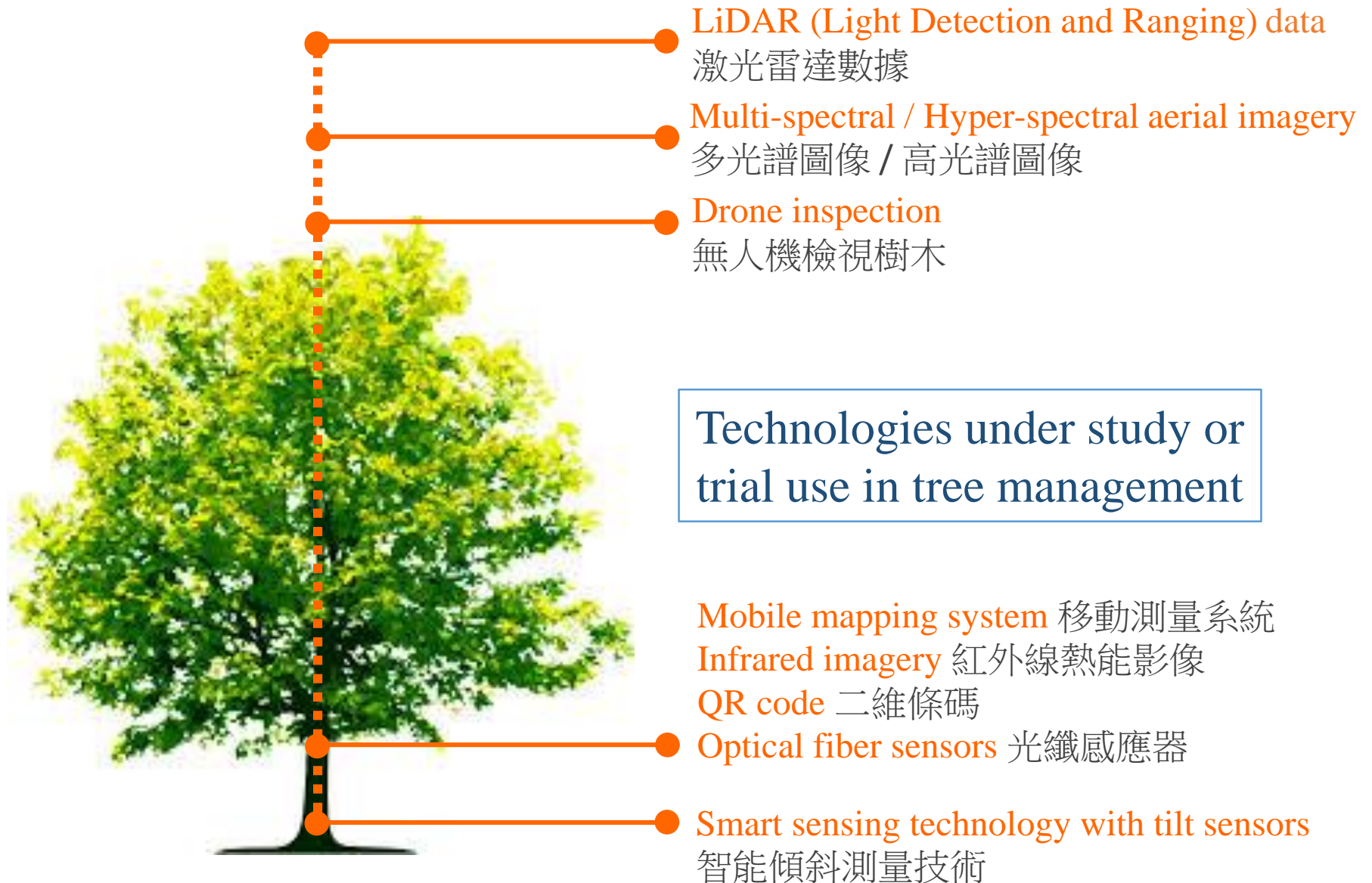


Use of Technology in Tree Management

Outline and Project Sharing

12 September 2020

Overview of Technologies for Use in Tree Management



Knowing more about our trees –

Application of QR Code in Tree Labelling
(二維條碼樹木標籤) and
Smart sensing technology with tilt sensors
(智能傾斜測量技術)

Application of QR Code in Tree Labelling

Objectives

- Identify location of trees quickly through tree identification number to facilitate tree management
- Facilitate more efficient and effective handling of tree failures and tree-related complaints
- Provide educational information about trees

Targeted Trees

To be selected from the following groups:

- Roadside trees maintained by Leisure and Cultural Services Department (about 110,000 trees)
- Trees in public housing estates maintained by Housing Department (about 78,000 trees)
- Trees in the Tree Register (about 800 trees)

Project Duration

- Commenced in January 2020, for completion in about 2 years

Draft Design of tree label with QR code

Tree number 樹木編號

Chinese name 中文名

Scientific name 學名

Common name 英文名

1823 enquiry hotline

查詢熱線



(dark green in colour with size of 80mm x 130mm)

Function of the QR code




Information to be displayed upon scanning (tentative) :

Tree Number	202012312345678
名稱	異葉南洋杉
Botanical Name	<i>Araucaria heterophylla</i>
Common Name	Norfolk Island Pine

To learn more about the anecdotes and traits for identification for this species, please visit :

https://www.greening.gov.hk/en/community_outreach/tree_species/0020.html (tentative)

To submit enquiries or report tree issues, please :

- 1) Call 1823  ; or
- 2) Send an e-mail to tellme@1823.gov.hk  ; or
- 3) Provide details at <https://www.1823.gov.hk/tc> ; or
- 4) Provide details at 1823 Mobile App  .

