


Review article: Common use of drones in the agricultural sector

Matygov Movsar Musaevich¹^a, Akkizov Azamat Yusufovich²^b and Natalya Ivanovna Pikuleva³^c

¹*Kadyrov Chechen State University, Grozny, Russia*

²*Associate Professor and Ph.D. of the Department of Biology, Geoecology and Molecular Genetic Foundations of Living Systems, Kabardino-Balkarian State University named after A.I. HM. Berbekova, st. Chernyshevsky, 173, Nalchik, Russia*

³*Department of Computer Systems Kazan National Research Technical University named after A. N. Tupolev-KAI, Kazan, Russia*

matygov.movsar@gmail.com, akkizov@mail.ru, pikulevan@inbox.ru

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Abstract: The following article focuses on the use of unmanned aerial vehicles or drones in the agricultural sector. Agriculture is currently not in line with nature and hence has a negative impact on the environment and the planet as a whole. Unmanned aerial vehicle no way near of being natural, but these technologies are more eco-friendly and, thus, can be used for to practice agriculture. Drones are applicable in many sectors, but the agricultural sector is a promising sector that can be positively impacted. Over time, they have shown that not only does it get better, but the functionality increases significantly. Thus, the work will cover the main areas of application of technology in the field of agriculture. The following applications will be considered: monitoring, dispersion of liquids, Seeding, pollinators and machine vision. The drawbacks of the technology will also be outlined.


1 INTRODUCTION


The agricultural sector is on the verge of massive change. The variety of technology is unimaginable, and the scope of their application is wide. Nowadays, many technologies are being introduced to automate any business in the most efficient way. Most technologies come out performing one task or are at first intended to do so, but eventually spreads to other sectors. It is a common path for the emergence of new technologies. However, in recent times, the transition of a new technology to mass use and a variety of its applications is happening faster than a few decades ago. Meaning that the technology is more available and almost applicable everywhere. It is also fair to say that technological revolutions are taking place every time, with an ever-shorter interval between them. It all leads to a sensible conclusion that the adaptation of technology in different industries will be easier and quicker.


Technology unnoticeably penetrates our lives and pushes it to a new level. Once it appeared as a fantasy,

now it is a reality. We have no yet human like robots, but there are mechanisms and machines that are capable of doing things beyond any human reach. A robotic arm that mimics human arms' mobility to perform complex tasks in industry. Digital sensors, which can be used to monitor and analyses almost anything. Embedding AI in various technologies to almost eliminate human involvement and the common mistakes associated with it. These technologies make our life more diverse and comfortable. Although it must be kept in mind that these technologies have two sides of usability. They can be used to give more meaning and value to our environment and ourselves. Similarly, they can be used or misused to harm the planet and therefore us as a whole.

Lately, we are starting to notice the intersection of different new technologies together. These collisions bring us new technologies with better capabilities and functionality. For example, the internet of thing uses various technologies to function in a more convenient way, such as: AI, all kind of sensors, various mechanisms, communication technologies and so on.

^a <https://orcid.org/0000-0001-5796-1783>

^b <https://orcid.org/0000-0002-8900-7457>

^c <https://orcid.org/0009-0002-4561-6303>

To build a robotic arm, one would need to have the mechanical parts, the sensors and all the spatial fillers and program to assign tasks, which together are called mechatronics. But the main concern of this work is to cover the yet to come unmanned aerial vehicle or drone and its use in the agricultural sector. An example of drone advantage can be seen in a forestry surveying.

Modern drones are not just flying sources, but well-equipped and multifunctional technology. Its range of application spreads from the entertainment industrial to industrial sectors. There are drones of different sizes, shapes, functionality, capabilities, and so on. The positive effect of them is so high that they have replaced the old methods and approaches, providing users not only with higher quality, but also with accuracy. As with any technology, there are some drawbacks that will also be highlighted in this paper. However, as mentioned earlier, the purpose of the work is to study the use of drones in the agricultural sector.

2 APPLICATIONS OF DRONES IN THE AGRICULTURAL SECTOR

Agriculture is a sector that almost immediately uses new technologies to automate production processes and increase yields. Drones are no exception and are being used to their full potential in many areas of agriculture. The drone industry in the agricultural sector is expected to grow from 1.2 billion (USD) in 2019 to 4.8 billion (USD) in 2024. Therefore, the next paragraph will focus on the agricultural sector and the use of drones in it.



