

# SMART IOT APPLICATIONS FOR GROWING AGRICULTURE BUSINESS

## Abstract

The Internet of Things (IoT) is becoming more and more prevalent, and linked devices are now present in every aspect of our lives, from automotive to home automation and logistics to industrial IoT and smart cities. IoT, connected devices, and automation will thus be used in agriculture and as a result, dramatically enhance nearly every element of it, which makes sense. Farming has seen a great deal of technological development recently that seems to be more industrialized and technology-driven. By utilizing a number of smart agricultural instruments, farmers may get more control over the process of raising animals and growing crops, which also improves predictability and efficiency. As a result, the use of smart agricultural technology has increased on a global scale. Increased demand from consumers for agricultural products. In 2020, the IoT market share in agriculture increased to \$5.6 billion.

**Keywords:** IoT, AI, ML, GPS, ICT

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## I. INTRODUCTION

An emerging idea called "smart farming" advocates abandoning conventional farming practices in favour of embracing technology. In order to improve the quantity and quality of the harvest, it makes use of geospatial AI approaches along with robots, IoT, drones, and AI. These days, efficient farming also emphasizes the best use of labourers. Thanks to incredible breakthroughs in AI and IoT devices, smart farms, which use these technologies, are no longer just a distant fantasy but rather a reality. The agriculture industry has changed significantly over the last few decades, and today it is possible to produce plants even in the most inhospitable climate zones. Cultivation of crops that is better able to withstand weeds, insects, and climate change [1].

## II. SMART FARMING TECHNIQUE

The idea of "smart farming" aims to make the practice dependable, sustainable, and predictable. Although smart farming is still one of the farming industry's top priorities, using conventional farming techniques frequently makes it impossible to achieve this goal. But with to innovations in the internet of things, robotics, drones, sensors, and actuators, this transformation is a thing of the past. Utilizing many technologies, including UAVs, AI, machine learning, robotics, and IoT, smart farming management oversees agricultural operations, reduces the need for human labour, and increases the quality and output of agricultural products. These applications give farmers complete control over the level of activity on their farms. Additionally, it helped them make decisions that would show off their cattle and harvests. Internet use is coupled with smart farming.

Farmers may now manage their fields using a variety of technology, such as satellite imagery, geographic information systems, and GPS location systems.

- To track sensors for humidity, water levels, soil pH, sunlight, and temperature.
- Software designed specifically for agriculture that combines agronomy and cybernetic to make farm management. Use of cellular IoT solutions and low power widearea networks (LPWANs) for communication.
- Real-time information on crop and animal health is made available to farmers via data analysis systems hassle-free.

Precision agriculture, sometimes known as smart farming, is one of the crucial application cases of spatial data science. It envisions using the satellite images and Landsat data of fields to anticipate weather and make forecasts about crop health. Future applications like artificial intelligence and machine learning have the potential to reduce this gap. In order to enable farm management and boost production, the AgTech sector is developing ways to use satellite imaging data, Landsat data, IoT data, visual image, and drive through spatial analytic methodologies. Finally, it will improve agricultural productivity and efficiency while lowering food production costs. Nowadays, there are many AgTech startups that want to benefit investors by adding farmland to their portfolios of investments.

**1. Smart Farming versus Conventional Farming Methods:** Smart farming differs greatly from traditional agricultural practices. Let's look into the traditional vs. smart farming argument.

