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IOT BASED SMART FARMING

Ashwini Ashok More[1], Varsha Bharat Sonawane[2]

[1]Ashwini Ashok More, Department of Master of Computer Applications, ASM's Institute of Management and Computer Studies(IMCOST), Thane, Maharashtra, India.
[2]Varsha Bharat Sonawane, Department of Master of Computer Applications, ASM's Institute of Management and Computer Studies(IMCOST), Thane, Maharashtra, India.

Abstract - *Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. In olden Days Farmers used to figure the ripeness of soil and influenced suspicions to develop which to kind of yield. They didn't think about the humidity, level of water and especially climate condition which terrible a farmer increasingly. The Internet of things (IoT) is remodeling the agribusiness empowering the agriculturists through the extensive range of strategies. In today's era of IoT, lots of new research in terms of Smart IoT based product's development is being carried out to facilitate Smart Farming in terms of Crop Management, Pest Management, Agriculture Precision, Agriculture Fields Monitoring via Sensors and even Drones. The production rate of crops in agriculture is based on various parameters like temperature, humidity, rain, etc. Hence the project aims is making agriculture smart using IoT technologies use of Unmanned Aerial Vehicles (UAVs), also known as drones, and connected analytics has great potential to support and address some of the most pressing problems faced by agriculture in terms of access to actionable real-time quality data. Basic purpose and the use of drones for spraying plants could be allowing for rapid application of plant protection agents on the growing areas.*

Keywords*: *Unmanned Aerial Vehicles, Smart agriculture, Drones, Internet-of-Things (IoTs), Sensor.

1. INTRODUCTION

Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nation's capital comes from farming .Agriculture is considered as the premise of life for the human species as it is the fundamental wellspring of nourishment grains and other crude materials. It assumes crucial job in the development of nation's economy. It additionally gives vast sufficient work chances to the general population. The future of agriculture is expected to grow at 4 billion by 2020. Data generated from sensors on agriculture field can also be used for Data analytics, which will help farmers to improve crop yields. So, IoT based smart farming can solve many agricultures-based issues.

Agriculture products need applications like soil moisture monitoring, environmental condition monitoring for temperature, moisture, soil type, crop, crop variety, season, and if available fertility status, supply chain management and infrastructure management, humidity maintenance and theft detection. Agricultural aircraft have been in use for this purpose since the 1920s. Remote sensed data from satellites have been used increasingly to assess crop distribution, extent and health from the sky. Over the last few years unmanned aerial vehicles (UAVs) or drones have become one of the world's most talked about technologies, used by people in a wide range of professions. Although UAVs are unlikely to entirely replace manned aircraft or satellites, they have a number of advantages over these more traditional remote-sensing methods. The technology is capable of collecting very high-resolution imagery below the cloud level, with much more detail than the satellite imagery usually available to developing country analysts. They are easy to use: most drone mapping and data-collection missions are now conducted autonomously, meaning that the UAV essentially flies itself. Moreover, data processing applications are becoming less expensive and easier to use.

Precision farming combines sensor data and imaging with real-time data analytics to improve farm productivity through mapping spatial variability in the field. Data collected through drone sorties provide the much-needed wealth of raw data to activate analytical models for agriculture. In supporting precision farming, drones can do soil health scans, monitor crop health, assist in planning irrigation schedules, apply fertilizers, estimate yield data and provide valuable data for weather analysis. Drones are remote controlled aircraft with no human pilot on-board. These have a huge potential in agriculture in supporting evidence-based planning and in spatial data collection.

2. LITERATURE REVIEW

During this research development we have referred various papers to analyze the problems in the existing system and figure out solutions that are economically and timely viable.

[1] Marthinus Reinecke - , "**The influence of dronemonitoring on crop health and harvest size.**", 1st International Conference on Next Generation Computing Applications (NextComp), [2017]. Have proposed the usage of drones for the betterment of crop quality. This could help the farmers increase their production by detecting the loopholes beforehand. The crops could be managed by using specific cameras connected to the drones to detect water shortages and harmful pests.

[2] Rodrigo Filev Maia - "**Precision agriculture using remote monitoring systems in Brazil.**", IEEE Global Humanitarian Technology Conference (GHTC), [2017]. Have discussed about an IoT device which is used to monitor various agricultural parameters. The device uses a network of sensors for measuring the soil temperature, humidity, moisture etc. The test was carried out in Sao Paulo, Brazil. Reference climate data was taken to support various decisions on crop life and its sustainability.

