

SOFTWARE APPLICATIONS FOR THE USE OF AERIAL IMAGES IN PRECISION AGRICULTURE

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Abstract

Precision agriculture represents a new branch developed due to the new technologies, which represents, for most farmers, a challenge in their use in order to obtain improved productions from year to year, and the conservation of the potential of agricultural lands.

Determining the problems of agricultural crops, was done recently through field inspections, which requires a great deal of time.

The emergence of drones, dedicated applications for using the results obtained with the help of drones and other new technologies, such as multi-spectral satellite imagery, opens a new perspective for farmers, which allows them to obtain better results in the field of crops but also the conservation of agricultural land.

The use of drones and the applications dedicated to the processing of the data obtained with them, will allow to increase the efficiency of the farms and also to conserve the potential of agricultural lands. It will be possible to determine precisely the areas in which to intervene in case of drought / excess humidity, deficiency / excess of nutrients. Also, yield maps can be made that will highlight the distribution and density of the plants on the surface, the number of berries / fruits, etc. Early detection of weeds, fungi and other pests in crops, to prevent their spread as well as various diseases.

At present, more and more farmers are convinced of the efficiency of drone application and precision agriculture applications. In addition to these solutions, farmers also need machines dedicated to the application of the results obtained with these technologies (agricultural equipment equipped with GPS, sensors for various climatic and soil parameters, variable nozzles for seeders and fertilizers, motion / rotation sensors, counters, etc.).

Key words: precision agriculture, drone, aerial imagery

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MATERIAL AND METHOD

The emergence of drones, dedicated applications for using the results obtained with the help of drones and other new technologies, such as multi-spectral satellite imagery, opens up a new perspective for farmers, which allows them to achieve better results in the field of crops but also the conservation of agricultural land.

Determining the problems of agricultural crops, was done, until recently, through field inspections, which requires a great deal of time.

Precision agriculture is a new branch developed due to the new technologies, which represents for most farmers a challenge in their use in order to obtain improved productions from year to year, and the conservation of agricultural land potential (<https://www.geo-farms.com/precision-farming>).

The use of drones in agriculture involves a certain workflow, explained in the image below.

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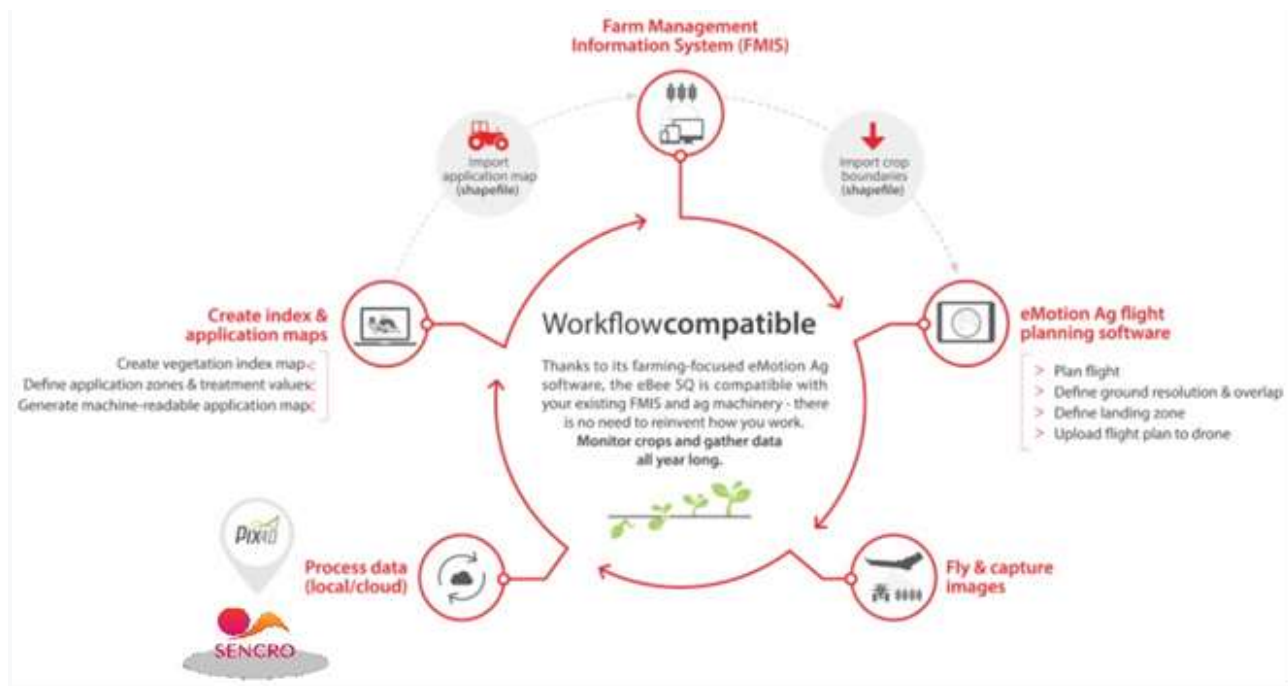


Figure 1 Workflow for the use of drones in agriculture

What data does a drone collect?

