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An Analysis and Reporting on "Study of Various Drone Technologies Available to Provide Low Cost and Effective Solutions to Agricultural Sector with Respect to Indian Context"

Dr. Umesh B. Pawar[1], Shubham K. Darade[2], Prof. Ramesh P. Daund[3], Prof. Ravindra Pandit[4]
Professor and Head, Department of Computer Engineering[1]
PG – Computer Engineering Student, Department of Computer Engineering[2]
PG Cordinator and System Admin, Department of Computer Engineering[3]
Asst. Professor, Department of Computer Engineering[4]
SND College of Engineering and Research Center, Yeola, Nashik, MS, India
umesh.pawar@sndcoe.ac.in, shubham.darade@sndcoe.ac.in, ramesh.daund@sndcoe.ac.in,
ravindra.pandit@sndcoe.ac.in

Abstract: *An aircraft without a human pilot on board is referred to as a drone, also known as an unmanned aerial vehicle (UAV) or unmanned aircraft system (UAS). Software-controlled flight plans allow drones to be remotely piloted, operated autonomously, or both. From small consumer drones for recreational use to larger, more complex drones used for commercial, military, and scientific applications, they come in a variety of sizes, forms, and capabilities. A variety of sensors and technology, including cameras, GPS, accelerometers, gyroscopes, and occasionally even specialized gear like LiDAR or thermal imaging cameras, are installed on drones. Applications for them are numerous and include search and rescue, agriculture, scientific research, surveillance, aerial photography, and videography.*
Drone technology in agriculture aids farmers in decision-making, boosts productivity, lowers resource input costs, and eventually increases agricultural yields and profitability. To properly take use of new technology, farmers must be trained in drone operation and data analysis. Additionally, while employing drones for agricultural, adherence to local legislation is essential.

Keywords: unmanned aerial vehicle

I. INTRODUCTION

The world's population is expected to grow daily to 9 billion people by 2050, which would lead to a rise in agricultural consumption. Ensuring that every individual's eating needs are met is crucial. The most promising industry is agriculture, which deals with many of the issues of today. One of the primary issues is the lack of workers for farming. Extreme weather, insufficient and ineffective fertilizer application, infections, illnesses, allergies, and other health issues brought on by chemical application (fungicide, pesticide, insecticide, etc.) or insect/animal bites are additional issues or challenges. Using cutting-edge technology in agriculture, like drones, presents the possibility of encountering a number of significant or minor difficulties. Drones' principal uses in agriculture [1].

The drone business in India is predicted to grow to around 2.5 trillion Indian rupees by 2030. In 2020, the market size was only 29 billion rupees, a ten-year difference. The defence industry was predicted to be the largest drone market contributor by 2030 [2].

According to a recent analysis by the market research and strategic consulting firm BlueWeave Consulting, the India Agriculture Drones market is expected to expand at a compound annual growth rate (CAGR) of more than 25% between 2022 and 2028. Unmanned aerial vehicles, or UAVs, are utilised in crop production for near-infrared views, digital imaging, and multispectral pictures, in contrast to commercial drones. Crop analysis, field mapping, and agricultural photography are just a few of the many uses for these drones in the agriculture industry. India's agriculture

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industry has benefited from an increase in the use of technology. Drones are a perfect tool for creating sustainable food systems in the future. As technology develops, drone proficiency in creating three-dimensional maps for real-time agricultural analysis is increasing [3].

