Research Field And Department	Electronics Technology Department. Applied Optical Sensing and Spectroscopy
Supervisor	Marta Ruiz Llata
Title of the Work	Development and Test of an Optical Sensor for Water Stress Monitoring in Trees

Abstract:

The knowledge of the physiological status of different plant species in response to water stress is perceived as a value proposition for establishing the need for irrigation in agricultural plantations, thereby optimizing their productivity. To achieve this, digital technologies such as IoT, sensors, Cloud, and Machine Learning play a fundamental role, as they allow the end user to monitor and understand the water status of the plantation in real time.

The present Individual Training Plan focuses on the development of portable optical sensors that, by means of diffuse reflection spectroscopy techniques, allow for the determination of different indices associated with water stress.

Main Tasks to Carry Out:

The project will focus on the following core tasks, structured over the 6-week period:

1. Familiarization and Laboratory Setup (Instrumentation)
Receive comprehensive training on the operation and calibration of essential laboratory instruments, including the Oscilloscope, Function Generator, Optical Spectrum Analyzer, and Data Acquisition System.

Establish and document the necessary measurement setups required for the subsequent characterization of optical and electronic devices.

2. Component Characterization and Selection
Conduct practical characterization experiments on fundamental optical components (LEDs and photodiodes) and their associated driving/processing electronics.

Analyze the specifications and performance metrics of the tested devices to gain autonomy in device handling and selection.

Identify and select the specific new LEDs and photodiodes required for the final sensor prototype, based on the established performance criteria.

3. Sensor Prototype Development and Preliminary Testing
Assemble and integrate the selected optical and electronic components into a working sensor prototype designed for measuring foliar reflectance.

Perform initial characterization experiments to assess the prototype's performance, focusing on key operational parameters such as power consumption, connectivity capabilities, and optimal measurement distance.

Conduct preliminary calibration of the sensor against known standards or references.

4. Data Extraction and Final Documentation
Develop and implement methods to extract and process the measured foliar reflectance data to calculate relevant indices associated with water stress.

Prepare a final technical report detailing the experimental procedures, component specifications, prototype design choices, and the results of the sensor's characterization and calibration.

References/Bibliography if required

José Javier Peguero-Pina, Domingo Sancho-Knapik, Juan Pedro Ferrio , Ana López-Ballesteros, Marta Ruiz-Llata and Eustaquio Gil-Pelegrín. 'Reevaluating Near-Infrared Reflectance as a Tool for the Study of Plant Water Status in Holm Oak'. Forests 2023, 14, 1825. DOI: https://doi.org/10.3390/f14091825