Examples on botanical descriptions on tree species

洋紫荊

- 學名：*Bauhinia × blakeana* Dunn
- 中文名：洋紫荊、紅花羊蹄甲、豔紫荊
- 英文名：Hong Kong Orchid Tree
- 科名：蘇木科
- 來源：原生



洋紫荊

🌿 植物趣聞 🌿

- **原產地：**香港。1880年代首次發現於香港薄扶林，由巴黎傳教會的神父將之插枝移植。
- **應用：**花碩大而奪目，是很受歡迎的園藝樹種。但其不育，需透過人工手法如嫁接法進行繁殖。
- **與香港的關係：**香港的市民對洋紫荊一定不會陌生，因為它是香港的市花，亦是區旗及區徽上圖案的花。
- **名字由來：**學名中的種尾名 “blakeana” 是紀念香港第12任港督卜力(Sir Henry Arthur Blake)伉儷，以表彰他們在植物學研究及對香港植物公園 (現 香港動植物公園)的貢獻。洋紫荊於1908年被當時的植物及林務部總監鄧恩 (S.T. Dunn) 判定為新物種，予以命名。
- **洋紫荊的父母：**根據現代分子生物學研究顯示，洋紫荊是雜交種，母本植物為紅花羊蹄甲，父本植物為宮粉羊蹄甲。

洋紫荊

♂ 辨認特徵 ♀

- 生長習性：常綠喬木。
- 高度：8至10米。
- 莖：樹幹基部有嫁接痕。有時砧木萌蘖，一株樹可長出兩種顏色截然不同的花。
- 葉：近革質，外型近圓形至闊心形，葉基心形，葉端2淺裂，裂片頂端鈍圓，形狀猶如羊的蹄部。
- 花：花瓣5片，紫紅色，近等大，倒披針形。最上方的花瓣基部至中央具深紫紅色條紋。
- 果：通常不能結果。
- 種子：不育。
- 花期：本港11月至3月。



白蘭

- 學名：*Michelia x alba* DC.
- 中文名：白蘭、白蘭花、白玉蘭
- 英文名：White Jade Orchid Tree, White Champak
- 科名：木蘭科
- 來源：外來



白蘭

❧ 植物趣聞 ❧

- **原產地：**印尼爪哇。廣東、廣西、雲南、福建各省廣泛栽培。較冷地區多以盆栽種植，冬季需移入室內越冬。
- **應用：**當提及白蘭花，大家便會想起其獨特而濃烈的香氣，也會想起在街上長者們售賣的一袋袋便宜的白蘭花。這些白蘭花都是花農熬夜採摘的，否則花蕾綻放，其香氣便會消散減退。白蘭花在香料界具高級地位。其葉及花可分別提煉成白蘭葉油、白蘭花浸膏，是香精、香水的優質原料。此外，花可作為中藥，能行氣化濕、止咳。
- **白蘭的身世謎團：**白蘭是雜交種，因較少結果，一般都是透過人工繁殖如嫁接和壓條大量栽培。然而，其身世一直成疑，學術界普遍認為白蘭為黃蘭(*Michelia champaca* L.)及木蘭屬植物 *Magnolia montana* (Blume) Figlar的雜交種。
- **古樹名木：**香港動植物公園的一株白蘭樹冠廣達22米，高達32米，胸徑達1.2米，已被列入古樹名木冊 (LCSD CW/43)。

