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INSECTICIDE SPRAYING DRONE

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Chapter 1: Introduction

India is an agricultural-based country, where more than 50% of the population relies on the agricultural sector. Population growth leads to improved productivity and the level of agricultural protection. Insects often damage plants, reducing production and killing them by using other insecticide or pesticides. Often the agricultural field suffers losses due to plant diseases.

Insecticides and fertilizers are an important part of insecticides, pesticides and plant growth. Spraying with hand pesticides or insecticide Control of fertilizer Spray and crop monitoring can be done affects people leading to cancer, allergies, asthma and other diseases. Therefore automatic with hexa-copter which is used for programs such as search and rescue, police , code testing, Emergency Management ,fire. Additional benefits of this hexa-copter are flexibility, increased charge, higher lift capacity and stability. Control of the hexa-copter is easier than aircraft. Hexa-copter is used in dangerous area and is used indoors and outdoors. It contains a sprayer that spray liquid and solid content. The global pipeline sprays insecticide and fertilizers but a pressure pump is used for insecticide spraying and it has not been used for fertilizer spray. GPS can be used to automatically steer the hexa-copter and remotely control over large areas. The hexa-copter controlled by automatic control and paid upload is controlled by RF Transmitter and motors.

Fig(1.1 Image of Spraying drone)

Interchangeable nozzles are used for spraying. Drones spraying boosts the crop yield and minimize the expenses of pesticides. The drone operators are free to monitor the drone spraying fertilizers and insecticides that keep insects, pests, and worms away and increase crop life longevity.

Easy and intelligent operation method used widely in agriculture. Drones provide optimum spraying results across varying topography. Smart farms use drone for agriculture spraying, which reduces the contact of humans with fertilizers, insecticide and other harmful chemicals. Drones enhances spraying capacity up-to five times faster than with traditional machinery in comparison to conventional spraying methods, the cost of the drone is reduced.

Chapter 2:DesignMethodology

2.1 Design and Working of Drone:

Design specifications:

COMPONENTS	SPECIFICATION
Propeller	10- inch plastic propeller
Motor	Brushless dc 1400kv motor
Flight controller	M-lite flight controller
Electronic speed controller	30A BLDC
Radio transmitter	Radio control transmitter with six channels.
Battery	2200 mAh LiPo battery
Charger	4 cell battery charger.

Table no2.1. Parts and Materials

Working of Hexacopter Drone:

Our model will have an ability to hover, by generating enough thrust and also it has enough control. Comparatively the body of the model is light-weight, including a battery with the highest power to weight ratio. The design is done in such a way that there should not be any damage to the propellers, motors and electrical equipments.

The drone is powered by a 11.1V 25C 2200mAh Li-Po battery.

ESC is an electronic circuit used for the purpose to vary an electric motor's speed, its direction and possibly also to act as a dynamic brake. An ESC can be used as a stand-alone unit which plugs into the receiver's throttle control channel or can be incorporated into the receiver itself

All the electronic equipment's are connected to a power distribution board which controls the distribution of power from the battery to various electronic devices connected to it.

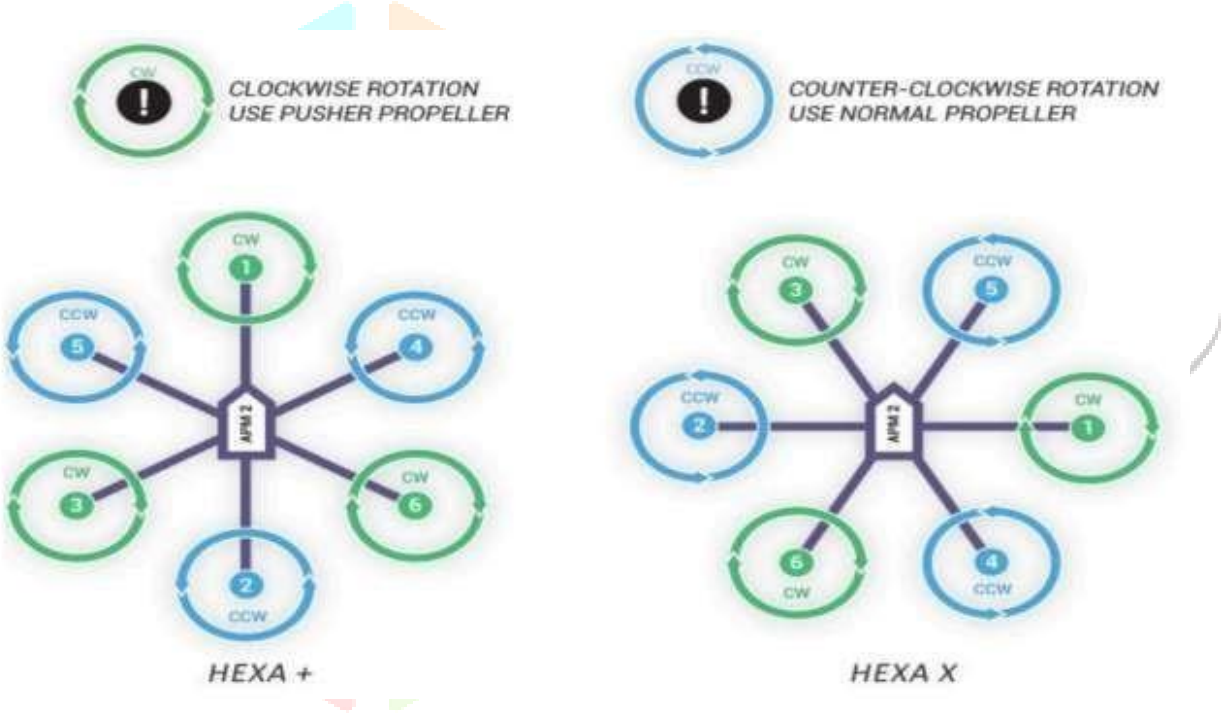


Fig 2.1.1.Working principle of hexa-copter drone

The hexa-copter is simple design with six rotor propeller with controller. The flight controller is one of the major part of this vehicle. It works on the principle of Newton's 3rd law of motion "For every action there is an equal and opposite reaction". Hexa-copter is a device with a intense mixture of Electronics, Mechanical and mainly on the principle of Aviation.

The Hexa-copter has 6 motors whose speed of rotation and the direction of rotation changes according to the users desire to move the device in a particular direction. The six rotors creates differential thrust and the hexa-copter hover and move accordance with the speed of those rotors.

To control the hexa-copter motion fixed pitch rotors are used. The speed of these rotors are independent. The basic three motions in the Hexa-copter are:

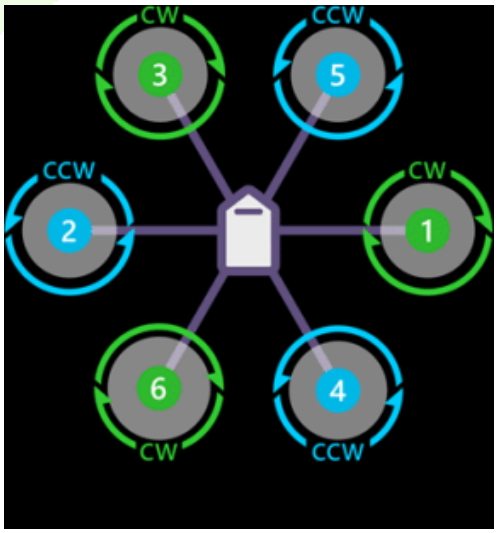
Hover: All the propellers are operated at approximately the same speed and therefore produce approximately the same thrust. Since all the propellers are equally spaced from the center of gravity, the thrust of the propellers produces no net rotating torque on drone. Additionally, the hexa-copter uses three clockwise (CW) rotating propellers and three counter clock-wise (CCW)rotating propellers so that the propeller torque is cancelled when they are operating at equal speeds. In hover, the total upward thrust balances the downward gravitational force, and the multi-copter maintains zero pitch and roll angles in zero wind(drag) conditions.

Roll control: A hexa-copter can be controlled about its roll axis by increasing the speed of the propellers on one side and decreasing the speed of the propellers on the other side. When the thrust increase on one side is the same as the thrust decrease on the opposite side, the net thrust remains the same. Similarly the net effect of torque remains the same.

Take-off & Landing motion mechanism: Take-off is movement of hexa-copter that lifts up from ground to hover position &landing motion is versa of take-off position. Take-off (landing)motion is controlled by increasing (decreasing) speed of six rotors simultaneously which means changing the vertical motion.

Forward & Backward motion: Forward (backward)motion is controlled by increasing (decreasing)speed of rear(front)rotor. Decreasing (increasing)rear (front) rotor speed simultaneously will affect the pitch angle of the hexa-copter.

Left & right motion: For left and right motion, it can be controlled by changing the yaw angle of the hexa-copter. Yaw control is achieved by balancing the clockwise propeller rotational torques with the counter-clockwise propeller rotational torques.



Fig(2.1.2. Hexa-copter layout)

2.2 Design Details:-

1. **F550 6-axis DJI hexa-copter Frame:**
   This is a very simple glass fibre hexa-copter frame and easy to build frame. This frame is one of the best known outside frame for many good reasons
   - It is less expensive
   - It last a long time in popularity

Fig(2.2.1)F550 HJ550 FRAME

Specifications:

- Frame Arms made from ultra-strength material and design to provide better crash worthiness.
- Frame Weight: 282g; Diagonal Wheelbase: 450mm; Take-off Weight: 800g ~ 1200g
- A high strength compound PCB frame board which makes ESCs and wiring easier and safer.
- Optimized frame design with abundant assembly space for autopilot systems and other DJI gadgets.

2. Electronic Speed Controller:

Electronic speed controller or ESC, is what tells engine how fast they turn at any given time. You need four ESC quadcopter, one connected to each engine. ESC's are then connected directly to the battery using a cable harness or power distribution board.

Fig(2.2.2)Electronic speed controller

Specifications:

- This 30 amp ESC for BLDC has onboard BEC
- This ESC comes with a male dean T-connector
- Auto low Battery slow down at 3.0V/cell LiPo, cut-off at 2.9V/cell LiPo

3. Brushless DC Motor:

Brushless DC electric motor (BLDC motors) also known as electronic commutated motors (ECMs, ECmotors) synchronous motors are powered by a DC power source through an inverter/switching generator , generating signal AC power . Driving a car.

Fig(2.2.3) Brushless DC Motor

Specifications:

- Equips high-quality Japan bearings for smooth operation
- It has N45SH Magnets for long life.
- Designed with 2mm laminations for best operational characteristics.
- 180-degree oxygen free Copper wire makes them more durable in class.
- Shows 0.005g or better balancing.
- Perfect lay-down windings.

4. Propeller:

In this hexa-copter project, there is need for two types of propellers to require the purpose of flight. A three propellers of clock operators (CW) and three propellers of anticlockwise (ACW)are required. Care should be taken when completing the propeller. A propeller is a type of fan that transmits energy by converting circular motion into a thrust.

Fig(2.2.4)Propellers

Specifications:

- Propeller used in this project (10 x 10.45) inches.
- The thickness of propeller is 0.45 inch
- Diameter of the propeller is 0.8 inch
- Weight of the propeller is 22gms.

5. Flight controller:

KK2.1.5 is the next major version of the first generation KK flight control board. KK2.1.5 was built from the ground up to deliver a multi-rotor aircraft for everyone , not just professionals. LCD screens and built-in software make installations and setup easier than ever. A wide variety of handicrafts with lots of ash are introduced first, just choose your art type, check the design of the car/propeller and measure your ESCs and radios.

