

# IoT based automation using Drones for Agriculture

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**Abstract - Drones are also known as Unmanned Aerial Vehicle (UAV). It is a kind of flying robot which do not carry a human operator and can be controlled remotely. Drones are growing rapidly and are used in many applications like agriculture, commercial, intelligent transportation, hunting hurricane, research and development. They bring more benefits to people and industries. Drones when connected to Internet of Things make the object smarter through the network.**

**This paper is currently focusing on how the drones are used for agriculture. In the present era, there are many techniques to increase the crop productivity. Especially in countries like India where 70% of the people are dependent on fields. They face a huge loss due to the diseases. These diseases are caused from pests and the insects, which will reduce the productivity of the crops. Pesticides and fertilizers are used in agriculture to kill the insects and pests so as to increase the crop quality. It is estimated from WHO (World Health Organization) that many people are affected from ill when using the pesticides manually. UAVs are used in order to spray the water, pesticides, and insects and to avoid the health problems of humans.**

**Keywords—Internet of Things, UAVs, Agriculture, NDVI**

## I. INTRODUCTION

Unmanned Aerial Vehicle (UAV) is in use since 1980. As they are rapidly expanding, they meet the increased population and the food production. The drone is the only solution to get the desired efficiency, accuracy and the ability to overcome obstacles which is not possible in the normal traditional machines. As the IoT is becoming more advanced, when the concepts of IoT is integrated with the drones it will improve the agriculture industry.

Drones are easier to use and can be used by the farmers in order to get the accurate and real-time data. By mapping, localization and the high resolution images captured by the drone will help for the efficient crop management. Satellite images are used for applications such as to identify the shrub lands and the grasslands for monitoring with 79% and 66% accuracy respectively. However to satisfy all these needs drones must be used.

By using the drones we can measure the distance and adjust from the terrain, measure the water level of the crops and many other applications. Thus a drone when equipped to adequate tools will make the agriculture as a precision agriculture. As a result it will benefit the farmers in order to look after the crops.

Paper is organized as follow: Section 2 explains about Background Information, Section 3 describes the Types of Drones in Agriculture, Section 4 describes Benefits and Disadvantage, Section 5 describes Drones in Agriculture and Section 6 describes the methodology.

## II. BACKGROUND INFORMATION

Automatons are utilized only for the sake of entertainment and diversion yet they have a wide scope of advantages in the horticulture area too.

### A. Problem Statement

Farmers won't almost certainly take care of the whole field, some of parts of the landscape will get dismissed this will prompt fix at bigger scales. From one viewpoint, this implies a portion of the irrelevant territories don't occupy the farmer's time, however then again it implies that regions that may wind up critical are by and large left to nature's benevolence, for instance, a field that can be utilized for eating in the following season. The main technique regularly utilized by the farmers to cure this is to contract more specialists who need to watch the earth and report any earnest upkeep. This isn't constantly successful as specialists are not constantly outfitted with the required dimension of competency.

### B. Research questions and Objectives

The most essential question is: How the automatons help the farmers to screen their crops exercises?

The second research question is that:

- What is a drone? This will give the details regarding their benefits, disadvantages and their features.
- What is NDVI observing? The genuine drones with their high-resolution cameras and their capacities will be clarified.
- Why ranchers ought to think about the automatons in their agriculture field? Reasons and their particular uses of drones are itemized?

## III. TYPES OF DRONES IN AGRICULTURE

Various varieties of drones are available today but not all are good for agriculture. Those which are suitable for the agriculture fall in two categories: Fixed-wing and the Multi-rotor drones. The cost and also the payload capacity of these drones are similar; the hardware is becoming more economically valued.

Fixed drones have higher flight capabilities so that they can cover the large area and it consumes less power.

Multi rotor drones are faster to set up in the field and can take off and land vertically. It has less flight capability and higher power consumption. They are also crash tolerant when compared to that of the fixed. Though they have many advantages like they are easier to operate, require no advance wind planning and can fly more precisely. With either type of drone the actual flight process is relatively straight forward.

