

# Technology Frontier

News Bite on PolyU's Innovation



## Smart Monitoring System for Urban Tree Management Monitoring tree stability and collecting data for tree management strategies

Trees enhance streetscape while improving air quality. They are indeed an indispensable asset of a city. To maintain healthy growth of urban trees, it is essential to provide proper care for them. Funded by The Hong Kong Jockey Club Charities Trust and in collaboration with The University of Hong Kong, The Hong Kong University of Science and Technology and The Friends of the Earth (Hong Kong), the Department of Land Surveying and Geo-informatics is developing a smart system that monitors the tilting angles of trees. Not only does it serve as an advanced notification system for potential leaning of trees, but it also helps us study the factors that affect tree stability. The system is adopted by the Jockey Club Smart City Tree Management Project, under which smart sensors will be installed on about 8,000 trees by 2021.



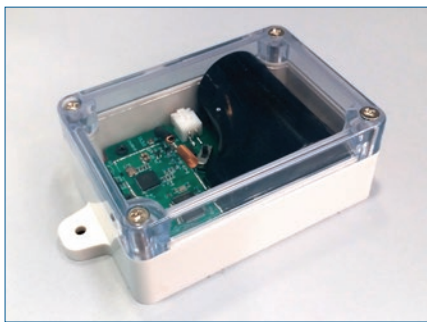
Dr Charles Wong

In September 2018, super typhoon Mangkhut wreaked havoc territory-wide and toppled tens of thousands of trees. More than 1,000 roads were blocked by the debris, paralyzing public transport. Experts warned of the potential danger of falling trees even after the hurricane has gone as the strong wind and heavy precipitation might have loosened their roots from the soil. The importance of urban tree management once again comes under the spotlight. Trees are an indispensable asset to a city – they enhance streetscape and air quality while cooling the sweltering heat in summer. To ensure that trees

are in good health and are growing properly, appropriate care and management are necessary. Dr Charles Wong, Associate Professor, Department of Land Surveying and Geo-informatics, collaborates with The University of Hong Kong, The Hong Kong University of Science and Technology, and The Friends of the Earth (Hong Kong) in developing a smart system to monitor the tilting angles of trees in the city, not only as an advanced notification system of potential tree leaning, but also as an in-depth study on the various factors that affect tree stability. The data collected over time will be of paramount importance to the



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Sensor developed by PolyU

formulation of strategies on urban tree management.

### Wireless sensors and Big Data analytics

The smart monitoring system for urban tree management uses wireless sensors which are attached to lower tree trunks. They are capable of detecting the tilting angle of each tree with a built-in accelerometer, similar to the gyroscope in your smartphone. Data is regularly and wirelessly sent to a cloud server for processing and analysis. When the tilting angle of a certain tree is beyond the tilt threshold, the system will notify the user of potential leaning. A certified arborist may then be required to perform an on-site inspection immediately to examine the conditions of the tree. But the system is not just about monitoring and early preservation to prevent potential tree falls. "With Big Data analytics, we collect all sorts of information associated with a tree's criteria of falling, such as aspect, topography, proximity to pedestrian and motor traffic, rainfall, speed and direction of the wind, etc. In the long run, when enough data is collected, our understanding on how each factor contributes to tree tilts or falls will be enhanced. Then we will be in a better position to advise which trees need more diligent care and monitoring than others. That would

also shed light on the formulation of strategies related to urban tree management," said Dr Wong.

### Smartphone app

The team is also developing an educational app alongside the smart monitoring system. Users will have access to the tilting status of certain trees being monitored and some samples demonstrating how the system works. "On top of that, the project team is also hosting a train-the-trainer programme to engage university and secondary school students, in a bid to arouse awareness of tree management on a community level. Lectures will be offered to around 100 university students who will be appointed as our ambassadors. They will then pass on the concepts of tree care and management to about 3,600 secondary school students," added Dr Wong.

### Pilot programme

The smart monitoring system is adopted by the Jockey Club Smart City Tree Management Project, a 3-year pilot scheme that started in February 2018. Sensors will be installed on about 8,000 trees by the end of the third year. "We would like to take this opportunity to express our most heartfelt gratitude to The Hong Kong Jockey Club Charities Trust for their generous support," said Dr Wong.