Fig(2.2.5) Flight controller board

Specifications:

- The KK2.1.5 is an extremely powerful and robust flight controller.
- It has various multi-rotor craft types pre-installed to simply choose from.
- Onboard firmware and LCD screen make it extremely easy to setup using easy to follow on-screen prompts and 4 buttons to navigate through the menus.
- It is integrated with a 6 pin AVR interface.
- The KK 2.1.5 flight controller uses a signal of 1520 us to control the ESCs.

6. FLYSKY Transmitter and Receiver:

The FLYSKY Transmitter and Receiver we use is CT6B with 6 channels. Require PCs to change channel dynamics, servo mixing and deceleration. The radio transmitter and receiver let you to control the quadcopter.

Fig(2.2.6) FLYSKY transmitter and receiver

Specifications:

- Super active and passive anti-jamming capabilities.
- Very low power consumption.
- High receiving sensitivity.
- 8 model memory, digital control.
- High quality and stability.
- Full range 2.4Ghz 6-channel radio.

7. LiPo Battery:

Quadcopters typically use LiPo batteries that come in a variety of sizes and configuration. we usually use 3SIP batteries, which displays 3 cells in conjunction. each cell is 3.7 volts, so this batter is rated at 11.1 volts.

Fig (2.2.7) 2200 mAh LiPo battery

Specifications:

- Product type- Lithium polymer
- Good temperature control
- Minimum weight in class.

8. Pump and Nozzle:

To pressurize the liquid a 12V DC water pump can be used which has 2.5L/min capacity. Then the pressurised liquid enters the nozzle and gets sprayed. The nozzle that can be used is a flat fan type for spraying the liquid. Four nozzles are connected with ducts and they are placed at 45 cm distance between each other.

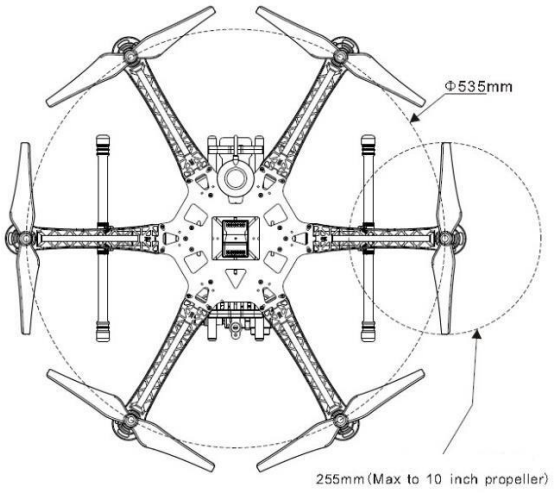
Fig (2.2.8)Flat fan nozzle and Pump

Specifications:

- Watering configuration: much the same, additional sprinklers are required
- Voltage: 12V, current: at least 3A
- Suction: 3 meters or so, preferably 2 metes