2. **Predicated on Farming Methods Techniques:** With conventional techniques, crop output is uniform throughout the region. To ensure resource optimization, smart farming techniques go one step further and investigate potential crops and their water needs.
3. **Depending on Maintenance:** In traditional farming, the field data is manually entered and kept, that may result in mistakes. There is no possibility of foreseeing soil issues. Intelligent agricultural practices aid in overcoming this challenge and avert financial losses.
4. **Using Fertilizer and Pesticide Use:** Farmers that practice smart farming techniques adjust their usage of fertilizers and pesticides as necessary. Such opportunities do not exist in conventional farming. Systems for distributing fertilizer make crop recommendations based on soil sample data and NPK (nitrogen, phosphorus, and potassium) concentrations, as well as forecast yields.
5. **Using satellite-based Imaging:** A clever agricultural approach aids in locating impacted regions so that remedial action may be taken. Traditional farming cannot use zone detection, geotagging, or related technologies. Satellites and associated imaging data may monitor soil parameters, such as moisture content and ground temperature, to identify the best circumstances for growing crops when we talk about the impacted areas. Additionally, satellite photography may be used to monitor a farm's natural surroundings, enabling more precise targeting of insecticides and fertilizers.
6. **Using Predictions of the Weather:** Farmers are unable to anticipate the weather using conventional ways due to a lack of technology. Smart technology aids in weather analysis and forecasting to prevent agricultural damage from excessive rain or drought. Similar to this, pest attack prediction models allow for planning ahead for the anticipated onslaught.
7. **Problems with Smart Farming:** Scientific Tools like satellite imaging data and Landsat data are used to describe the landscape of agriculture and the food sector. They portend well for implementing agriculture in a sustainable way, which can provide food security. It will also be possible to produce food without harming the environment. It does not, however, come without its fair share of difficulties.

### III. IOT DEVICE ENABLEMENT

Only until processing power grows and sensor energy consumption falls can IoT truly function at its best. The gadgets won't become energy independent till then. Additionally, smart features that provide self-configuration and self-management are required for devices. There is desire for these sensors to be affordable while also taking the financial element into consideration. If the price of the food material is on the cheap side, it might not always be possible to include sensors with RFID and NFC tags. Focusing on device attributes is also necessary due to decreased advantage margins.

1. **System operations:** Devices with stable standards and proprietary designs have an opportunity for mainstream adoption. It is as a result of problems like system compatibility component. There are instances where systems having standards don't need to be modified.

2. **Network Accessibility:** High-grade connectivity choices are required for IoT devices to work at their best. There is a connection issue when IoT techniques are used in farms located in remote regions. It makes the case for the requirement of communication devices that can run on lower power.
3. **Advanced Data Capabilities:** IoT devices may produce a lot of data; therefore it's crucial to draw insights from that data. The agriculture industry's degree of data generation is still in its infancy, though. The Decision-support systems work best with data that already exists. Innovative data, such as that used in production planning and predictive modelling, is still a far shot.
4. **Security of Data:** Anytime there is data, there is always anxiety over its security. Protecting sensitive data related to predicting crop yield and soil fertility is necessary. Such data is best processed and stored using cloud-based technologies. The security of individual farm data must be taken into consideration when combining data from several farms.
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#### **IV. SMART IOT SOLUTIONS FROM EASTERN PEAK CAN HELP AGRICULTURE BUSINESSES GROW**

By 2050, the UN Food and Agriculture Organization (FAO) projects that there will be more than 9 billion people on the planet. Agriculture output volumes must rise by 50% to produce adequate food for the current population. Due to a lack of resources (the bulk of places suitable for farming are already in use), the only way to expand agricultural operations is to raise production efficiency. There is no doubt about the extent to which smart farming can assist in meeting this need; in fact, it would appear that it would not be feasible without it. At Easterly Peak, we provide specialized IoT solutions for agriculture that are catered to your specific requirements.

According to estimates from the UN Food and Agriculture Organization (FAO), there will be more than 9 billion people on the earth by 2050. For agriculture to generate enough food for the existing population, production volumes must increase by 50%. Increasing production efficiency is the only way to expand agricultural operations because there aren't many resources accessible (the bulk of land suitable for farming is already occupied). There is no question about how much smart farming can help in fulfilling this demand; in fact, it seems like it wouldn't be possible without it. We at Easterly Peak offer specialist Internet of Things (IoT) solutions for agriculture that are tailored to your unique needs.

You may define the project's complete scope and create a roadmap using the product discovery phase. You can also set a clear budget for your MVP and organize your resources.

- Test the waters with your audience by utilizing a prototype sensory system.
- Create an effective investment pitch[2].

