THE STRAITS TIMES

NTU team harvests sunlight for underground spaces

'Smart' device could address future demand for round-the-clock lighting in underground buildings

Assistant Professor Yoo Seongwoo (left) from NTU's School of Electrical and Electronic Engineering and principal research fellow Charu Goel from NTU's Photonics Institute with their "smart" device that includes an acrylic ball, a single plastic optical fibre and computer chip-assisted motors. PHOTO: LIANHE ZAOBAO

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PUBLISHED 6 HOURS AGO

Researchers from Nanyang Technological University (NTU) have designed a "smart" device to harvest daylight and relay it to underground spaces.

The device was designed by Assistant Professor Yoo Seongwoo from the School of Electrical and Electronic Engineering and Dr Charu Goel, principal research fellow at NTU's Photonics Institute.

An acrylic ball, a single plastic optical fibre - a type of cable that carries a beam of light from one end to another - and computer chip-assisted motors were used to build the device, which weighs 10kg and has a total height of 50cm.

"Our innovation comprises commercially available off-the-shelf materials, making it potentially very easy to fabricate at scale," said Prof Yoo, at a media briefing and prototype demonstration event yesterday.

The prototype also comes with a 3mm transparent, polycarbonate dome-shaped cover to protect the device from environmental conditions such as dust and ultraviolet light.

The device works similar to how a magnifying glass is used to focus sunlight onto a single point.

The acrylic ball acts as the solar concentrator, enabling parallel rays of sunlight to form a sharp focus at its opposite side.

The plastic fibre cable then collects and relays harvested sunlight to underground spaces.

Meanwhile, the computer chip-assisted motors automatically adjust the position of the fibre's collecting end, to optimise the amount of sunlight that can be received and transported as the sun moves across the sky.

The current device developed by the researchers can relay an optimal output of sunlight up to two levels underground for optimal usage.

However, Dr Charu said the device is scalable and may be able to relay optimal output of sunlight up to 10 levels underground if glass fibres were used instead of plastic ones.

"Since the light-capturing capacity of the ball lens is proportional to its size, we can customise the device to a desired output optical power by replacing it with a bigger or smaller ball," she said.

As the Singapore authorities look into the feasibility of creating new infrastructure, storage and utility spaces underground, this smart device could address future demand for round-the-clock lighting in underground infrastructure.

Technolite, a Singapore-based design-focused agency specialising in lighting, is currently in the development stages of producing and incorporating the device for real-world use.

"While we have the commercial and application knowledge, NTU's in-depth know-how from a technical perspective has taken the execution of the project to the next level that is beyond our expectations," said Mr Michael Chia, managing director of Technolite.