[3] Prof. P. P. Mone, Chavhan Priyanka Shivaji, Jagtap Komal Tanaji, Nimbalkar Aishwarya Satish has published a paper entitled "**Agriculture Drone for Spraying fertilizer and Pesticides**". In this paper authors has given detail about implementation of Agriculture drone for automatic spraying mechanism. In this paper, they gave problem statement of World Health Organization where it estimates that there are 3 million cases of pesticide poisions in each year and upto 220,000 deaths, primarily in developing countries. In this paper they also explain what precautions the farmer should have to use to avoid harmful effects of pesticides and fertilizing effects as well as cost effective technology using components such as PIC microcontroller for the control of agriculture robots. The published paper is available at IJRTI, Volume 2, Issue 6, 2017.[1]

3. CHALLENGES

The Republic of India is a multiproduct agricultural nation with highly diverse topography, climate and soil. The country's small-sized, family farms practice a unique kind of mixed agri-horti-livestock farming, which is a cost-effective model ideal for other developing nations with small farms. Indian farmers multitask, and shift with ease from crop cultivation to animal husbandry, thereby remaining engaged throughout the year. By and large, this versatility has transformed the Indian agricultural sector and in 2016-2017 it contributed 17.32 percent to the country's Gross Value Added (Statistics Times, 2017). Despite the transformation, Indian agriculture is still limited by a number of factors including the unpredictable weather, scattered and small landholdings, non-scientific way of farming, poor technological adoption. It points to a dire need for technological intervention in the system. To keep pace with world agriculture, farming needs to be become more technologically driven. It has to be more reliant on real time information thus enabling the farmers to make more informed decisions. There are several challenges pertaining to the implementation of UAVs in the agricultural context:

1. **Quality software** – Right from planning the flight path till processing the final image, software plays a crucial role in the applicability of this technology.
2. **Legal aspects** – Different nations have their own regulatory regimes pertaining to the use of UAVs in agriculture.
3. **Acceptability on the farmer front** – Technological unawareness may be a hurdle in its penetration.
4. **Flight time and flight range** – Most drones have short flight ranges thus limiting the acreage that they can cover. The ones with the longer flight ranges are relatively more expensive.
5. **Initial cost of purchase** – Drones with features that are suitable for use in agriculture are quite expensive.
6. **Interference with the airspace** – Drones share the same airspace with manually manned aircraft.
7. **Connectivity** – Mostly farmlands may not have good connectivity, thus either the farmer has to invest in connectivity or buy a drone capable of capturing data locally for later processing.
8. **Weather dependency** – Drones' operations are heavily dependent on climatic conditions, thus limiting their usage.

4. METHODOLOGY TO BE USED

Unmanned aerial vehicles (UAVs) or unmanned aerial systems (UAS), better known as drones, in a technological context are unmanned aircrafts that can be remotely controlled or fly autonomously. They work in conjunction with GPS and others sensors mounted on them. The total addressable value of drone-powered solutions in all applicable industries is significant – more than USD 127 billion, according to a recent PwC analysis. Drones have been mostly associated with military and warfare in the past but keeping pace with technological advancements, they have found application in a plethora of disciplines. With the world population projected to reach 9 billion by 2050 and agricultural consumption expected to increase by 70 percent over the same period, agri-producers need to embrace emerging technological advancements such as UAVs. Drones in agriculture are simply a low-cost aerial camera platform, equipped with an autopilot using GPS and sensors for collecting relevant data. They can be compared to a regular point-and-shoot camera for visible images, but whereas a regular camera can provide some information about plant growth, coverage and other things, a multispectral sensor expands the utility of the technique and allows farmers to see things that cannot be seen in the visible spectrum, such as moisture content in the soil, plant health, stress levels and fruits. These could help overcome the various limitations that hinder agricultural production. PwC estimates the potential market for drone-powered solutions in agriculture at USD 32.4 billion. UAVs application in agriculture opens the gateway to access real time information on the farm. It can be used at different stages throughout the cropping cycle:

4.1 Soil and Field Analysis

Drones are able to produce precise information to analyze the soil before sowing the crop, which helps to determine the most suitable crop for specific land; furthermore, it suggests the seed type and its planting patterns. At the beginning, middle, and end of a crop cycle drones can be used to help obtain useful data surrounding the quality of the existing soil. By obtaining 3D maps of existing soil, you'll be able to see if there are any issues surrounding soil quality, nutrient management, or soil dead zones. This information can help farmers determine the most effective patterns for planting, managing crops, soil, and more. Ongoing monitoring can help to better utilize water resources, and more effectively manage crop nutrient levels.

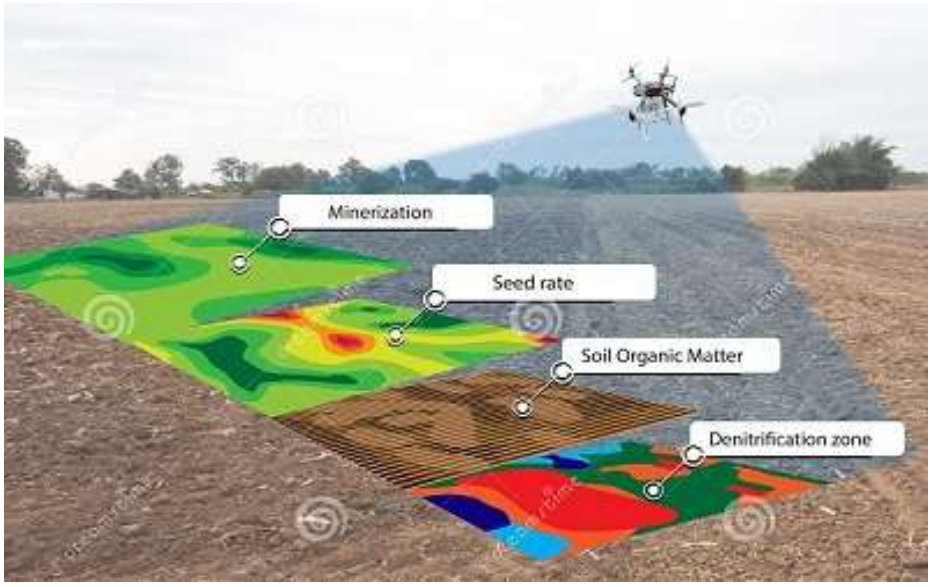

Figure - 1

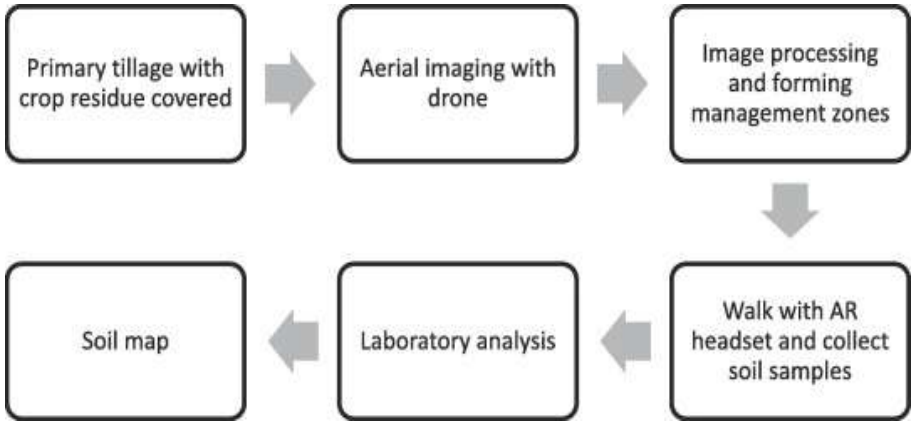

Figure - 2

4.2 Seed Planting

Millions of acres of land are currently under-utilized due to being human inaccessible or lack of suitable workers. Safety concerns of rough terrain are main reason not to utilize these areas for forestry or agriculture purpose. For this purpose, drone based planting systems are being developed that decrease planting costs upto 85 percent. Not only cost, but within shorter time as some recently developed drones can plant 100,000 trees in a single day. These systems shoot pods which include the seeds and necessary nutrients required to grow the plant. This method is found very effective for rough terrain; most importantly the success rate is more than 75%. Due to the success and flexibility they offer, UAVs are being considered the best candidate for plantation all over the world.

Drone planting is a relatively newer technology and not as widely used, but some companies are experimenting with drone planting. Essentially, manufacturers are experimenting with custom systems that have the ability to shoot seed pods into prepared soil. Drone startup companies have been instrumental in developing unique drone technologies to assist with a wide range of ecological and agricultural issues. For example, the company DroneSeed is using unmanned aircraft capable of delivering up to 57 pounds of payload in the form of tree seeds, herbicides, fertilizer and water per aircraft per flight to assist reforestation and replanting projects. This technology helps to minimize the need for on-the-ground planting, which can be costly, time-intensive, and strenuous work. This same drone technology can be adapted and applied to a wide range of farm types, reducing overall planting times and labor costs across the board.

4.3 Crop Spraying and Spot Spraying

The drones can scan the ground and spray the correct amount of liquid, modulating distance from the ground and spraying in real time for even coverage. The result: increased efficiency with a reduction of in the amount of chemicals penetrating into groundwater. In fact, experts estimate that aerial spraying can be completed up to five times faster with drones than with traditional machinery.

Crops require consistent fertilization and spraying in order to maintain high yields. Traditionally this was done manually, with vehicles, or even via airplane. These methods are not only inefficient, and burdensome, but they can be very costly as well. With approval from the FAA, Drones can be equipped with large reservoirs, which can be filled with fertilizers, herbicides, or pesticides. Using drones for crop spraying is much safer and cost-effective. Drones can even be operated completely autonomously and programmed to run on specific schedules and routes. For example, if there's a fungus breakout in a certain section of the crops, drones can be used to spot treat the issue. With the speed at which drones can operate, you can diagnose and treat potential crop issues before they become a widespread issue across the entire farm.

4.4 Crop Mapping and Surveying

One of the biggest advantages of using drone technology is the ease and effectiveness of large-scale crop and acreage monitoring. In the past, satellite or plane imagery was used to help get a large scale view of the farm, while helping to spot potential issues. However, these images were not only expensive but lacked the precision that drones can provide. Today, you can not only obtain real-time footage but also time-based animation which can illuminate crop progression in real-time. With drone mapping and surveying, technology decisions can now be made based on real-time data, not outdated imagery, or best-practice guesswork. With near infrared (NIR) drone sensors you can actually determine plant health based upon light absorption, giving you a birds-eye view of the overall farm health. We recently interviewed a drone pilot who used NIR to help vineyard owners determine the health of their grapevines.

With agriculture drones you'll be able to collect information like:

1. The overall crop and plant health
2. Land distribution based on crop type
3. Current crop life cycle
4. Detailed GPS maps of current crop area

The end result is simple, drones can help to maximize land and resource usage, and help farmers better determine crop planting locations.

4.5 Irrigation Monitoring and Management

Use of drones for irrigation applications is, again, two-fold. On one side, equipping UAVs with a variety of sensors and cameras can help to identify areas that are under water stress and conclude what irrigation changes are required. At the same time, they can be used for sprinkling water and pesticides on the crops precisely, especially in emergency cases, which would save both time and wastage. In multispectral images of citrus crops were acquired using the fixed-wing UAV, where the retrieved data was used to assess and detect structural and physiological changes in the targeted crop. Furthermore, UAVs are not only used to analyze the irrigation properties but also provide solutions by sprinkling water precisely over the water stress areas. Due to this application of UAVs, they are being considered the newest water-saving tool, while their use is helping not only to increase watering efficiency but also detect possible pooling or leaks in irrigation.

Figure - 3

4.6 Real-Time Livestock Monitoring

Some drones are equipped with thermal imaging cameras that enable a single pilot to manage and monitor livestock. This allows farmers to keep track of livestock a much greater frequency, and with less time and staff investment. The drone

operator can quickly check in on herd to see if there are any injured or missing livestock, as well as see livestock who are giving birth. Drones are used to keep an eye on the heard at all times, a once costly and time-intensive task.

Plus, thermal imaging will also help to keep an eye out for any livestock predators, which can be a huge advantage for some farm owners.

5. CONCLUSION

In coming days, Agricultural Drone become an integral part of smart farming, they help farmers deal with a wide range of challenges and reap a great number of benefits. Drone technologies are a unique opportunity for the EU economy to generate additional growth and prosperity. Drones or UAVs will be of immense help in the field of agriculture with the increase in population as they are essential at the very beginning of a crop cycle. It will not only reduce time but also yield better cultivation based on analyzed data. Drones are not just used in the analysis of soil and fields but also in planting seeds and shooting plant nutrients in the soil. Crop management will be more efficient due to systematic monitoring. With the upcoming technologies, the production rate will increase rapidly with lesser consumption of energy. By gaining access to a vast pool of data, farmers can increase crop yields, save time, reduce expenses and act with unparallelled accuracy and precision. The major advantage of Drone is the auto landing capability which reduces the risk factors designed in a simple and cost effective manner. The study investigated the importance of drones in agriculture and is regarded as an eye-opener in industry and agriculture for development and integration of more drones for making agriculture tasks better in near future.

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