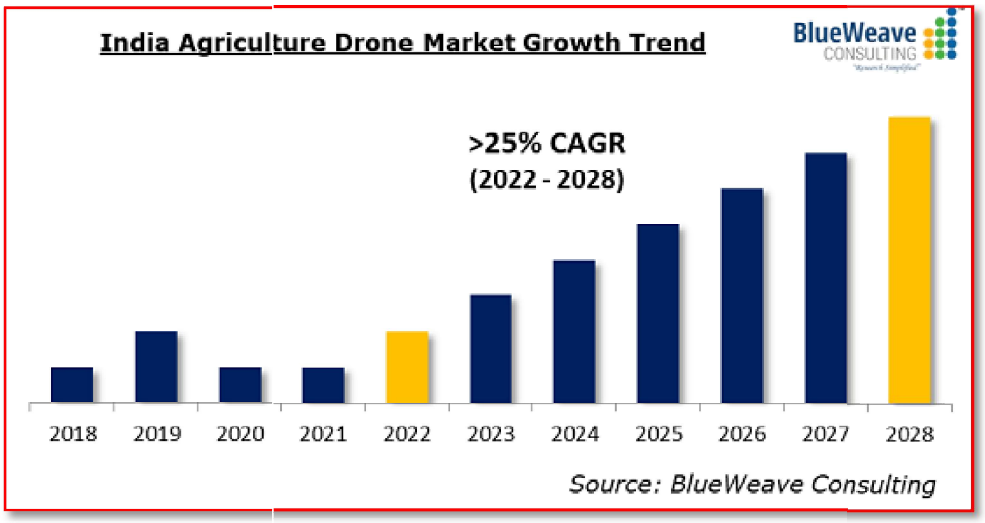

Figure 1 : India Agriculture Drone Market by 2028 [3]

II. LITERATURE SURVEY

Table 2.1 depicts the summary of the literature survey which can be considered as quick reference. The survey is also involved some indirect measures which will help in qualitative parameters. We also worked on the quantitative parameters for getting insights for our research.

Table 2.1: The Summary of the Literature Review for Quick Reference

Sr	Authors	Paper Title	Contributions
1	Pathak H, Kumar GAK, Mohapatra SD, Gaikwad BB and Rane J, (2020).	Use of Drones in Agriculture: Potentials, Problems and Policy Needs, Publication no. 300, ICAR-NIASM, pp 13+iv.[4]	Versions of Drone Deploying Drone Technology in Agriculture
2	S. Ahirwar, R. Swarnkar, S. Bhukya and G. Namwade 2019	Application of Drone in Agriculture [1]	Various Applications of Drones in Agricultural sectors.
3.	Shangliao Sun	Market size of drone in India 2020-2030 [2]	Prediction of Use of Drones by 2030
4	Bashar Alsadik, FarzanehDadrassJavan, Francesco Nex	UAV Remote Sensing for Smart Agriculture	Described use of UAVs and various sensors can be used for smart agreecultural development. [5]

III. OBJECTIVES PLANNED FOR RESEARCH

As per as various technologies available for more and more productivity in case on agricultural sector and considering the indian future market for drones by 2025, the sttistics says that India will be third largest drone market by 2025 .
Also Industry demands rapid application prototyping and simulations of the protocols to save time, money and energy. Use of intelligent systems with high speed communication, the sector is moving towards the standardizations [6]. The broad objectives of research are

- Study of Indian Agriculture scenario with respect to use of technologies and tools to minimize the human efforts and to increase the productivity.

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- Study of various drones solutions available in india.
- Cost effectiveness parameters for implementation.
- Study of various sensors supported in agricultural applications.
- To design low cost solution for agricultural sectors using drones as well as sensors.
- To understand the feasibility and possibility of use of cloud platforms.
- To connect Indian farmers on global platforms.
- To study various challenges while designing the solutions.
- By considering the above objectives the proposed methodology is mentioned in architecture.

