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Members of the research team include (from left) PhD student Li Wenlong, President's Chair Professor in Materials Science and Engineering Chen Xiaodong, A*Star Professor Loh Xian Jun and PhD student Luo Yifei. PHOTO: NTU SINGAPORE

S'pore scientists use phone to 'communicate' with plant

Researchers attach Venus flytrap to robotic arm and signals plant via phone to grab a wire

Shabana Begum

Imagine the day when crops are able to tell you they are thirsty or when you can instruct a plant to delicately pick up an item.

Far-fetched? Scientists in Singapore have created a way for humans to "communicate" with plants, via a smartphone no less.

The team at Nanyang Technological University (NTU) did this by developing a small conductive material that allows electrical signals to enter and leave the plant.

Like the human brain that sends out electrical signals, plants also emit electrical signals to respond to their environment and show signs of distress or poor health. The scientists found that these signals can be harnessed to broaden the plants' abilities and functions.

For instance, it is now possible for a Venus flytrap – a carnivorous plant that naturally ensnares bugs – to grab hold of a thin piece of wire when a scientist sends electrical signals through the plant.

All the scientist needs is a smartphone and an electrode, which is the metallic conductive material.

In the experiment, the team pasted a 3mm-wide electrode onto one of the traps of the Venus flytrap using a soft and sticky adhesive known as thermogel, a glue that transforms from liquid to a flexible gel at room temperature.

The electrode is harmless to the plant and does not affect its ability to carry out photosynthesis.

Within 1.3 seconds of the smartphone sending electric pulses to the electrode, the Venus flytrap snapped shut.

The researchers also attached the Venus flytrap to a robotic arm and, powering the plant with the electrical signals, made it grab and pick up a thin wire half a millimetre thick. This achievement was published in scientific journal Nature Electronics in January.

In one experiment, the team pasted a 3mm-wide electrode onto one of the traps of the Venus flytrap. Within 1.3 seconds of the smartphone sending electric pulses to the electrode, the Venus flytrap snapped shut. PHOTO: NTU SINGAPORE

The research team said the findings could lead to the creation of plant-based technologies such as robot grippers that use plants to pick up fragile and delicate objects that may be damaged by existing grippers.

"The flytrap behaves like a robot, which can be controlled electrically by humans," said Ms Luo Yifei, a PhD student at NTU's School of Materials Science and Engineering.

But since a Venus flytrap takes 24 hours to reopen, it may be more practical to artificially build a robotic grip inspired by the plant, said President's Chair Professor in Materials Science and Engineering Chen Xiaodong, who is the study's lead author.

Moreover, the electrode can also be considered a "plant whisperer", which can sense if a plant is in distress when the plant emits abnormal electrical signals. This is particularly useful for farmers who need to be alerted if their crops are not growing well, said Prof Chen.

"By monitoring the plants' electrical signals, we may be able to detect possible distress signals and abnormalities. When used for agriculture purposes, farmers may find out when a disease is in progress, even before full-blown symptoms appear on the crops, such as yellowed leaves," added Prof Chen.

Since the thermogel can conform to the shape of plants, which tend to be hairy, waxy and textured, the electrode will not drop off when plants grow and move.

The NTU team worked with researchers at the Institute of Materials Research and Engineering, a unit of the Agency for Science, Technology and Research (A*Star), to enhance the adhesiveness of the electrode device.

To be an effective "plant whisperer", the electrode device must be properly and fully attached to leaves because plants' electrical signals are very weak. The scientists also managed to attach the electrode to a sunflower's hairy stem.

Beyond plant health, Prof Chen said it is possible to use plants as living sensors in factories and industrial areas. If there is a toxic chemical leak, the plants will sense trouble, and their signals may turn abnormal.

nshab@sph.com.sg