**1. Devices Used for Smart Farming:** Here is a list of several tools that are frequently used for data analysis in smart farming.

- **Sensors for soil testing:** They measure the soil's moisture and water content to determine if it is suitable for growing crops.
- **Humidity sensors:** By determining the soil's moisture content, they assist farmers in assessing the health of their crops.
- Farmers use permafrost testers to examine and validate the existence of permafrost surfaces in the soil.
- **Nutrient sensors:** They aid in determining the soil's nutrient content to improve crop yield.
- **Precision harvesters:** They increase the effectiveness and economy of harvesting activities.
- **Sprinklers:** They aid in providing crops with the best irrigation possible.
- **Drones:** Farmers may use drones to monitor crop growth and improve agricultural operations[3].

Farmers can precisely calculate the quantity of pesticides and fertilizer they must apply to achieve maximum efficiency, for instance, by employing smart farming techniques where sensors are used to monitor the condition of crops. The definition of smart farming uses the same methods.

The market is still quite impulsive even if smart farming IoT and industrial IoT in general aren't as popular as consumer-related gadgets. IoT technology is increasingly being used in agriculture. In particular, COVID-19 has a beneficial effect on IoT market share in agriculture. The supply chain's interruptions and shortage of trained staff have driven up the CAGR to 99%. In fact, according to current farming data, the market share for smart farming is anticipated to reach \$6.2 billion by 2021.

At the same time, it is anticipated that the global smart farming market would triple in size by 2025, from a little over \$5 billion in 2016 to \$15.3 billion.

Because the industry is still growing, there are still plenty of opportunities for companies who want to participate. In the upcoming years, creating IoT goods for

agriculture might make you stand out as an early adopter and open you opportunities for success [3].

**2. The Benefits of smart farming:** IoT technology has the potential to change several facets of the agriculture industry. There are specifically 5 approaches to enhance IoT agriculture:

- Data, a tone of data, gathered by sensors used in smart farming, such as weather conditions, soil quality, crop growth status, or cow health. This information may be utilized to track the overall health of your company as well as employee productivity, equipment effectiveness, etc.
- Better internal process control, resulting in decreased production risks. With the ability to predict your production's results, you can make better distribution plans for your products. You can ensure that your goods won't sit on the shelf unclaimed if you know exactly how much of your crops you will harvest each year.
- Cost management and waste reduction made possible by the increased the ability to direct production. You will be able to reduce the likelihood of losing your produce if you are able to spot any irregularities in crop growth or livestock health.
- Enhanced operational effectiveness thanks to process automation. You may alter a number of processes involved in your production cycle utilizing smart devices, such as irrigation, fertilization, and insect control.
- Increased production quantities and quality. Using automation, improve control over the production process and uphold greater criteria for crop quality and growth potential [2].

All of these elements can therefore result in increased income.

Let's look at how the stated advantages may be used in daily life now that we have outlined how IoT can be usefully implemented in the field of agriculture.

**3. IoT Application Cases in Agriculture:** IoT applications in agricultural and IoT sensors for agriculture often come in a wide variety of forms:

- **Climate Conditions are Being Monitored:** The least popular smart agricultural technology is probably weather stations, which integrate multiple smart farming sensors. They collect various environmental data while dispersed over the region and then upload it to the cloud. One may map the climate using the measures provided, choose the right crops, and take the required actions to improve their capacity (such as precision farming). Examples include the IoT devices for agriculture from allMETEO, Smart Elements, and Pycno.
- **Automation of Greenhouses:** Growers often control the greenhouse atmosphere by hand. Thanks to the usage of IoT sensors, they can now get extremely precise real-time information on greenhouse conditions, such as lighting, temperature, soil quality, and humidity. In addition to gathering environmental data, weather stations have the ability to modify the environment on its own so that it meets the defined requirements. Similar principles are frequently used to guide automation systems for greenhouses.