IV. LIMITATIONS IDENTIFIED (TECHNOLOGY PERSPECTIVES)

- **Weather Conditions:** Unfavorable meteorological conditions, including heavy rain, wind, or poor visibility, can affect the efficiency and security of drones. Drones in inclement weather may find it difficult to stay stable or navigate properly.
- **Range:** The operational range of drones is usually restricted, especially for consumer models. Their ability to cover wide areas and travel far from the operator may be hampered as a result.
- **Capacity of Payload :** Due to their limited payload capabilities, drones may not be able to carry all sorts of sensors or equipment. Their applicability for some applications that demand large or specialised payloads is impacted by this constraint.
- **Battary Life :** The majority of professional and consumer drones have a short battery life, usually 20 to 40 minutes. This reduces the amount of time they can fly for before having to come back to refuel.
- **Regulatory Restrictions:** Various countries' aviation agencies have restrictions pertaining to drones. These laws frequently include limitations on the areas in which drones may be flown, ceilings on altitude, and qualification standards for pilots. To stay out of legal trouble, compliance with these regulations is essential.
- **Autonomy Limitations:** Even with their sophisticated autonomous characteristics, many drones still need to be operated by trained operators. Drones can't fly completely autonomously, and they frequently rely on GPS signals for navigation, which might be troublesome in some situations.
- **Capacity of Sensing:** Drones can be fitted with a variety of sensors, however their sensitivity could be lower than on other platforms. They might not be able to sense as accurately as piloted aircraft or satellites, for instance.
- Security of Data along with Privacy issues: Data security and privacy are issues that are brought up by the use of drones. Sensitive information may be captured by drones that are fitted with cameras and other sensors, so rules addressing privacy concerns in connection with data gathering and surveillance must be established.

4.1 Limitations Identified (Acceptance Perspectives):

The critical survey, interaction with the farmers and the study results into following limitations (challenges) observed.

- **The Lack of Knowledge:** the first and foremost point noted as , the knowledge in terms of awareness plays a vital role for adapting any new technological change especially in rural areas.
- **Reluctance:** The reluctance or rigidness is also observed while accepting the new technologies. As the traditional approach is the only way the farmers are using.
- **Threat:** The threat of failure of technologies and may results in heavy financial loss is also observed and noted.
- **Lack of Government Support:** The country like India is always supporting farmers in terms of loans, subsidies in direct and indirect methods. As per as these technologies are concerned, it is observed that the funding provision is not enough to motivate the farmers.

V. PROPOSED ARCHITECTURE

The use of contemporary technology to enhance farming management and raise crop yields both qualitatively and quantitatively is known as "mart agriculture." In the business realm, it's sometimes referred to as "precision agriculture"

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or "AgriTech." The goal of smart agriculture is to minimise inputs such as irrigation, fertiliser, pesticides, herbicides, and so on, while simultaneously lowering the costs and dangers associated with crop growth. Finding an optimal balance between needs and resources based on the agricultural field's observed temporal and spatial inconsistencies is a key goal of smart agriculture [5] .

VI. FURTHER PLAN OF RESEARCH

With the critical study regarding various aspects of agricultural scenario in India. Also the the study and importance of use of Drones for saving time, money and energy especially in context with Indian farmers. The paln involved the following steps for the proposed systems.

Step 1 : To understand the various low cost sensors available in the markets.

Step – 2 : To study various software's available in the markets for rapid prototyping, analysis as well as making predictions with respect to time, money and energy.

Step 3 : Design the system architecture for development of the systems.

Step 4 : Development of The Systems.

Step 5 : Testing of the systems for effective implementation considering the cost for implementations against the revenue against the implementations.

Step 6 : Keep Continue this Process for betterment.

VII. CONCLUSIONS AND FUTURE SCOPE

A prudent and efficient use of drones requires an understanding of the constraints. While some of these issues are being addressed by ongoing technology and legal changes, users should be mindful of the limitations that are in place when using drones for different purposes.

The proposed paper highlighted various aspects with respect to drones, sensors and the need of the systems. The further action plan is also discussed. As this is survey paper, which has given the broad idea of the flow of research. The future challenges that are observed are the acceptance of the technologies by small farmers, the knowledge and the training required to adopt the technology, also the maintenance will be the hurdle in acceptance. The availability of the spare parts is also one of the challenges.

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