DRONES IN THE SKY: NEW FRONTIER IN AGRICULTURE

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ABSTRACT

Drones or Unmanned Arial Vehicle(UAV) are gaining popularity because of its possible application in different sectors. Agricultural sector has also promising future for drones. The paper discusses UAV technology and its use in different agricultural applications with possible benefits.

Keywords *: drone, agriculture*

INTRODUCTION

An unmanned aerial vehicle (UAV), commonly known as a drone, as an unmanned aircraft system (UAS), or by several other names, is an aircraft without a human pilot aboard. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator, or fully or intermittently autonomously, by onboard computers.

Compared to manned aircraft, UAVs are often preferred for missions that are too "dull, dirty or dangerous" for humans. They originated mostly in military applications, although their use is expanding in commercial, scientific, recreational, agricultural, and other applications, such as policing and surveillance, aerial photography, agriculture and drone racing. Civilian drones now vastly outnumber military drones, with estimates of over a million sold by 2015.

METHODOLOGY

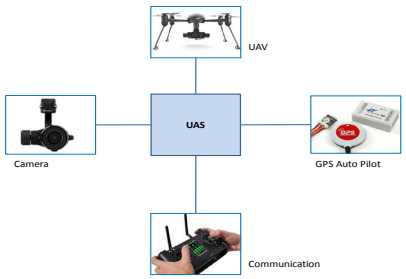

Fig. 1 : Unmanned Arial System

UAS consist of Unmanned Arial Vehicle, High Resolution Camera, Ground Positioning System and Sensors. It is controlled by Remote Control at ground station. There are two basic types of drones: rotary wing (e.g., helicopters, multi-rotors) and fixed-wing(airplanes). Both types of drones are typically equipped with autonomous or semi-autonomous control systems that use GPS to provide a high degree of accuracy and the ability to fly pre-planned routes.

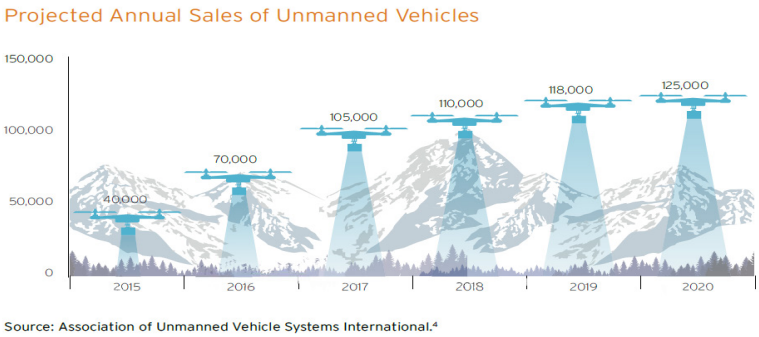

Fig. 2 : Projected Annual Sales of Unmanned Vehicles

As per Association of Unmanned Vehicle Systems International(AUVSI), the projected sales of UAV will be reach to 1,25,000 till 2020. Drones have proven to be important tools for many industries, gaining popularity for achieving fast results cost-effectively.

Figure 3 : UAV adoption across industries based on market viability and solution complexity

UAV usage is staggered across the globe with companies in various stages of experimentation, research and business case justification. In countries where regulatory restrictions are not an issue, such as Japan and Australia, the rate of adoption is accelerated. There is more limited usage occurring in the UK and Canada and early trials in the US. Despite this lag, the Association of Unmanned Vehicle Systems International (AUVSI) predicts in the first three years of UAV integration in the US, more than 70,000 jobs (including 34,000 manufacturing jobs) will be created with an economic impact of $13.6 billion. By 2025, the number of jobs will increase to 100,000 and the economic value to $82 billion. According to AUVSI, for every year commercial UAV integration into the national airspace is delayed, more than $10 billion in economic potential is lost. As the market advances, enterprises in many different verticals will explore UAVs to automate workflows by replacing or augmenting human loop, with the oil, gas and agriculture industries taking the lead. Overall, we see the enterprise adoption of UAVs dependent on two variables: market viability and solution complexity.

RESULTS AND DISCUSSION

Drone Applications in Agriculture

According to the Association of Unmanned Vehicle Systems International (AUVSI), the agricultural use of drones could comprise 80% of the market. Experts point to agriculture as the most promising commercial market for drones because the technology is a perfect fit for large-scale farms and vast rural areas where privacy and safety issues are less of a concern. Already, farmers, researchers and companies are developing unmanned aircraft systems equipped with cameras and other sensors to survey crops, monitor for disease or precision-spray pesticides and fertilizers. Some of the reliable applications of UAV in agriculture are as under.

