

The Open University of Hong Kong
The International Conference on Intelligent and Green Building Technology
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Good evening Chairman, distinguished guests, ladies and gentlemen.

Opening

It's my great pleasure to open the Intelligent and Green Building Technology International Conference in a hybrid mode. Despite numerous hurdles imposed by the pandemic, exchange of knowledge never ceases, thanks to the advancement in technology.

Today, we have many bright minds here from all around the world. Tomorrow, there is also a global event, the Tokyo Olympics, which gathers elites from the five continents.

Just like the 5 Rings of the Olympics, the development of intelligent and green buildings is driven by "five interlocking rings"!

You could probably guess the first four elements from the topics of this conference, namely, materials, smart sensing, internet of things and building informatics. For the fifth element, which I regard as the most important one, neither the Olympics nor this conference could have materialised without it. Let me hold on to it at the moment, and I will reveal this last puzzle at the end of my speech.

Advances in Material Applications

With the countdown to the Olympic Games begun earlier, most of us are excited about the much-anticipated sports games. Nonetheless, the highlight of the Tokyo Olympics 2020 extends to the innovative initiatives for a sustainable environment.

Following a nationwide campaign, the Tokyo 2020 Olympic medals are made of precious recycled metals collected from 79,000 tons of mobile phones and other electronic devices donated by the public. The Olympic podium are made of plastic, such as shampoo bottles

donated by the public and recovered from the oceans. Even the uniform of staff and volunteer consists of sustainable materials like recycled polyester and plastic bottles. While the Tokyo Olympic is going green with recycled materials, we can make our building more eco-friendly with new materials.

The first Ring – Material Advancement is indispensable to intelligent and green building development.

Take an example, and that may be beyond our imagination, how about cooling our homes without using energy nor the global warming refrigerant. This year, the City University of Hong Kong invented "An Energy-Free, Low-Cost and High Cooling Performance Passive Radiative Cooling Technology for Building Applications", which provides a sustainable and energy-saving solution to the electricity consumption in buildings. The research team led by Dr Edwin Tso developed a passive radiative cooling paint that uses the universe as a cooling source. It is an energy-free and refrigerant-free cooling technology that reflects incoming solar irradiance while emitting thermal radiation to the cold universe and achieving sub-ambient cooling. By applying this cooling technology on a building rooftop, it is said that there could be about 10% saving in cooling energy compared with traditional air-conditioning system. The invention won the Gold Medal with Congratulations in the Inventions Geneva 2021, which is one of the biggest global events showcasing innovations and inventions from around the world. It also exemplifies Hong Kong's talents, strong innovation and R&D capabilities.

Smart Sensing

The second Ring is Smart Sensing. The fruitful result from the R&D allows extensive implementation in practice and greatly contributes to the development of intelligent buildings and smart cities.

Taking an example from one of the most highly patronaged public transit systems in the world, the Yamanote Line in Tokyo, sensors attached to trains collect operational data, which is then analysed to identify weak points, predict equipment failures, and pinpoint precisely when and where maintenance is needed. The implementation of innovative technological solutions can make sure that the trains run safely and on schedule.

We in the Electrical and Mechanical Services Department in Hong Kong have applied similar techniques to our engineering assets. Since 2019, we have applied optical cum electrical sensing networks for different E&M assets, including lifts, escalators and electrical supply systems. Optical Fibre Bragg Grating (FBG) possesses unique features including multiple parameter sensing, immunity to electromagnetic interference, corrosion resistance and multiplexing capability, making it an ideal candidate for real time monitoring of critical L&E components. Previously limited by the sensitivity, accuracy and reliability of sensors, real-time dynamics of our E&M assets cannot be captured in the past. Now, through our customised optical cum electrical sensing network, real-time data measurement, including 3-axis vibration, temperature, strain etc., can be collected effectively for predictive analytics. The system generates an alarm when there are abnormal operation, and our staff can promptly respond to the situation ahead of any occurrence of breakdown or incident.

The innovative sensing designs won two Gold Medals and one Silver Medal at the Inventions Geneva 2021.

Internet of Things (IoT)

The third Ring that I would like to introduce is – IoT - Internet of Things. This technology is capable of connecting thousands of sensors, allowing real-time data collection and analysis that will make buildings smarter in terms of efficiency and enhanced user experience.

The Tokyo Olympics deployed IoT sensors and 5G technology in the smart stadium. Spectators, though not many now, can download the stadium app to watch instant replays on their smartphones, estimate the waiting time in the toilet, order food to be delivered directly to their seats, find available parking spaces, etc. Things in distance are all connected and at our hand through IoT.

