Leaf Dust Accumulation Analysis: Spectroscopy and Computer Vision for Plant Stress

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Pollution and dust accumulation are a growing global concern. Researchers are using several engineering and biological methods to mitigate and combat dust pollution. However, the methods need elaborate infrastructure and high-cost inputs. Dust accumulated on leaves makes it difficult for the plants to stay healthy and survive under such conditions. Therefore, the aim of this project is to develop a low-cost, easy-to-handle, non-destructive method for detecting the chlorophyll content and plant health in dust-exposed plants. The design consisted of the AS7265x Triad Spectral Sensor, a leaf rotary system, a dust sensor, and a controlled process of airflow for dust exposure to simulate natural conditions. Multiple leaves from different plant species were compared using a spectroscopy sensor. The results were verified by the Standard Spectrophotometer, and Lichtenthaler's (1987) equations. Two novel indices, CREI = (R730/R680) - 1 and NRR = R810/R680 were used to compare the values of the spectral sensors and the UV Spectrophotometer. Final equation to describe the chlorophyll concentration was derived, where the disturbance caused by dust was also accounted for. Dust-induced spectral shifts are detectable, species-dependent, and partially reversible and the model successfully predicts chlorophyll concentration on dust-contaminated leaves where conventional indices fail. With additional support data from Computer Vision Analysis, the present method will help in selecting the suitable species for plantation in landscapes where dust pollution is prevalent.

Awards Won: