AGROCOPTER

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Abstract—
In the present era, there are too many developments in precision agriculture for increasing the crop productivity. Especially, in the developing countries like India, over 70% of the rural people depends upon the agriculture fields. The agriculture fields faces dramatic losses due to the diseases. These diseases came from the pests and insets, which reduces the productivity of the crops. Pesticides and fertilizers are used to kill the insects and pests in order to enhance the crop quality. The WHO (World Health Organization) estimated as one million cases of ill effected, when spraying the pesticides in the crop filed manually. The Unmanned aerial vehicle (UAV) – aircrafts are used to spray the pesticides to avoid the health problems of humans when they spray manually. UAVs can be used easily, where the equipment and labors difficulty to operate. This paper reviews briefly the implementation of UAVs for crop monitoring and pesticide spraying.

Keywords: Unmanned aerial vehicle, Spraying System, Crop Monitoring, Quad copter, BLDC, ESC, PWM.

1. INTRODUCTION

As much as India depends upon the agriculture, still it is far short from adapting latest technologies in it to get good farm. Developed countries have already started use of UAV's in their precision agriculture , photography and remote sensing . It is very fast and it could reduce the work load of a farmer. In general, UAVs are equipped with the cameras and sensors for crop monitoring and sprayers for pesticide spraying. In the past, Variety of UAV models running on military and civilian applications . In agriculture, the first UAV model is developed by Yamaha .Unmanned helicopter Yamaha RMAX was introduced for agriculture pest control and crop monitoring applications. However,. A technical analysis of UAVs in precision agriculture is to analyze their applicability in agriculture operations like crop monitoring , crop height Estimations , pesticide Spraying , soil and field analysis . However, their hardware implementations are purely depended on critical aspects like weight, range of flight, payload, configuration and their costs. A research involving technologies, methods, systems and limitations of UAVs are examined . In order to select the suitable UAV in agriculture more than 250 models are analyzed and summarized . Techniques and crucial components involved to build a mini autonomous mini unmanned rotorcraft vehicle, which includes the construction of hardware components, integrates with the software system, autonomous flight controlling, aerodynamic modeling, design and implementations .

Another strategy came on ground i.e., a sprayer system is mounted on UAV for pesticides spraying. The integration of UAV with sprayer system results a potential to provide a platform to pest management and vector control. This is accurate site specific application for a large crop fields. For this purpose heavy lift UAVs are required for large area of spraying. The efficiency of the spraying system which is mounted to the UAV increases through the PWM controller in the pesticide applications

A blimp integrated quad copter aerial automated pesticide sprayer (AAPS) was developed for pesticide spraying based on the GPS coordinates in lower altitude environment . To, overcome this a low cost user flexible pesticide spraying drone "Freyr" was developed which is controlled by an uno. A laboratory and field evolutions are analyzed for discharge and pressure rate of the liquid, spray uniformity and liquid loss, droplet density and sizes of a developed hexa copter mounted sprayer . To reduce the wastage of pesticides an electrostatic sprayer introduced and designed on electrostatic spray technology with a hexa rotor UAV.

Keeping in view of these facts, a crop monitoring and Pesticide spraying UAVs are developed consisting of an automated drone system and sprinkling system with multi spectral camera. The sprinkling system is attached to the lower region off the UAV which has a nozzle beneath the pesticide tank to sprinkle the pesticide towards downstream. First monitoring is done by multi spectral camera, the camera scans the whole crop field and generates a spatial map. This map manifest the condition of the crop through NDVI and then the

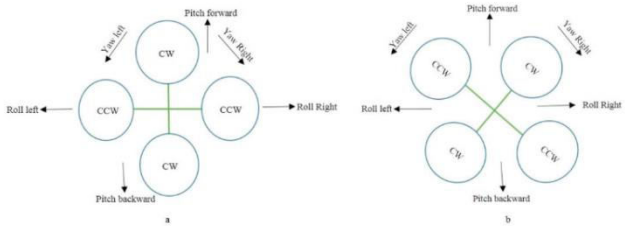
farmer evaluates which type of pesticides/fertilizers apply on the crop.

2. METHODOLOY

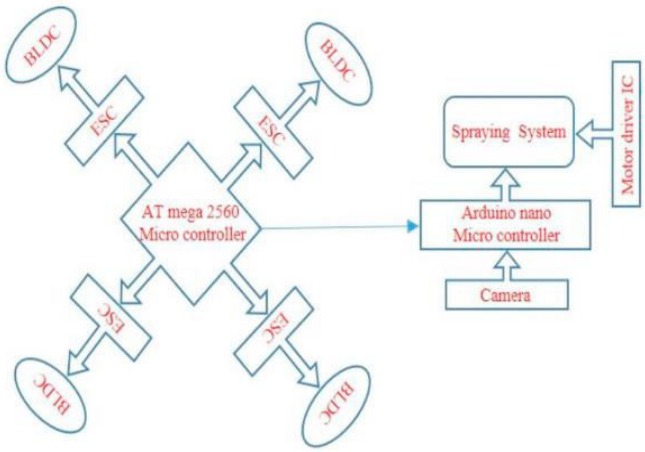
Unmanned Aerial Vehicle

A UAV is an aircraft which can flight without a human pilot and controlled by the radio channel. Multi rotors are the one type of UAVs, further which are classified into number of rotors in their platform

A quad copter, is unique design of UAVs which has four rotors in their model. The lift of quad copter is generated by these rotors. In four rotors, the two opposite rotors are turn in clockwise direction (CW) and the other two turn in counter clockwise direction (CCW).The quad copter movement around the axis includes pitch (Backward and forward), roll (left and right) and yaw (clockwise and counter clockwise).Basically, the configuration of a quad copter is divided into two ways one is plus (+) model shown in Fig. 2(a) and another one is cross (X) model shown in Fig. 2(b).Cross model is very popular and more stable compare to plus model



The flight controller is the main board in the UAV is embedded with the most advanced firmware and responsible for the actual flight. Flight controller controls lot of things simultaneously during the flight or UAV. It built with a micro controller and communicates to the four brushless motors. BLDC motor connect with the rotors in directions of the UAV configuration model. These BLDC motors are controlled by the Electronic Speed controllers (ESC). The UAV controlled by the Radio channel transmitter and receiver. Ever RC transmitter have number of channels for individual activity to control the UAV. A sample block diagram shown in Fig.