Farmapp and Growlink are two examples of IoT agricultural solutions with similar qualities. GreenIQ is a fascinating technology that also uses intelligent farm sensors. You can remotely control your irrigation and lighting systems using this smart sprinkler controller.

- **Crop Management:** Another IoT product area for agriculture and a component of precision farming is crop management devices. To capture data on crop farming, such as temperature and precipitation as well as leaf water potential and overall crop health, they need to be put up in the field, much like weather stations. In order to effectively fight off any diseases or insect infestations that might decrease your yield, you can keep an eye on both the growth of your crop and the progress of each individual. Excellent illustrations of how this use case might be applied in actuality are Arable and Semios.
- **Management and Observation of Cattle:** In the same way that crops are monitored, there are IoT agricultural devices that can be connected to the animals on a farm to keep an eye on their performance and measure their health. Through live stock following and monitoring, information on the condition, happiness, and whereabouts of livestock is acquired. For example, a sensor component of this kind may detect ill animals, allowing farmers to remove them from the herd and reduce contamination. By deploying drones to watch livestock in real time, farmers may be able to reduce manpower expenditures. This functions in a manner similar to IoT pet care devices. For instance, SCR by Allflex and Cowlar makes use of smart agricultural sensors (collar tags) to collect information on the temperature, well-being, activity level, and nutrition of each individual cow as well as the herd as a whole.
- **Precision Agriculture:** Precision agriculture, often known as precision farming, is all about efficiency and making accurate data-driven decisions. It's also among the most well-liked and productive IoT applications in agriculture. IoT sensors may be used by farmers to collect a wide range of data on the ecology and microclimate of their fields, including the amount of light, temperature, soil quality, humidity, CO2 levels, and insect infestations. With the use of this knowledge, farmers can more accurately predict the water, fertilizer, and pesticide needs that are perfect for their crops, save expenses, and yield better, healthier crops. For instance, CropX develops Internet of Things (IoT) soil sensors that measure the soil's temperature, electric conductivity, and moisture content. This enables farmers to adjust their practices to the unique needs of each crop. Similar services are offered by Mothive, a company that helps farmers increase agricultural sustainability by reducing waste and raising yields.
- **Agricultural Drones:** One of the agritech innovations that are potentially most likely to materialize is the use of agricultural drones in smart farming. In comparison to satellites and aero planes, drones, also known as UAVs (unmanned aerial vehicles), are better adapted to collect agricultural data. Drones may do a variety of tasks that formerly required human labour, such as sowing crops, fending off diseases and pests, spraying for agriculture, monitoring crops, etc., in addition to surveillance.

- **Predictive Analytics for Smart Farming:** Precision agriculture and predictive data analytics go hand in hand. IoT and smart sensor technologies are a gold mine for extremely helpful real-time data, but utilizing data analytics aids farmers in understanding it and making crucial forecasts, such as when to harvest crops, the possibility of diseases and pests, yield amount, etc. Farming, which is inherently highly reliant on the weather, may be made more controlled and predictable with the use of data analytics tools. For instance, farmers may obtain harvest volume and quality as well as their vulnerability to unfavourable weather conditions like floods and drought in advance thanks to the Crop Demonstration platform. Farmers may also change the quantity of water and nutrients they provide each crop, and they can even select a yield aspect. When used in agriculture, tools like SoilScout help farmers save up to 50% on irrigation water, prevent fertilizer loss from overwatering, and give actionable data no matter the season or weather.
  
- **End-to-end Farm Management Systems:** One way to produce IoT in agriculture is through what are known as "farm productiveness management systems." They frequently include a variety of on-site sensors and IoT devices for agriculture in addition to a powerful dashboard with analytical tools and integrated accounting/reporting tools. This enables you to simplify most of your business operations and remotely monitor your farm. Both FarmLogs and Cropio display comparable answers. Other interesting opportunities include logistics, storage management, vehicle tracking (or perhaps automation), etc., in addition to the IoT agriculture use cases already stated.
  - **Things to Conceive before Developing Your Smart Farming Solution:** As we can see, there are countless ways that IoT may be used in agriculture. You may increase the productivity and income of your farm in a variety of ways with the aid of smart technologies. It's not simple, though, to enhance IoT applications for agricultural. If you're contemplating investing in smart farming, there are some issues that you need to be aware of.
  
