DRONE TECHNOLOGY IN AGRICULTURAL MECHANIZATION

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Absctract: *Technological innovations and radical products that drive the whole world forward can sometimes have an impact on different areas than planned. The drones ' positive impact on innovative agriculture has yet to be manifested in the stages of land and seed preparation. Advanced drone technology enables realistic 3D maps to be created, leading to soil analysis and seed development. Drones successfully manage the seed planting process in the soil. Furthermore, thanks to advanced imaging techniques and special thermal sensors, which part of the field needs water and where nutrients need to be supplemented easily can be determined.*

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1.Introduction

Technological innovations and radical products that drive the whole world, sometimes have an impact on different areas than planned. In the past, unmanned aircraft, dubbed “drone,” has quickly adapted to civilian life. Drones, which are now being used for a variety of purposes, ranging from cargo delivery to tracking of missing people in the woods, video-photography and fun activities, are also an important part of the agricultural sector, which has become more technologically and innovative by rapidly changing. Although drone technology may seem futuristic, it has been used in agriculture since 1980, starting with the use of Japanese fertilisers for the first time. Drones, which were very primitive in the first place and which combine sophisticated technologies and different algorithms with each other, add an innovative perspective to agriculture in every aspect (Food and Society, 2018).

Sustainable agriculture is a concept in which the drone potential is best reflected and shed light on the future of the agricultural food system, and drones are the key source of the ultimate goal to achieve a truly sustainable agriculture.

The drone’s positive impact on innovative agriculture has yet to be manifested in the stages of land and seed preparation. Advanced drone technology enables realistic 3D maps to be created, leading to soil analysis and seed development. Drones successfully manage the seed planting process in the soil. This new technique allows the seed to be sprouted and nutrients to be placed directly into the soil and exactly where they are desired. This system allows farmers to rooting 75%, reducing planting costs by 85% and increasing sustainability. Furthermore, thanks to advanced imaging techniques and special thermal sensors, which part of the field needs water and where nutrients need to be supplemented easily can be determined (Food and Society, 2018).

Cultivation of the soil completed in the process of planting, traditional methods in terms of keeping the soil under control may be inadequate. Satellite images are not always possible, and even if the images are removed, the farmer does not give enough detail to be a solution to the problem. That's where the drones come in. Drones can map the terrain several times a day with practical technology, provide a comprehensive flow of information on a regular basis, and all this data makes it easier to calculate the best time to start harvesting.

One of the most important factors for sustainable agriculture is the amount of pesticides used. At this stage, drones provide effective and nature-friendly solutions especially for pesticide applications thanks to their ability to determine the right place for the soil to be applied. Thus, by preventing unnecessary pesticide use, a further increase is added to the success level in sustainable agriculture.

2.Materials and Methods

The advancement of drone technology has seen many new uses, including the expansion of drones in agriculture. Display sensors provide farmers with new opportunities to increase product efficiency, minimize product losses and thus maximize profits. Farmers are now using technology reserved for monitoring airborne crops once for the army, instead of inspecting their crops visually on foot. The information obtained from the drone product display provides a greater and more accurate view of product health (Drone Omega , 2017).

Drones can fly up to 400 feet without the need for a special permit from the Federal Aviation Administration. This low-altitude high-altitude aircraft or satellite images are superior and cheap high-resolution images can be obtained. It also eliminates the problems of clouds that have to deal with low altitude satellite imagery (Drone Omega , 2017).

Cheap, but high-functioning drones can be used Micro-Electromechanical Systems, small GPS modules, more powerful computer processors and advances in technologies such as miniaturized digital radios can be monitored. The advancement and accessibility of these components mainly use smartphones and mass-produced parts due to economies of scale. The basic function that makes crop tracing extremely useful for farmers is autopilot, which automates drone flying. Autopilot software can pre-determine the flight pattern to maximize the coverage of product areas, and the imaging software can place aerial images on a mosaic map. The generated map is the key to improving product performance and reducing costs. This shows exactly what areas of the crops you need to pay more attention to. Farmers can spend more time treating plants and less time scouting (Drone Omega , 2017).

Information that can be obtained in the human visual spectrum pales to what image sensors can do. The availability of different camera sensors allows drones to provide more information on what to observe in the human eye. The larger the sensor, the greater the information obtained from the images. The following sensors are available:
RGB (red, green blue): for plant counting, height modeling and visual inspection
NIR (infra-red near): water management, erosion analysis, plant count, soil moisture analysis and plant health
RE (red edge): plant count, water management and product health
Thermal infrared: irrigation planning, Plant Physiology and yield estimation

The normalized differential vegetation index (ndvi) shows the difference between red light reflected from plants and close infrared light. Healthy leaves absorb red light through an active photosynthesis process and strongly reflect near infrared light. Dead or unhealthy leaves reflect both wavelengths of light. This property can be used to measure the health of crops. Does not receive special sensors to obtain this data. A normal camera, which has been replaced by a simple filter, can be made to a close-up infrared camera (Drone Omega , 2017).

