

# HKIE Control, Automation & Instrumentation Division 22/23 Summit

2 May 2023

## When CAIr meets CAI

**Ir Eric PANG, JP, Director, EMSD**

### *Greeting*

Ir Prof LAM, (President, HKMU), Ir Prof LOCK (Chairman, Organizing Committee), Ir Prof GE (Chairman, CAD), esteemed guests, ladies and gentlemen, good morning.

### *Introduction*

It is my great pleasure to share my thoughts today with our fellow Control and Automation Engineer, or CAIr in short.

Before I begin, I'd like to share a chat between a teen and a chatbot. ChatGPT has been a trending topic since its release, and the teen was concerned about whether he should start his first career with AI technology. So he asked the chatbot, 'How would my future be if I work for AI? Will AI take over my job?' The chatbot replied, 'I'm sorry, but I don't have the ability to predict the future or tell fortunes. My deep learning tells that the future is always uncertain and is subject to change based on the choices we made and the actions we have taken.' The chatbot went on to reassure him that AI will only learn to enhance the quality and efficiency, but can never replace human ingenuity and creativity.

The Summit today is a timely platform where CAIr – Control and Automation Engineers meet another C A I, that is “Collaboration, AI, and Innovation”. It also reinforces my belief that ingenuity and creativity is what our fellow engineers treasure and take pride in. Everyone here is the testimony to the AI's answer that AI could never take over anybody here. Let's explore the possibilities of this wonderful “C A I”, and how it can drive our society to advance.

## *Collaboration*

In the Chief Executive's 2022 Policy Address, the government sets out policy and directions to chart Hong Kong in moving full stream towards our vision of an international Innovation and Technology Centre in the GBA. In parallel, the government proactively sets out strategies and measures to strive for reducing carbon emission by 50% before 2035, and eventually achieve the goal of carbon neutrality before 2050.<sup>1</sup> To achieve these challenging targets, the collaborative effort from all stakeholders from the GBA, Mainland and overseas is needed. Building on EMSD's on-line I&T platform, the E&M InnoPortal, together with our strategic partnerships with eighteen universities and research institutions in Hong Kong and the GBA, we jointly support government departments in applying more I&T solutions and conduct field trials. Also many of these trials are related to improving building energy performance and building a smart city.

From Wikipedia, control engineering means applying control theory to design systems with desired behaviors in control environment. Sensors are networked to tell the real time performance. Signals from sensors are fed back to the system, and so drive the system towards the desired performance.<sup>2</sup> To achieve this, it requires the tapping of correct and updated signals from the right sensors for analysis by the right algorithm and ultimately to achieve the right outcomes. Most importantly, we need the right people to accomplish the task. Today, I have met you all here – the right people, for meeting the grand challenge of smart city and carbon neutrality collaboratively.

Nowadays, with over 60% of our carbon emissions attributable to generating electricity for buildings<sup>3</sup>, it is apparent that control engineering should play a pivotal role in our decarbonization journey through continuous enhancement of energy performance of buildings. Riding on the promulgation of the Retro-Commissioning (RCx) for improving energy efficiency of existing buildings, the EMSD has signed the second Memorandum of

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<sup>1</sup> The Chief Executive 2022's Policy Address - Striving towards Carbon Neutrality  
[<https://www.policyaddress.gov.hk/2022/en/p110.html>]

<sup>2</sup> Control Engineering - Wikipedia  
[https://en.wikipedia.org/wiki/Control\\_engineering](https://en.wikipedia.org/wiki/Control_engineering)

<sup>3</sup> The Chief Executive 2022's Policy Address - Striving towards Carbon Neutrality  
[<https://www.policyaddress.gov.hk/2022/en/p110.html>]

Cooperation<sup>4</sup> on building energy saving retrofit to extend the MoC on Retro-commissioning (RCx) to retrofiting of buildings.

Entering into the era of Web 3.0 and metaverse, our collaboration shall not be limited to the physical world – we must be ready to embrace and therefore extend our collaboration to the digital domain, and to imagine in the digitized world. To this end, EMSD has digitalized the collection of asset data and connect more than 400 major government buildings to the EMSD’s Regional Digital Control Centre (RDCC). With the RDCC, EMSD duty staff can have a quick grasp of the operating condition of our E&M assets and diagnose faults at an early stage for carrying out repairs. Apart from enabling remote real-time monitoring of the operating status of the assets, the E&M digitization also provides massive streams of data, which will open up new opportunities of collaboration for real-time and continuous optimization of energy use. And for these purposes, we need the second golden key to do so, and that is Artificial Intelligence (AI).

### *Artificial Intelligence (AI)*

The transformative impact of Artificial Intelligence on E&M operation and maintenance is just as enormous as that on our daily life. AI help engineers predict equipment breakdowns and defects, optimize energy usage, and improve overall efficiency. With machine learning algorithms, AI can identify subtle patterns and trends in massive data such as real-time system operation data and external weather conditions. AI has freed the mind of engineers from the confine of conventional rule-based approaches, and enabled us to explore boundless possibilities to achieve optimized control that can adapt to changing circumstances. The insights from AI can help one make informed decisions, leading to cost savings, increased productivity, and improved sustainability.