白蘭

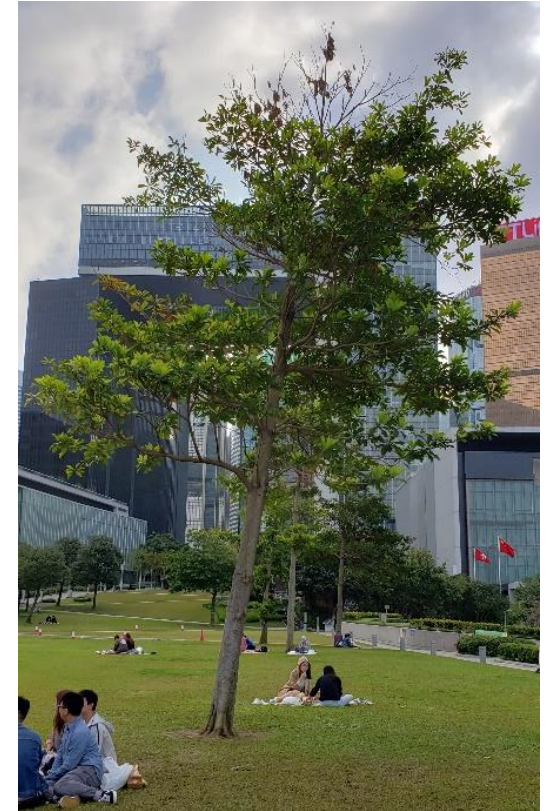
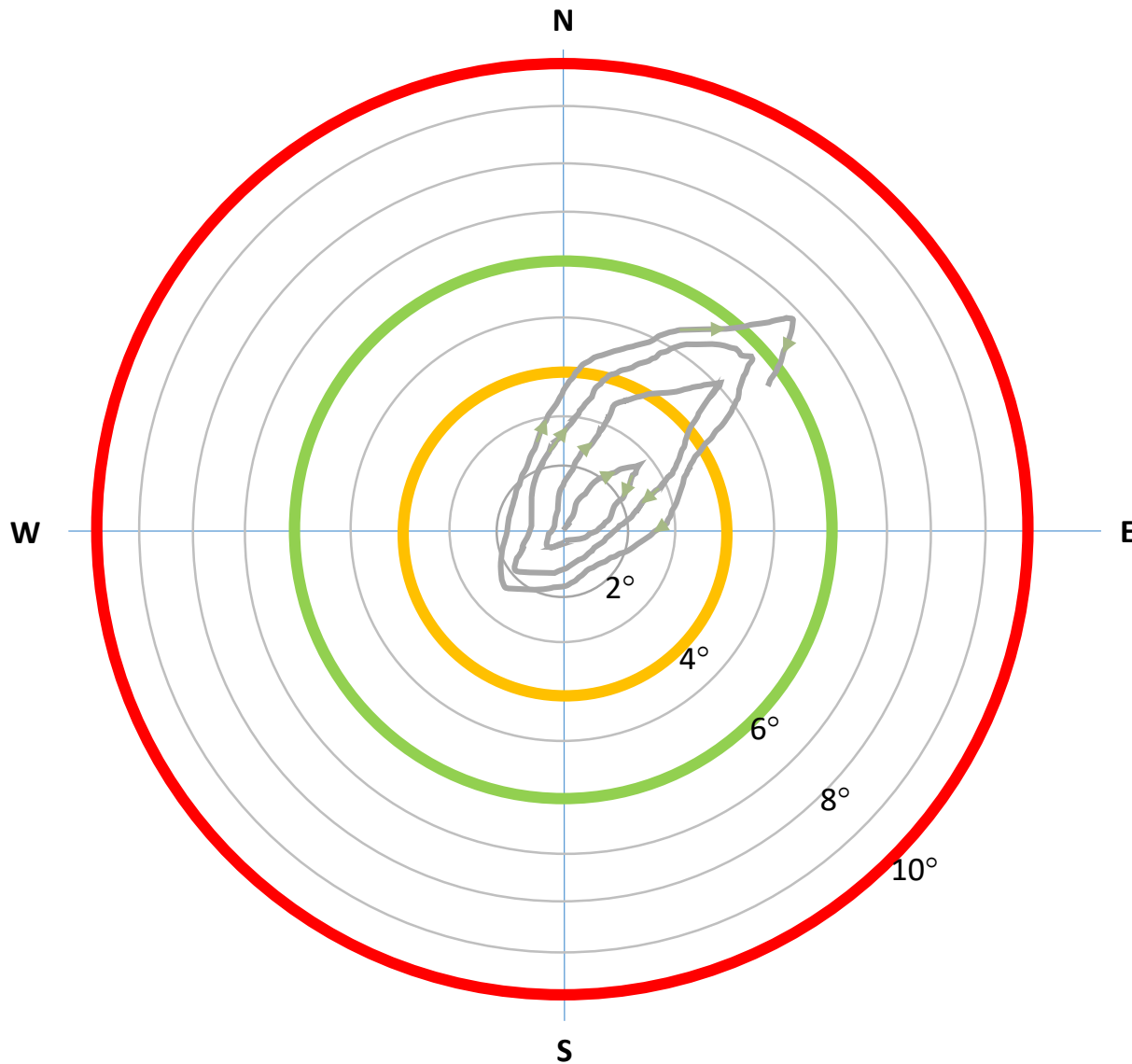
✂ 辨認特徵 ✂

- 生長習性：常綠喬木。
- 高度：可達17米。
- 莖：主幹樹皮灰色、胸徑可達30厘米。枝條廣展，樹冠呈闊傘形。具油細胞，枝葉揉搓後散發香氣。
- 葉：長橢圓形至披針狀橢圓形，薄革質，葉尖長漸尖至尾狀漸尖，葉基楔形。葉片乾後兩面清楚可見網狀脈。托葉早落，托葉痕為葉柄長度的一半或下。
- 花：甚為芳香。花被片10，白色，披針形。雄蕊雌蕊多數、分離。尖頭狀的藥隔伸出。心皮在雌蕊群柄上螺旋形排列。
- 果：多不結實。稀疏的聚合蓇葖果，成熟時鮮紅色。
- 花期：本港4月至9月。

