

Autonomous Agricultural Pesticide Spraying UAV

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Abstract. The discussion is about the optimal design outline and examination of an Autonomous agricultural pesticide spraying UAV. Farming techniques have drastically evolved over the last few decades to keep up with the ever-growing demand for food. Among its various applications, the use of drones in farming, called agricultural drones, can help in increasing the yield of crop and to monitor its growth. This type of drone is termed as agricultural drone. These drones can be used to spray fertilizers or pesticides uniformly across the field. Also, the aerial mapping feature will give the farmers a bird eye view of their fields and help them quickly identify presence of pests, crop damages and soil conditions. Hence, our main was to build a market ready agricultural drone and not just a prototype – a drone which is affordable, user friendly, portable and can perform autonomous flight without the use of an operator. This paper gives an overview of an indigenously designed folding quad copter frame with 1300mm diameter with following features namely, 5L tank capacity with remote controlled spray module, 4K camera, lift weight up to maximum of 12kg, advanced autopilot system with high precision GPS for autonomous mission.

Keywords: UAV, WSN, BLDC, ESC

1. Introduction

Unmanned aerial vehicles (UAV) have end up so cheap as they have many control features which can be implemented in software program rather than having to depend upon pricey hardware. Even for single applications this technology may allow multiple UAVs to be used, they may also have communication facilities with each other. This may be achieved by using wire-less mesh node equipped with an UAV [1]. In this state of affairs, the un-manned aerial vehicles swarm can be taken into consideration to be a noticeably cellular wire-less mesh network [2]. Here we focus on advice new type of structure as shown in figure 1 based on un-manned aerial vehicle which can be put into a control loop for agricultural purposes to spray chemicals over crops. The manner of making use of the chemical compounds is managed with the aid of the feedback from the wire-less sensors network (WSN) deployed at ground stage at the crop discipline. In order to provide solution in supporting short delays in control loop while spraying, it can process the information from the sensors [3]. In addition, the algorithm may be evaluated for adjusting the UAV direction may be changed under varying wind and the related exchange of number of messages among UAV and WSN can be represented easily. In pre defined areas the spraying can be done by the information retrieved by the WSN with the help of UAV.





Figure 1: Structure of un-manned aerial vehicle

2. System Description

Electronically commutated motors are sometimes called as BLDC (brushless direct current motors) electric motor. Normally three phases or multi phase brushless motors used for direct supply of DC power may not turn on motors. To continuously keep the motor in running condition which can be generated by ESC (electronic speed control) with different controlled phases and three high frequency signals. To measure the acceleration and force in different orientations can be done using accelerometer. The angular velocity can be measured by using gyroscope consisting of freely rotating disk or simply rotor which is mounted on spinning axis. Li-Po battery can be found as a popular choice of battery for a UAV. The total system description is shown in figure 2 below.

