

Things You Should Know About Kissan Drone: The Future of Indian Agriculture

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History of Drones in Agriculture

In agriculture, drone technology use is more extensive than we believe. Can you assume that the USA is using this type of technology from the last 100 years. In 1939, Royal New Zealand Air Force used drones to spray seeds, fertilizer and chemicals.

Drones are also called Unmanned Aerial Vehicles (UAVs) which have been trading since around the early 1980s. However, the use of drones has never gained much popularity as it has nowadays. From then to the present time, drone solutions started their way and now the benefits of drones are giving a tremendous assistance in agricultural practices.

Introduction

A lot of innovations and inventions have been made in the world to make our day-to-day activities easy. One of the greatest innovations that has helped to achieve milestones in the field of technology is the introduction of drone to the public. Drones have uprisen several aspects of human life and have had positive effects on various aspects of the human community. They are now used in security, agriculture, photography and many other fields. The use of drones in agriculture and the changes it has brought to agriculture are discussed in this essay.

Drones are the ground-breaking latest technology shaking up each and every sector of business like agriculture. This is looking to give the agricultural industry, a big technological makeover with proper planning and pouting based on real-time data collecting and processing. There are effectual ways by which performing and ground-based drones will help to improve several aspects of agriculture. In agriculture, they have helped to to change



farming practices by offering farmers significant cost savings, increased operational efficiency, and better profit.

Over the past decade, the topic of ‘Agriculture Drones’ have attracted and overwhelming attention. The selection of the correct drone for your agricultural operation needs can deliver unmatched benefits in terms of precision agriculture, data and monitoring, general monitoring, and even help to perform day-to-day agricultural tasks like proportionate use of pesticides, herbicides, weedicides and fertilizers. One can also streamline the operations of agriculture through drones just like crop spraying or else, as you may achieve a better image of your farmland. Drones in agriculture provide new apparatus for monitoring and managing soils as well as irrigation. It moreover speeds up the process of information collection on crops, among other uses that are discussed as below in detail.

If we compare it with traditional ways of crop management, then drones have great advantages recognized not only by farmers, producers, agricultural scientists and other experts but also by businesses, industrialists and researchers. This has led to an expansion in drone production as well. This study is one of the first attempts to summarize drone research in agriculture and suggests future research directions. The drone industry will become the most outstanding and appreciated industry in the world in the future which will make a great revolution in agriculture.

Precision Agriculture

Precision agriculture is a meaningful term becoming more and more popular these days and goes well with the discussion of ‘Drones in Agriculture’. But, the majority of people misunderstood this term as they are unaware of precision agriculture. Precision agriculture is also known as precise farming or smart farming or high-tech agriculture. This means a way of crop management, inputs and monitoring like water, interculture and fertilizers given on right time with the right amount in right place which can increase farm productivity.

These fertilizers and chemical application in the field as per the requirement, precision application is done by drones. These drones are engaged with the special gadgets and right tools which provide specialized information and contribute to precision/smart farming. With the help of drones, healthy plants are grown by the farmers which will further enhance crop production. In the past, especially the large-scale farmers of developed nations,

relied on images taken by satellite and manned aircraft to provide information about the fields on their farms.

Smart farming or precision agriculture means that farmers are incorporating advanced technology as part of their farming practices to manage their crops and livestock as well, a measure to increase their yields without negatively affecting the quality of production. The use of drones will be predicted to become a very common occurrence in farms in both developed and developing countries.

Uses of Drones in Agriculture:

1. Crop Monitoring

One of the greatest barriers that crop farmers face is the difficulty in monitoring the crops they have in their very huge fields. These farmers cannot monitor these huge agricultural fields crops effectively as monitoring these crops due to unsure weather conditions. Before the invention of drones, they were depending upon on the use of satellite imagery as the most advanced form of monitoring but even this had drawbacks. The images provided by the satellites were not correct. Had to be ordered in advance and could only be done once in a single day. But, by introducing drones farmers could now generate real images and a series of animations to show the development of their crops at a low price giving room for better crop regulations. Drones can monitor your farmland and provide an ever-growing digital picture of your land. As the crop monitoring challenges are exacerbated due to unpredictable weather condition, ‘Drones’ seem to be an intelligent way to monitor reducing the risk and field maintenance costs.

