

Keeping trees standing tall

Singapore is growing leafier by the minute, with efforts to add another million trees to the island, on top of its already intense planting regime. Inspectors will branch out with high-tech tools to track tree health, after a year of tests. Ng Keng Gene explains.

TERRESTRIAL LIDAR SCANNER

Global Navigation Satellite System Receiver

1 MAPPING

- The exact location of the trees from as far away as 100m can be extracted from a Lidar scan.
- Lidar scanners use reflected lasers to determine how far away target objects are.
- A software called the Remote Tree Measurement System (RTMS) helps to determine the exact location of the tree, by using its distance relative to the terrestrial Lidar scanner's position.

Camera

2 CAPTURING



- A camera captures wide-angle images of the trees, which are stitched together, allowing arborists to perform a quick visual inspection by zooming in to specific trees on their devices.
- Trees that require in-depth physical inspection can be identified.

Lidar Scanner

3 MEASURING

- A tree's physical statistics, such as height and girth, can be automatically extracted from Lidar scans by the RTMS.
- Such information is uploaded to a centralised platform for arborists' easy access.



4 TESTING STRUCTURE

- A 3D model of individual trees is built using data extracted from Lidar scans.
- Arborists can simulate weather conditions or mitigation measures like wind load or pruning, to determine if a tree is able to withstand the forces of nature.
- Such simulations take into account the physical dimensions of the tree extracted from the RTMS, as well as wood strength and tree tilt.
- Arborists can also decide how much to prune a tree using this feature.



Wooden tripod

- Wood helps with shock-absorption and is less affected by temperature changes than other materials.

5 CHECKING HEALTH

- Using satellite and hyperspectral images, which capture colours beyond the spectrum visible to the human eye, a tree's health can be assessed based on its chlorophyll content and leaf area index.
- A lack of chlorophyll indicates that a tree might be under stress.



- A multi-spectral analysis of images, which measures the specific wavelengths of light reflected from a tree's leaves, is carried out.
- In the future, trees that are less green than they are expected to be can be highlighted for further assessment.

BY THE NUMBERS

7 million

The number of trees in Singapore now, with at least another million to be planted by 2030

Of these, NParks manages

6 million trees

including 2 million in urban areas like parks and gardens, and along roads

Urban trees are inspected once every

6 to 24 months

with higher frequency depending on the locality and size of trees

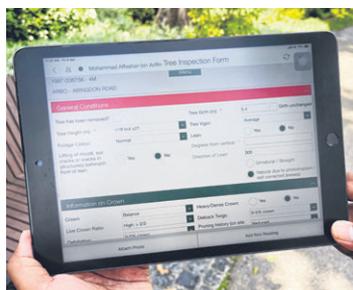
With the use of technology for inspection, yearly tree incidents have fallen from about 3,100 in 2001 to about 420 in 2019, and

340 last year

HOW DO ARBORISTS TELL THAT TREES ARE HEALTHY?

First-level visual inspections

- Arborists have to fill in a tree inspection form that has more than 80 data fields.
 - Signs or symptoms like leaf shedding and slanted trunks are looked out for.
 - About 15 mins per tree is needed.
- With the RTMS, less than half the time per tree is needed.
- The Lidar scans also provide a much richer dataset than what is visible to the human eye, thus increasing the productivity of inspections.



Second-level diagnostic inspections

- Should the first-level checks suggest that more checks are needed, second-level checks take place.
- As they are invasive, and may create doorways for bacteria and fungi, not all trees undergo diagnostic checks.
- Tools like a sonic tomograph, which measures the speed at which sound travels through the wood, are used.

