Harnessing technology in new ways

HDB has embarked on three innovations which could potentially reap improvements in time savings, site productivity and safety. The Straits Times takes a look at them.

ARTIFICIAL INTELLIGENCE (AI) SYSTEM TO REDUCE WORKSITE ACCIDENTS

Detection and analysis of potentially hazardous situations from real-time CCTV footage

• Able to automatically identify safety lapses and detect unsafe behaviours and conditions at HDB construction sites in real time.
• When lapses are detected, alerts will be immediately sent to the site safety supervisor's mobile phone via the Telegram app (right).

☐ Lifted load detected ☐ Worker detected
☐ Danger zone

High-risk situation:
Struck by falling object

1 DETECTED LIFTED LOAD
Load lifted by tower cranes are automatically detected.

2 DANGER ZONE
The area directly under the lifted load (i.e. fall path) will be highlighted as a high-risk zone.

3 WORKER DETECTED UNDER LOAD
The AI system will immediately send an alert to the supervisor and he will tell the worker to leave the area.
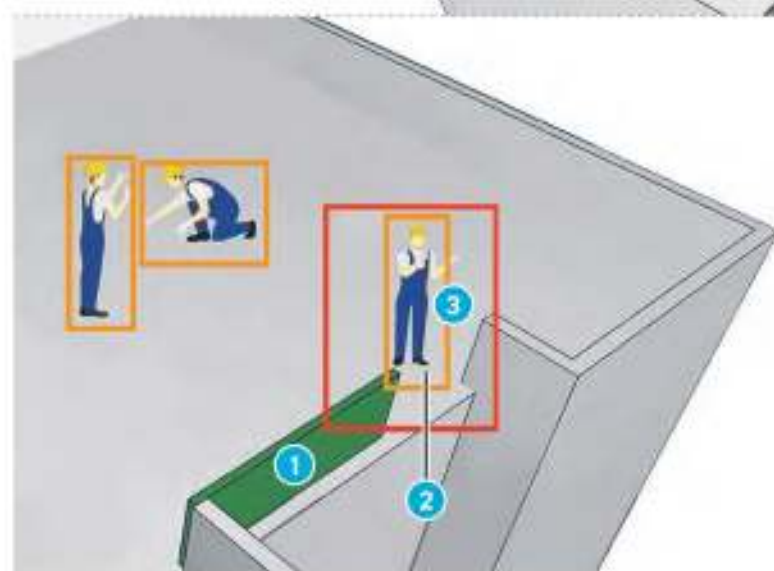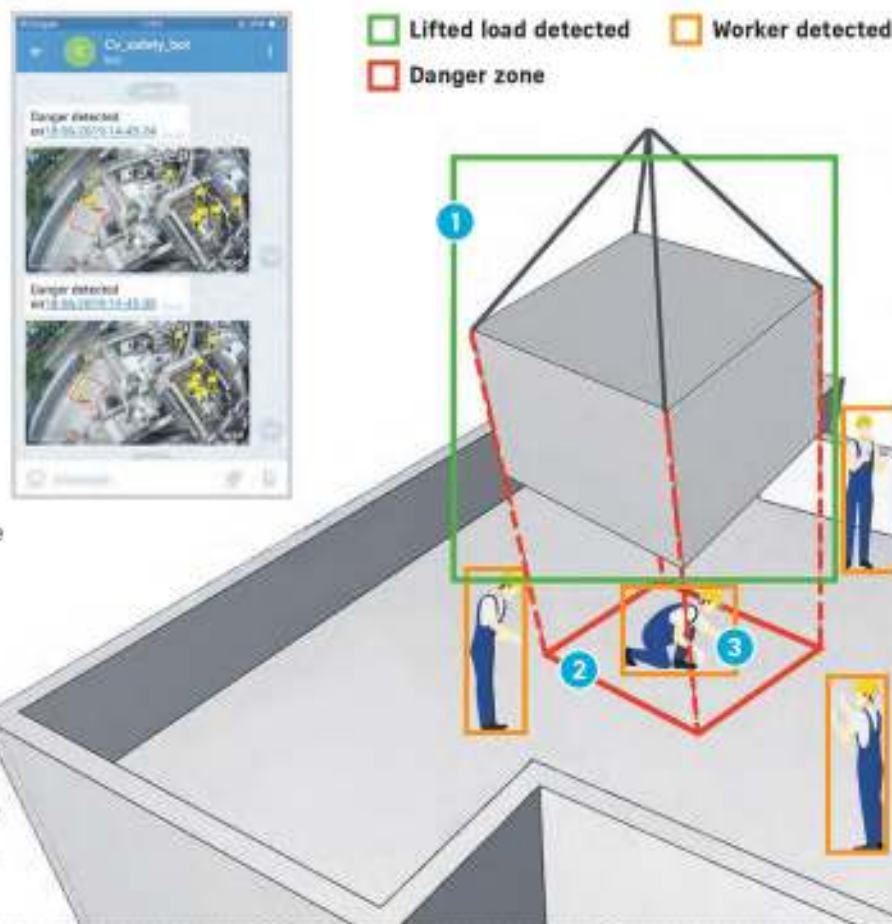
High-risk situation: Fall from height