2. Health Assessment

On any farm, it is very important to monitor the health of the plants, animals and insect buds that are present on such farms. The invention of drones made this easy, plants can now be scanned with both visible and near light. These drones can detect which plant has a different amount of green light of NIR. This information is to produce multidimensional images that will show and track different changes in plants and how it affects their health. With the help of drones, farmers can track different changes in plants and how it impacts their health. This information can now help the farming community to react and treat accordingly to the plants' health situation.

3. Estimating Soil Condition



Today, drone surveys have become common in different sectors and also allow farmers to obtain information about their agricultural land as well as its soil conditions. Multispectral sensors and cameras allow seizing data useful for different agricultural activities like nutrients, seed planting, patterns, irrigation, nitrogen-level management, etc. Precise 3D mapping of the field with drones allows farmers to analyze their soil conditions assiduously.

For efficient field planning, agricultural drones can be used for soil as well as overall field analysis. They can be used by mounting different types of sensors and cameras to evaluate moisture content, terrain conditions, soil conditions, soil erosion, nutrient content, and fertility of the field soil.

4. Spray Planning

Managing pests and diseases through planning for your spray program for best results. Fruits and vegetable quality can all be severely affected by pests and diseases. A well-planned spray program can give you the confidence to know that you have the right tools and best practices in place to meet these challenges.

5. Crop Spraying

Nowadays, larger and bigger drones are fixed with small quantities of fertilizers and other liquid farm inputs to send help to plants on the farm to grow properly. With this, farmers can save them from chemicals, as well as time and extra costs. The precision farming controls systems can help farmers to spray targeted area where your chemical application and pesticide spraying is exactly needed.

6. Pollination

Now, there are some new uses for drones in the field of horticulture as well as in floriculture is still in testing mode. Pollination with drones is one of the most novelized uses. Researchers and scientists from different developed nations are developing nano and micro-drones that are capable of pollinating plants without disturbing and damaging them just like a real bee.

7. Livestock Management

Drones technology also is used to monitor and supervise huge livestock through different sensors, high-resolution infrared and thermal cameras, and also detect a sick animal and act accordingly. So, the impact of this technology on precision dairy farming is soon to become normal and bring revolution.

8. Farmers Life

Providing drones is a good solution to farmers' safety and health concerns owing to spraying and other chemical interactive activities in the field. Farmer's field death is reported due to some reasons like snakebite and similarly, some health problems, as well as diseases, are reported due to some agricultural activities like spraying of chemicals in India. So, drones have the potential to mitigate these issues for farmers.

9. Drone-As-A-Service (Daas)

In India, various major sectors including agriculture, navigation, security and surveillance, aerial photography and videography, infrastructure solutions for roads and highways, construction support, telecom services, LiDAR in mining, watershed management and monitoring emergency/ disaster situations use the latest drone technologies. In the discussion of the 2022 annual budget, the Finance Minister of India stated that "There is a need to introduce the Kissan Drone as a service model in India, especially in the agriculture sector. The use of drones in spraying insecticides, pesticides, and nutrients, etc, digitizing land records and monitoring crop health is included in this budget.

Drone Rules And Guidelines By Dgca

The new drone rules 2021 were enforced on 26th August 2021 by the Ministry of Civil Aviation, Government of India and as per requirement, it was amended the Drone (Amendment) Rules, 2022 on 15th February 2022. The drone rules have the potential to raise India as a global drone hub in the future and will boost the morale of Indian drone manufacturers and government organizations. Regulations for owning and operating drones in India as explained below:

1. Registration And Licensing: The registration of all drones is compulsory with the Directorate General of Civil Aviation (DGCA), and operators must have a drone pilot license to fly them. Drone and certified drone pilot license registrations are done on the Digital Sky platform managed by the DGCA which issues a single-window online platform for drone registrations and approvals related to drone operations.