  - **The Hardware:** To develop an IoT solution for agricultural, you must pick the sensors for your device (or design a custom one). Your choice will depend on the kind of information you want to acquire and the overarching objective of your solution. In any case, the accuracy and dependability of the data that is collected will be critical to your product's success, making the quality of your sensors essential.
  
  - **The Brain:** All solutions for smart agriculture should be built on data analytics. If you can't make sense of the acquired data, it won't be any use to you. In order to get useful insights from the gathered data, you must thus have strong data analytics skills and utilise prediction algorithms and machine learning.
  
  - **The Maintenance:** Due to the sensor element's frequent usage in the field and ease of damage, hardware maintenance is a difficulty that is crucial for IoT production in farming. You thus insist on having gear that is both unbreakable and simple to maintain. If not, you'll have to replenish your sensors more frequently than you'd want.



- **The Mobility:** For usage in the field, intelligent agriculture apps should be tailored. It should be possible for a business owner or farm manager to access the data locally or remotely using a Smartphone or desktop computer. Additionally, each linked device has to be independent and have a sufficient wireless coverage area to communicate with other connected devices and transmit data to the main server [2] [3].
- **Smart Farming Techniques:** Some of the leading techniques concerned in smart farming with AI.

## V. MONITORING OF REMOTE EQUIPMENT

The tool connects to the agricultural equipment using a communications controller or computer. Data buses and other machine controls are connected through a connection. Sensor alerts are transmitted to the controller through the data bus, which is connected to controllers. Additionally, it creates information snapshots and summaries that are sent to central information servers. Finally, the user of the programme receives the information.

1. **Resource and Field Mapping:** Remote sensing is now the ideal data source for applications and their revision thanks to sensor-based mapping. Farmers greatly benefit from the sensors that provide information to a Smartphone application. Such a chance to obtain cutting-edge information or support from agricultural professionals wasn't available in the past.
2. **Statistical Prediction:** The tool connects to the agricultural equipment using a communications controller or computer. Data buses and other machine controls are connected through a connection. Sensor alerts are transmitted to the controller through the data bus, which is connected to controllers. Additionally, it creates information snapshots and summaries that are sent to central information servers. Finally, the user of the programme receives the information.
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  - **Predictive Analytics:** To plan for future yield, it is plausible to analyze historical as well as current farming data. Using satellite imaging, farmers may better understand and manage the natural surroundings of their operations, providing them with signals for sustainable agricultural practices. Yield maps also provide better fertilizer targeting for increased agricultural production standards. Making decisions based on data is crucial for boosting profitability. Therefore, predictive analytics aids farmers in making wise choices for increased income.
  - **Crop Monitoring:** Crops may be remotely observed using field data and remote sensing data. It aids in the evaluation of crucial aspects such as crop production,

yield, and condition, as well as cropping intensity, planting status, and drought prediction.

- **Weather Prediction:** Crop productivity is impacted by unpredictably weather patterns. Historical climate data is used in statistical weather forecasts to illustrate the link between various time periods. Therefore, using information about summertime temperatures, it is feasible to forecast wintertime temperatures. Any change in the former will probably also apply to the latter.
- **Using Predictive Analytics in Smart Farming:** Data analytics is used in smart farming to gather information from various farming operations. It facilitates the development of algorithms for better, more sustainable farming. The many elements of predictive analytics in smart farming approaches are listed below.
- **Data Collection:** Cloud computing in agriculture enables extensive data collection and retrieval from many sources. Soil conditions, crop mapping, agricultural environment monitoring, satellite photos, yield information management, and many more sorts of data are just a few examples. They provide information quickly and precisely. Since the data is still kept on the cloud, it is always available. Farmers may solve agricultural production issues by using historical data.
- **Data Analysis:** Data analysis assists in gaining knowledge that improves decision-making. Examples include information on the availability of water, soil moisture content, and GIS. The AgTech sector may use this knowledge to better estimate ideal water needs, soil moisture levels, and many other things. The system would also notify the concerned party to take remedial action if there are any anomalies. Additionally, the system will issue a warning if a pest attack is possible.
- **Data Storage:** A crucial component of predictive analytics is it. It was difficult to maintain physical infrastructure in the past when storage demanded it. Any hardware issue meant that data may be readily compromised. However, in a situation including contemporary agriculture, cloud solutions eliminate this issue. Purchasing pricey gear is not necessary right now. Additionally, anyone at any moment may view the data on their devices. Large volumes of high-quality data provide superior insights for better decision-making[2][3].

