



## **TH - GREEN: INNOVATION THAT BENEFITS TREES**

Modular Hub for Outdoor Sensor  
and Accessory Installation

*Developed as a Master's Thesis  
Project in collaboration with*



**POLITECNICO  
MILANO 1863**



## The Project

Developed as an applied research project with the Politecnico di Milano, TH-Green is a modular hub designed for outdoor environments, specifically for trees and urban green infrastructure. The system integrates lighting and environmental monitoring through a Multi-Layer architecture, with sensors distributed across different canopy levels to generate a comprehensive model of plant health conditions.



## The Challenge

The core innovation lies in the development of a compact, modular, and weather-resistant enclosure capable of housing lighting systems and environmental sensors while enabling quick, non-invasive installation on trees, branches, and poles. The system is also available in a Mini version—TH-Green Mini—designed for smaller installation volumes while maintaining the same Multi-Layer monitoring approach.

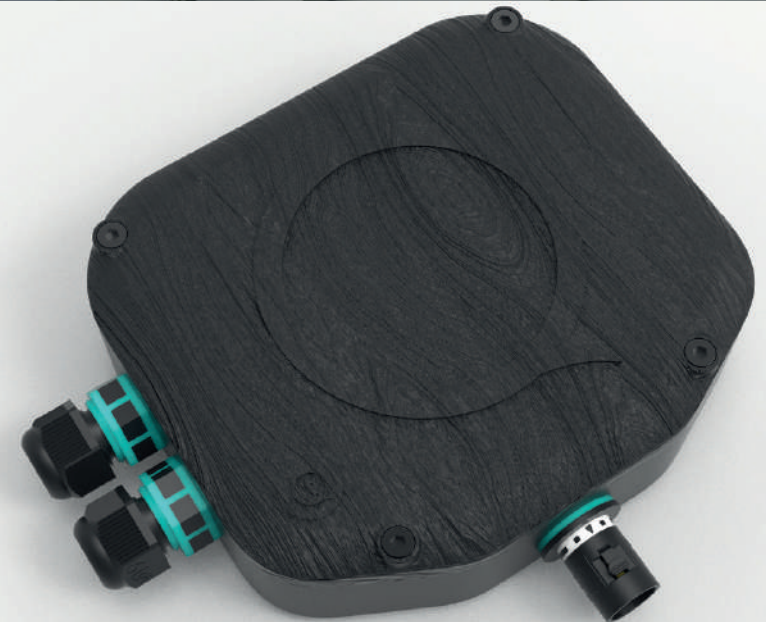
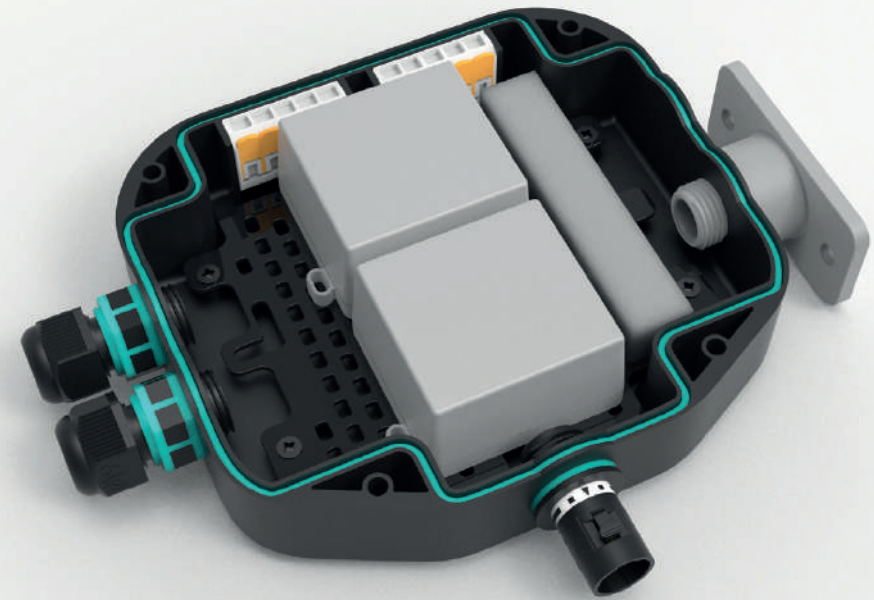