The Drone Rules 2021, states that the registration of every new drone is compulsory with the digital sky platform and have a Unique Identification Number (UIN). A person owning an existing drone imported or manufactured before 31st December 2021 needs to

self-register and generate the UIN which can be conveniently done online on the aforementioned platform.

2. Drone pilot certification requirements: Drone operators must be over 18 years of age, have completed a training course from a DGCA-authorized Remote Pilot Training Organizations (RPTO) institution, and pass a written exam. Once the drone operation license is issued, it is valid for 10 years. No pilot certificate is required for operating Nano drones and non-commercial micro drones.

3. Restrictions on Use: There are restrictions on where and when operators can fly drones. For example, operators cannot fly near airports or in densely populated areas.

4. Interactive Airspace Maps: The Indian Ministry of Civil Aviation (MoCA) has installed an interactive airspace map for the benefit of drone operators on the Digital Sky Platform. Zones are marked on the map with different colors such as red, yellow, and green.

Drone pilots are not required to obtain permission to operate in green zones. Yellow zones are governed by airspace and can only be entered with special permission. Red zones prohibit flying strictly. The army bases, cents or thermal energy stations (like nuclear power) and other restricted regions are remembered as Red zones and are limited because of the gamble of mishaps, security issues, or public safety purposes. Drone pilots should not fly Nano and micro drones over 50 ft. from ground level and not exceed a speed of 25 m/s.

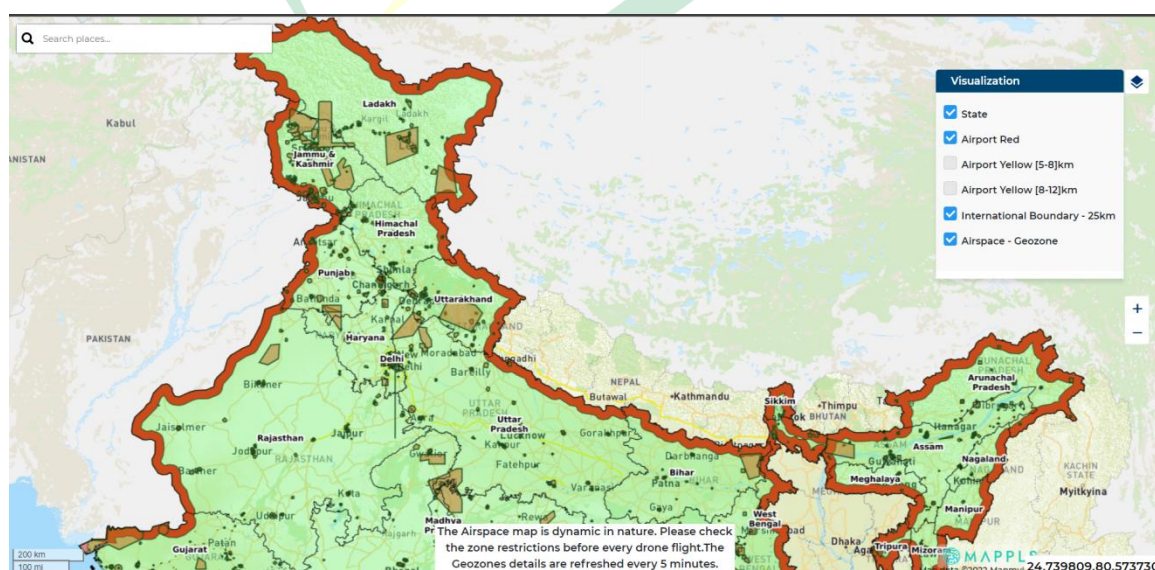


Fig. 1: Digital Sky Map for an Interactive Airspace Map for Drone Flying



5. No permission - No Take-off: Whenever a drone is used for different operations in India, authorization is required. Through the digital sky platform, drone operators may view authorization, which automatically approves or refuses the request. Drones must fulfill certain requirements in order to operate in India, including being unable to take off without authority permission. Drone pilots/operators must make sure they abide by all of these limitations. If this isn't done, there could be repercussions, including a fine of up to INR 1,00,000.