Smart Sensors for Tree Risk Management



Movement Monitoring

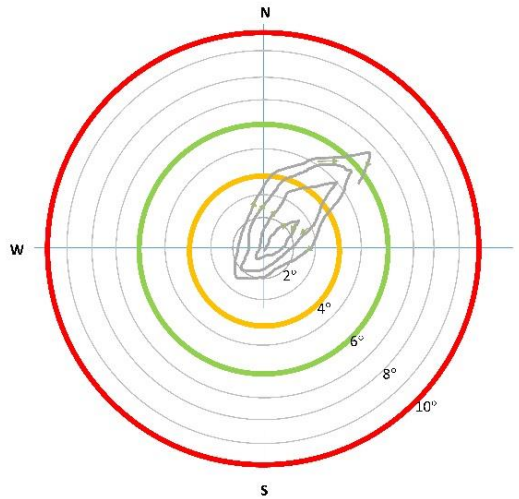
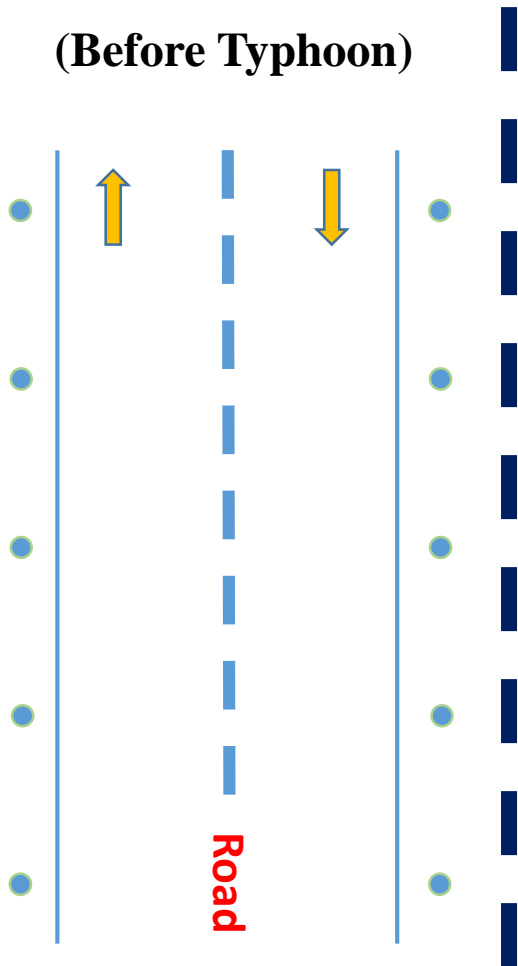


Warning Level

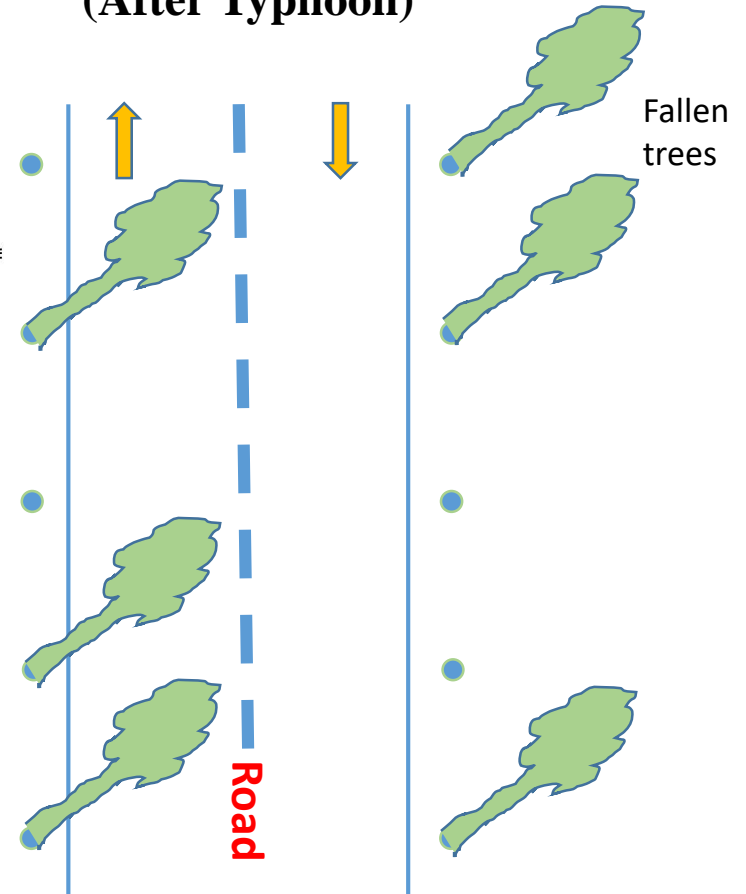
- Alert
- Alarm
- Action

Orientation of Tree Failure

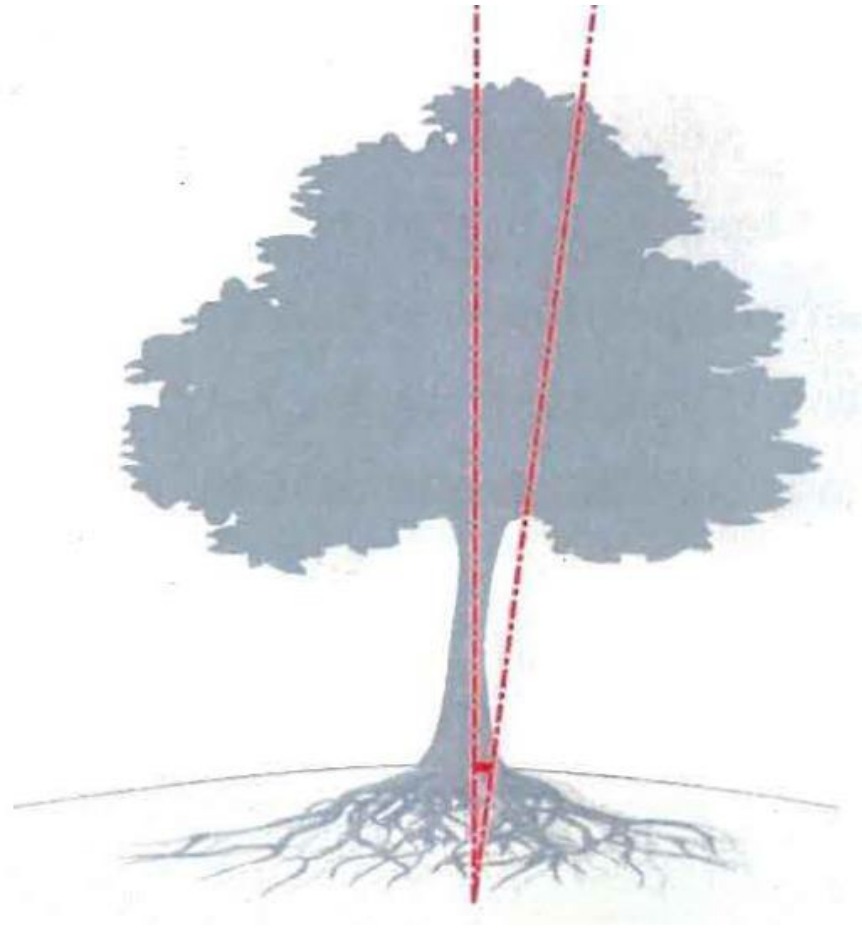
(Before Typhoon)



