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## Building cleaner and greener

Robotics and AI-driven systems are accelerating the roll-out of smarter, cleaner processes in the built environment

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Senior Correspondent

A robot which does the dirty job of cleaning out the tile grouting machine which takes over the back-breaking work of five labourers. And a laser-guided cleaning robot that eliminates the need for workers to be perched precariously at great heights.

These were some of the uses of artificial intelligence (AI) showcased at two of the top events for the building and construction industry.

Both International Built Environment Week (IBEW) and its sister trade show Built Environment Expo (BEX) Asia took place from Wednesday to Friday at Sands Expo & Convention Centre. Robots of every shape and size were rolled out, as well as smart indoor solutions designed to improve working conditions for construction workers and reduce wasteful energy consumption.

Sustainability, which has been a major concern of the industry in recent years, was addressed at both events.

IBEW launched in 2019 as a major Asia-Pacific event that draws local and global players to share knowledge as well as look at possible business ties.

Organised by IBCA International, a widely owned subsidiary of the Building and Construction Authority (BCA), it also features a summit of industry leaders and BEX Asia, now in its fifth year.

There were 560 booths at BEX Asia 2023, showcasing 250 brands from across 18 countries.

The exhibition showcased innovative market-ready solutions such as sustainable building materials and advanced technologies in air purification, digitalisation and smart building management.

The 2023 theme of "Intelligent Building in a Vertical World" is about rethinking assumptions and conventions to find new and better ways of solving problems.

This is especially relevant to the built environment sector, says Mr Ang Kim Seng, group director of BCA's Environmental Sustainability Group, Transformation in the industry has been key to the sector's progress.

He says, "We would like to consider quicker, alternative methods of building, instead of thinking of lowering the cost of materials".

BCA launched the Built Environment Industry Transformation Map at IBEW in 2022.

The authority worked with industry partners to transform the building life cycle by harnessing emerging technologies and innovations that drive collaboration.

"With strategic shifts in transformation and collaboration, the sector can also be incentivised to work together to pursue more ambitious sustainability standards in line with the Singapore Green Building Masterplan," Mr Ang says, referring to the latest masterplan which was launched in 2020. The first was launched in 2006.

Over the years, the built environment sector has helped save costs and played a major role in Singapore's sustainability efforts.

Since 2003, more than 70 commercial buildings have been Green Mark certified.

The Green Mark certification scheme refers to BCA's green building rating system, which is designed to evaluate a building's environmental impact and performance.

This represents \$800 million a year in energy savings and has helped the sector notch up a carbon-emissions reduction equivalent of having 80,000ha - slightly bigger than Singapore's land area of forest, or removing 30,000 non-electric cars from roads.

"An increasing number of buildings are now Super Low Energy or have pushed the boundaries to become 'Positive' energy buildings that produce more energy than they consume," says Mr Ang.

The biggest challenge to the sector's decarbonising, which refers to reducing or removing carbon dioxide output from the planet's atmosphere caused by human activities such as construction, transport and industrial processes.

Mr Lee Ang Seng, president of the Singapore Green Building Council, says that this can be done by thinking in terms of carbon in the built environment sector, retrofitting ageing buildings instead of tearing them down, and trying new building materials.

"Carbon emissions should become a central consideration at every stage of a building's life cycle, from design to construction to operation," says Mr Lee, adding that this awareness empowers organisations to develop their own unique carbon-reduction strategies and push for sustainable innovation.

However, he acknowledges that retrofitting existing buildings to improve energy efficiency and reduce carbon emissions is a long-term task, which poses many other challenges, such as many older buildings lack energy-efficient systems, making retrofitting an expensive and potentially disruptive undertaking.

"Decarbonising the built environment often implies upfront costs that can discourage investment, particularly among small businesses and property owners," he says.

To overcome these financial barriers, access to affordable financing, incentives and financial mechanisms that acknowledge long-term energy and cost savings is necessary.

Another key issue concerns construction materials such as cement and steel, which are carbon-intensive products.

Mr Lee says manufacturers in the building sector should establish collaborations with stakeholders such as architects, engineers, contractors and building owners to develop integrated and sustainable solutions.

Resilient buildings, how else can Singapore reach up decarbonisation by going next level?

Singapore Polytechnic (SP) may have the answer.

AI-BEW showcased the SP sustainability road map for the Jaha campus to achieve net-zero emissions by 2045.

SP is the first polytechnic in Singapore to develop a net-zero sustainability roadmap, which it is aiming to implement by 2045.

It has partnered leading professional services firm KPMG in Singapore (NSN) have designed a holistic cleaning robot that reduces the workload for human cleaners by 70 per cent.

The co-founders of Hivebees are chief executive Rishabh Patel, 26, a Singaporean, and chief operating officer Nguyen Tuan Dung, 25, a Vietnamese national.

The company, which was incorporated in July 2022, is a spin-off from an NUS deep-tech accelerator called the Graduate Research Innovation Programme, a 20th scheme that encourages graduate students and research staff to found and operate high-potential start-ups based on deep technologies.