#### IV. BENEFITS AND DISADVANTAGES

The following are some of the benefits of drones:

- Drones give NDVI imaging at lower cost than utilizing a helicopter or a little plane.
- Due to their small size, it is much better than any other traditional aircraft, which helps in making the photography easier and also faster.
- By knowing the knowledge of operating the drones in various aspects it is beneficial.
- Unlike the satellite images, it gives a clear image due to their hyper-spectral cameras.

Some of the disadvantages of drones are:

- It requires a training skill before operating, without the training it may cause the damage.
- The battery has a constrained limit.
- To reward this, bigger batteries can be utilized however because of its weight it is hard to keep up the elevation.
- All but some of the specialized drones are not allowed to use in dry climate as they are not waterproof.

#### V. DRONES USED IN AGRICULTURE

##### A. Monitoring Crops

Crop maladies can be delegated contagious, bacterial or viral. Drones when furnished with sensors and digital imaging it help the famers to get the clear picture of their agricultural field. The GPS map creation provides the farmers with more accurate about their filed which will literally give the efficiency and maximize the ability to plan where exactly the crops should be planted.

Drones when furnished with multispectral camera it can perceive the underground water content which will empower the farmers to acknowledge whether the harvest crude is dry or over hydrated. On the off chance that any of the crop is distinguished as contaminated before it spreads preventive measures can be taken - like evacuating the plant - before the disease begins spreading the neighboring plants.

Farmers will almost certainly modify their water system until an even water table is made, disposing of water as a wellspring of yield trouble. On the off chance that a multi-unearthly camera isn't accessible, the drone can at present take the photos of the fields and furthermore feature the regions where plants appear to be vapid or littler than the remainder of the field. This method is likewise be utilized to identify underground breaks in existing water system frameworks.

##### B. Mapping/Surveying

Drones when equipped with near infrared camera sensors will allow the drone to see the spectrum of light which is usually absorbed by the plants for their photosynthesis. From this, using

the NDVI (Normalized Difference Vegetation Index) farmers can easily understand the plant health. Software analyses help to change the values to reflect the crop type and also to determine which stage of life the crop is in.

In addition to crop health, the drones can create the GPS map of the crop field. This will help farmers to where to plant the crops so as to maximize water, fertilizer usage.

##### C. Crop Dusting/Spraying

For maintaining the yields crops require proper pesticides and fertilizers application. Manually driving the vehicle throughout the field for spraying are the past methods. Crop spraying drones will be able to carry a large liquid storage reservoirs are operated more safely.

##### D. Irrigation Management

Drones when equipped with thermal cameras can provide excellent insight into irrigation by highlighting the areas that are having pooling water or insufficient soil moisture. These will badly affect the yield and the quality. Thermal drones provide the farmers a better way in understanding their fields through more quick inspections and surveying.

##### E. Livestock Monitoring

Drones with thermal cameras will help the remote pilot to monitor the livestock. It helps in maintaining the agriculture from damaging the crops by any kind of cattle herds. Sometimes there might be damage in between the crops being eaten by the livestock which cannot be seen by the human eyes directly. As the drones are not much far from the ground through the high resolution cameras it capable of maintaining the livestock so as to prevent the crop from damage.

#### VI. METHODOLOGY

##### Working of NDVI

Drones collect data based on the light that is reflected on the crop. For agricultural purposes, using a specific type of sensor can help growers collect data that indicates where issues exist so that they can take appropriate action.

Plants, of course, capture visible light to drive photosynthesis. However, near infrared (NIR) photons don't carry enough energy for photosynthesis but they do bring lots of heat, so plants have evolved to reflect NIR light. This reflection mechanism breaks down as the leaf dies. Near Infrared sensors take advantage of this property by monitoring the difference between the NIR reflectance and the visible reflectance, a calculation known as normalized difference vegetation index or NDVI. A strong NDVI signal means a high density of plants and weak NDVI indicates problem areas on the field.

NDVI always range from -1 to +1. But there is no distinct boundary for each type of land cover. For example, when you have negative values, it's highly likely that it's water. On the other hand, if you have a NDVI value close to +1, there is a high possibility that it is dense green leaves. But when NDVI is close to zero, there is no green leaf and it could even be an urbanized area.