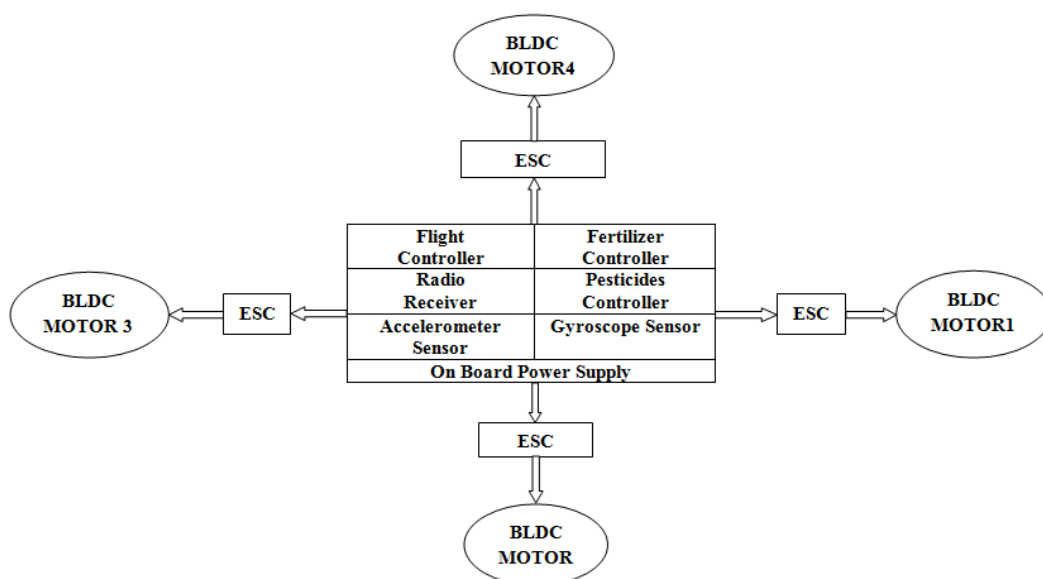


Figure 2: System description

3. Hardware Description

The processor used is pixhawk STM32F427 with 168 MHz, RAM of KB 256, Flash of MB 2, bit 32 processor. Here we used two sensors with 14 bit accelerometer and 16 bit gyroscope as MPU6000 and barometer MEAS. To run the motor BLDC is used, for controlling ESC is used. From the transmitter 2.4GHz signals will be received by radio controller. The power is supplied by the Li-Po battery.

4. Software Description

The software used for running UAV is Mission Planner as shown in figure 3 which can control ground station for Copter, Plane and Rover. It can work with windows as well. This can be used for dynamic control substitute for any autonomous vehicle. The vehicle can be controlled by loading the firmware into autopilot, try for ideal trail then plan for self mission with google maps, there after we can download the mission log files of autopilot for interfacing to follow up the pesticide spray. In this software we can also see the flight plan as shown in figure 4 to understand the home position and other locations for identifying the spraying zone before starting the operation.

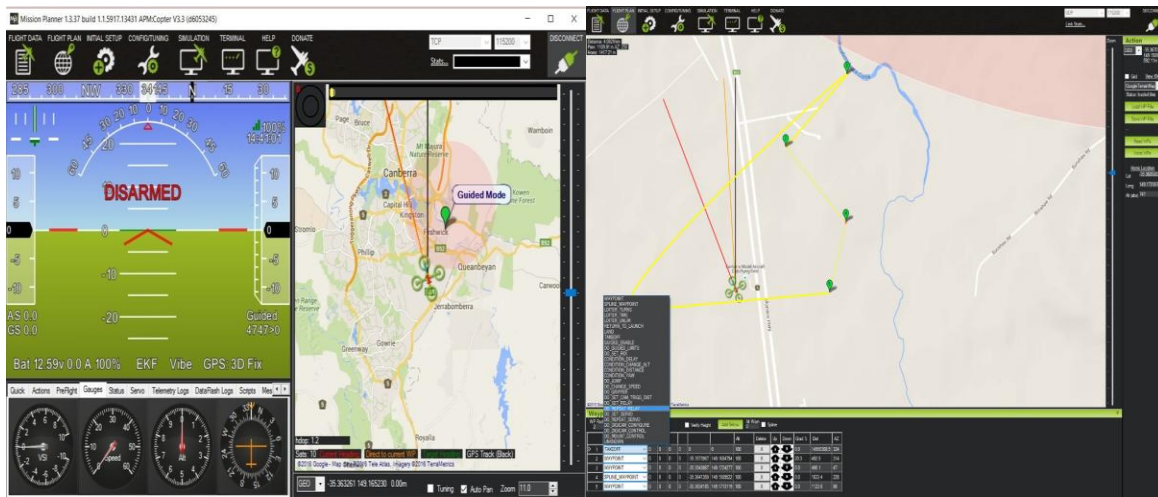


Figure 3: Mission Planner

Figure 4: Flight Plan Screen

5. Conclusion

In this context, an attempt is made to express the UAV and its application for agriculture purpose that can utilize the various software and hardware to spray chemicals on crop with the aid of autonomous. Pesticide spraying can be controlled by means of the feedback from the wireless sensors network which is placed at the ground level specified location on the field. The corresponding algorithm and its feedback concept is used to adjust the UAV locations according to the wind variations. The estimated savings in terms of pesticide spraying, water utilization and other costs may be from 20% to 90% based on the weight of UAV and altitude positions.

References

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