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While constantly monitoring trolleys throughout the airport, the system is programmed to blur other visual content to ensure passenger privacy and security. Photo: CUHK

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## Trolley management being enhanced at airport with new system

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Hong Kong authorities are taking steps to improve the trolley management system at the city's international airport as part of efforts to provide better service to passengers.

A real-time trolley supply monitoring system has been deployed at the Hong Kong International Airport (HKIA), incorporating artificial intelligence techniques for video content analysis so that frontline staff can make proper and timely allocation of trolleys when passengers need them, particularly during daily peak hours.

The system was jointly developed by the Chinese University of Hong Kong's Department of Systems Engineering and Engineering Management, Hong Kong R&D Centre for Logistics and Supply Chain Management, and the Airport Authority, according to a press release from CUHK.

HKIA served over 70.5 million travelers in 2016 and currently handles over 1,100 flights a day. Around 13,000 baggage trolleys are distributed throughout the airport to cope with the enormous passenger flow.

As the airport is set to see robust passenger growth with several expansion projects underway, maintaining a steady supply and allocation of trolleys has become a challenge.

To come up with a better system, the CUHK team collaborated with HKIA in gauging baggage trolley usage at various trolley racks or pick-up points since 2014, taking advantage of machine learning techniques, image-based technologies and existing surveillance CCTV cameras.

The new system is accessible on iOS and Android platform for frontline service providers to monitor trolley availability at all pick-up points throughout the airport's four terminal buildings and ground transport centers.

A yellow alert will be sent when the number of trolleys drops below 50, and a red alert for empty racks and green alert for normal supply of more than 50.

In addition, the system is able to support data-oriented analysis and even big data analysis for a range of long term resource planning as it continuously collects operational data on trolley usage and replenishment.

The new system is also easy and cheap to install.

"By using machine learning techniques such as support vector machines and neural networks, we are able to use video data to build trolley detectors that can identify four different types of trolley and conduct the smart counting. Thanks to HKIA for providing the testing site and solid support, the detection rate of the system has increased from 87 percent to 92 percent," said Prof. Cheng Chun-hung, the project leader.

"Installing an extensive camera and CCTV network infrastructure normally incur cost from building, cabling and engineering works. But our team has devised a data network with edge processing capability to eliminate the need of high bandwidth video transfer while at the same time maintaining image quality and data quantity."

Chris AuYoung, general manager overseeing the "smart airport" initiative for the Airport Authority, said: "HKIA strives to develop into a smart airport through the application of intelligent data and automation technologies. This baggage trolley tracking system not only greatly reduces the need for manual checking of the trolleys, but also helps our service provider to replenish the trolleys at specific locations."

"Since trolley management is a common challenge for most of the airports in the world, there would be a good opportunity to export such a solution and HKIA would be a good showcase."

A total of 18 video cameras have been placed in baggage reclaim hall in Terminal 1 for monitoring trolley availability.

Keeping in mind the passenger privacy issue, the team has worked with HKIA to define the most appropriate video monitoring areas. The system will automatically blur visual contents other than the trolley racks.

All images are encrypted and require specific client applications to decrypt for viewing so as to minimize both the privacy and security concerns.