Figure 1: Drones with removable modules.

2.1 Monitoring with Drones

Drones are great for quickly covering a large amount of areas due to their size and speed. They can be used to monitor a larger area with no effort and expensive and complex equipment. The first and easiest thing most drones are capable of is getting a bird's eye view. All drones nowadays are equipped with strong cameras that allow to capture pictures (RGB maps) from a point of view, which a human cannot view. Drone footage is giving agricultural industries and individual farmers a fresh look at their land, allowing them to better identify problem areas. The collected information can be used to visualize farmland, plan for future changes if necessary, track the condition of the land over the years, and so on. In addition, Normalized Difference Vegetation Index (NDVI) maps can be used. NDVI maps show the amount of infrared light reflected in a selected area. These maps are more informative in terms of hidden information for the human eye. They can indicate areas with malnutrition and drought. And also drones can help detecting different kind of disease such as parasites. Since they can replace many expansive tools that have been used in the past, drones are a need technology for monitoring and giving insight of agricultural areas.

2.2 Dispersion of Liquids

As it was mentioned previously, drones are very quickly evolving and including in itself newer abilities. Lately, drones are good at carrying various equipment and extra modules. Of course, the capabilities of carrying different stuff depends on their size, power and other parameters.

Irrigation in agriculture is the main source of well-being of harvest. The other thing is the proficient utilization of water, which could benefit in many aspects. Latest challenges are directly influencing the availability of clean water. Therefore, it is a priority to use water in irrigation with precision. Drones provide this kind of opportunity to the farmers and larger agricultural sector. Drones are able not only to cover the ground with water, but to carefully disperse it, depending on the need for water in the areas. Areas of covered land are first analyzed digitally to find out areas of drought and other parameters and thus enable precision farming.

Fertilizers are also an important part of modern agriculture to enrich the soil and future harvest. Depending on the appearance of the crop, drones can provide a reasonable amount of fertilizer. Like water, fertilizers can be evenly distributed over large areas in a short period of time. Drones can be used to spray various substances depending on the task.

2.3 Seeding Process

Compared to other drone applications, sowing seeds is something new and can be described as experimental at the moment. However, there are startups and companies that are already testing the technology for faster and more efficient seed planting by using different mechanisms. Once the technology has fully passed the testing stage, new approaches will appear that will make landing easier and more efficient.

2.4 Pollinators

Another promising part of using drones in agriculture is that they can act as mechanical pollinators. While insect vectors are still the most important pollinators, drones may one day replace bees as the most important pollinators. Although extensive research is needed in this area, researchers hope that drones will be able to transport and distribute pollen seeds in gardens and fields.

2.5 MV and Drones

Drones by themselves are not that precise, but when powered by the AI they can perform outstandingly. Machine vision on of the main power of drones that allows them to analyse the area of soil or crop and respectively to act. Machine vision in drones could bring precise agriculture to the next level as the waste as over usage of any source will be solved. All the before mentioned points are driven by the machine vision and, hence, further improvement in MV will consequently push other functionality of drones to the next stage.

4 DISCUSSIONS

With so much advantages from the usage of the technology arises a question is there any drawbacks to the technology. Similar to other technology, drones use in agriculture have negative side too. Data satellites is a technology that improves drones' implementation in agriculture. These implementations also need specialized algorithms such as map representations an recursive auctions. With the improvement of drone's new regulation started emerging. Therefore, it is important to follow and understand the rules as some of them can be confusing for the farmers. Farmers or other agricultural sectors also need well-skilled operators to fully use the potential of the drones. It is obvious that

a common farmer will not be able to operate a drone not just to its potential, but a basic level stuff too. The labour related issue is not the main one for the agricultural sector, but its cost. For sure the overall price for the common drones went down, but specialized drones still are expensive not considering other related cost of the components. The disadvantages are related to more skills and cost rather than quality of the performance and, hence, they are dependent on the user.

5 CONCLUSIONS

The work was conducted to outline the major areas of use of drones in the agricultural sector. This technology brings a lot to the table when introduced to the agriculture. It provides many tools for the improvement and further development in the sector of agriculture. One can argue that drones will revolutionize any selected sector if used correctly. Agricultural sector is just at the beginning of application of drones and hence the full impact is yet to be seen.

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