Throughout the world, drones are becoming more and more popular for both leisure and business uses. Drone operation in India has never been easier thanks to the publishing of the Drone Rules, 2021, and the Drone (Amendment) Rules, 2021. Along with the notification of these Rules, a drone import restriction is intended to encourage the Indian manufacturing sector to quickly adopt new technologies to meet the demands of the Indian market. New laws and guidelines support the ambitious goal of the Indian government to establish India as a hub for drones by 2030. Before using a drone in India, it is important to familiarize yourself with these laws and guidelines.

As we can see, these drones have an immense impact on the agricultural future, and it is even possible shortly, that the drawbacks which affect drone technology will be fixed, and it will enable us to benefit more from them.

By flying safely at high speeds, drones can cover large and small properties quickly to manage buds insects on the land. Many farms use drones to check and maintain water levels in the dams and other resources previously removing any risk to the operator or surrounding areas.

Steps towards The Drone Technology By Government

The government of India has demonstrated a lot of visionary zeal in estimating the immense potential of drones for development. Taking another step towards the vision of an *Aatma nirbhar Bharat*, the Government of India (GoI) has approved the Production-Linked Incentive (PLI) scheme for drones and drone components. In India, many people are expected to possess drones in the future, similar to how many people own smart phones. We may all start to see drones frequently, and they will likely be employed widely in the sectors like entertainment and agriculture. Government regulations aim for sustained and rapid growth in the drone industry by boosting both supply and demand in the ecosystem. They are



aimed at creating a conducive ecosystem for manufacturing as well as using drones. Here are some of the government initiatives to encourage growth in the drone sector.

1. **Drone Policy:** It started with the new Drone Policy launched on 24th August 2021. Citizens are permitted to own drones and use them for non-commercial and private reasons under this policy. Nano-drone flying no longer requires a pilot certification. They can fly drones anywhere outside the restricted zones near airports. For instance, the number of permits and approvals required by a drone operator has been reduced from 25 to 6.
2. **Drone Shakti:** In the budget 2022, Finance Minister introduced the Drone Shakti scheme to boost up new startups and facilitate growth in the drone sector. Startups are encouraged to provide Drone-as-a-Service. Citizens can rent drones and use them in agricultural operations just like as taking videos and photos.
3. **Drone Mahoutsav:** The Prime Minister of India inaugurated the largest Drone Festival “Bharat Drone Mahotsav” in May 2022. The drones of various sizes and advanced capabilities were displayed at this festival at Pragati Maidan, Delhi, to show the wide adoption of drones and the huge employment opportunities created in this sector. Drones will help in connecting every citizen of the country with the facilities and welfare schemes.

The GoI has been promoting innovation in the realm of drones via policies as part of "Atam Nirbhar Bharat." The government has made it simpler for corporations to develop and innovate sophisticated drones for a variety of uses by offering a variety of legislative perks and incentives. Its new initiatives created a significant demand for this novel technology.

4. **SVAMITVA Scheme:** SVAMITA means survey of villages and mapping with improvised technology in rural areas, which was launched on 24th April 2020. The aim of the scheme is simply depends on drone technology and to carry out the world’s largest drone mapping operation by covering 6 lakh villages of India. Survey of India along with private drone manufacturers is conducting drone operations across India.

Type of Drones Used in Agriculture

- a. **On the basis of Size:** The five main categories of drones on the basis of size (Fig. 2) and weight carrying capacity.

1. **Nano drones:** Carry upto 250 gm weight.
2. **Micro drones:** Carry more than 250 gm upto 2 kg weight.
3. **Small drones:** Carry more than 2 kg up to 25 kg weight.
4. **Medium drones:** Carry more than 25 kg up to 150 kg weight and not allowed for the agriculture as well as commercial use.
5. **Large drones:** Carry more than 150 kg weight.