At EMSD, we aspire to be at the forefront of integrating AI technology into our E&M facilities for predictive maintenance and energy optimization. I am glad to say that our efforts have yielded some promising results, including the development of specific AI models for predictive maintenance and energy optimization for chiller plants in some pilot premises.

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[https://www.energysaving.gov.hk/en/building\\_energy\\_saving\\_retrofit/moc\\_in\\_gba\\_introduction.html](https://www.energysaving.gov.hk/en/building_energy_saving_retrofit/moc_in_gba_introduction.html)

Through these models, we have been able to predict equipment failure before it occurs, saving time and money on repairs and reducing unnecessary downtime, and more importantly, saving energy use.

Additionally, we have been working on the standardization of E&M operational data to enable cross platform training and development of AI models. This initiative will enable us to train AI models more effectively, allow portability of data across AI platforms, thereby leading to even more significant improvements in predictive maintenance and energy optimization. In particular, AI is also a great helping hand in on-going RCx to identify abnormal operating scenarios for the control engineer to refine his control strategies. My team will share with you later today the collaborative achievement with the trade and academia on our AI chiller plant energy optimization projects.

Apart from the AI applications in EMSD, we are also devoted to promoting AI to the trade and the community. In 2022, we co-organized the Global AI Challenge for Building E&M Facilities with the Guangdong Provincial Association for Science and Technology. The Global AI Challenge brought together the best and the brightest mind from around the world to create innovative solutions for building and managing E&M facilities. The subsequent launching of the E&M AI Lab has also provided a platform for collaboration and knowledge sharing. It allowed participants to learn from each other and develop new ideas. We believe that the E&M AI Lab is not only a data hub, but an AI hub and a platform connecting people and solutions working on AI.

The importance of staying ahead of the curve is particularly remarkable when it comes to AI technology. We are continuously exploring new ways to leverage AI and big data analytics to improve the efficiency of our facilities and reduce our carbon footprint. We are committed to driving innovation and sustainability in the E&M industry, and we look forward to collaborating with other organizations to achieve this goal.

### *Innovation*

Now that we have the collaborative efforts from experts and the ever-evolving AI technology, I would like to share with you the final key – innovation. At EMSD, we are privileged to

have undertaken a number of innovative projects that have transformed the way we worked and brought significant benefits to the community we serve.

In 2021, our engineers have launched a breakthrough innovative AI solution through the collaboration between EMSD and E&M trade participants in Hong Kong, which is, in fact, another “C A I” successful case in EMSD. The product, namely 'Digital Log-books for Lifts and Escalators', is the first-of-its-kind which leverages the combined power of blockchain, AI, and big data technology to create a secure Digital Log-book to upkeep the record and data related to the operation and maintenance of lift and escalators. By using the innovative system, both EMSD and trade participants do not only boost their security and confidence level on the accuracy of the asset and maintenance records, but also enable the close-to-real-time trend analysis on safety critical components or hardware. By monitoring the “health index” of lifts and escalators, the system provides real-time notification and dashboard visualization to the stakeholders of trade and related property management agents. It ensures the safety for the community while improving the overall efficiency and effectiveness of maintenance works.

Another example of EMSD's innovation and collaboration with MTRC and CityU is the implementation of a train-borne high-speed scanning system to detect and predict railway tunnel infrastructure defects using live train cars running at 80 km per hour. This 3D point cloud imaging analysis adopts advanced technologies such as LiDAR, AI Stereo Computer Vision, Dual-band Infrared Imaging, and 5G Edge Computing to detect concrete spalling and cracks, water seepage, and trackside equipment displacement inside railway tunnels. Using the new system, the accuracy of defect detection has already exceeded 70%, and the AI continues to learn and improve. Currently, the system has been installed in the Kwun Tong line for testing, and we are confident that it will prove to be a valuable addition to our railway safety inspection procedures.

I am proud to share the happiness with you that both examples that I have presented, that is the Digital Log-books and 3D Point Cloud imaging analysis projects, won a Silver and a Bronze Medal at the International Exhibition of Invention of Geneva 2023 in late April. In fact, these projects are just a few examples of the 22 medals (3 gold, 7 silver and 12 bronze) won by the EMSD in the Geneva Invention 2023. It demonstrates the success of our collaboration with partners, and our commitment in innovation and technology for improving

the services we provided. By pushing the boundaries of what is possible, we strive to achieve the impossible, and in the journey make a positive impact on the lives of the people we serve.

### *Summary*

When CAIr meets CAI, there is immense potential for technology to revolutionize the way we live and work. As CAI Engineers, we have a unique opportunity to drive this transformation and lead the way toward a brighter future with CAI, i.e. Collaboration, AI and Innovation.

In closing, I would like to express my sincere thanks to the HKIE CAI Division for hosting this meaningful Summit. Let us embrace this challenge with enthusiasm and determination, and continue to push the boundaries of what is possible. Finally, I wish the HKIE CAD Summit 2023 a great success with fruitful sharing of the speakers in the sessions ahead. Thank you very much.