NTU researchers develop underground and coastal solutions to address urban land scarcity and rising sea levels

SINGAPORE: As the global population continues to grow, land and resource limitations are becoming increasingly urgent concerns, particularly in densely populated megacities. In response, researchers from Nanyang Technological University's (NTU) School of Civil and Environmental Engineering (CEE) are working on solutions that focus on utilising underground space and strengthening coastal protection measures.

Underground development presents a potential solution to urban land scarcity, offering new opportunities for social, economic, and environmental advancements. Coastal cities, meanwhile, face the growing threat of rising sea levels and erosion, making it essential to implement measures that protect shorelines and low-lying areas.

At NTU, the Centre for Urban Solutions (CUS) plays a key role in addressing these challenges. This multidisciplinary initiative focuses on integrating digital technologies, including artificial intelligence (AI), to improve urban planning and construction.

One of CUS's main areas of research is underground engineering. With land becoming increasingly scarce, cities are expanding upwards with high-rise buildings and downwards. This approach creates additional space while ensuring cities are prepared for future growth.

Assoc Prof Wu Wei, who leads the Underground Engineering Cluster at CUS, oversees teams developing digital solutions to improve the safety and efficiency of underground construction. "Digging up to 100 metres deep poses significant engineering challenges, such as managing costs and controlling surface settlement to prevent accidents like

the ground collapsing," he explains, referring to cases where sinkholes have formed during construction.

His team employs AI-driven methods to map underground structures more accurately. By using machine learning, they can detect anomalies such as hidden cavities or boulders, improving precision while reducing costs and minimising the need for human supervision.

Similarly, Asst Prof Shi Chao is applying digital technologies to underground and coastal engineering. His team uses digital twins—virtual models that simulate underground conditions—to optimise construction planning. These models enhance predictive analysis, reducing the reliance on physical site testing.

"We harness emerging AI technology to combine geological knowledge and site-specific data to automatically build and update digital twins," says Assistant Professor Shi. Accurate underground modelling…

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