(After Typhoon)



Tilt Angle of Root Plate (Root Plate Failure)



(Extracted from “Enhancement of tree risk management: through the use of smart sensing technologies, capacity building and public education” by HK PolyU)

Smart Sensing Technologies for Urban Tree Risk Management



Effective and safe means for elevated tree inspection -

Use of Drone in Tree Inspection (運用無人機檢視樹木)

Use of drone in tree inspection

The operation of drone is generally composed of -

- ✓ a unmanned aerial vehicle (UAV),
- ✓ a ground-based controller, and
- ✓ a system to connect the two



It is small and light weight that can assist Inspection Officers to collect high resolution photographs or videos at height without climbing up the tree

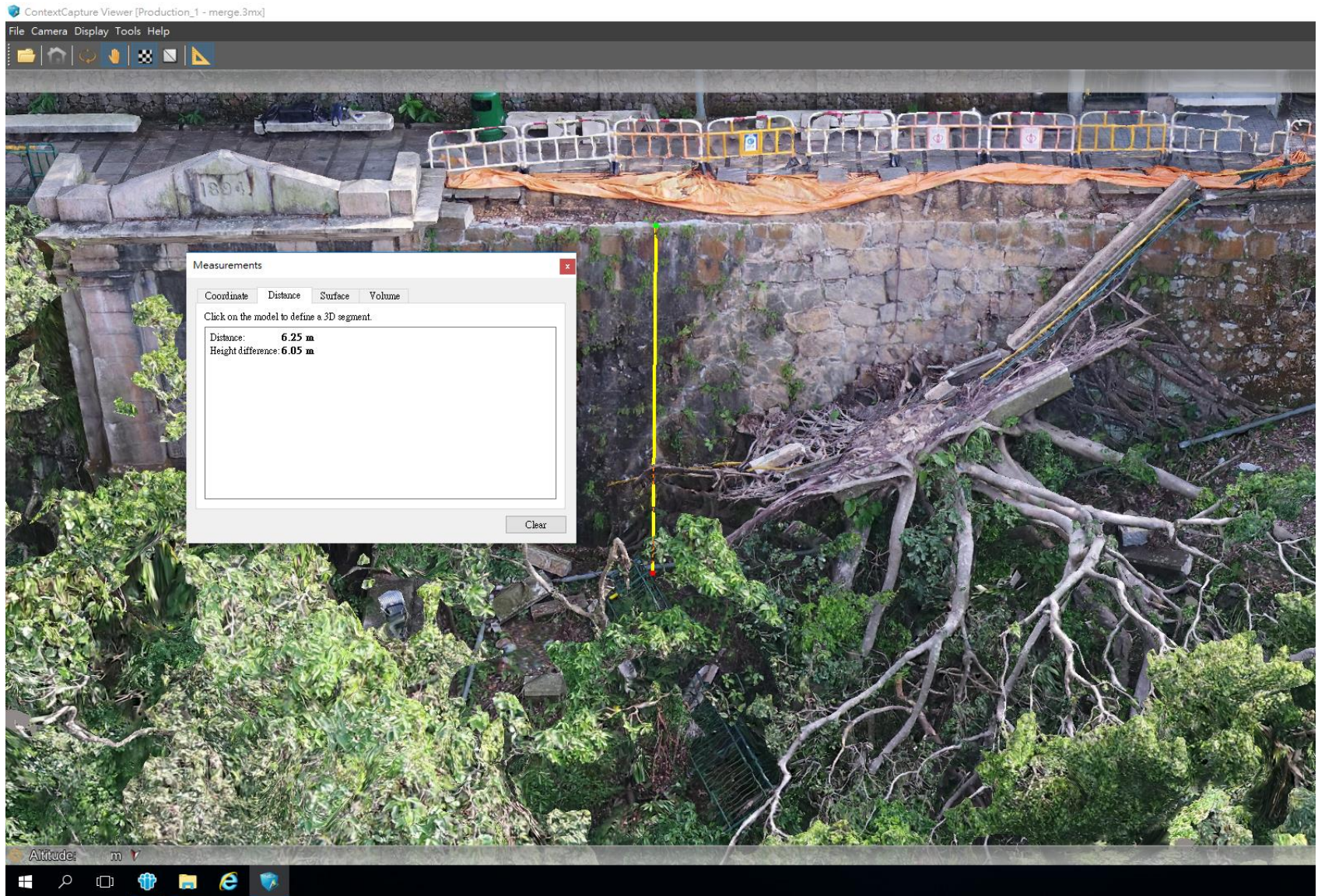
Drone - Image / Video Processing



Drone - Image / Video Processing



Drone - Image / Video Processing



Drone - Image / Video Processing



Vision for future approach of tree management -

Thermal Infrared Imagery (紅外線熱能影像),
LiDAR (激光雷達),
Hyper-spectral Imagery (高光譜圖像) and
Multi-spectral Imagery (多光譜圖像)