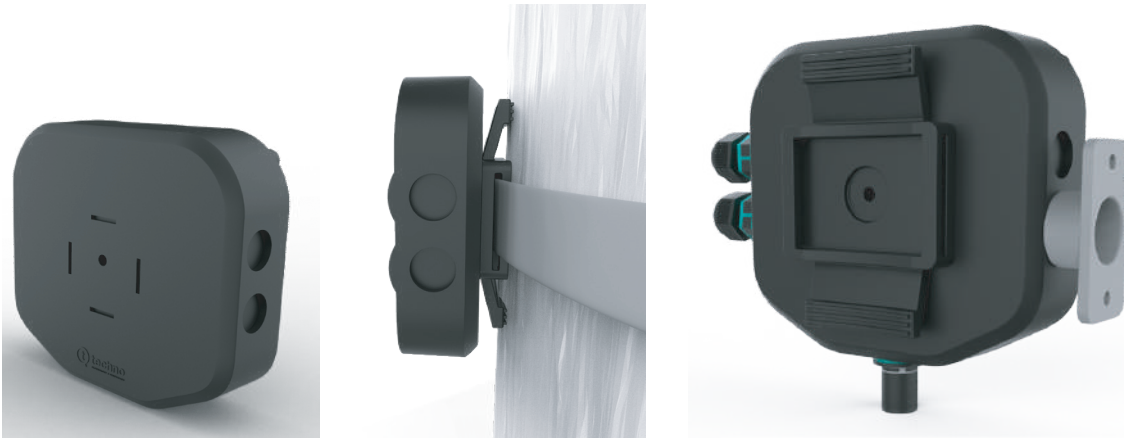
## Requirements

- DLP enclosure with IP66/IP67 protection rating and IK08 impact resistance.
- Multi-Layer Modularity: Internal mounting grids designed for sensors (T/RH, PAR, global radiation), spotlights, and IoT devices in virtually unlimited configurations.
- Universal Mounting System: Adjustable brackets and straps for trees, branches, and poles without damaging the bark.
- On-Demand Manufacturing: Compatibility with 3D printing for rapid customization and scalability.

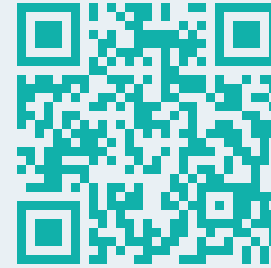


Key Challenges	Solutions
<p><b>Logistics</b> Bulky systems with limited transportability in green areas and natural environments.</p>	<p><b>Compact Design</b> Standard and Mini pocket-sized versions, easy to transport and install.</p>
<p><b>Durability</b> Material degradation caused by rain, UV exposure, and extreme temperatures in harsh outdoor conditions.</p>	<p><b>Protection</b> DLP enclosure with IP66/IP67 protection rating and IK08 impact resistance.</p>
<p><b>Installation</b> Traditional systems are invasive and potentially harmful to trees, branches, and urban structures.</p>	<p><b>Universal Mounting System</b> Adjustable straps and mounting brackets suitable for virtually any tree or structure.</p>
<p><b>Monitoring</b> Lack of accurate tools for measuring environmental parameters.</p>	<p><b>Scientific Monitoring</b> Accurate monitoring of ozone, particulate matter, and plant health indicators.</p>
<p><b>Hardware Engineering Challenge</b> Development of an enclosure optimized for wiring management and technical compatibility.</p>	<p><b>Board System Integration</b> Electronic system analysis and integration to maximize efficiency and internal compatibility.</p>
<p><b>Maintenance</b> Costly and complex technical interventions requiring specialized equipment.</p>	<p><b>Tool-Less Design</b> Field replacement of components without the need for specialized tools (tool-less system).</p>





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