

USAGE OF DRONES IN PRECISION AGRICULTURE AND CHALLENGES IN INTRODUCING THE DRONE TECHNOLOGY FOR LOCAL FARMERS IN INDI

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ABSTRACT

Agriculture in India has always been viewed as adopting primitive tools, methods and techniques. The reason for this is the lack of awareness among the farmers or the reluctance of the farmers to adapt to the growing technology around them. Although there have been many developments in the area of tools and implements used in farming, the latest developments in technology is yet to be leveraged in most parts of farming communities. This paper will explore about drones which are fast emerging technology and its application to precision agriculture and how it can support and improve the productivity and also some of the challenges in delivering this technology to the local farmers.

Keywords: Drones, Unmanned Aerial Vehicles, Precision agriculture, Productivity

1. INTRODUCTION

2.1 DEFINITIONS

2.1.1 DRONES

Drones are Unmanned Aerial Vehicles (UAV) which are controlled remotely. Depending on the applications the drones are available in many variety and sizes. Initially drones were used for military purposes, in the recent past drones have found many useful applications in many areas. Agriculture is one area in which drones can be used in plethora of ways.



2.1.2 PRECISION AGRICULTURE

Precision Agriculture or farming is generally defined as an information and technology based farm management system to identify, analyze and manage variability within fields to achieve optimum productivity, profitability and sustainability and protection of the land resource.

2. RECENT CHALLENGES IN AGRICULTURE/FARMING IN INDIA

Agriculture an art to be long forgotten among today's generation. An art because like any other job culture it requires so much passion and skill. Wondering at today's apathy of agriculture and its dependent farmers, its highly important to understand where did we miss understanding the uncertainties that agriculture hold forth.

Agriculture is the source of food for billions living on earth. The main source of livelihood for many. Still so much ignored and less attention towards the great job providing sector. When there are many policies that are formulated by central and various state governments there is little improvement in the living conditions of farmers and agricultural sector on the whole. Is it the policy that keeps the sector grounded or the poor implementation of these policies? Is there a requirement for transformation of the agricultural sector to a well-advanced technology packed one? Seriously if we think about this, we understand that the so-called technology era we are living in has not reached to its fullest form into the farming sector.

When there are still debates on the merits and demerits of Green revolution, the irony is that after the initiation of such a strong wave towards revolutionizing the agriculture there has been very little initiation of that kind since then. Or if there has been developments which probably was underrated and has not reached the local farmers.

Through various researches it has been understood that, by and large farmers still adopt the primitive form of farming practices. These practices do not lead them towards the roads to development or improved standard of living.

3.1 OBJECTIVES OF THE STUDY

1. To understand the impact of technology in agricultural productivity
2. To understand the challenges to introduce new technology for the local farmers

3.2 SCOPE OF THE STUDY

1. The study helps in understanding the significance of technology in the field of agriculture
2. The study also helps in identifying various technological improvements required in the agriculture

3.3 LIMITATIONS OF THE STUDY

1. Primary focus is on the technological influence on increasing the agricultural productivity therefore rest of the factors are not considered
2. Agriculture being an unorganized sector leads to difficulty in maintenance of data.

4. USAGE OF DRONE TECHNOLOGY TO SUPPORT SUSTAINABLE AGRICULTURAL PRODUCTION

In recent years, the drone technology has been finding its use in improving various activities in farming and agriculture. The hardware and software that are being used is becoming relatively less complex as is the cost. But, all this is in terms of technical aspect, when we come to the practical usage of the technology, countries like India are still lagging behind. Although the signs of leveraging these technologies are very optimistic, the method to deliver it to the local farmer is becoming a challenge.

Before we delve into the delivery methodology of the of these technologies, let us look at what are the possible applications of drones in farming and agriculture

4.1 CROP MONITORING

Drones are capable of flying through the entire vegetation and observing the crops for various parameters. Quad copter is a type of drone which can be fitted with multispectral camera, which captures 1 photo per second and stores it in the memory and also communicates the same to the ground station using telemetry. MAVLINK protocol is widely used for this wireless communication.

Using geo-fencing techniques to markup the area of the vegetation, the drones in their flight first creates a digital map of the field. Using this digital map and photos obtained through the multispectral camera fitted in the drone, the data can be analyzed using the Normalized Difference Vegetation Index (NDVI) techniques the health of the crops such as pests, weeds and disease detection.

Other areas in which these data can be used is to monitor and analyse Crop Water Stress Index (CWSI) and Canopy Chlorophyll Content Index (CCCI).