A drone allows the collection of aerial images on the ground, in RGB and multipsectral mode.

The processing of these images, by means of a special software, allows to obtain various information necessary for an agronomist engineer in order to establish the health status of the crops and the treatments that are necessary to improve their condition.

The software solution for the processing of photographic data, allows to obtain the following results:

- orthophotoplan of the studied area
- digital model of land for the studied areas
- multispectral image for the studied area

The combination of these results is done through dedicated software solutions. In this regard, SysCAD Solutions s.r.l together with the Faculty of Functional Improvements and the Environmental Engineering, participates together in the development of a software solution necessary for the information management of the farms. The development of this solution is coordinated by Mr. Engineer Dipl. Sasu Andrei Sebastian, employee of SysCAD Solutions s.r.l.

The application has the following functionalities:

- Real estate management

- Graphic connection to ANCPi cadastral numbers
- Contract management
- Property
- Lease
- Crop management
- Graphic view of buildings (map)
- Thematic maps on property or lease type buildings
- Satellite analysis NDVI, NDWI, temperature
- General report
- Topographic Information (ANCPi Cadastral Numbers, Tarla outline, plot plans)
- Geolocation - can be used from the mobile phone in the field

The application allows the analysis of data from multiple sources, such as:

- images obtained with the drone
- satellite images
- topographic maps
- maps for APIA
- multispectral images

This information is analyzed and the results obtained are displayed in various forms or reports, such as summary statistical reports for NDVI, NDWI, temperature, cumulative temperature for active physical blocks, etc (<https://www.sciencedirect.com/science/article/abs/pii/S0034425796000673>).



Figure 2 Reports for NDVI, NDWI, temperature, cumulative temperature for active physical blocks

The Crops menu allows the following operations:

- Shapefile file introduction (according to APIA requirements - Stereo 70 coordinates)
- Possibility of duplicating a crop to enter a new agricultural year
- Graphic representation of cultures
- Date of sowing and harvesting (estimated)

• Type of culture and physical block (information related to APIA)

• The name of the cultivated product

• Estimated production / ha (production culture capacity)

