Appendix
附件

The HKIE Enginpreneurs Award 2021 (for HKIE members)

Awardee Ir LEE Ka Kin, Mr OR Chun Yin
李嘉健工程師、柯俊賢先生

Project Building a Virus-Free Society -- C-Polar Technology
C-POLAR 生物駐極體

C-POLAR bioelectret is claimed to have the ability arrest, inactivate and eliminate 99.9% of viruses and bacteria, including COVID-19 virus, from fast air flow, with short contact time (within 5 minutes) and low pressure drop. As such, C-POLAR is able to protect people, from viruses and bacteria, to a much greater degree than "meltblown" fabric. It is discovered that the combination of C-POLAR bioelectret and natural cellulose provides a better viral filtration. Further testing with recognisable virus test laboratories in EU and US has also verified the performance of C-POLAR.

The mechanism of C-POLAR is independent from external energy, chemical consumption, and toxicity to human cells, and is not harmful to human. With its cost competitiveness, easy deployment and scientific breakthrough, C-POLAR generated interests from various parties from both local and overseas.

C-POLAR 生物駐極體，聲稱能於快速氣流下，只需極低氣流阻力，即可在短時間內（5 分鐘內）攔截並殺滅 99.9%的細菌和病毒，包括新冠病毒，因此比熔噴布更能保護人類免受病毒及細菌感染。而 C-POLAR 生物駐極體和天然纖維素的組合可提供更佳的病毒過濾效果，其功效經過歐盟及美國病毒實驗室的測試。

C-POLAR 不需外部能源，亦無化學消耗，並且沒有毒性，對人體無害。憑藉成本優勢、易於使用和技術突破的特點，吸引本地及海外不同機構及企業對產品的興趣。

Appendix
附件

The HKIE Enginpreneurs Award -- Young Innovators

Awardees	Mr CHEUNG Ho Chi
得獎者	張皓智先生
Project	Micro-hydropower system by domestic sewage in buildings
項目	建築物中的小型家居污水發電系統

"Micro-hydropower system by domestic sewage in buildings" is an idea of using the potential energy of domestic sewage to generate electricity. As skyscrapers are everywhere in Hong Kong and according to the data in 2017-2018, Drainage Service Department dealt with 2,800,000 cubic meters of sewage every day. To utilise these wasted potential energies, engineers can collect domestic sewage from each floor and install micro-hydropower generators on the ground floor to generate power.

The system can be installed in any buildings with a drainage system with simple modification to the pipes near the ground floor. It is only a small change comparing with enhancing the whole existing drainage system. Although the residents have to share the cost of installing the micro-hydropower generators, the electricity generated from the domestic sewage can be used for internal consumption or for sale to electricity company to their power grid.

「建築物中的小型家居污水發電系統」是一個利用家居污水勢能發電的項目。香港人口稠密，高樓林立。於 2017 至 2018 年，渠務署每天處理 280 萬立方米的污水，當中蘊藏的勢能，因污水被直接送往污水處理廠而白白浪費。有鑑於此，工程師利用這特點，從大廈不同樓層收集家居污水，並在大廈底部安裝小型水力發電機將污水轉換為電能。

這個系統可安裝在任何有排水系統的建築物內，只需在大廈底層改造管道，無須改動整個排水系統，。雖然居民需要分擔安裝電力系統的成本，但同時亦可利用家居的污水流量提升發電量產生電力供居民使用或通過電網出售予電力公司。

Appendix
附件

The HKIE Innovation Award 2021
Category I – An Invention
香港工程師學會創意獎 2021
組別 I —發明

Awardee	Ir Chan Cheuk Ming
得獎者	陳卓銘工程師
Project	3D Printed Augmented Reality Copper Acupuncture Human Model (3D Acu-Man)
項目	3D 針灸銅人

Acupuncture is a great treasure. Traditionally, the prototype of the "copper acupuncture man" constructed under the order of Emperor Renzong in Sung Dynasty was used as a teaching model in acupuncture.

Now a thousand years later, the "3D Acu-Man" project has been designed by the project team of Hong Kong Museum of Medical Sciences Society. The Fused Filament Fabrication (FFF) technique of metal 3D printing has been optimised to significantly reduce the production cost of the innovative generation of the 6 feet tall "copper man". Besides, over 370 virtual acupuncture points are also precisely overlaid on the "acupuncture man" through Augmented Reality (AR) technologies.