Thermal Infrared Imaging

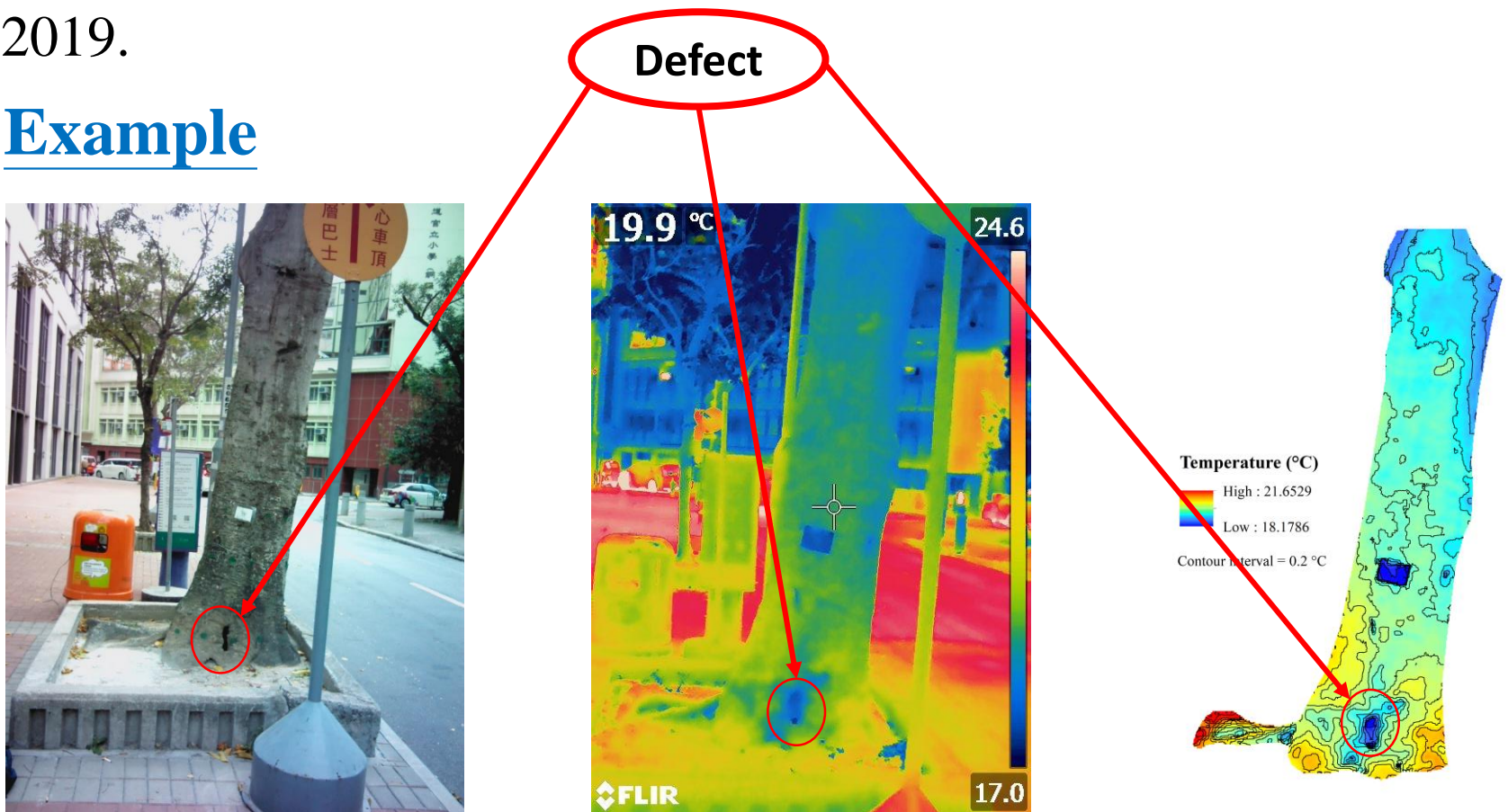
Principle

- Trees produce very low metabolic energy
- Healthy wood has good connectivity and water distribution between cells. It has uniform heat dissipation over the tree's surface
- If decays or voids exist, the flow of heat is interrupted and cooler areas become apparent
- Infrared camera registers different temperature levels and convert them into image

Thermal Infrared Imaging

Development Bureau has conducted a consultancy study “**Pilot Testing of Thermal Infrared Imaging Technique for Detection of Structural Defects within Trees**”, which was completed in mid-2019.