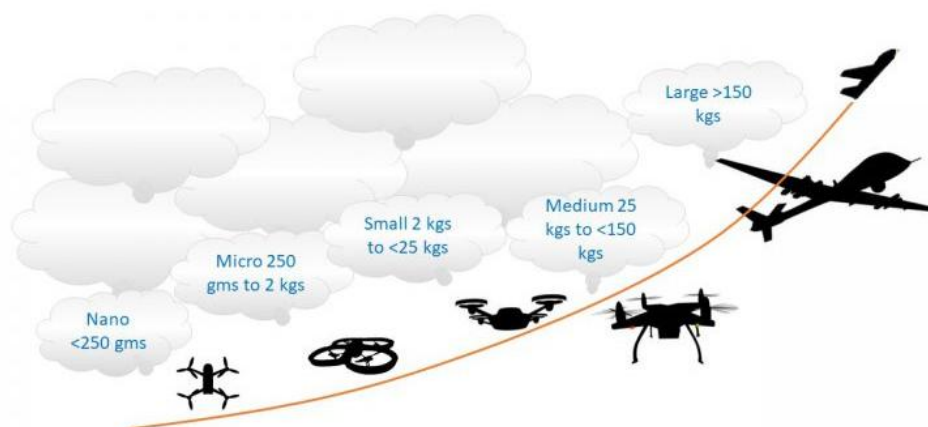


Fig. 2: Classifications of drones on the basis of size as per DGCA rules

In India, nano, micro and small drones are allowed for commercial as well as agriculture practices.

b. On the basis of Rotor: The three main categories of drones on the basis of rotor.

1. **Single rotor drones:** This drone is similar to a helicopter which consists of only one rotor. So, the name suggests a Single rotor drone with a small tail to control its direction but carries less load as compared to other drones. It is more dangerous and proper training is required.



Fig. 3: Single rotor drone

2. **Multi-rotor drones:** Multi-rotor drone that has more than one rotor/propeller which helps to take flight. Multi-rotor drones work on the principle of the traditional helicopter and are the most common type of drone for creating maps

and models. These drones are of numerous types such as bicopter (2 rotors), tricopter (3 rotors), quadcopter (4 rotors), hexacopter (6 rotors) and octocopter (8 rotors).



Fig. 4: Multi rotor drone

3. **Fixed rotor drones:** This drone is just like an airplane which has fixed wings in place of propellers. They cannot float at one place. They fly on the set course till their energy source is functional.

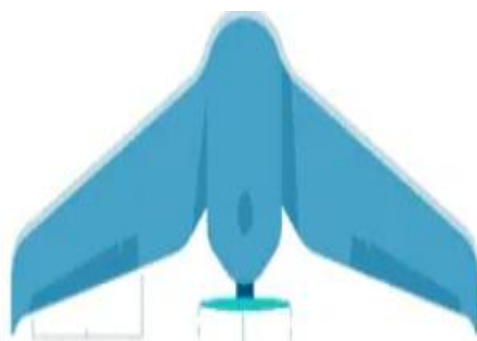


Fig. 5: Fixed rotor drone

4. **Hybrid fixed-wing vertical takeoff lift rotors drones:** Hybrid VTOL Fixed-Wing drones combine the benefits of multirotor platforms with fixed-wing drones and transition between the two modes during flight. The ability to vertically take off and land, without the need for a launcher or runway, means these drones can be operated in almost any location. The fixed-wing design provides greater endurance, the ability to cover longer distances, and the option to fly faster, allowing operators to fly for longer and cover more ground when compared to a multi-rotor UAV.



Fig. 6: Hybrid fixed-wing vertical lift rotors drone

Drone Components

1. Propeller
2. Brushless Motor
3. Frame
4. Battery Pack
5. Flight Controller/Remote/Autopilot
6. Front Indicators
7. Camera Gimbal
8. Sensor
9. Stand

How to Operate And Control A Drone

When learning how to fly a drone, the controls will become second nature once you know how they operate and interact together to form a complete flying experience. When you first start, push the sticks very gently so the drone performs slight movements. As you get more comfortable, you can make sharper movements.

There are four main drone controls:

1. **Throttle:** The throttle is also known as thrust control. This control is always on left side of the remote in India. To take off, push the left stick forwards. To increase and decrease the position in the vertical direction, slowly pull the left stick forward and backward direction respectively. This adjusts the altitude, or height, of the drone.