The "3D Acu-Man" project is developed by Ir CHAN Cheuk Ming (Project Engineer), Dr YU Chau Leung (Project Chief Coordinator) and Dr Tong Ka Shun (Project Scientific Leader). The design and production was done in Hong Kong and patented. The "3D Acu-Man" is instituted in the Hong Kong Museum of Medical Sciences for the promotion to and education of the general public on traditional Chinese medicine and acupuncture. It is also used to train learners and practitioners for locating the acupuncture points and needling techniques.

針灸穴位是中國醫學的瑰寶，北宋宋仁宗下令鑄造「針灸銅人」作為教學模型。

一千年後的今天，香港醫學博物館的參賽團隊，自行研發改良版的熔融沉積成型立體打印技術，大大減低了研新鑄造六尺高「針灸銅人」的成本。此外，團隊亦將超過 370 個穴位及相關資料透過擴增實境技術(AR)更精準呈現在「3D 針灸銅人」之上。

這項目由陳卓銘工程師(項目工程師)、余秋良醫生(項目總籌)及唐嘉信博士(科技領導人)合作在香港設計及生產，並已獲批專利。項目於香港醫學博物館展覽以作公眾教育及中醫學生訓練之用。

Appendix
附件

The HKIE Innovation Award 2021
Category II – An Innovative Application of Engineering Theories
香港工程師學會創意獎 2021
組別 II—創新應用

Awardees 得獎者	Ir Dr Zou Xiaokang, Ir Cheung Chi Kin, Ir Chung Man Yee Barry and Ir Jong King Hei 鄒曉康工程師、張志健工程師、鍾萬宜工程師、楊景熙工程師
Project 項目	Together We Build to Fight the Virus Fast Track Design and Build of the World's First Hospital with All-MiC Negative Pressure 816 Beds in 4 Months – "The North Lantau Hospital Hong Kong Infection Control Centre" 同心抗疫——四個月內建成 816 張負壓隔離病床醫院 全球首家全 MiC 負壓隔離病房醫院—— 北大嶼山醫院香港感染控制中心

In August 2020, COVID-19 pandemic situation worsened in Hong Kong (HK). The Central Government of the People's Republic of China (PRC) fully supported HK to build "The North Lantau Hospital Hong Kong Infection Control Centre" (HKICC) near the Asia World Expo. It was designed and built within four months, with full compliance with HK building regulations and international healthcare standards, and providing 816 negative-pressure isolation beds.

The HKICC is the world's first hospital with all-MiC negative-pressure isolation wards, covering 44,000m²-construction floor area and having a total of 524 MiC units. By combining the Design for Manufacture and Assembly (DfMA) and Modular Integrated Construction (MiC) method with 7D-Building Information Modelling (BIM), and by applying the Digital Works Supervision System (DWSS), Virtual Reality (VR) and Augmented Reality (AR) in smart construction, the project team controlled installation tolerance, realised seamless design and construction, significantly reduced on-site procedures and expedited the whole design-build process.

The innovative technologies boost construction productivity and bring about 50% savings in construction time and manpower. The project has gone through design, construction to testing and commissioning within the targeted four months. Its outcome is a miraculous feat in the HK construction history. Its success in the fast track design-build sets a benchmark for future hospital buildings.

該工程項目為全球首個全 MiC 負壓隔離病房醫院，佔地 4.4 萬平米，共有 504 個 MiC 單元、816 張負壓隔離病床。

該項目採用各種創新技術，主要有 7D-BIM 與 MiC 結合、可供製造和裝配的設計（DfMA）、虛擬實境與擴增實境（VR 與 AR）、智慧建造系統等等，優化設計

Appendix
附件

與施工，結構設備安裝精準快捷，各環節無縫連接。從設計至建造完成，不足 4 個月時間。開創香港快速設計、建造醫院的先河，為未來醫院的建設樹立標杆。

鄒曉康博士、工程師和張志健工程師來自中建醫療產業發展有限公司，鍾萬宜工程師和楊景熙工程師來自中國建築工程(香港)有限公司，均為項目創科團隊主要成員。

Appendix
附件

The HKIE Innovation Award 2021 (Young Member Group)
Category I – An Invention
香港工程師學會創意獎(青年會員組) 2021
組別 I —發明

