

Date: 09<sup>th</sup> Nov 2022

via Zoom online

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# HKABAEIMA Training Centre Season 8

Theme:  
Innovations in openBIM  
and openGIS

Class 52

Part 1  
Assessing vibrancy of  
a district by GIS and AI

Part 2

Robotic Monitoring and Simulation Based on OpenBIM and Digital Twin



Schedule	Speaker/Moderator
17:45 - 18:00	Reception
18:00 - 18:05	Moderator - Yvonne CHEU
18:05 - 18:15	Welcome Address - Ada Fung
18:15 - 18:45	Assessing vibrancy of a district by GIS and AI - Issac Ng
18:45 - 19:15	Robotic Monitoring and Simulation Based on OpenBIM and Digital Twin - Henry Song & Joey Chen
19:15 - 19:30	Q&A

**Part 1:** Urban vibrancy may be leveraged to attract capital and talent, increase competitiveness and innovation. However, excessive urban vibrancy is not a healthy phenomenon when the urban capacity is no longer to be capable of keeping up with demand, resulting in urban problems such as overcrowding. Given such, the optimal position for urban vibrancy is for it to remain in a state of equilibrium.

In the era of technology, the data-driven methodology has been recognized as the bridge between the concepts of urban analytics and urban planning practice. Theoretically, the "Vibrancy" examination can use state-of-the-art machine learning techniques and the concept of urban data science to evaluate the socio-economic status of a region and GIS enables incorporation of digital maps to analyze and visualize spatial stories for optimizing vibrancy level.

**Part 2:** Faced with the incoming age of artificial intelligence (AI), more and more robotic applications have been introduced in the AEC/FM industry. This research presents an integrated framework of the monitoring and simulation of construction robots through openBIM and digital twin approaches. The proposed framework consists of an IFC-based map generation, a digital-twin-based visual monitoring, and a robot-specific kinodynamic simulation. In the map generation module, IFC information integration is performed first to handle complex geometry in indoor conditions and the robot's characteristics. For monitoring, a novel object detection technique is proposed based on deep learning techniques and digital twin representations. Finally, this study designs an advanced motion planning algorithm, where physical properties are customized based on the robot information defined in IFC. The proposed framework is validated in two representative construction-related scenarios: (1) an office building with furniture elements, and (2) a plant room with MEP components. The robot prototypes are customized based on existing wheeled robots and drones. Based on the validation scenarios, it can be concluded that the proposed study provides an effective solution to smart construction robots and fulfills the gaps of BIM-to-robot data transformation, object-oriented monitoring, and kinodynamic motion planning.

## Speakers' Biography

**Mr. Issac Ng**, a member of HKGISA, works as a Research Officer on GIS-related projects at the Science Unit of Lingnan University. Mr. Ng is one the winner of Esri Young Scholar Award 2022. Prior to earning a master's degree in Urban Analytics from the University of Hong Kong, Mr. Ng got a bachelor's degree from the Hong Kong Polytechnic University with a major in Environmental Engineering and a minor in Social Policy and Administration. Mr. Ng is passionate in using urban data analytics in urban planning and managing the smart city's sustainable growth.

**Mr. Changhao Henry SONG** is currently a PhD candidate in civil engineering at HKUST. He completed his undergraduate study in civil engineering at HKUST, and then continued as a research postgraduate student majoring in smart construction. His research focuses include BIM and construction robots. Henry has abundant experience on research projects regarding openBIM-based robot applications, such as autonomous drones for mobile laser scanning, digital twin-based motion simulation, and robot localization with object recognition techniques. Email: csongae@connect.ust.hk

**Mr. Zhengyi Joey CHEN** is a Ph.D. student in the Department of Civil and Environmental Engineering at the Hong Kong University of Science and Technology. He received his Bachelor's degree (2017) and Master degree (2020) from Southeast University. His research interests include building information modeling (BIM), robotic path planning, and intelligent sensor placement. He has received the Merit Award in the Hong Kong openBIM/openGIS Award 2022. Email: zchenfq@connect.ust.hk

Note:

1. Participation at this training class is free of charge, but registration is required. The registration will close at 3pm on the day.
2. Upon the completion of this class, a 1.5 hour CPD will be offered at the cost of HK\$ 50 (as a handling charge).
3. The class will be conducted in English.