• Production done / ha

• Name / type and quantity of fertilizer at ha level

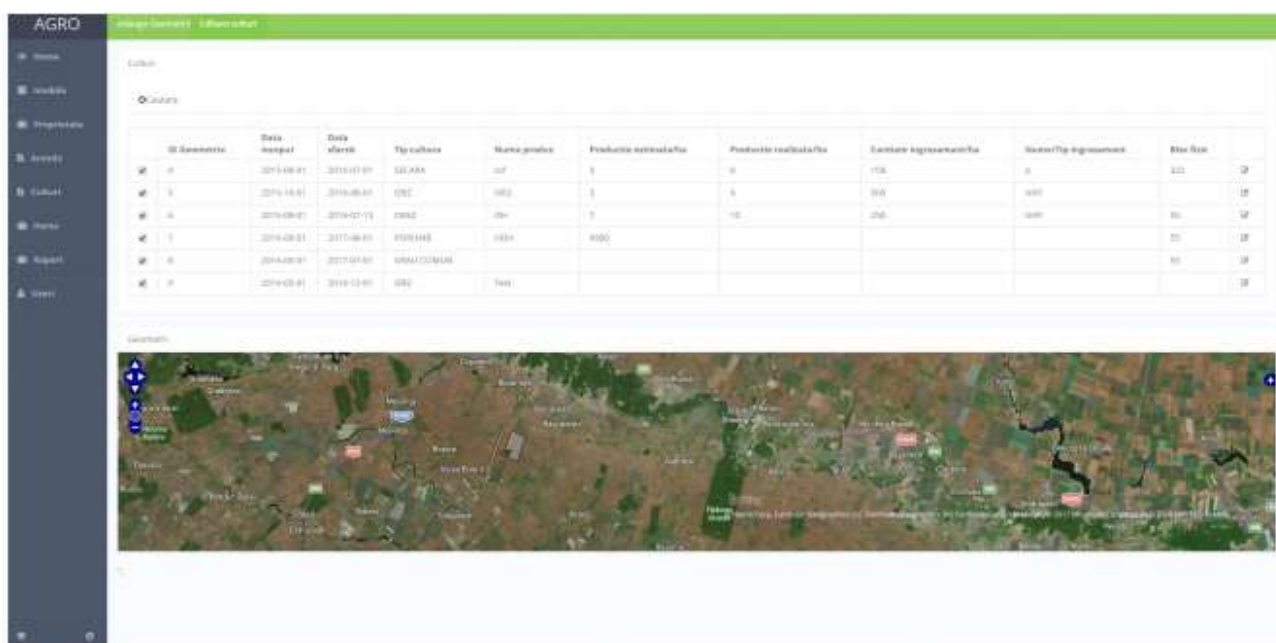


Figure 3 The Crops menu

Reporting the obtained results allows (<https://eos.com/ndwi/>; https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet_ndwi.pdf):

- determining the NDVI index
- determining the NDWI index
- drawing up a general report

RESULTS AND DISCUSSIONS

Why SENCRO?

SENCRO is a Romanian application, developed 100% for the needs of farmers in Romania, with the possibility of rapid adaptation to

their requirements, according to the demands of farmers, with a rapid response to the changes due to the legislation (https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet_ndwi.pdf).

As strengths of smart agriculture using drones and SENCRO, we can highlight the following:

• NDVI analysis helps to determine the level of fertilizer applied in the field (can lead to savings)

• NDWI analysis helps determine the level of water used in the land

- Can be used from the mobile phone in the field to view the location and identify problem areas
- Simple information management
- Identifying problems at the office
- Identifying problems in areas that are difficult to access or difficult to see in the field

- Correlation with ANCPI tabulated buildings
- GIS technical support for the graphic part
- Implementation of databases
- Support in the interpretation of satellite analyzes
- Support for creating detailed reports