The inspiration for the robot called Abba (Latin for "cleanse") came in 2021 when Mr Patel's friend, who owns a small cleaning company, said he could not find enough workers to fulfil his contract with firms.

Mr Patel learnt that his friend and his colleague had to clean toilets themselves when workers did not report for work. Cleaning jobs are one of the hardest to fill, in an MDM report in January, seven of 10 jobs with the most need for staff were operational roles such as cleaning, maintenance, janitorial, cleaners and table-service employees.

Blue-collar workers make up a fifth of Singapore's 3.5 million workforce, according to the Singapore Statistics.

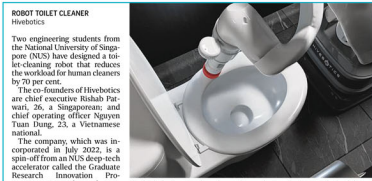
To understand the roles of a cleaner's job better, both founders rolled up their sleeves and cleaned several toilets in commercial properties.

friendly, offer better experiences for people inside them, and ensure safety and security.

In terms of sustainability, OpenBlue says it gathers data and applies AI that allows buildings to optimise energy consumption to reduce carbon emissions, save energy and work better.

GREEN ENERGY TECHNOLOGY (GET)

Green Energy Technology (GET), developed locally by SP Digital, integrates different building systems and data sources to make



Hivebees' toilet-cleaning robot assists cleaners toilet bowls, urinals, sinks and mirrors, as well as sanitising surfaces using a steam-cleaning system. PHOTO: HIVEBEES

enable Abba to work with minimal supervision. It will be able to connect to the Internet of Things for predictive maintenance as well.

In terms of technology, our core is the software intelligence to control and teach a robot arm to use different tools to perform complex tasks in a dynamic environment," adds Mr Patel.

Tuition cleaning is just the first step.

"Our plan is to continue developing the technology into a general-purpose AI platform that can be used to automate any task that requires human hands or having to perform dangerous tasks as well as welding for construction or building-facility cleaning," says Mr Patel.

Headed by former innovation in BiCap, which Signify says helps create healthier spaces by controlling the LED spectrum with cyan or blue light through the use of multiple lights.

This is when light is used to synchronise the internal body clock to bring the benefits of natural daylight indoors.

The light in the daytime helps with peak performance, but too much exposure from backlit electronic screens on televisions, computers, tablets and mobile phones may disrupt the body's sleep cycle.

For larger areas such as hospitals, airports and office buildings, Signify's Internet of Things (IoT) platform is a cost-efficient and connected lighting system that helps reduce energy wastage through a network of LED lights and high-tech, next-generation sensors.

For example, when it senses someone has left the room or that it is bright outside, it can switch off

managing sustainable utilities - such as electricity and water - in real-time, while also providing tools for local compliance.

Powered by EnergyTech, the Internet of Things and AI, GET enables building owners and facility managers to use energy more efficiently, make buildings better for people inside and advance sustainability efforts.

One Click LCA

A leading construction life-cycle assessment (LCA) and decarbonisation platform from Finland, One Click LCA is an easy-to-use, automated software that allows companies to calculate and reduce the environmental impact of buildings, infrastructure and renovation projects.

It provides consistent, standardised sustainability performance data across a company's global operations, while also providing tools for local compliance.

PLANRADAR

This is an Austrian cloud-based unified platform for documentation, task management and communication for construction and real-estate projects.

By improving collaboration and providing access to real-time data, PlanRadar's easy-to-use digital platform is said to help teams cut costs and work faster.

DATAMESH FACTORY

A high-tech innovator, China-based DataMesh, which also has offices in Seattle, Singapore and



FLOOR TILE GROUTING ROBOT Fabrica AI

Manual grouting of tiles - which involves a filler made with a mixture of cement, polymers and liquid latex - is not only bad for construction workers' backs, but also takes a toll on their knees.

But all that is about to change with a new robot designed by home-grown technology firm Fabrica AI.

It is said to do the work of five people, automatically grouting and cleaning the gaps at the press of a button. Operators need only refill the grout and water.

The company says its tile-grouting robot will give a boost to the construction industry, which is grappling with problems such as a long-standing labour crunch and high construction costs.

In its robot has been tested at more than 15 construction projects across Singapore, making up almost 40 per cent of the local construction market.

Founded in 2022 by Singaporean Kevin Wayne Teo, 26, with Czech national Jakub Sachatek, 24, and Ronald Lee, 26, the company is poised for bigger things to come.

The robot is part of a larger vision where leading and developing a robot for any task will take days, not years.

Mr Teo, who is chief operating and finance officer, says the founders believe, by building robots through reinforcement learning - a type of machine learning that involves rewarding good behaviour and boosting bad behaviour - the entire process from prototype to market-ready product can be accelerated.

They intend to achieve this by using a "simulation" system, which is hundreds of times faster than building physical prototypes.

This system can swiftly produce millions of hardware designs and then assess them using reinforcement learning. The approach allows the company to skip the initial stages of hardware design and development.