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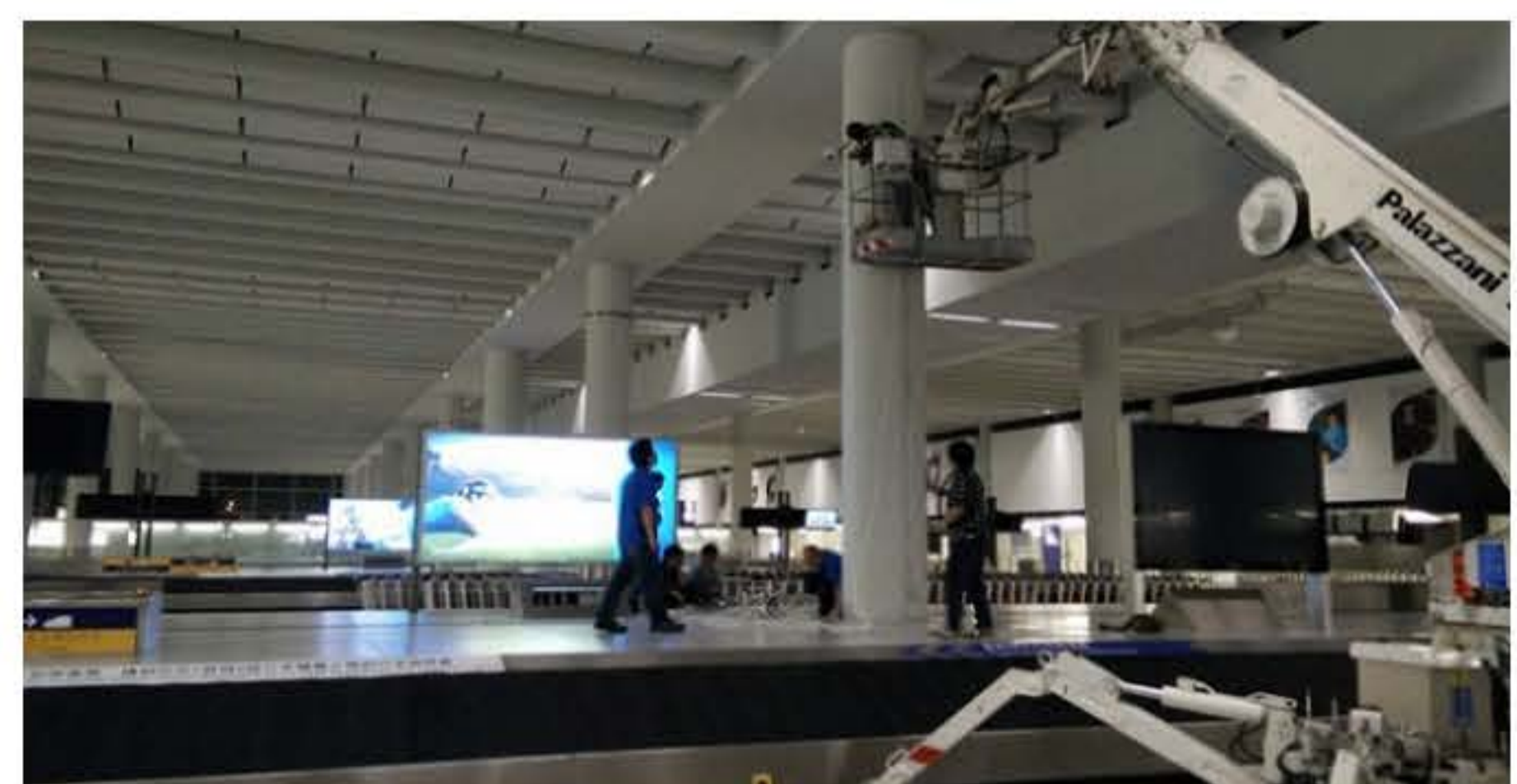
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CUHK's Cheng Chun-hung (1st left) and representatives from Airport Authority and cooperating partners brief the media on the system's trial operation at the Hong Kong airport. Photo: CUHK



Eighteen video cameras are installed in the baggage reclaim hall for monitoring trolley availability through machine learning techniques and image-based technologies. Photo: CUHK



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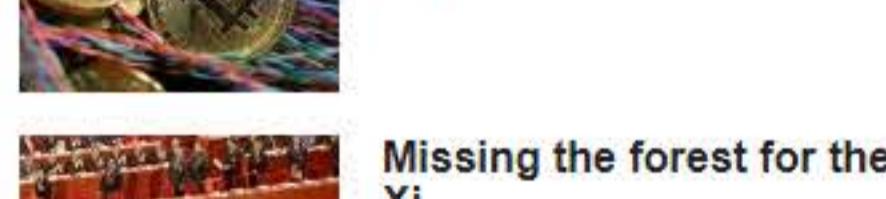
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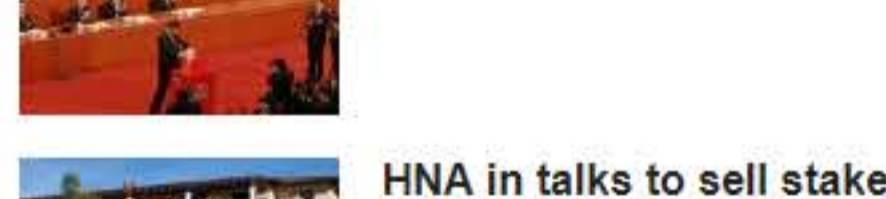
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