4.2 CROP SPRAYING

In the recent years, the amount of fertilizer and pesticides sprayed on the crops has been a major subject of debate. The consumers of the crops are being bombarded with information about how much of chemicals that they are consuming. The Government on its parts has been trying to restrict and regulate the amount of harmful chemicals used in pesticides.

The current method used by farmers is what we can term as generalized spraying, without taking into account the areas or specific crop's that are affected by pests or crop diseases. The usage of drones is boon in this area, because it creates a win-win situation both for the farmer and the consumer. This is achieved by using drones to first collect the data about the pest or disease affected crops or the area and spraying only the required amount of pesticide. There is cost saving in terms of volume of pesticide used, also crop yield increases.

Specialized drones equipped with sprinkler mechanism, it generally contains two modules one which holds the pesticide and other controller. On a single fly through the field, the drone uses the previously acquired data, and using the controller to regulate the sprinkler can apply the pesticide as required.

4.3 OTHER APPLICATIONS

With the improvement of technology in making the drone more intelligent, many new areas of applications are continuously being discovered. For example precision agriculture is one area which is gaining momentum. Some recent drones have been used for plantation also. Similarly soil and field analysis is another area in which drones will be used extensively.

5. CHALLENGES IN LEVERAGING OF DRONE TECHNOLOGY BY LOCAL FARMERS

In India, agriculture and farming sector is an area in which the traditional methods and primitive tools have been used for many years. Although there are multiple reason for this, one of the major reason is the risk involved in adopting new techniques and most of the local farmers are apprehensive to new technologies if it is directly going to impact or affect their overall yield. Additionally, farmers are also very sensitive about the cost of new technologies.

In case of drone technologies, extreme care should be taken to introduce and deliver the technology in a very structural and phased manner. Since the technology in itself is technically complex also

5.1 EDUCATION & AWARENESS

The initial aspect of introducing any new technology in the agriculture sector is to first create awareness. The onus will be on the Government mostly, also tech start-ups which are building drone technologies. The following are some of the ways to create awareness

Training & Visit

- Local panchayat, Village Knowledge Centres(VKC) and Village Resource Centres (VRC) can be leveraged to disseminate education and awareness with respect to drone technologies to the local farmers
- Live Demonstration sessions, including the analysis of data should be conducted for concentrated user groups (CUG) can be done to create awareness and get a first hand experience
- There are many model farms that are available around the country, audio-video of the experiences from the people involved in the model farm will be a very good way of bringing awareness to the local farmers
- Drones are very popular in the multimedia and entertainment domains, so this can be leveraged to an extent to show the capabilities of the drones
- Special packages to be provided, which include soil analysis and water table data to be done for farmers who would like to create a digital map of their field

5.2 DELIVERY METHODOLOGY

There needs to be a combine effort by both the government with cooperation private agri start-ups to strategize a clear process to deliver the drone technology to the local farmers.

As can be seen, usage of drone technology is a long term process, since increase in size of the data will help the software to calculate and analyze with more precision the requirements. This being the case, the delivery methodology should also support long term view of the introduction and usage of the technology.

The following is a possible framework using which the technology can be delivered to the local farmers. The framework will contain specific processes to address key challenges to deliver the technology.

5.2.1 SAMPLE FRAMEWORK

5.2.1.1 PRE-PRODUCTION

- Every area/region/district to have a combination of model farm for the region to collect data and common ground station for analyzing data
- Establish a template of data from model farm with basic NDVI parameters
- Leveraging semi-automation or full automation techniques of the drone software replicate the data from model farm to other areas of the local farmer community
- The data can be fine-tuned to include specific parameters as per requirements

5.2.1.2 PRODUCTION

- Use the data during crop production season to give valid and appropriate inputs to the local farmers

- Routine health assessment of fields for farmers participating the program
- Health assessment data can also be used for Pesticide spraying using drones

5.2.1.3 POST-PRODUCTION

- Every area/region/district stores the data (NDVI) for the use for the next season
- Build a local community with the easy access to information and data so as to enable sustainability of the program and also increase the confidence among local farmers

The above is a sample framework, which can be detailed with regional/district based applications. The aim should be to remove the apprehension about the technology jargons and reduce the complexity of the process so as to encourage participation and increase confidence among the local farmers

6. CONCLUSION

The application of drone technology to farming/agriculture is a boon for farmers. It can directly impact the productivity or crop yield. The need is to deliver the technology appropriately to the local farmers, so that they can benefit from the technology. This requires government and corporate support to reach out to farmers and create correct education and awareness about the technology. In the future too, there are multiple possible ways the collected data can be used, in order to support the local farmers.

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