2.1.Precision Agriculture

Sensitive agriculture refers to the method of managing crops to ensure the efficiency of inputs such as water and fertilizer, and to maximize productivity, quality and productivity. This term also includes harmful, unwanted flooding and disease to minimize.

Drones allow farmers to continually find problems that would not be visible at the ground level spot controls to monitor plant and livestock conditions through the air. For example, when a farmer-lapse drone is not properly watered down part of his crop you can find through the photo (Meola,2017).

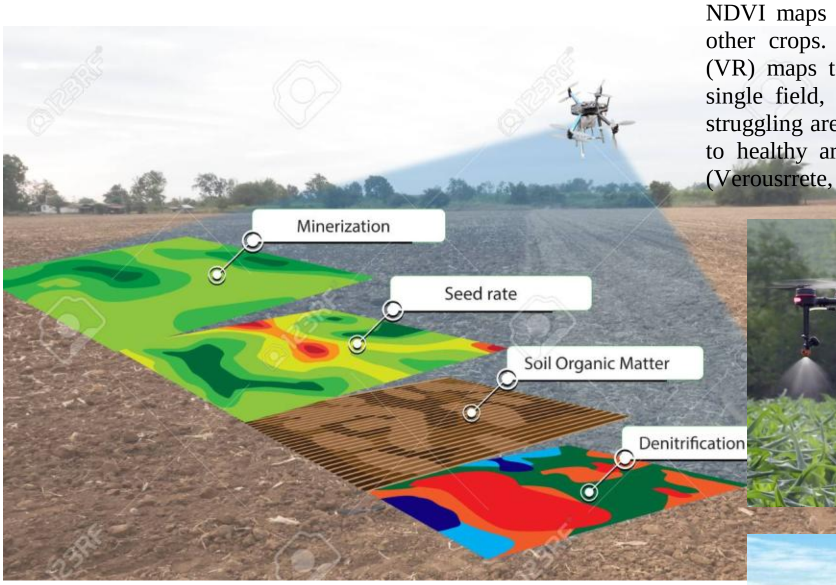

Fig1 *Determination of general soil condition by drone*

2.2.Mapping and Measurement

Using a drone is a relatively simple one in the map or research plants process. Many new agricultural drone models are equipped with flight planning software that allows the user to draw the space he or she needs to cover. Then, the software automatically makes a flight path, and in some cases, even the camera ready for shooting.
While drone is flying, it automatically shoots photos using onboard sensors and the built-in camera and uses GPS to determine when to take each shot. But if your drone doesn't have these automatic features, then you need to fly a person drone when taking other photos (Meola,2017).

Fig.2 *mapping and measurement*

2.3.Product Spraying and Fertilization

In 2015, the Federal Aviation Administration approved Yamaha RMAX as the first drone weighing more than 55 kilos to carry fertilizer and pesticides tanks to spray plants. Drones like this are capable of spraying plants with much more precision than a conventional tractor. This helps to reduce cost and potential pesticide exposure to workers who need to spray these plants manually (Meola,2017).

Though many will argue that ground-based investigations combined with satellite imagery, along with a dedicated grid soil sampling program is more practical for the purpose of treating nitrogen, phosphorus and potassium applications in agriculture, drones do have their fit. A drone service start-up company in the US has used NDVI maps to direct in-season fertility applications on corn and other crops. By using drone-generated, variable-rate application (VR) maps to determine the strength of nutrition uptake with a single field, the farmer practically 300 kg/ha of fertility to you struggling areas, 200 kg/ha to medium quality areas, and 150 kg/ha to healthy areas, decreasing fertilizer costs and increasing yield (Verousrrete, 2015).

Fig.3 *Spraying and fertilizing process with drone*

2.4.Data Processing and Analysis

As a drone collects data on an area, the camera takes several hundred photos as a “lawn mower” pattern flies back and forth on the field. These images were then made to make the results useful.
With a special software you can process your computer images locally, which can be time consuming level. In the beginning to achieve repeatable results to gain mastery of the software, the flight after the flight, can be a steep learning curve. Each time the data is loaded, the computer is ready to suppress productivity and monitor progress to ensure the operator is running.

One of the most useful reports that a drone can produce is an NDIV image. This is true to highlight areas where a NIR camera takes stitched images and has a “wrong painting” problem. Although there is no standard color scheme for these reports, Agribotix colorizes the image with strong signals that appear green, yellow transition, then red, and eventually gray for the weakest parts of the area (McKinnon,2016).

Agricultural Farm analysis: drones are high-quality reliable instruments flying in the sky and status at the beginning of any crop year that can be used by farmers to control the farm. The drones are producing 3-D. maps used for soil analysis seed collection. Soil and field analysis with drone also provides data on irrigation and crop growth, which is useful for better managing the nitrogen level of areas (Puri, 2017).

Saving Time: land hectares to reach every corner and corner area for control from time to time finds farmers difficult tons. Drones do this without any hiccups. farmers can do it regularly. time intervals to know the regular weather observation of the fields (Puri, 2017).

High agricultural yield: sensitive application of pesticides, water and fertilizer use is monitored by the correct drone will turn increase yield and overall quality can reduce (Puri, 2017).

