Index Set Green Cover Method for Automated Identification of Vegetation

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Abstract—The object of this study was to generate a new methodology for the generation of vegetation index by drone cameras for the quantification of green cover area. For this study a drone of the DJI Mavic PRO quadricopter model was used. The flight plan was made using the Drone Deploy application and a total of 56 images were obtained, with a 60% side cover and 70% front cover. The images were processed in the professional Photoscan software version (1.4.2) resulting in mosaic area. The following ICVA equation was applied: \(((pGreen-pRed / pGreen + pRed) * L)\) through the map algebra of ArcGis 10.3. The vegetation index was thus generated, without the need to use satellite images or multispectral data and thus generates a new way of identifying vegetation with the use of drones, Vants and RPAs, being a landmark in the advancement of studies of geotechnologies. The equation used will still be tested in new areas and different situations to show its capacity, and if necessary will be improved according to the observations made.

Keywords—Geotechnology, Drone, Mapping, Vegetation.

I. INTRODUCTION

Aber et al. (2010) presents an extensive history of applications and development using small format photographic images. Ramos and Bueno (2007) present some pioneering projects in the country. Recently, systems based on Remotely Piloted Aircraft have evolved with the development of flight controller boards, some with open hardware and software, such as the APM (APM, 2016) and Pixhall (MEIER, 2016) boards. This development allowed the appearance of cheap platforms and easy operation. Jorge and Inamasu (2014) present the current state of technology and applications in agriculture.
literature as HSB or HSV (Hue, Saturation and Brightness / Value) (CHANG et al., 2010). This space easily allows the separation of a certain color (hue), initial step in the proposed method. The features of this index allow you to obtain information on the relative amount of pixels with green tones in an area. A more specific application for agriculture is to accompany the development of a crop from its germination / sprouting, perceiving the failures in planting and problems in its development.

So the objective of this study is to generate a new methodology for the generation of vegetation index by drone cameras for the quantification of green cover area.

II. APPLIED METHODOLOGY

For this study a drone of the DJI model model Mavic PRO (Figure 1) of 12.35 Megapixels was used. This aerial vehicle is equipped with a sensor 1 / 2.3 "CMOS RGB (Red, Green and Blue) has a camera metric type of angular Supergrande format with opening of approximately 88 °. The images were obtained on May 14, 2018 flying at an altitude of 75 m.

A of the most significant advantages of using this equipment for this experiment is that it incorporates in its characteristics concerns related to traditional photogrammetry such as flight stability by inertial sensors and GPS, constant height, information records of the entire route flight scheduling, image georeferencing, and flight planning scheduling ease.

The study area was on the campus of the Para State University (UEPA) campus Paragominas, with coordinates 47° 21’ 32” at 47 ° 21’ 33” W longitude and 02 59’ 05 “at 02 59’ 10 South latitude with an area of approximately 1.6 hectares.

The flight plan was done using the Drone Deploy application and in total 56 images with 88 ° capture angle were obtained, with a 60% lateral cover and 70% frontal cover. The images were processed in the professional Photoscan software version (1.4.2) resulting in mosaic of the area, and later the orthophoto was georeferenced with 15 control points distributed in a way that can control the limits of the property, this collection was done by transporting coordinates by topography with the use of total station so it was exported in GeoTiff format with a resolution of 2.5 cm / pixel.

For the generation of the Adjusted Green Coverage Indices (ICVA) term used in this work, the software ArcMap 10.3 (ESRI) was used that from the orthophoto exported by the photoscan software, the following equation was proposed:

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\text{ICVA: } P_{\text{Green}} - P_{\text{Red}} \times L = \frac{P_{\text{Green}}}{P_{\text{Red}}} + L \]

\(P_{\text{Red}}: \text{Reflection of the Red region}\)
\(P_{\text{Green}}: \text{Reflection of the Green Region}\)
\(L: \text{Opening the equipment lens}\)

The spectral bands used in the calculation of the index make a relation between the greater absorption of the electromagnetic energy by the active vegetation in the spectral range of red and the greater reflection in the green region. The index varies from -1 to +1, and negative values are associated with greater presence of exposed soil, water and infrastructure (constructions) and positive values for the presence of vegetation. As there was no information available on the Mavic Pro drone sensor, it was not possible to convert the digital number to reflectance. However, the index was calculated directly with this equation bringing satisfactory results.

III. RESULTS AND DISCUSSION

The results of this study were surprising and proved to be effective with the equation used, the work of Neves et al. (2017) who used the green tint to approximate the vegetation cover result, stated in his study that the application shows that the method is not effective to differentiate areas completely occupied by vegetation. This fact, which with this new proposal of equation, can better adjust the vegetation coverage information, but classifying it at successional levels is not yet possible, because the vegetation reflectance is not well differentiated within the drone camera.

The characteristics of this new set of information and the challenges associated to its use, such as deformations and image degradation, can be rectified using techniques and methods available in areas related to Remote Sensing, such as computer vision, in typical problems of stereographic vision, multiple views, Digital Land Models, object reconstruction, among others. This new reality does not represent a threat to orbital SR and airborne by manned vehicles, but rather, it expands its possibilities, being a great challenge the development of new methods and approaches more appropriate to this
dataset. Below in figure 2 and 3 we have the representation of the processes and their due results.

In figure 2 we can observe the ICVA overlapping the orthophoto and can make clear its interaction and its prominence where exposed soil and buildings did not generate a confusion matrix, in figure 3 we have the extraction only of the green cover, in this case it is not possible to classify the vegetation in successional states, since we observed that the behavior of the green cover does not take into account the leaf area or the spectral response, but rather the reflectance of the green cover. We can observe that the methodology of Green NDVI, used by Gitelson et al. 1996, a variant of NDVI, is used to identify different rates of chlorophyll concentration in vegetation, since the green band is more sensitive to detect nutritional levels of a plantation. This index is widely used at the beginning of the harvest period, where nutritional levels are varied. However, the SAVI index, proposed by Hsu and Gitelson et al. (1988), decreases the effect of soil on different densities of the vegetation cover in the soil, that is, it considers the influence of the soil on the vegetation. Considering the use of sensors, several authors found good correlations in the late stages of the plant. Teal et al. (2006) find better correlations between NDVI and productivity at these stages. Clay et al. (2006) showed that the recommendation of N based on NDVI collection in the final stages was more accurate than models based only on productivity. In addition, when using the sensors it has the benefit of quantitatively identifying the spatial variability of the culture (MARTIN et al., 2007). Thus, we can observe that some works correspond to the ICVA proposed in this study.

**IV. CONCLUSION**

This study generated satisfactory results and proved effective in generating the Adjusted Green Coverage Index, without the need to use satellite imagery or multispectral data. Thus this is a new way of identifying vegetation with the use of drones, Vans and RPAs, being an advance of the studies of the geotechnologies. The equation used will still be tested in new areas and different situations to show its capacity, and if necessary will be improved according to the observations made. The method can be used to generate green cover and identify tree targets.

**ACKNOWLEDGEMENTS**

We thank the company SINGEO- Solutions in georeferencing for the drone used in this study

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