1 BARRICADE AT BUILDING EDGES
Open sides of a building will be barricaded to prevent workers from falling over.

2 BARRICADE REMOVAL DETECTED
Barricades at open edges are removed if work needs to be carried out in that area. Removal of barricades is automatically detected by the AI system, which identifies the area as a high-risk zone.

3 WORKER AT OPEN EDGES
Any worker who comes within 1m of a non-barricaded building edge will be highlighted so that safety supervisors can ensure that he has observed the proper safety procedures before commencing work close to the edge.

DRONES FOR BUILDING FACADE INSPECTION

• Future drone inspection system taps a cloud software platform to conduct a visual scan of building facades captured during inspection.
• Leveraging AI, it processes photos and identifies building defects in the cloud. It can detect and categorise the types of defects, and tag them to a visual of the building, including the exact location of the defect.
• The platform would then deliver a report to highlight the severity of the defects detected and recommend possible remedies.

3D CONCRETE PRINTING

The printer is capable of printing components up to 9m long, 3.5m wide and 3.8m tall. The complete cycle for HDB's first 3D printed room, including the insertion of reinforcement bars, took about six days to complete.

1 3D concrete printing material is prepared by mixing a customised cement blend with water.

2 Design plans for a concrete component are uploaded into the 3D printer control panel to control the print path of the nozzle.

3 Like squeezing toothpaste out of a tube, the concrete component is additively manufactured – one layer after another.

Source: HDB   PHOTOS: HDB, NUS, LIM KAILI   STRAITS TIMES GRAPHICS: LIM KAILI

HDB to try out automated alert system for worksite safety

Surveillance system that detects high-risk situations and sends alerts to be trialled at BTO sites

Lim Min Zhang

To improve worker safety and reduce the need for manual labour, the Housing Board (HDB) will try out a surveillance system that automatically detects high-risk situations at construction sites and sends alerts to the person in charge.

HDB will try out the system at several Build-To-Order (BTO) worksites, including the first trial at Clementi Peaks which will start later this month. The trials are expected to be completed by the last quarter of next year.

The project, in collaboration with the National University of Singapore's School of Design and Environment with support from AI Singapore, is among the technological innovations HDB is working on to improve productivity and safety.

It shared details with the media in a briefing last Thursday.

There are two scenarios being tested by the system, which uses video analytics and artificial intelligence (AI).

One, when workers are within a metre of a non-barricaded building edge with a fall height of more than 2m; and another, when they are directly under the fall path of heavy loads lifted by tower cranes.

When such situations arise and are caught by closed-circuit television cameras, alerts will be sent to the safety supervisor's mobile phone via the Telegram app, allowing him to take action if there are lapses.

Such a surveillance system, to complement manual inspections, would enable round-the-clock supervision, and reduce human errors that occur due to fatigue, said HDB.

If the trial is successful, the tool could be used to enhance worksite safety in other areas, such as when workers are in the way of vehicles.

The workplace fatal injury rate for the construction sector rose to 3.1 per 100,000 employed persons last year, with 14 fatalities – two more than in 2017.

There were more than 20 deaths per year from 2014 to 2016.

The sector is among the highest contributor to major injuries in the workplace, with 124 cases last year.

Among the most common incidents leading to such injuries are falls from height and being struck by falling objects.

HDB is also looking into using drones with its partner H3Zoom.ai to inspect building facades, to improve worker safety and reduce dependence on manual labour.

Typically, workers in suspended gondolas inspect buildings. It may take several days to inspect one block manually.

In a pilot trial conducted in Yuhua and Sembawang from July to October last year, the drone inspections took at most a day to complete.

The drone inspection system taps a cloud software platform to visually scan building facades captured during inspection.

Using AI, the system can process thousands of photos to identify building defects and categorise them. The platform then delivers a report to highlight the severity of the defects and recommend possible remedies.

HDB said it will continue to refine the system to overcome limitations, such as when inspection involves entering building recesses and airwells which could interfere with Global Positioning System signals.

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14
Number of fatalities in construction last year, two more than in 2017.

124
Number of major injuries in the workplace in the construction sector last year.