GIS mapping integration: GIS mapping has already proven its value throughout the agricultural industry to manage resources, increased input Cost Management, better business management and more. With integrated GIS mapping with drone, farmers can draw field boundaries for the correct flight pattern (Puri, 2017).

Product health status imaging: with drones, product health monitoring can be done using infrared, nvdi and multispectral sensors, farmers better product, sweating rates and absorption rates of solar radiation monitor health (Puri, 2017).

3. Results

Some farmers are reluctant to use drones for product management because of the initial cost of a drone. When you think that a visual walk inspection or an air survey cost an average of $ 2 acres, a drone purchase investment can be met back quickly. This can usually be accomplished in a growing season, or even less. The information obtained from drone can then be used to reduce operating costs and increase product efficiency.

There are many activities that make the farmer routine, it can be reinforced with the use of drones. To protect crop health, pest, disease and weeds need to be defined to develop a plan to address these problems. Collecting tissue and soil samples is necessary to identify fertility, disease and pest problems. The root structure of plants should be controlled for compaction, disease and pests symptoms. Soil erosion is always a problem, so erosion must be measured in channel width and depth. Finally, the product yields and population should be accurately estimated for resource management. These are important points for farmers.:

•*Approval:* Frequent control of plants growing at the expected rate
•*Early detection:* this is the key to addressing plant health issues in order to limit the effect and provide time to implement a solution
•*Fertilizer scheduling:* plants rarely grow equally and instead of distributing fertilizer based on plant health, they strive to spread evenly and reduce costs.

Drones are also used to apply plant nutrients and pesticides, instead of using workers ' Footprints or tractors. Air spray is much faster and cheaper using traditional methods such as tractors. Crop powder paints have been operating in Japan for nearly twenty years, and they finally start making their own way to use in the United States.

American product value lies in hundreds of billions of dollars per year, so even a small increase in yield would be a significant economic benefit. However, the fact is still unclear if drones can provide more usable information than the current aircraft and a cost advantage compared to Satellite viewing.

Part of the puzzle that is currently missing is the lack of expertise to analyze data, compare what is happening on the ground, and propose an appropriate action route to address product problems. There are services that provide image data, but an investment must be made in order to extract sensitive information from the data, in terms of time, money and software. This is not done well right now from sources that provide images from satellites or planes. It is not clear how this will change when the product is taken from drones. However, technological developments in the drones in agriculture are moving faster than satellite or plane image sources.

There are still other issues that need to be addressed. Over time, the generation of calibrated images that provide added value to product tracking is still under investigation. Image variability is also influenced by different sun angles and effect of cloud cover. Drone image calibration progress will soon address these technical issues and provide meaningful clipping performance metrics.

Increasing crop yield is always an important problem for farmers and will always be. However, for the first time in generations, digital and technological advancements enable farmers to make great improvements in their performance. It is important for an individual farmer who is profitable on a small scale. On a global scale, this is linked with the problem of feeding a growing global population. This is even more complex with environmental impact problems, reducing water waste, eliminating chemical evasion and reducing carbon dioxide emissions. Digital technology can contribute to addressing these problems to establish sustainable agricultural processes.

All members of the agricultural system must adopt new digital technologies to make their activities more efficient, profitable and efficient. Large farms can benefit from a number of data that can be applied to increase the amount of food produced from the same area. Doing so will result in potentially improved financial agricultural performance and higher profits. Smaller farms can also benefit from digital technology to increase product efficiency.

Today, soil and plant properties image processing methods are determined by such methods historical yield maps, seed and leaf samples, aircraft and satellite images. However, image resolution is the most important issue in these methods. Also, these methods can often be missing or time consuming, and the data may take longer to gather process and analysis. Today, the most popular soil and plant properties determination methods are used high-altitude weather images. UAV for this purpose, the most popular commonly known as drone tool. The drones provide real-time and high quality the aerial image according to satellite images the agricultural fields. Also, localization applications weed and diseases, determination of soil properties, determination and production of vegetation diversity correct height models are possible at this time with the help of the drones.

4. References

Drone Omega, 2017. Drones in Agriculture Applications. *www.droneomega.com/drones-in-agriculture*, 24.04.2018.

Food and Society, 2018. Sürdürülebilir tarım için bakış açınızı genişletin: Drone teknolojisi. *www.barillacfn.com /en/magazine/ food-and-society/drones-technology-for-the-benefit-of-sustainable-agriculture*, 24.04.2018

McKinnon, T.,2016. Agricultural Drones: What Farmers Need to Know. Founder and CTO of Agribotix.

Meola, A., 2017. Exploring agricultural drones: The future of farming is precision agriculture, mapping, and praying *www.businessinsider.com/farming-drones-precision-agriculture-mapping-spraying-2017-8*.

Veroustraete, F., 2015. The Rise of the Drones in Agriculture. Department of Bioscience Engineering, University of Antwerp, Groenenborgerlaan 171, 2020 Antwerp, Belgium.

Puri, V., Nayyar, A., Raja, L., 2017. Agriculture drones: A modern breakthrough in precision agriculture, Journal of Statistics and Management Systems, 20:4, 507-518.