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New Indoor Air-Ventilation Energy Monitoring System Developed by BSE-ME-CSO Collaboration Team

The Department of Building Services Engineering (BSE) of The Hong Kong Polytechnic University (PolyU) is pleased to announce that Ir Dr. Horace Mui Kwok Wai, Associate Head and Associate Professor of BSE, Dr. Wong Ling Tim, Associate Professor of BSE, and members from Department of Mechanical Engineering (ME) and Campus Sustainability Office (CSO), have developed an indoor air-ventilation energy monitoring system for improving indoor air quality (IAQ) while enhancing ventilation energy efficiency. In light of COVID-19 pandemic, they further developed a tracer gas system that can track virus transmission pathway within indoor environments. The new set-up enables effective and efficient identifications of higher-risk zones needed for quarantine and disinfection in case of an indoor outbreak. An online press conference was conducted successfully at PolyU on 2 September 2020.

Research team from BSE, ME and CSO

Basic mode

The IAQ module assesses the IAQ in a given space in real-time. Occupants can view the indoor air conditions through an Android app designed for smartphones or a webpage platform for computers. For easy understanding, an IAQ index representing the overall quality is adopted to enhance public engagement. For building operators, ventilation energy can be monitored using the IR ventilation energy monitoring module. Energy saving strategies can be formulated by balancing between occupant's comfort, IAQ and ventilation usage.

The entire system requires less resource investment and manpower as all measurement data are automatically collected and transferred to a cloud server for analysis. The simplicity and cost-effectiveness of the system allows implementation at different places like offices, schools or even homes. Users can use the app and scan the QR code attached to the IoT device to view the IAQ instantly and data in the past hour.

A year-long testing and trial period has been done in PolyU campus at 30 measuring points including open-plan office, private office, library and canteen. The team is currently seeking

to set up another 500 testing points in the coming year to carry out further studies on user's experience, IAQ and energy efficiency.

IAQ and IR ventilation energy monitoring module

Special mode

To tackle the COVID-19 pandemic, the team further developed a virus transmission tracing module with the given technology. By emitting tracer gas at a source point, the receivers placed at different locations can identify the spatial distribution of gas, therefore mimicking the transmission pathway and dispersion of virus within an indoor environment. With that, the authority can distinguish the high-risk zone for mitigation actions in case of an indoor outbreak. This technique can also help trace the source of air pollutants and identify the dispersion pattern in the event of gas leakage. In addition, air change rate (ACH) of a given space can be determined using tracer gas module, premise owners can therefore have knowledge whether the ventilation is adequate to remove harmful air pollutants and lower infection risks.

According to the team, compare to traditional sample-collecting and analyzing work, the newly developed tracer gas device is five to six times faster, meaning that results can be available within few hours. The tracer gas module will be employed in a COVID-19 research project collaborated between Department of Health Technology and Informatics (HTI) and BSE, which has received a funding of HK$1.5 million from the government's Health and Medical Research Fund (HMRF). The project aims at characterizing the distribution of aerosols released from drainage ventilating pipe of public housing buildings.

Airborne pathogen dispersion tracing module

Public responses

Positive responses were received from different parties and industries upon the successful press conference. The devices have been widely covered in media, including The Standard, Oriental Daily News, Ming Pao Daily News, Hong Kong Economic Times, Sing Tao Daily, Sky Post

and Ta Kung Pao. Online coverage includes RTHK, NowTV, Hong Kong Commercial Daily, HK01, OrangeNews and Bastille Post.

BSE would like to congratulate the success of the online press conference and provide our full support on the development of Indoor Air-Ventilation Energy Monitoring System, which has a significant positive impact on the society and University's image. In these days of difficulty, PolyU and BSE will stand strong and fight against the virus together. Our research efforts to help improve the situation are always crucial and highly valued. We look forward to seeing updates and contribution from the team and BSE in the near future.