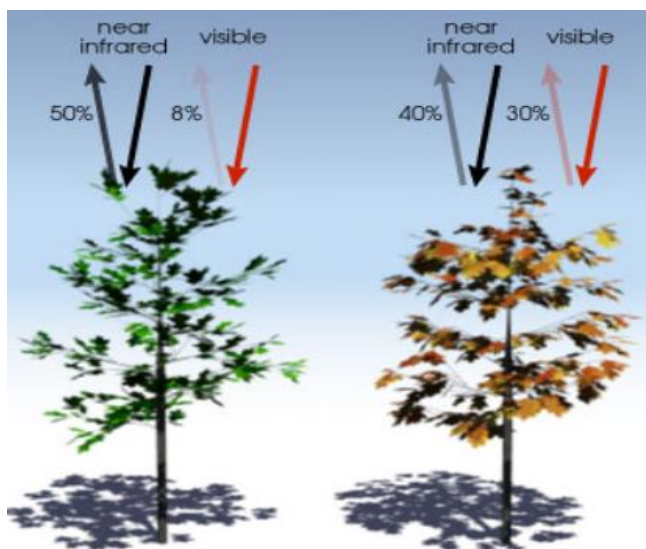


Figure 1: Illustration of NDVI

NDVI can be calculated by the formula:

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Healthy vegetation (chlorophyll) reflects more near-infrared (NIR) and green light compared to other wavelengths. But it absorbs more red and blue light. This is why our eyes see vegetation as the color green. If you could see near-infrared, then it would be strong for vegetation too. Satellite sensors like Land sat and Sentinel-2 both has the necessary bands with NIR and red.

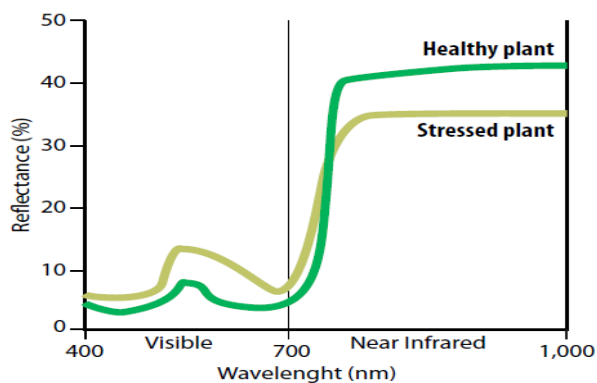


Fig 2: Typical reflectance spectrum of a healthy and stressed plant

The visual camera is used for mapping and surveying the field. The infra red camera is progressively appropriate in recognizing the plant heat pressure, water system lack and parasitic contamination. When seeing a whole field from above, it is anything but difficult to spot regions that need more consideration than the remainder of the field.

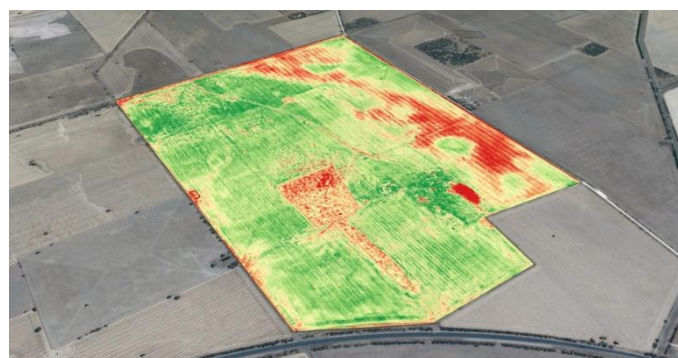


Figure 3: Plant heat stress

Utilizing information from the distinctive cameras, farmers can explore their crop fields to perceive what the issue is and address it. Warmth worry, as appeared with an infrared camera in figure 3, is most ordinarily brought about by a warm atmosphere, yet on account of this picture, the harvest field is situated in a moderately cool condition, with just pieces of the field encountering pressure. This can be brought about by exhausted soil that never again enables plants to ingest every one of the supplements they need.

## VII. CONCLUSION

Agricultural drone have the potential to improve the crops and helps in providing an insight about the disease management technique through imaging and sensors. It will also provide help in the monitoring of irrigation and water supply by predicting the availability of water. Agricultural drone can help the farmers to transform the agriculture industry.

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