Mid-Season Crop Health Monitoring

The ability to inspect in-progress crops from about 100 meters height using Normalized Difference Vegetative Index (NDVI) or nearinfrared (NIR) sensors is, thus far, the premier application for drones in farming. This was a task traditionally performed by often-reluctant college interns walking into the fields with a notepad. Drones from the present generation, allow for coverage of more surface area in a much shorter time stretch, as well as the capturing of data that cannot be seen by the human eye (like the NDVI or near-infrared). Moreover, it removes much of the human error aspect of traditional inventory work, though a physical inspection of an area of concern after viewing the imagery is still recommended.

Irrigation Equipment Monitoring

Managing multiple irrigation pivots is laborious, especially for large growers with many fields spread out across a county or region. Once crops like corn begin reaching certain heights, mid-season inspections of the nozzles and sprinklers on irrigation equipment that deliver the much-needed water really becomes a painstaking exercise.

Mid-Field Weed Identification

Using NDVI sensor data and post-flight image processing to create a weed map, farmers and their agronomists can easily differentiate areas of high-intensity weed proliferation from healthy crop areas growing right alongside them. Historically, many farmers haven't realized how pronounced their weed problem is until harvesting was performed.

Variable-Rate Fertility

Though many will argue that ground-based inspections combined with satellite imagery, along with a dedicated grid soil sampling rogram is more practical for the purpose of refining 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 fertilizer applications on corn and other crops. By using drone-generated, variable-rate application (VRA) maps to determine the strength of nutrient uptake within a single field, the farmer can apply 300 kg/ha of fertilizer to struggling areas, 200 kg/ha to medium quality areas, and 150 kg/ha to healthy areas, decreasing fertilizer costs and increasing yield.

Cattle Herd Monitoring

Many growers during periods of depressed commodity prices made the call to diversify their farms by adding cattle or swine operations. Drones are a solid option for monitoring herds from overhead, tracking the quantity and activity level of animals on one's fields. They are especially helpful for night-time monitoring due to a human's eye's inability to see in the dark.

Insurance and Disaster Management

The insurance industry is using drones to survey the condition of roofs for installation and damage assessment. Drones are very useful in adjusting property claims after a natural catastrophe, especially when extensive damage to infrastructure inhibits access into stricken areas. Other assessment applications include inspections for hailstone damage to steep or inaccessible roofs, and to determine damage to crops following flooding. Across the country, many businesses are carefully measuring the potential for increased efficiency, cost savings and accessibility that drone use offers. Tasks that previously required hours or days to accomplish, can now be completed with far less time and effort.

Drone Regulations in Different Countries

Ethical concerns and UAV-related accidents have driven nations to regulate the use of UAVs.

Country	Regulation
Australia	Permitted
Japan	Permitted
India	UAV flying is done with permission from Directorate General of Civil Aviation (DGCA) and Ministry of Defence (MoD).
Canada	Legislation in place since 2008
US	UAV's between 250 grams and 25 kilograms needed to be registered with FAA
UK	Civil Aviation Authority permission required.

The application of drones or UAVs for agriculture purposes involves strengths and weaknesses. These, as well as opportunities and threats, are summarized in the following SWOT (Strengths, weaknesses, opportunities, threats) analysis.

Strengths ◆ Portability ◆ Low cost of operation ◆ Ease of Use ◆ Automation of analysis ◆ Productivity	**Weaknesses** ◆ Data overflow ◆ Flight regulations are not advanced ◆ Durability ◆ Initial investment for farmers
Opportunities ◆ Increase public safety ◆ Increase reliability ◆ Fast and accurate output ◆ Reduce health and safety risk for human	**Threats** ◆ Violation of human rights ◆ Hacking into software ◆ Regulatory issues ◆ Public availability – Do it yourself drones can be created for criminal purposes

CONCLUSION

Precision technology has driven the farming revolution of recent years. Mmonitoring crops from the sky will drive the next. Agricultural drones are becoming a tool like any other consumer device, and we're starting to talk about what we can do with them. Agriculture is predicted to be one of the major industries to incorporate drones in the short term future. Farmers can employ drones to assess crop health with thermal imaging, assess drought conditions, and use them to apply insecticides.

REFERENCES

https://en.wikipedia.org/wiki/Unmanned_aerial_vehicle

http://www.aaisonline.com/Portals/0/AAISDocuments/Viewpoint/Online%20Articles/2016-Issue%20I/7-Guest%20Column.pdf

https://www.cognizant.com/InsightsWhitepapers/drones-the-insurance-industrys-next-game-changer-codex1019.pdf

https://www.accenture.com/in-en/insight-its-time-for-flying-robots

https://www.ecronicon.com/ecag/pdf/ECAG-02-000035.pdf

https://www.sensefly.com/fileadmin/user_upload/sensefly/documents/brochures/eBee_Ag_en.pdf

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