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# Role and Application of Drones for Smart Agriculture

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## Abstract

Evolutions of technologies for agriculture are now essential to tackle the food deficient crisis all over the world. More than 60% people are directly connected in agriculture sector in India. Drones are used now a day in farming for field and soil sample analysis, crop monitoring and spraying, irrigation, weed identification and health assessments etc. by using sensors (Multi spectral, thermal, hyper spectral and LIDAR) attached in it along with use of GPS (Global Positioning System). Drone usage in agriculture now in initial phase and can be a potential future for smart agriculture.

## Introduction

Agriculture is the backbone of the whole Southeast Asia and some other global countries. India marks more than 60% of populations are directly involved in agriculture. Various new, technically superior, advanced techniques and machineries are needed for smarter agriculture so that it can be a potential source for mitigating global needs in shorter period of time and make one country sustainable in case of food production. Drone which is otherwise known as UAV (Unmanned Aerial Vehicle) is a flying robot as well as it can be assessed or controlled by use of software, sensors attached onboard and with Global Positioning System (GPS).

## Sensors Used in Drones

### 1. Multi Spectral

These sensors are useful in case of plant health assessment, water quality assessments as well as estimation of plant population and vegetation indexes.

### 2. LIDAR

This is useful for flood mapping, plant height measurements from canopy and below ground parts etc.

### 3. Thermal

Thermal sensors are used for water and heat signature detection, surveillance and security purposes.

### 4. Hyper Spectral

Mineral and surface composition survey, plant health measurements, water quality assessments are done by this sensor.

## Applications of Drones in Agriculture

### 1. Soil and Field Analysis

The accurate 3D maps provided by drones are useful for advanced soil and field analysis by taking soil moisture, soil properties, planting seed dimensions, the irrigation needs and nitrogen levels are also managed by drone analysis.



Figure 1: Crop monitoring



Figure 2: Crop spraying

### 2. Crop Spraying, Monitoring and Fertilizer Applications

The drones with auto distance and height measuring abilities help in spraying of chemicals in adequate amount and on exact plant parts so that losses are minimized. Drones are also helpful in monitoring crop growth, disease and pest risk assessment. The fertilizers which susceptible to losses (e.g. Nitrogen-Leaching and Volatilization) are also smartly applied on the exact crop plant parts that increase its efficiency and uptake by plants.

### 3. Irrigation

Drones with hyper spectral, multispectral or thermal sensors are useful in detection of drier regions in the field so that irrigation requirements can be mitigated and proper crop growth can be ensured. Irrigation is a major and essential operation in crop production. Water scarcity or over water usages are detected by sensors used in drones and with the help of wireless softwares and other machineries are used for controlling irrigation systems in crop fields.

### 4. Health Assessment and Weed Identification

Various fungal as well as bacterial diseases and pest movements are scanned by drones on different spectral levels. Then the lights emitted at visible and infra red

spectrums from plants are analyzed using drones and other software is controlled properly. The post flight images and sensors help in producing high quality images that help farmers identifying weeds and separate them properly.

### 5. Farming System Monitoring

The devices and sensors with good quality images taken by drones are helpful in observing the farming systems on a particular location. Effect on weather on farming systems are closely observed by the drones.

### 6. Ground Water Quality Monitoring

Heavy usages of fertilizers and pesticides have deteriorated the quality of ground water. The sensors along with wireless network software are very much helpful in detecting the ground water level for further analysis.

### 7. Greenhouse Gases Monitoring

Green house gases like CH<sub>4</sub> and CO<sub>2</sub> emissions are being detected and monitored by using sensors and wireless networking softwares.

### 8. Climate Monitoring

Changes in climatic conditions such as global warming, flooding and other calamities affect the crop growth and thus reduce production. Advanced systems and sensors help in early detection of flood situations which is proven effective in farming.

## Conclusion

Agriculture with advanced systems like drones is helpful in creating possibilities for a better future in this farming sector. Although limitations like high initial cost, lack of skill, proper mode of functioning are there but it can be evaluated by high intelligent personnel with other governing bodies and can be recommended in future. Drone farming is in early stage and can open up a vast possibilities if augmented by concepts of precision farming, nanotechnologies etc.

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