SMART AGRICULTURAL MONITORING USING NDVI AND MULTISPECTRAL CAMERAS

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***Abstract*: The smart camera applications in advanced imaging, monitoring and mapping, in agriculture has become a part of precision farming that supports the conservation of pesticides, fertilizer, and machine time. This technique reduces the amount of energy required in terms of fuel. To overcome this drawback Smart, low-cost cameras are used which are well adapted to agricultural applications. The Normalized Difference Vegetation Index (NDVI) for image pixel is an algorithm and it will help to differentiate plant information from the soil background by a large difference in the reflectance between red channel optical frequency band and the near infrared (NIR). Here we explain the basics of multispectral imaging technology, reflectance, wavebands and vegetation indices such as NDVI and NDRE. All this information gives the farmer terrific insights into the health of the soil and plants.**

***Keywords*: Multispectral Images, NDVI, Vegetation Indices, Spectrum**

1. INTRODUCTION

Agriculture is the basis for the human species as it is the main source of food and it plays important role in the growth of country's economy. It also gives large ample employment opportunities to the people. The farmers are still using traditional methods for agriculture, which results in low yielding of crops and fruits. In this paper we use Multispectral Imaging Camera Drones for smart agriculture with NDVI. An agricultural drone is an aerial vehicle applied to farming to help increase crop production and monitor crop growth. Multispectral imaging camera sensors in agricultural drones allows farmer to manage crops, soil, fertilizing and irrigation more effectively. There are huge benefits both to the farmer and to the wider environment by minimizing the use of sprays, fertilizers, wastage of water and at the same time increasing the yield from crops. Multispectral camera remote sensing imaging technology use Green, Red, Red-Edge and Near Infrared wavebands to capture both visible and invisible images of crops and vegetation.

The Normalized Difference Vegetation Index (NDVI) is a type of numerical indicator and it uses visible and near infrared bands of the electromagnetic spectrum and is adopted to analyse remote sensing measurements and checks whether the target being observed contains live green vegetation. The NDVI is a parameter used to separate vital plant pixels from soil pixels in an image or to separate vital from non-vital plants. The NIR reflection is high in the vital plants and low in soil plants which absorbs more light with red wavelengths, from 620 nm to 660 nm, than soil.

2. LITERATURE SURVEY

G Filippa et al., [1] proposed a work on NDVI derived from near-infrared-enabled digital cameras. The aim of the paper is making agriculture smart using automation. This paper gives information about NDVI sensors provide increased accuracy when comparing plant health data over time, which is a major benefit over visible spectrum cameras. This is helpful when you're trying to identify trends beyond a single point in time, such as throughout the course of a crop in the season.

H Yang et al., [2] proposed a work on Seasonal variations of leaf and canopy properties tracked by ground-based NDVI imagery in a temperate forest. This paper gives information about an NDVI (Normalized Difference Vegetation Index) camera to monitor daily variations of vegetation reflectance at visible and near-infrared (NIR) bands with high spatial resolution and resolutions with respect to time, and found that the NDVI based infrared cameras agreed well with the leaf expansion.

George E. Meyer et al., [3] proposed a work on Verification of color vegetation indices for automated crop imaging applications. This paper gives information about an accurate vegetation index is required to identify plant biomass versus soil and residue backgrounds for automated remote sensing and machine vision applications.

Sebastian Candiago et al., [4] proposed a work on Evaluating Multispectral Images and Vegetation Indices for Precision Farming Applications from UAV Images. This paper gives information about farm resources management. This paper gives some experiences related to the analysis of cultivations (vineyards and tomatoes) with Tetracam multispectral data.

3. PROPOSED SYSTEM

Multispectral Imaging Technology

A multispectral image sensors captures image at specific frequencies across the electromagnetic spectrum. The wavelengths may be separated by filters or it may be seperated by the use of instruments which are sensitive to particular wavelengths, including light from frequencies such as infrared. Spectral imaging allows additional information for extraction where the human eye fails to capture.