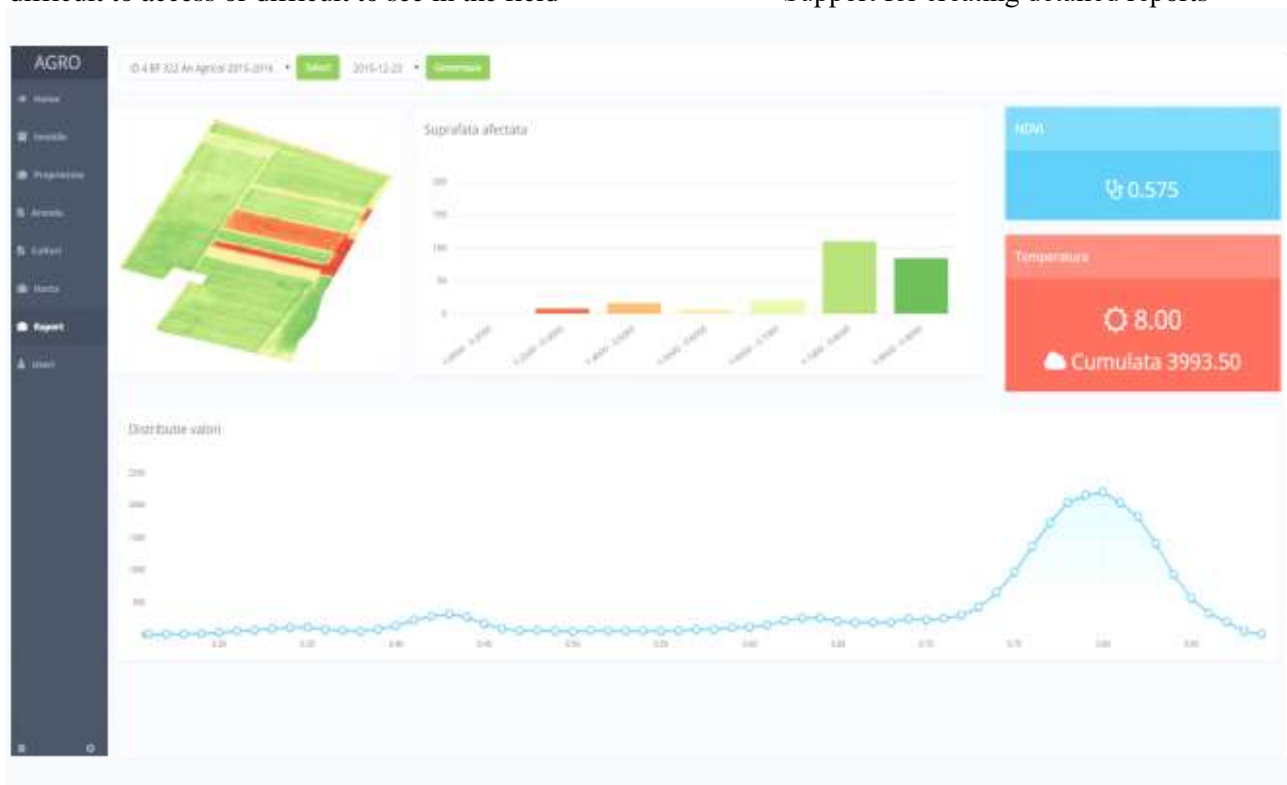


Figure 4 Example of a general report



Figure 5 Spatial query within the database

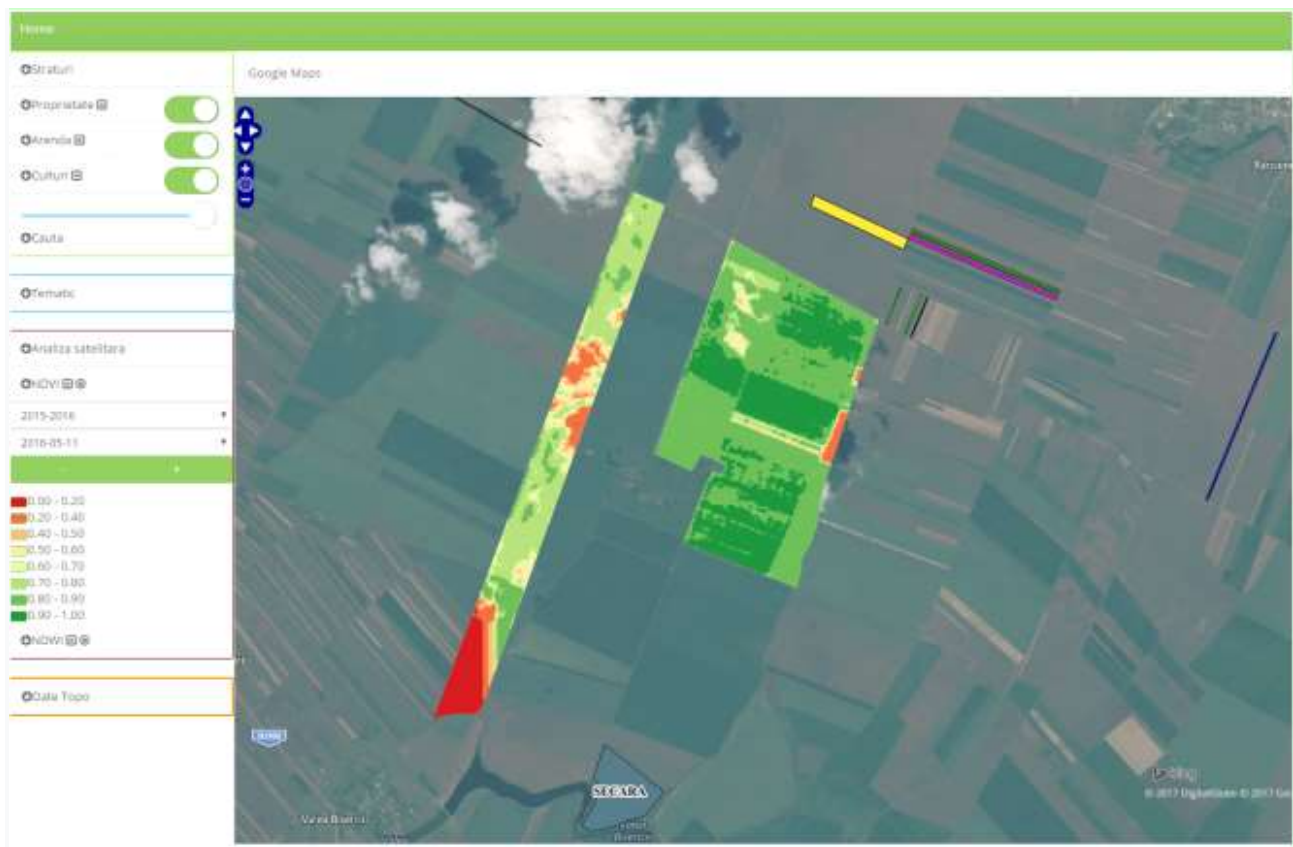


Figure 6 Determination of the NDVI index

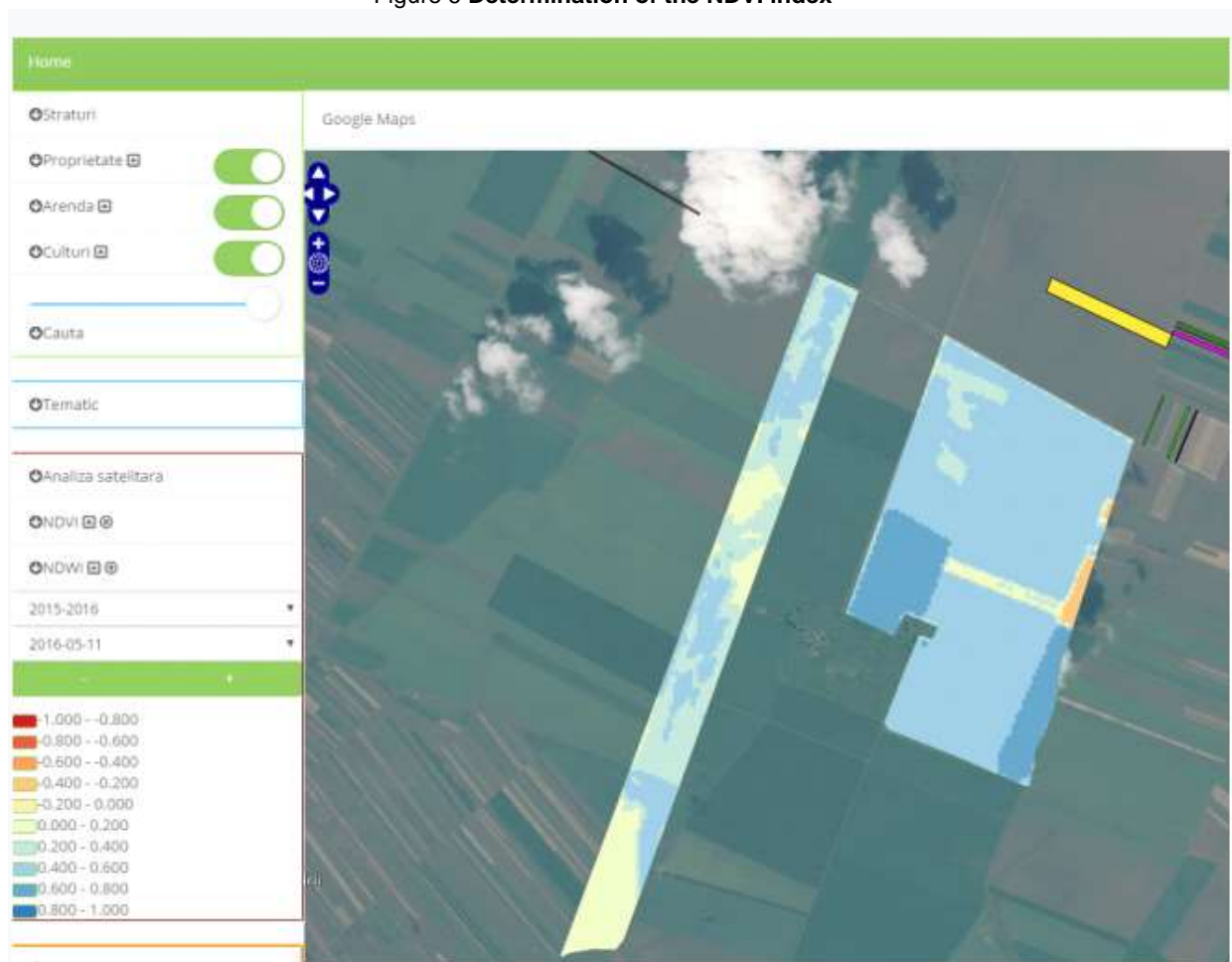


Figure 7 Determination of the NDWI index - the water level in the plant

CONCLUSIONS

The use of drones and the applications dedicated to the processing of the data obtained with them, will allow to increase the efficiency of the farms and also to conserve the potential of agricultural lands.

At present, more and more farmers are convinced of the efficiency of drone application and applications dedicated to smart agriculture.

In addition to these solutions, farmers also need machines dedicated to applying the results obtained with these technologies, such as:

- ☐ tractors equipped with GPS equipment
- ☐ seed nozzles with variable nozzle
- ☐ fertilizers with variable nozzle
- ☐ etc.

ACKNOWLEDGMENTS

We are grateful for the direct help received from the team of SysCAD Solutions S.R.L., who executed the drone flight and took over the aerial images necessary to realize the SENCRO application.

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