Example

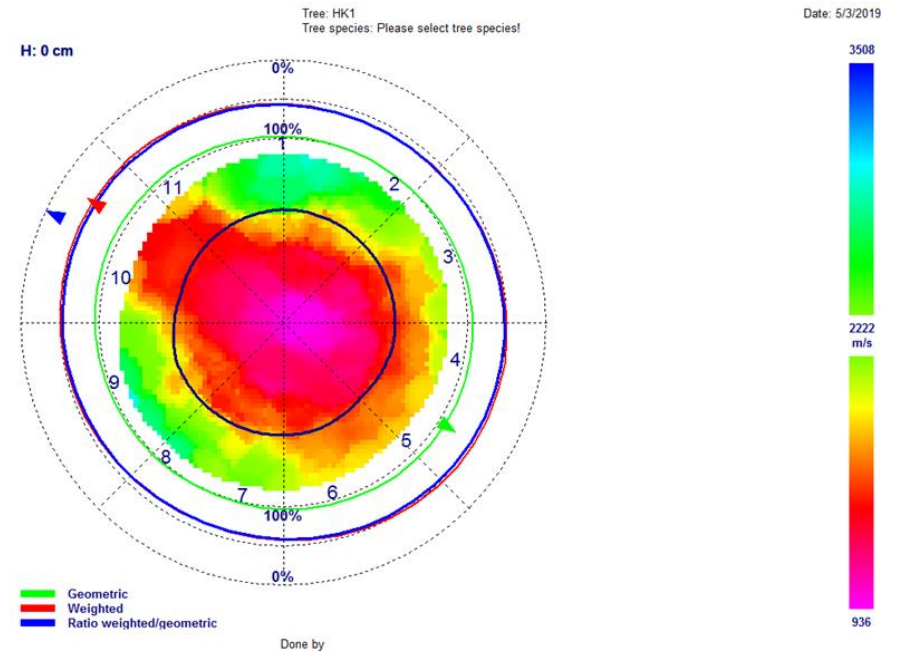


Verification of Infrared Results by Sonic Tomography



Project: Compare with IR on trees
Location: Cotton Path

Tomogram



Study on use of Hyper-spectral Imagery, Light Detection and Ranging (LiDAR) and Multi-spectral Imagery

Light Detection and Ranging (LiDAR)

- Use of LiDAR data to obtain tree location and dimensions
- By analysis of the reflected laser point cloud data

Hyper-spectral Imagery

- Use of hyper-spectral imagery (>200 spectral bands) to identify tree species
- Based on the reflectance characteristics to establish the hyperspectral signature of individual species

Multi-spectral Imagery

- Use of multi-spectral (4 spectral bands: red, blue, green, near infra-red) imagery to detect tree health
- Change of reflectance of different spectral of light reflects the change of the health of the leaves, which is a key indication of the tree health
- Assessment of the tree health by comparing the change of vegetation index over time

Research-based initiative –

Optical Fiber Sensors (光纖感應器)