Crop Monitoring

UAVs are capable of observing the crop with different indice. The UAVs are able to cover up hectares of fields in single flight. For this observation thermal and multi spectral Cameras to record reflectance of vegetation canopy, which is mounted to downside of the quad copter. The camera takes 1 capture per second and stores it into memory and sends to the ground station through telemetry. For this wireless communication it uses MAVLINK (Micro Air Vehicle Link) protocol.

Sprinkling system

Generally, the sprinkling system is attached to the lower region off the UAV which as a nozzle beneath the pesticide tank to sprinkle the pesticide towards downstream. The sprinkling system as two modules one is sprinkling system itself and second one is Controller. The sprinkling system contains the spraying content (pesticides or fertilizers) and a nozzle for spraying. Second one is controller used to activate the nozzle of the sprayer. A pressure pump is a component of the sprinkler system which pressurizes the pesticide to flow through the nozzle. A motor driver integrated circuit is used to pressure the pump as per the requirement.

3. RESULT

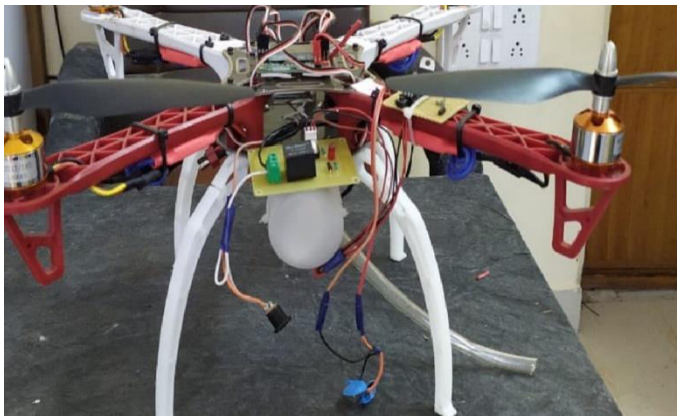
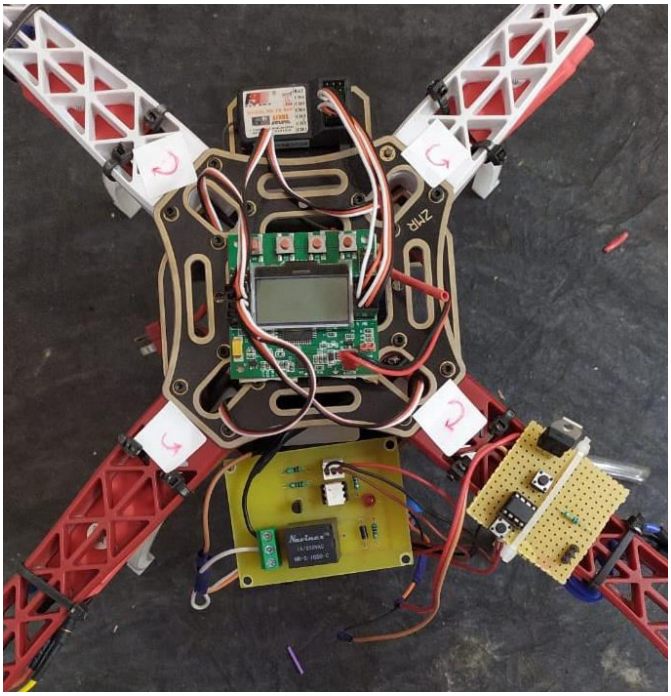


Image of spraying system

Sr. No.	Parameters	Drone parameters expected or theoretical	Working parameters
1	Height(flying height)	300 feet	250 feet
2	Range (distance from receiver)	700m	500m
3	Battery life	1hr	20 mins (because of weight and leakage)
4	Operating Frequency	2.44 Hz	2.44 Hz
5	Channel used for receiver	6 channels	6 channels
6	Camera output (picture quality)	HD	HD
7	Weight that can be carried by drone	2kg	1kg



Controller image

4. CONCLUSION

In the past decade latest technologies are included into the precision agriculture to improve the productivity of the crop. These technologies are useful where human interventions are not possible for spraying of chemicals on crops and scarcity of the labor. It also helps the spraying job easy and faster. The proposed system describes the crop monitoring through the multispectral camera which is mounted in UAV. In one flight the camera takes pictures and analyze by the geographic indicator. Based on the results it could be easy to find the area where to spray the pesticides.

This could also be reduced the wasting of water and chemicals.

5. FUTURE SCOPE

UAVs in precision agriculture is still in its early stage and maybe a scope for further development in both the technology and the agriculture applications. Providentially, it is expended that with the development of UAV'S technology, improved image processing techniques, lower costs, flying times, batteries, new camera designs, low volume sprayers, and nozzle types. A significant number of experimental studies of UAV'S based remote sensing for agriculture application. It will be a more prominent advantages of these systems in precision agriculture and environmental monitoring.

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