PAPER TITLE :- Nondestructive Determination of Nitrogen, Phosphorus and Potassium Contents in Greenhouse Tomato Plants Based on Multispectral Three-Dimensional Imaging

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PROBLEM MENTIONED/SOLUTION OBTAINED:- Measurement of plant nitrogen (N), phosphorus (P), and potassium (K) levels are important for determining precise fertilization management approaches for crops cultivated in greenhouses

A nondestructive determination method based on multispectral three-dimensional (3D) imaging was proposed to accurately, rapidly, stably, and nondestructively measure the NPK levels in tomato plants. Multiview RGB-D images and multispectral images were synchronously collected, and the plant multispectral reflectance was registered to the depth coordinates according to Fourier transform principles. The unified transformation of the multiview point cloud coordinate system was realized using Kinect sensor pose estimation and self-calibration. The iterative closest point (ICP) algorithm was used for the precise registration of multiview point clouds and the reconstruction of plant multispectral 3D point cloud models. Determination models for the NPK contents in tomato plants were constructed based on the reflectance characteristics of plant multispectral 3D point cloud models using back-propagation artificial neural network (BPANN), support vector machine regression (SVMR), and gaussian process regression (GPR) methods. These models provided highly efficient and accurate measurements of the NPK contents in tomato plants, with better stability than single-view models

ALGORITHM USED:- Multispectral three-dimensional (3D) imaging was used as a non-destructive determination method for measuring the nitrogen (N), phosphorus (P), and potassium (K) levels in tomato plants. Multiview RGB-D images and multispectral images were collected synchronously for data acquisition. The plant multispectral reflectance was registered to the depth coordinates using Fourier transform principles. Kinect sensor pose estimation and self-calibration were used for the unified transformation of the multiview point cloud coordinate system. The iterative closest point (ICP) algorithm was employed for precise registration of Multiview point clouds and reconstruction of plant multispectral 3D point cloud models. Back-propagation artificial neural network (BPANN), support vector machine regression (SVMR), and gaussian process regression (GPR) methods were used for constructing determination models for NPK contents in tomato plants based on the reflectance characteristics of plant multispectral 3D point cloud models

TOOLS USED/IMPLEMENTED:-

Multispectral 3D

Kinect sensor

Iterative closest point

Back-propagation artificial neural network

Normalized grayscale

Flame atomic

RESULTS AND DISCUSSION:-

A nondestructive determination method based on multispectral three-dimensional (3D) imaging was proposed for accurately measuring the nitrogen (N), phosphorus (P), and potassium (K) levels in greenhouse tomato plants [1] . The method involved synchronously collecting multiview RGB-D images and multispectral images, registering the plant multispectral reflectance to the depth coordinates using Fourier transform principles, and reconstructing plant multispectral 3D point cloud models using the Kinect sensor pose estimation and self-calibration [1] . Prediction models for NPK contents in tomato plants were constructed separately using back-propagation artificial neural network (BPANN), support vector machine regression (SVMR), and Gaussian process regression (GPR) methods based on the reflectance characteristics of plant multispectral 3D point cloud models [1] . The accuracy of the prediction models using the 3D multispectral information of the plant canopy as input values was better than that of single-view models, providing highly efficient and accurate measurements of NPK contents in tomato plants [1] . The plant multispectral 3D reconstruction and measurement systems proposed in this study offer accurate and highly efficient methods for high-throughput measurements of plant nutrient contents, with potential applications in plant phenomics and other research fields

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