IoT is fundamental to develop Hong Kong as a smart city. We in the EMSD started to build a key infrastructure network to support smart city development since 2019 – that is, the 'Government Wide IoT Network', or GWIN in short. GWIN is designed to serve as a backbone to collect big data to better serve the public. It can support different types of IoT sensors, which are used for a wide spectrum of applications in the adoption of

innovation and technology inside the building. This network supports long range data transmission with low power IoT sensors, thereby reduces the cost, time and complexity of installing the sensors and establishment of the communication network, and improves the security of the system and data without the need of using a third-party network.

By establishing a cost-effective solution for real-time monitoring and data analysis, building performance can be enhanced. Taking advantage of IoT technology, data analytics and cloud computing, we enhance our operational continuity, agility, and connectivity.

Using GWIN and IoT sensors, we have launched the "Smart Toilet". It collects and analyses real-time data, including occupancy, sanitation level, consumable utilisation, user experiences, etc., for facility planning, consumables management, timely cleansing and maintenance services. The collected information such as toilet cubicle occupancy, queuing situation and indoor air quality are analysed and displayed real-time on tablet computers or mobile phones, notifying users of available washrooms nearby, their cleanliness as well as the estimated waiting time for diversion of users to toilets nearby.

Building informatics - BIM-AM, iBMS, RDCC, Semantic AI

With the latest inventions in materials, application of smart sensors and IoT technology advancement, an exponential amount of data from buildings can now be realised. A scientific approach for gathering, manipulating, storing, retrieving and classifying recorded data and transform it into valuable information to realise intelligent and green building is essential, and building informatics is the fourth ring for intelligent and green buildings.

I would like to share my humble experience of our E&M digitalisation journey. EMSD provides maintenance for E&M facilities and project management of building services systems to more than 8,000 government facilities. Crucial data of these facilities is now destined to be connected via the integrated Building Management System (iBMS) to the Regional Digital Control Centres.

For asset management, EMSD has been deploying the BIM-AM, which is our patented system for extended use of BIM in asset management. The BIM-AM platform connected

the digitized assets of a building with data infeed from on-site sensors in real-time. The integrated BIM-AM platform has proved effective in streamlining workflow, facilitating responsive incident handling and sustainable asset management.

To realise building informatics, our first RDCC (Regional Digital Control Centre) was established in 2020. It is used for AI remote real-time equipment monitoring, indicative alarm for fault responses, system diagnosis and energy management. The centre acts as a data hub to integrate various information from different systems including the BIM-AM system. The tool has brought significant benefits, including long-term cost savings and hence energy saving in the O&M building lifecycle.

An AI platform is designed to perform big data processing and analytics. One recent significant breakthrough is the application of Semantic AI technology in our AI engine.

Semantic AI is developed by EMSD together with the experts in the field. It is a brand-new approach of using knowledge graphic ontology for describing building components and the relationships between them. It represents buildings as directed labelled graphs using the RDF data model, describe the relationship between spaces, equipment, sensors, data and etc. and makes building and its systems become machine-readable.

Semantic AI has been deployed to perform building E&M facility performance analysis and prediction modelling in equipment performance trending, forecasting cooling demand and recommending optimised setting for energy saving. AI model developed for specific building can now be portable across buildings and redeployed in a regional and then city scales. It won another Gold Medal in the Inventions Geneva 2021.

Now, it's time to uncover the final Ring for an intelligent and green building.

It is the collaboration of people, which is of course the winning factor of our conference today. We have the opportunity to exchange global research ideas and experience in this occasion and further develop for local applications. The success will be contributing back to the international context, forming a ring of collaboration in knowledge and intelligence. These can only be achieved by the effort of all of us together. Intelligent and green building is not only a catchphrase but a mindset, a habit and a way of life. Users' participation is needed just as much as the effort invested by engineers and scientists.

Quoting from the Olympic Gold Winner and one of the Greatest Basketball Players of All Time, Michael Jordan. “Talent wins games, but teamwork and intelligence wins championships.”

We can build an intelligent and green building with the latest material, smartest sensors, largest IoT network and most advanced building informatics. But we need everyone of you to build an intelligent and green city.

Like the Olympics, today is a rare opportunity to gather all the best players in the fields from the globe to exchange brilliant ideas; and it is also a brilliant occasion for advertising.

Please allow me to give a placement marketing here. EMSD together with Guangdong Provincial Association for Science and Technology is now organising the “Global AI Challenge for Building E&M facilities”. A series of activities including an internal conference and AI competition around the awarded Semantic AI technology will be arranged from October 2021 to January 2022. The aim of the challenge is to encourage AI application and development on buildings which echo the conference topics today. I believe everyone here may find interest in it. More details will be announced within month and may I appeal to your support in advance.

Closing

Last but not least, I would like to thank the Open University Organising Committee for hosting this conference, as well as everyone taking part in this extraordinary event. I wish you the very best for a successful conference in the hours that follow and look forward to seeing more collaborated innovative ideas after the sharing by fellow speakers on intelligent and green buildings.

Thank you.