## VI. BENEFITS OF SMART FARMING USING SAAS SOLUTIONS

Here are some advantages of using SaaS solutions in smart methods of farming.

- It is a versatile and all-inclusive farm management system.
- Anyone can access data at any moment.
- Warnings to prevent issues like insect attacks.
- Advice on the weather
- Possibilities for higher yields through ongoing agricultural activity monitoring.
- Results that is predictable.
- Detailed analyses and information.
- Increased accountability and operational efficiency.

- Geotagging for straightforward tracking.
- Better resource management resulting in lower manufacturing costs.
- Compliance with regulations and standards.

1. **AI Yield Prediction and Optimization:** Crop output cannot be predicted since there are so many variables, including the environment and genetics. If we comprehend how these factors affect agricultural productivity, we may accurately estimate future harvests. Artificial intelligence can help in this situation.

To predict agricultural yield, the appropriate computers may be provided the pertinent datasets. Artificial intelligence systems can predict agricultural production over time with high accuracy by comparing previous crop yield data to more recent data.

With the aid of a precise production projection, growers would be able to manage their crops using data. Don't forget to consider their financial status.

2. **IoT Smart Plant Monitoring:** Farmers may use AI systems to determine how much light the foliage of their crops receives. Crop spacing can be changed to make enough room for sunlight penetration if certain plants are not getting enough sunlight. The foliage gap must be manually observed, which is expensive and time-consuming.

Artificial intelligence (AI) systems with visual capabilities may also monitor and assess daily changes in plants to determine their pace of growth. These systems can make use of data from infrared sensors, satellite imaging, and thermal cameras.

3. **Role of Artificial Intelligence in Agriculture:** The technology can track and gauge how the crops react when farmers apply fertilizers and insecticides. Utilizing the data, farmers may see crops that aren't doing well and take the appropriate action to solve the issue.

Autonomous tractors can use IoT and AI technologies to assist in gathering real-time data regarding soil health, including water levels, temperature, and PH. Farmers may monitor the health of their crops using various sensors, satellite pictures, and drone cameras. The findings, when analyzed, can assist producers in locating nutritional deficiencies in the soil as well as crop pests and illnesses.

## VII. AI AND AUTOMATION ARE TRANSFORMING FARMING

Large corporations are already using AI to create autonomous tractors that a farmer can operate from a distance. Self-driving tractors will improve agricultural productivity and crop output in addition to lowering labour expenses

1. **Automated Robotic Farming:** Farmers will be able to remotely monitor crop conditions and take pictures of their crops using autonomous drone technology. Growers may spray agricultural treatments like fertilizer and insecticides from the air using UAVs. Large-scale farms can use drones equipped with AI-powered cameras. The cameras will aid farmers in identifying agricultural problems, counting fruits, and even predicting crop production.

Other farming tasks including harvesting, sowing, weeding, and crop sorting may also be automated thanks to AI. In fact, a farm in Australia uses robotics and artificial intelligence to perform hands-free farming.

Farmers may employ strong and effective AI technologies to manage all the incoming data. The power of data may boost productivity, decrease waste, and lower labour costs environmental impact of agriculture.

Additionally, it can assist farmers in assessing their resource management plans for optimum production and profitability[2] [3].

