

# 用於城市樹木管理的智能監察系統 Smart Monitoring System for Urban Tree Management

## 用智能傳感技術及地理資訊系統大規模監測樹木的穩定性 Large-scale monitoring of tree stability using Smart Sensing Technology and Geographic Information Systems

樹木的錨力是指根部抓緊泥土以支撐樹幹及樹冠的能力。若樹木的錨力不足，樹幹便會傾斜，嚴重時更有倒塌危機。理大的研究團隊利用人工智能、智能傳感技術及地理資訊系統建立了一套樹木監測系統來監察樹木的傾斜狀況。

透過安裝於樹幹較低位置、經特別設計的傳感器，樹木管理人員能以遙距方式監測樹木的傾斜角度及移動軌跡。當傾斜角度超越臨界角度時，系統會即時發出預警、警報及行動三個等級的訊息。

同時，系統通過地理資訊平台確定樹木的所在位置及收集其周邊環境的數據（如附近風速、雨量），從而對其根盤的移動狀況進行量化分析。另外，系統具備以地理大數據分析為基礎的人工智能算法，能夠預測樹木傾斜的趨勢。此智能系統能大規模監測樹木的穩定性，以便為有問題的樹木安排適時、適切的護養措施。



安裝於樹幹較低位置的傳感器監測樹木的傾斜角度  
The sensor installed on lower tree trunk for monitoring tilt angles

Tree anchorage refers to the tree's ability to hold soil firmly with its roots to support its trunk and canopy. Weak anchorage is reflected in the tilting of a tree, which may pose the hazard of falling in a serious case. The monitoring system developed by PolyU was designed and structured based on Artificial Intelligence (AI), Smart Sensing Technology and Geographic Information Systems (GIS) to monitor tree tilt.

With tailor-made remote sensors installed on the lower trunk of urban trees, their tilt angles and sway trajectories can be monitored. If the tilt angle of a tree exceeds the threshold, the system will send out messages to trigger the Alert, Alarm and Action (A.A.A.) levels. The locations of the trees and the data of its surrounding environment (e.g. wind speed, precipitation) can be identified using the GIS-based platform for quantifiable analysis of the trees' root plate movement. The system is also equipped with a set of AI algorithms developed with Spatial Big Data analytics, which can predict the leaning trend of a tree. This smart system enables large-scale monitoring of tree stability, allowing timely and appropriate mitigation measures to be taken.

### Principal Investigator

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### 特色與優點

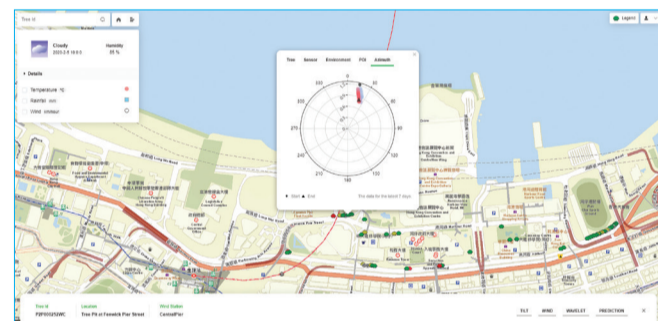
- 考慮各項環境因素及地理大數據，從而分析樹木的傾斜角度
- 提供客觀而可量化的數據，以便評估樹木的移動狀況
- 預測樹木傾斜的趨勢

### 應用

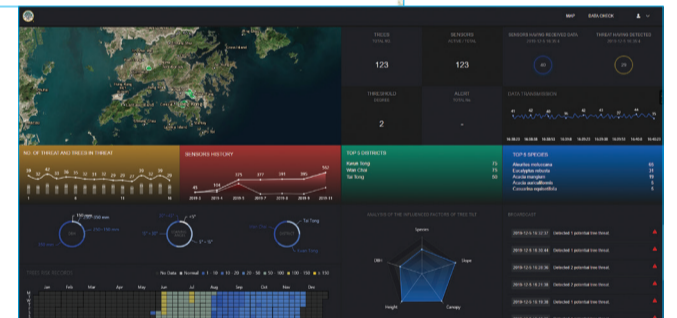
- 城市樹木健康監測：系統的研發工作乃賽馬會智慧城市樹木管理計劃的一部分，在相關政府部門支持下，將用以監察本港8,000多棵位於市區的樹木
- 收集數據，以助研究影響樹木穩定性的風險參數
- 協助制訂城市樹木管理策略
- 協助管理城市的綠色空間，進而改善熱島效應

### 獎項

瑞士日內瓦國際發明展 - 2021年網上特別版 - 金獎 (2021年3月)



系統控制界面  
Control interfaces of the system



### Special Features and Advantages

- Takes into consideration various environmental factors and Spatial Big Data to analyze tree tilt angle
- Provides objective and quantifiable data for assessing the movement of a tree
- Forecasts the leaning trend of a tree

### Applications

- Urban tree health monitoring: The system was developed under The Jockey Club Smart City Tree Management Project. With support from relevant Government departments and Bureau, the system will be used to monitor approximately 8,000 urban trees.
- Data acquisition for research on the risk factors affecting tree stability
- To facilitate the formulation of urban tree management strategies
- To facilitate green management in a city to mitigate the Urban Heat Island effect

### Award

Gold Medal - Special Edition 2021 Inventions Geneva Evaluation Days - Virtual Event (Mar 2021)

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