Application of Optical Fiber Sensing Technology

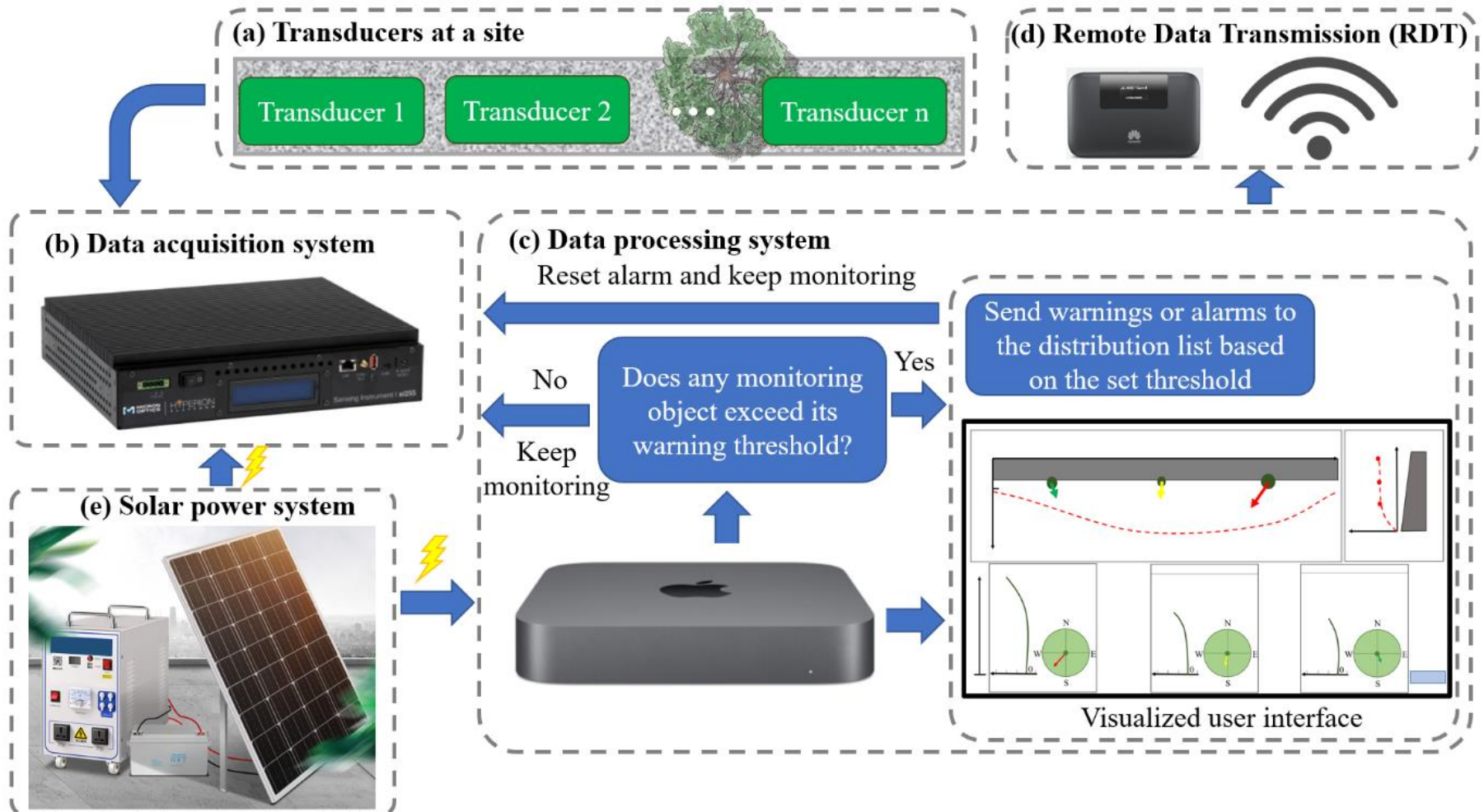
Purpose

- To evaluate the technical applicability of the optical fiber sensing technology in monitoring the movement of masonry retaining walls, stonewall trees and large trees at selected sites in Hong Kong

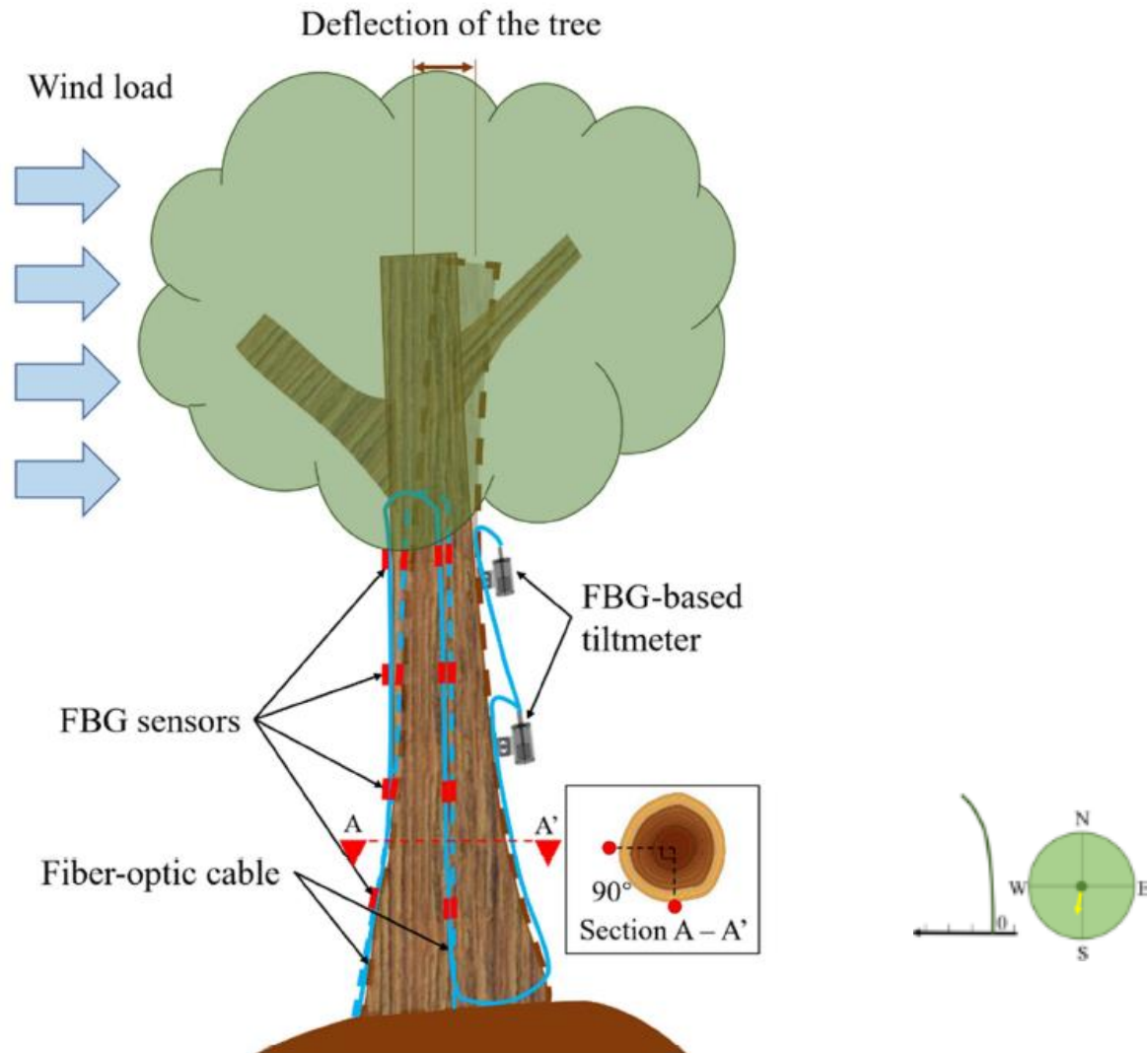
Key tasks

- Technical review on the use of optical fiber sensing technology in order to establish its technical viability
- Detailed design for the monitoring system for the three trial sites
- Site installation and monitoring
- Evaluation

Schematic design of monitoring system



Arrangement of transducers on tree for movement monitoring



~ End ~