- 2. IoT Solutions to Agricultural Problems:** Many people think that IoT can improve all facets of farming, from grain production to forestry. Precision farming and farming automation are two of the key ways that IoT may revolutionize agriculture, while there are many more methods as well[3].
- 3. Precision Farming:** The phrase "precision farming," often known as "precision agriculture," refers to IoT-based tactics that increase the control and accuracy of farming. Simply put, machines with superhuman precision select exactly what kind of treatment plants and animals need to receive. Precision farming differs from conventional farming in that decisions may be made on an individual plant or animal basis, rather than per field, or even per square meter.

By carefully observing variations within a field, farmers can boost the efficiency of insecticides and fertilizers or administer them selectively.

- 4. Precision Livestock Farming:** Similar to precision agriculture, smart farming methods let farmers better track the nutritional requirements of specific animals and modify the animals' diets as necessary, reducing disease and improving herd health.

To keep an eye on the welfare, security, and health of their livestock, large farm owners may use wireless IoT apps. With this knowledge, they can recognize sick animals and remove them from the herd in order to stop the disease from spreading.

- 5. Automation in Smart Greenhouses:** Traditional greenhouses frequently employ a proportional control system or manual intervention to maintain the environmental parameters, which frequently leads to output loss, energy waste, and higher labour costs.

With IoT-powered smart greenhouses, intelligent climate management and monitoring are both feasible, reducing the need for physical intervention. A variety of sensors are fitted to monitor the ambient conditions in line with the special demands of the crop. For future processing and administration, the data is stored on a platform that is accessible through the cloud.

## VIII. AGRICULTURAL DRONES

For purposes such as crop health evaluation, irrigation, crop monitoring, crop spraying, planting, soil and field analysis, among others, agriculture is one of the key

verticals to include both ground-based and aerial drones.

Drones capture multispectral, thermal, and visual imagery as they fly, giving farmers access to information on a various measures, such as plant health indices, plant counting and yield estimate, plant height measurement, canopy cover mapping, field water pond mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat, drainage mapping and weed pressure mapping.

It's important to note that IoT-based smart farming doesn't just focus on large-scale farming operations; it may also benefit new agricultural trends like organic farming, family farming, including breeding unique animals and/or cultivating specific cultures, preservation of specific or premium kinds, and promote farming that is extremely transparent to customers, society, and the market.

- 1. What's next in Smart Farming:** Of course, none of these advancements are useful if they don't address societal issues. Here are two positive effects that smart farming will have in the future.
- 2. Food Internet or Farm 2020:** If we already have the Internet of Things (IoT) and the Internet of Medical Things (IoMT), why not create an Internet of Food Things? The European Commission's Internet of Food and Farm 2020 (IoF2020) project, which is a part of Horizon 2020 Industrial Leadership, investigates the possibilities of IoT technology for the European food and agricultural industry through research and recurrent conferences.

The idea that a network of intelligent sensors, actuators, cameras, drones, robots, and other connected devices could give agriculture an unmatched level of control and automated decision-making, enabling a long-lasting ecosystem of innovation in this oldest of industries, has been encouraged by the Internet of Things (IoT).

- 3. Third Green Revolution:** A third green revolution is being prepared for by smart farming and IoT-driven agriculture.

The Third Green Revolution, which came after the Plant Breeding and Genetics Revolutions, is altering agriculture. The Internet of Things, big data analytics, robotics, unmanned aerial vehicles (UAVs or drones), and other technologies that make use of data-driven analytics are all a part of the same revolution in agriculture.

Less pesticide and fertilizer will be utilized thanks to the "smart farming" revolution, and productivity will increase overall. IoT technology will enhance food safety by boosting food traceability. Additionally, it will help the environment by enhancing water efficiency or optimizing intake and treatment.

Therefore, there is a probability that smart farming may result in a more precise, resource-efficient, and sustainable method of agricultural production. Thanks to new farms, humanity's everlasting dream will finally come true. Our population, which may reach 9.6 billion by 2050, will be fed by it[3].

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