2. **Yaw:** Yaw means to rotate the drone it's on its axis (left or right). This command is also done by pushing the left stick to the left or the right. Points the front of the copter in different directions and helps with changing directions while flying.
3. **Roll:** This command is used by pushing the right stick to the left or right. Literally rolls the drone, which maneuvers the drone left or right direction.
4. **Pitch:** Done by pushing the right stick forwards or backward. Tilts the drone, which maneuvers the drone forwards or backward direction.



Fig. 7: Controller (<https://uavcoach.com/>)

Going through a pre-flight checklist will keep you and your drone safe. Following is a check list can be use before each flight:

Weather & Site Safety Check

- Chance of precipitation less than 10%
- Wind speed under 15 knots (less than 20 mph)
- Cloud base at least 500 feet
- Visibility at least 3 statute miles (SM)
- If flying at dawn / dusk, double-check civil twilight hours
- Establish take - off, landing, and emergency hover zones
- Potential for electromagnetic interference?
- Look for towers, wires, buildings, trees, or other obstructions
- Look for pedestrians and/or animals and set up safety perimeter if needed

- Discuss flight mission with other crew members if present

Visual Aircraft / System Inspection

- Registration number is displayed properly and is legible
- Look for abnormalities - aircraft frame, propellers, motors, undercarriage
- Look for abnormalities - gimbal, camera, transmitter, payloads, etc.
- Gimbal clamp and lens caps are removed
- Clean lens with microfiber cloth
- Attach propellers, battery/fuel/pesticide source, and insert SD card / lens filters

Powering Up

1. Turn on the remote control and open up Ground Control Station application
2. Turn on aircraft by connecting batteries
3. Verify established connection between transmitter and aircraft
4. Position antennas on transmitter toward the sky
5. Verify display panel / FPV screen is functioning properly
6. Calibrate Inertial Measurement Unit (IMU) as needed
7. Calibrate compass before every flight
8. Verify battery / fuel levels on both transmitter and aircraft
9. Verify that the UAS has acquired GPS location from at least six satellites

Taking Off

1. Take-off to eye-level altitude for about 10-15 seconds
2. Look for any imbalances or irregularities
3. Listen for abnormal sounds
4. Pitch, roll, and yaw to test control response and sensitivity
5. Check for electromagnetic interference or other software warnings
6. Do one final check to secure safety of flight operations area
7. Proceed with flight mission

Changes with Drone Technology

Everybody knows that the cost of a labour person to manually spray an acre is about Rs. 350- 400 and it can spray only 2 acres area in a day. Therefore the spraying cost in the case of renting drones for the spray is presently on the higher side considering the going average rate of about Rs. 700/acre. Moreover, it is time, health as well as money saving



technology. Hence if drone spraying costs go a little lower, they may capture the market of spraying and farmers would perhaps be willing to rent drones on a pay-per-use basis and shift to drones for their precise spraying requirements. However, it will highly affect the labour class.

Reduction in input costs of spray items (pesticides/weedicides) is estimated at around 25-30% due to automated processes. Citing an illustration of nano urea here, considering a cost of Rs.240/bottle for spray on an acre, if savings are 25%, then input cost is reduced to that extent for the farmer. Consequently, around 80-90% reduction in water is also achieved because of tiny droplet sizes of approximately 50 microns as against manual spray droplet size of approx. 500 microns. Drone sprays save time as 1 spray takes around 5-7 minutes/acre whereas manually typically a person can cover only 3-4 acres in a day.

Towards a New Indian Model of Information and Communications Technology-Led Growth and Development, 12 younger aged farmers may be more willing to adapt to drone sprays and farmers with fields in challenging terrains/ cultivating crops which are difficult to spray may also prefer drones. Farmers may also like to experiment with drone use in parts of their farms to test both economics as well as the efficacy of drone use. Such documentation and research efforts would also help to produce a crop-wise drone spray guide to help farmers take an informed decision.

Limitations

There are some limitations with this technology in the field of agriculture.

1. Required Skilled Workers
2. Knowledge of Drones and Software's
3. Weather Dependency
4. Battery dependent
5. Short Time of Flights
6. Highly expensive

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