Awardees 得獎者 Mr Muhammad Saad Shahid Anwel and Mr Taha Abid

Project 項目 "SNAPP" – The Search and Rescue (SAR) robotic fish

Snapp is a fast swimming robotic fish that expands the capacity and accessibility of Search and Rescue (SAR) operations by redefining underwater mobility. SNAPP's fish-inspired morphology allows it to patrol waters for extended periods and is capable of fast swims (2.3 m/s) in complex underwater environments. SNAPP aims to eliminate drowning everywhere - pools, coastal areas, caves- by assisting SAR personnel. SNAPP is made entirely from accessible materials available in local hardware stores and it is currently the world's fastest robotic fish. The combination of "low-tech" and high performance allows SNAPP to be easily deployed for SAR missions and accessible to all.

Formerly known as the Vayu Project, BREED HKU was founded in 2019 to provide a collaborative environment between students and researchers to jointly create advanced bio-inspired robots. SNAPP is the culmination of their efforts and is currently housed by the Department of Mechanical Engineering with support from the Tam Wing Fan Innovation Wing, at The University of Hong Kong.

Appendix
附件

The HKIE Innovation Award 2021 (Young Member Group)
Category II – An Innovative Application of Engineering Theories

香港工程師學會創意獎 (青年會員組) 2021　組別 II—創新應用

Awardees	Ir Lai Ho Keung, Mr Wong Ham Kwan Anthony and Ir Li Kin Lung
得獎者	黎浩強工程師、王涵坤先生、李健龍工程師
Project	Fast-track Box Culvert Construction by Deep Cement Mixing Method
項目	應用深層水泥拌合法以加快建造箱形排水暗渠

Temporary retaining wall formed by deeply embedded pile walls and bracing struts are commonly adopted prior to the excavation for box culvert construction. The major disadvantages are that it requires (i) piles driven into a relatively stiff stratum to maintain sufficient stability; (ii) continuous dewatering to mitigate water seepage, which affects the subsequent construction; and (iii) closely spaced bracing / struts and king posts that become obstructions to the construction of box culvert.

Deep Cement Mixing (DCM) technique involves mechanical blending of marine deposit with cementitious materials to form a solidified soil mass with increased strength and stiffness. Tung Chung East reclamation project pioneers the application of DCM technique in the context of earth retaining system, which is revolutionary in Hong Kong and has successfully built an innovated DCM retaining wall for the construction of a 16m wide 4-cell box culvert. This design has a number of decisive advantages over conventional retaining walls, including: (i) superior stability and deformation control; (ii) elimination of closely spaced steel lateral props; and (iii) significant low permeability of solidified soil due to DCM technique achieving a phenomenal waterproofing retaining wall. In addition, the DCM retaining wall also substantially simplifies the subsequent box culvert construction process, resulting in savings in construction time and cost. More remarkable still, it greatly enhances the site safety by eliminating high risk operations, such as lifting of steel struts.

過往在挖掘深坑建造箱形排水暗渠前，通常需要安裝深嵌樁柱牆和支撐結構以作臨時擋土牆。這方法的缺點是 (i) 深嵌樁柱牆需要深入堅固土層以維持穩定性；(ii) 需要持續抽水以減少滲水對施工時的影響； (iii) 緊密排列的支撐結構會阻礙箱形排水暗渠的施工。

深層水泥拌合法技術利用機械攪拌器將鬆軟的海泥與水泥漿混合，增加強度和剛度。東涌東填海工程首次將此技術應用於擋土牆設計，並成功建造創新的深層水泥拌合法擋土牆，以建造寬 16 米的 4 孔式箱形排水暗渠。與傳統擋土牆相比，此設計的各項優勢包括：(i) 更堅固穩定及較少變形； (ii) 毋需安裝排列緊密的鋼支撐結構；和 (iii) 由於深層水泥拌合法顯著地減低泥土滲透性，因此提高擋土牆的防水作用。此外，深層水泥拌合法擋土牆亦大大簡化了其後箱形排水暗渠建造工序，不但節省了施工時間和成本，而且省卻了例如吊運安裝鋼支撐結構等高風險操作，大大提高工地施工安全。