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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
項目	Acu-Man) 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。

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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 萬平方米，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

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計與施工，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。

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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 Mr Muhammad Saad Shahid Anwel and Mr Taha Abid

得獎者

Project “SNAPP” – The Search and Rescue (SAR) robotic fish

項目

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.

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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，此設計的各项優勢包括：(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

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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。