"We started Fabrica AI because we want to make robots transformatively cheaper and more autonomous," says Mr Teo.

The robot is able to map, navigate and grout over 90 per cent of a given floor space, leaving only the trickier corners and sides to be done manually. In the future, no prior training of the robot or uploading of floor plans will be required.

The box-shaped robot on wheels is also portable and designed to be easily scalable. It "sees" with a laser which scans and maps the shape of the room, while cameras help detect grout lines with the floor's computer vision and deep-learning algorithm.

Each robot is designed to do the work of five men, therefore freeing up labour for more hands-on, higher-value tasks for our construction workers," says Mr Teo.

He adds that the company is made up of strong believers of robotics design which is task-specific, rather than a general-purpose robot.

"Most people think that robots are about doing heavy lifting, but this is not necessarily the case," he says. "This is not necessarily a bulky robot arm to be completed using cheaper, smaller and more efficient robots, without a bulky robot arm."

He says Fabrica AI's grouting robot at bit.ly/H3MEAI and go to fabrica.ai for updates.

Fabrica AI's co-founder Kevin Teo with the company's life-grouting robot at BEX Asia. The robot is said to do the work of five people, grouting and cleaning tile gaps at the press of a button. ST PHOTO: NG SUI LAM

**NATURECONNECT LIGHTING** Signify Singapore

Signify's NatureConnect lighting system uses the company's most advanced Body technology, which mimics the natural patterns of daylight indoors to create healthy and engaging environments.

Signify, formerly known as Philips Lighting, was founded in the Netherlands in 1991 and has a 30-year history in Singapore. It has maintained a market presence since 1991, when it first opened as a Dutch trading firm.

Today, it has rolled out a range of ultra-efficient LED light sources and smart lighting systems that help both homes and commercial properties save on costly energy bills.

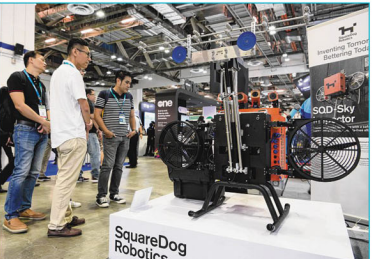
This comes as a pivotal time as the National Environmental Agency announced in March a slew of new lighting regulations that require lamps sold in Singapore to have a higher energy efficiency rating from April 1, 2024.

Both businesses and consumers will have to make this change. The new regulations will require lamps sold in Singapore to have a higher energy efficiency rating from April 1, 2024.

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SquareDog Robotics' Sky Wash robots are equipped with a "sixth sense" called RobuDetect, a proprietary intuitive software that allows workers to clean facades up to 200m high using a specialised cable robot-and-winch system. ST PHOTO: NG SUI LAM

**SAFER GONDOLAS FOR CLEANING** SquareDog Robotics

Hong Kong-based technology company SquareDog Robotics has rolled out a robotic cleaning system for the facades of skyscrapers which dispenses with the precarious gondola system and can be operated safely from a distance by a team of cleaners.

It says its Sky Wash is the safest in the world for high-rise cleaning works because no human cleaners are needed to scale the heights of skyscrapers.

This is possible thanks to SquareDog Robotics' proprietary core technology of enhanced AI software and industry-leading hardware, which has led to pioneering robotics solutions for a variety of facilities in 2022.

One of the main reasons for this invention is to help humans perform with greater precision and productivity, and in a safer environment," says Mr Antonio Cheung, the company's chief executive and a veteran entrepreneur with more than 30 years of experience in finance and technology.

SquareDog Robotics was founded in 2018 in Hong Kong by Mr C.H. Li, who has over 30 years of experience in 3D geometry algorithm and complex programming.

He previously led a team that created the world's first welding robot to be used on-site for construction with the RobuDetect technology.

SquareDog Robotics set up a Singapore office in April 2023, which serves as its headquarters for all markets outside Greater China.

Mr Cheung says the company rolled out Sky Wash along with Sky Inspector, a robot for high-rise building inspection, in Singapore in July.

With Sky Wash and Sky Inspector, construction industry workers are able to collaborate with their robot "colleagues" safely to complete tasks that can be life-threatening if done without leveraging technology.

Info: squaredogrobotics.com/index.php/en/

The Sky Wash robots are equipped with a "sixth sense" called RobuDetect, a proprietary intuitive software that allows workers to clean facades up to 200m high using a specialised cable robot-and-winch system.

Energy saving lighting such as the Internet system not only helps businesses unlock greater efficiencies in terms of reduced energy bills, but also makes other associated systems such as heating, ventilation and air-conditioning function more efficiently," says Mr Jeyaraj Kumar, country head and managing director at Signify Singapore.

"Simple switch from conventional to energy-efficient LED light will save up to 50 per cent in energy consumption and significantly reduce carbon emissions. If we take a step further and switch to connected LED lights, we can reduce lighting-related energy consumption by up to 80 per cent."

Info: Check out Signify's systems at signify.com

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