TP-GTL-1

GREENHOUSE HIGH-THROUGHPUT PLANT PHENOTYPE ACQUISITION AND ANALYSIS PLATFORM

Introduction

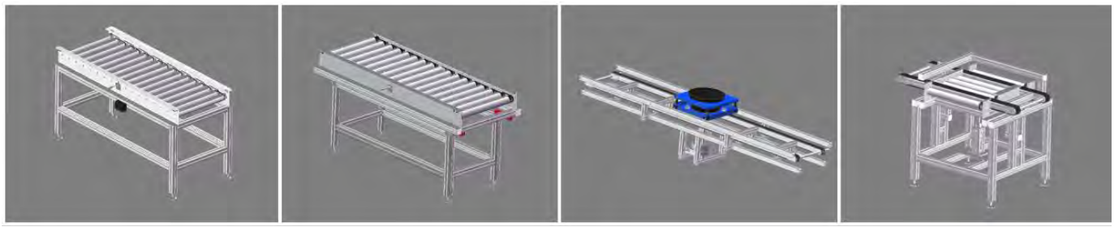
The Greenhouse High-Throughput Plant Phenotype Acquisition and Analysis Platform is a high-throughput platform that integrates plant phenotype image acquisition and parameter analysis under medium- and large-sized greenhouse conditions. The platform adopts the form of pipeline transmission, transferring plants to the imaging darkroom for imaging and analysis, and efficiently realizes the phenotype acquisition and analysis of potted plants through the working mode of plant-sensor-analysis. The product can be equipped with visible 2D, visible 3D, hyperspectral and other imaging units, which can be used to screen and identify mutants, record the growth status of plants, as well as study the morphology, color, texture, growth, and changes in component content of plants under adversity conditions such as high temperatures, high salinity, diseases, and insect pests. It is suitable for genetic breeding, molecular biology, plant physiology, plant pathology, ecology, environmental science, plant protection and other research fields.

Automated Transport Units + Multidimensional Sensor Fusion Image Imaging Unit + Edge Computing and Resolution Unit + Data Management Module

Features

- Multi-scenario application: suitable for a variety of indoor scenarios of plant high-throughput acquisition and application; can be applied to the greenhouse under controlled conditions, the experimental application of plant growth, response to adversity, disease level analysis and other scenarios.
- Highly integrated: the system can be integrated with visible two-dimensional, visible three-dimensional and hyperspectral imaging units, fully automated, high-throughput visible imaging and hyperspectral imaging of plant samples.
- Automatic transmission system: the system adopts fully automatic transmission device, equipped with intelligent image acquisition module, the system operation is fully automated, reducing the error of manual operation.
- Automatic data collection: the system supports automatic identification code for plant samples, which is automatically associated when the plant moves to the target position and automatically records the collection data of the corresponding equipment.
- Sample weighing and biomass calculation: optional weighing module, high-precision sensors to determine the weight of the sample during transmission.
- Automated parameter analysis: the system automatically built-in crop analysis model algorithm, according to the visible light 2D, visible light 3D, hyperspectral and other modules directly and automatically analyze a number of plant type, color, texture and other parameters; full-angle multi-camera image automatic acquisition, no need to manually calibrate the automatic construction of high-precision three-dimensional model according to the plant.
- Data transmission and storage management: the system supports the construction of local area network/public network, realizing automated uploading, automated data storage management and automated and efficient analysis from the PC side of the data collection terminal to the server in the data center.
- Data security: The data adopts safe transmission mode and unlimited storage space expansion, which protects the user's needs and data security at the same time.

Automated Transport Units



General Conveying	Weighing Conveyor	Box Conveyor Ejector Rotation	90° Turning Conveyor

Transmission speed	13m/min, adjustable according to demand
Positioning accuracy	⩽ ±2mm
Electronic identification	RFID for identification and positioning of each plant pot