Vegetation Indices

To derive vegetation indices (VIs) Vegetation reflectance properties are used. The indices are used to analyse various ecologies. From reflectance measurements Vegetation Indices are constructed in one or two wavelengths to analyse specific characteristics of vegetation, such as leaf area and water content. In the reflected optical spectrum water, pigments, nutrients, and carbon are expressed from 400 nm to 2500 nm, with often overlapping, but spectrally distinct, reflectance behaviours More than 150 vegetation indexes have been published in scientific literature, but only a small subset have substantial biophysical basis or have been systematically tested. The most popular vegetation index is NDVI (Normalized Difference Vegetation Index). The Normalized Difference Vegetation Index (NDVI) is an index of plant "greenness" or photosynthetic activity, The Normalized Difference Vegetation Index (NDVI) is an index of plant "greenness" or photosynthetic activity. NDVI can be calculated for any image which has a red and a near infrared band.

Vegetation Spectrum

The vegetation reflectance properties of any object depend on the particular material and its physical and chemical state (e.g. moisture) such as the surface roughness as well as the geometric circumstances (e.g. incidence angle of the sunlight). The most important surface features are color, structure and surface texture. The perceived color of an object corresponds to the wavelength of the visible spectrum with the greatest reflectance.

The vegetation spectrum images how typical spectral reflectance curves of three basic types of Earth features: green vegetation, dry bare soil and clear water.Infrared,Green and Red are mainly used in agriculture. The Red Edge (short band corresponding to the Near Infrared entry point) is also sometimes used to obtain additional indices.

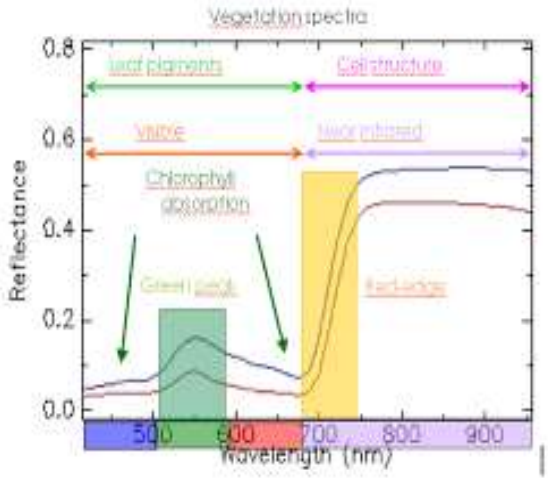

Fig: Vegetation Spectram

Multispectral Camera Sensors for Agriculture:

Fig: Sentera – 3 Multispectral Sensors for Drones

Sentera multispectral drone sensors deliver unusual performance and are very competitive in price, quality and function. Sentera have three types of multispectral sensors for drones which are for agriculture

Sentera High Precision NDVI and NDRE Single Sensor:

The Sensor integrates onto a multitude of drone platforms, enabling any grower too quickly and affordably access critical, precise True NDVI crop data. The Sentera High Precision Single Sensor filters effectively reject out-of-band leakage before it can contaminate the measurement and lead to index errors.

Sentera Quad:

This is lightest in weight, most compact and highest performance multispectral sensor available for drones today. Quad Sensors are providing deeper insights about crop health and vigor to the agriculture industry.

Sentera Double 4k Sensor:

Sentera Double 4k agriculture Sensor is the smallest and lightest dual sensor available today. It is also compatible with any drone. The Double 4K helps to capture 12 megapixel high resolution images and features an enhanced processor which expedites delivery of precise crop health images to popular stitching tools, including Pix4D.

Parrot Sequoia Multispectral Sensor:

The Parrot Sequoia is one of the smallest and lightest multispectral UAS remote sensors on the market to date. It captures images of crops across the four highly defined, visible and also non-visible spectral bands, and RGB imagery.This solution uses two sensors.

The second sensor in this is the sunshine Sensor and is mounted on the back of the drone. During the flight the sunshine sensor will always sense and record the light conditions in the same spectral bands as the multispectral sensor. The light data collected by this allows the values of the identified spectral signatures to be confirmed.

4. CONCLUSION

NDVI image could be optimized with a more specific optical filter.NDVI is a well-known and frequently used index for gathering the information content of plants, the direct application of a low-cost and single-chip plant camera is difficult for outdoor conditions. A multispectral imagecaptures image data within specific wavelength ranges across the electromagnetic spectrum. Multispectral imaging measures light in a small number of spectral bands.Data from multispectral imaging has the benefits of identifying pests and weeds.Then make improvement to land areas such as drainage system and waterways based on the multispectral data,view damage to crops from farm machinery and make necessary repairs or replace problematic machinery.

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