Development of Crop Detecting System Using on UAV Platform in Precision Agriculture

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Introduction

Farmland information perception is important in precision agriculture. To change the traditional ways of the agriculture measurement with destructive sampling and chemical test in the lab, the spectral sensor system were developed to measure the plant information based on the UAV platform. It involves rapid acquisition of spectral reflectance, data transformation and data management system. It could help and improve the production efficient in the precision agriculture. With the Application of spectrum analysis and image processing technology, a crop detecting system using on UAV was developed.

System Design

The system includes three parts with the crop detector, controller on the ground and the WEB management system. To detect the crop, a feasible multi-spectral camera system was designed based on spectroscopy. In order to use on the UAV platform, the GPS data were collected. The controller was used to receive, store, process and display the data from the sensor. The signal was also send to the WEB management system by the 4G network.

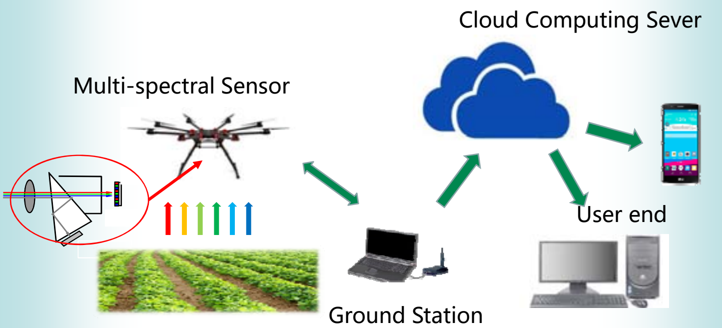

Fig. 1 System structure

The system includes hardware and software in which hardware is divided into three modules.

i.Multi-spectral sensor: The reflectance of crop canopy in the waveband with 400-700nm and 760-1000nm..

ii.Panel computer with communication ports.

iii.The NEO6M GPS module: Position data in the field is provide. This module has two antenna interfaces (a group of SMA antenna gain, a group of IPX port ceramic antenna).

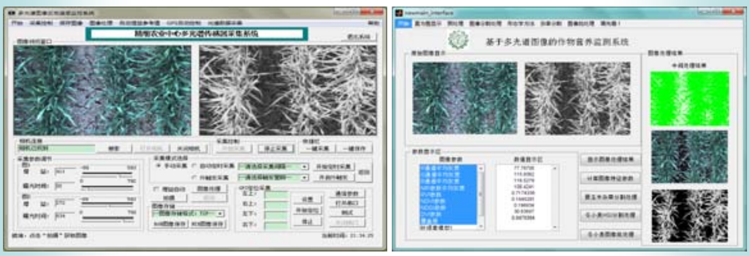

Fig. 2 Structure of image processing system

System Application & Optimization

In order to test the crop detector performance in the field, The canopy images of winter wheat in band of Blue (B), Green (G), Red (R), Near-infrared (NIR) were acquired. Multi spectral images were processed by adaptive smoothing, filtering and segmentation based on the H component of HSI color model.

Fig.3 System application demostration

The correlation between detection parameters and crop coverage index was analyzed. The MLR model was with $R_c^2=0.956$ and $R_v^2=0.935$. However, to improve the data processing efficiency and provide more nutrient parameters, a new multi-spectral reflectance sensor was designed as shown in Fig.4, it will support for field crop growth evaluation and management.

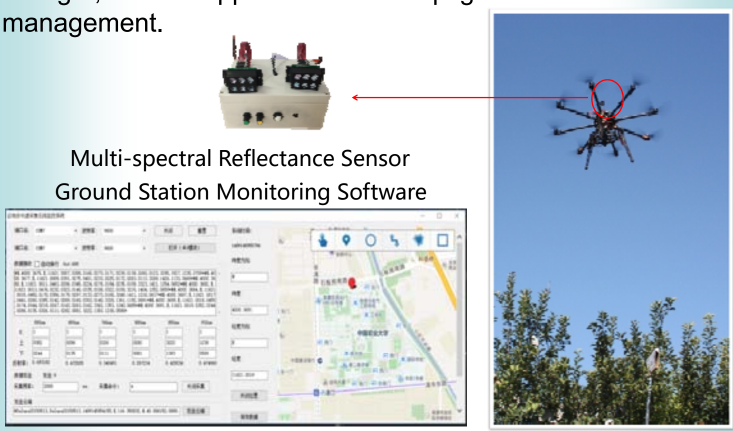

Fig. 4 System optimization

Conclusions and Acknowledgements

1. The system was design for the crop monitoring non-destructively. The UAV mounted multi-spectral sensor used to measure the canopy spectral reflectance, the ground controller could be communicated with the sensor and cloud computing sever, the data could help to make the precision agriculture management decision by different user ends.
2. The multi-spectral camera was applied to monitor the coverage index in the field. To improve the efficiency and parameter numbers, a new multi-spectral reflectance sensor was designed to optimize the system.
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