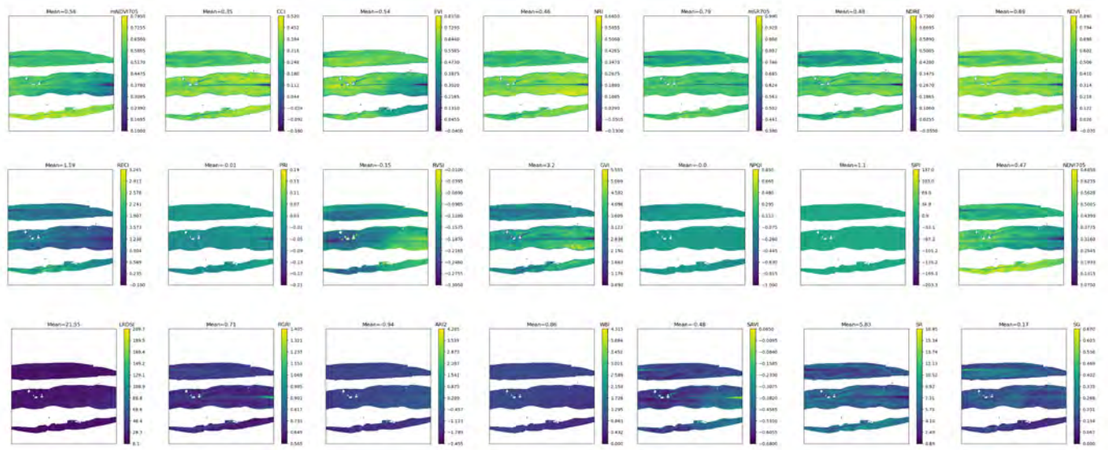
Visible Light Modules

Visible Light 2D

Visible Light 3D

Imaging Wavelength Range	400-1000nm	Hyperspectral sin-gle-plant analysis time	<5s
Pixel size	5.86 μ mx5.86 μ m	Spectral Resolution	2.5nm
Number of spectral bands (number of bands)	1200 bands	Image resolution	1920x1920
Incident slit width	25 μ m	Dynamic range	12bit
Imaging height	Support customized height	Data transmission	USB3.0/Gigabit Ether-net (optional)
llumination light source	Low flicker high quality halogen lamp light source		

Hyperspectral Light Module



Imaging Sensor	High Resolution RGB Lens	Resolution	5120x5120
Element Size	2.5 μ mx2.5 μ m	Imaging Platform	360° rotating platform
Imaging height	Supports multi-stage imaging, customized height	Illumination light source	Side LED uniform light source
Time to reconstructing and parsing single-plant(3D)	<7min	Time to analyze sin-gle-plant （2D）	<5s
Imaging height	Supports multi-stage imaging, customized height		

Model Comparison

Model	Measurement Parameters	Fields of application
TP-GTL-1-VL2 (Visible 2D imaging unit)	-Obtain contour area (top view, side view), convex hull area (top view, side view), crown height, crown width, leaf curl, leaf apex number, green holding degree, senescence degree, firmness, eccentricity, volume, biomass, etc. -HD measurement of plant color and real texture	-Basic plant morphology can be analyzed, which can be used for mutant screening/variety difference comparison.Comparison and other scenarios.-Measure the color information such as the degree of greening and senescence, which can be applied to the analysis of It can be used to analyze the response to environmental stress, plant health status, plant diseases and pests, etc.
TP-GTL-1-VL3 (Visible 3D imaging unit)	-3D modeling based on visible light images to generate high-precision 3D models of the plants. -Analyze the overall plant morphology and accurately obtain morphological parameters such as plant crown height, crown width, crown height ratio, etc. based on the 3D model. -Analyze the color distribution of plants as a whole. - Analyze the volume, surface area and biomass of plants.	- Analyze the three-dimensional structure of plant strain, which can be applied to the analysis of the effect of strain on yield, the correlation between strain and plant health status, strain mutant screening and other directions of research.-Calculate plant biomass, which can be used to analyze the changes of plant growth status, establish a growth model, record the process of plant growth and biomass changes, and be used to analyze the impact of the environment on plant biomass.
TP-GTL-1-HIPS (Hyper-spectral im-aging unit)	-Spectral reflectance curves of various parts of plants.-Peak reflectance of chlorophyll and other components.-Main spectral indices (NDVI, RVI, GVI, etc.).-Biological parameters such as canopy chlorophyll content, canopy nitrogen content, etc.	- The hyperspectral imaging unit can realize the calculation of the basic vegetation index of plants, which can respond to the growth status, pigment content, nutritional status of plants, etc., and is suitable for its yield, breeding, stress, and other research work -It can obtain the spectral reflectance of plant tissues, and generate the spectral reflectance curve. Spectral reflectance curve trend can reflect the degree of difference in the growth status of different parts of the plant or not.- Built-in model calculates the chlorophyll content and nitrogen content of the plant canopy, which can directly reflect the nutritional status and health status of the plant.4. Can be applied to disease research. The spectral reflectance curves of the diseased and healthy parts change, and through the study of the changing trend, we can analyze the occurrence and severity of the disease.