實施交通管制。學生將設計和開發新穎的智能交通和物流控制模型，充分結合這些新興物聯網的傳感功能、運算和控制技術。例子包括智能交通燈、自動駕駛汽車、智能泊車、庫存控制和物流系統。</p>
	SYE-C2	<p>Smart Poultry Farming</p> <p>智能家禽養殖</p>	<p>The occurrence of avian influenza has a significant impact on the poultry farming income of poultry farmers. It is estimated that an outbreak of avian influenza will cause an average decrease of 65% in poultry farming income of poultry farmers. With the design of smart poultry farming, we expect to control</p>

		<p>the spread of the virus within the farm, therefore, reducing the death of the poultry and saving the damage caused by the outbreak of the virus.</p> <p>禽流感的發生對養雞戶的養禽收入影響很大。據估計，禽流感的爆發將導致養禽養殖戶的養禽收入平均減少65%。通過智能家禽養殖的設計，我們能夠控制病毒在農場內的傳播，從而減少家禽的死亡，挽救病毒爆發造成的損失。</p>
SYE-C3	<p>Fault Diagnosis in Smart Manufacturing</p> <p>智能製造中的故障診斷</p>	<p>Fault Diagnosis is critical to ensure safety in operations during smart manufacturing processes.</p> <p>Leveraging the advanced sensing techniques with multiple transduction mechanisms, large amount of monitoring data can be obtained for machinery. By using these sensor data, students will first understand the physics of the sensor signals and then apply various machine learning algorithms to identify the fault status in using the machines as well as predict the remaining service life of the machinery.</p> <p>在智能製造過程中，故障診斷在確保操作安全中起到關鍵作用。</p> <p>利用先進的多模式傳感器技術，機械的大量監測數據可以採集到。利用這些數據，學生們將首先理解這些傳感器信號的物理意義。之後將應用不同的機器學習算法去診斷機械故障同時預測機械的剩餘使用壽命。</p>
SYE-C4	<p>Classifier for License Plate Detection</p> <p>自動車牌檢測分類器設計</p>	<p>Students will collaborate to learn the Python programming language and machine learning models, specifically focusing on image classification. They will apply their logical thinking and creativity to design and implement a classifier. The primary task will be to identify digits in noisy images for real-world applications such as automatic license plate detection.</p> <p>學生們將合作學習 Python 編程語言和用於圖像分類的</p>

		<p>機器學習模型。他們將運用邏輯思維和創造力來設計和編寫分類器，以從雜訊圖像中識別數字，用於自動車牌檢測等實際應用。</p>
SYE-C5	<p>Building a 3D Prototype and Hologram of Smart City</p> <p>構建智慧城市 3D 模型和全息影像</p>	<p>A smart city employs various electrical devices and sensors to gather and use data efficiently. Students will design and build a 3D smart city prototype in computer software and demonstrate the prototype using a home-made 3D pyramid hologram system. Example includes design a new transportation system that links multiple city facilities using self-driving vehicles, etc.</p> <p>智慧城市採用各種電氣設備和傳感器來有效地收集和使用數據。學生將使用計算機軟件設計和構建 3D 智慧城市模型，並使用自製的 3D 金字塔全息系統演示該模型。示例包括設計一個使用自動駕駛車輛連接多個城市設施的新交通系統等。</p>
SYE-C6	<p>DSG Forecast Model</p> <p>分散式光伏預測</p>	<p>How to effectively predict the distribution of photovoltaic power generation is a key factor in helping integrate distributed photovoltaic solar energy into the grid. There are already over 200 historical data points for distributed photovoltaic power generation, with more than 140 locations used as the training set and over 60 locations used as the validation set. By constructing a data learning model, the best prediction results can be achieved.</p> <p>如何有效的預測分散式光伏發電是幫助分散式光伏太陽能併網的關鍵因素，已有 200 多個分散式光伏發電的歷史數據，其中 140 多個地點作為訓練集，60 多個地點作為驗證集， 建構數據學習模型，取得最好的預測結果</p>
SYE-C7	<p>Sustainable Water Management Solutions for Semiconductor</p>	<p>Semiconductor manufacturing is a water-intensive industry, and efficient water management is vital for reducing environmental impact and ensuring a sustainable future. In this project, students will investigate water-related challenges in</p>

		<p>Manufacturing</p> <p>半導體工業的可持續水管理解決方案</p>	<p>semiconductor manufacturing and develop innovative solutions to address them. This project aims to engage students in exploring sustainable water management solutions specifically tailored to the semiconductor manufacturing industry, where water plays a crucial role in various processes.</p> <p>半導體製造是一個水資源密集型行業，有效的水管理對於減少環境影響和確保可持續的未來至關重要。在該項目中，學生將研究半導體製造中與水相關的挑戰，並開發創新的解決方案來解決這些問題。該項目旨在讓學生探索專為半導體製造行業量身定制的可持續水管理解決方案，水在半導體製造行業的各種流程中發揮著至關重要的作用。</p>
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