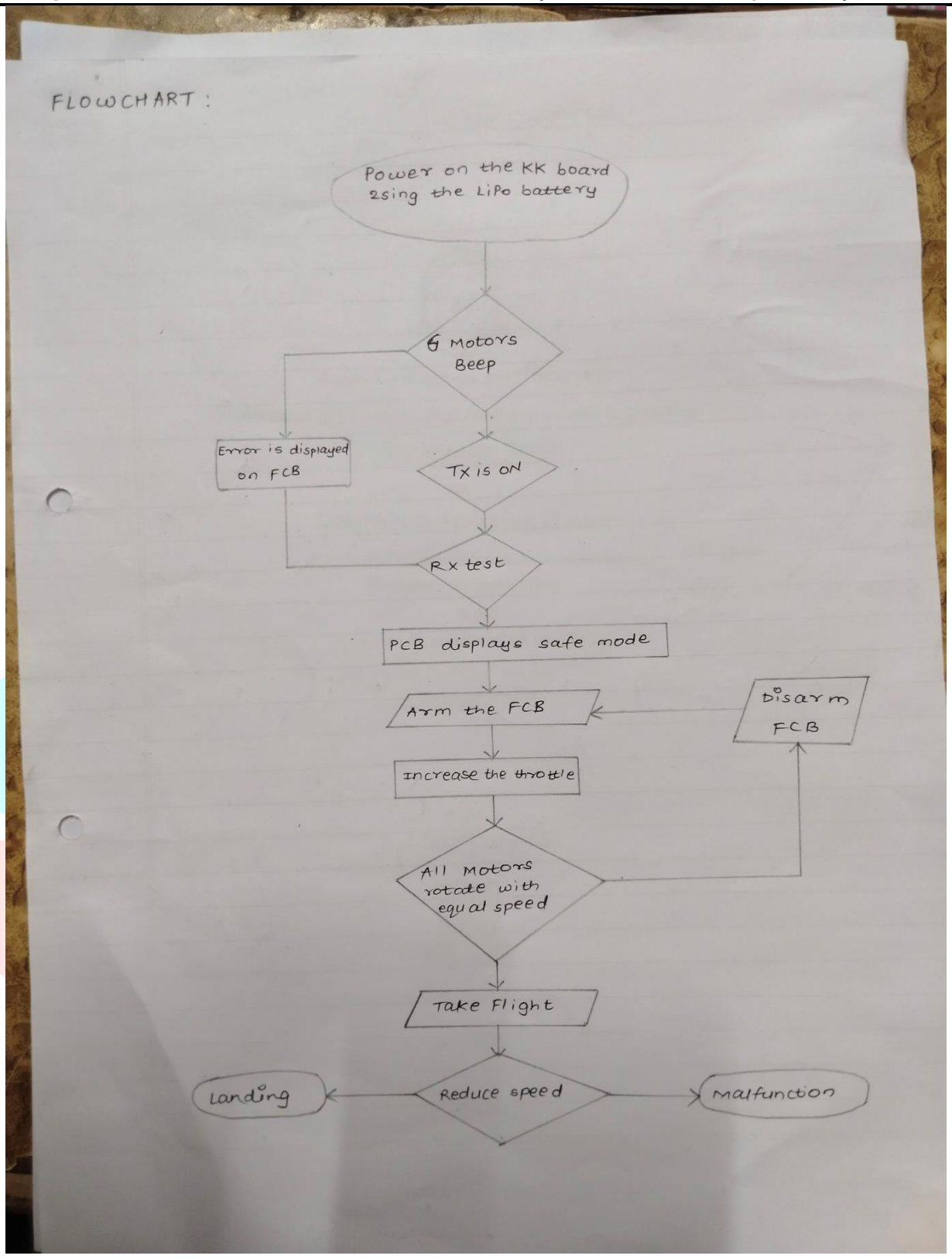
2.3. Methodology:-

The proposed methodology uses both observation and measurement methods and includes numerous methods such as expert opinions, focus groups, and content verification. It also involves sophisticated assessment of construct validity including substantive and structural aspects. The operating system can be seen as the spectrum of bulk as well as quantitative methods. It contains an analysis of the body of the methods and principles associated with the field of knowledge as the methods used in the various region vary depending on their historical developments.



Fig(2.3.1 Sketch design of Hexa-copter)

1. First, we are making a frame of light weight material.
2. Hexa-copter is a device with a intense mixture of Electronics, Mechanical and mainly on the principle of Aviation.
3. The Hexa-copter has 6motors whose speed of rotation and direction of rotation changes according to the users desire to move the device in a particular direction(i.e Take-off motion, Landing motion, Forward motion, Backward motion, Left motion, Right motion.)
4. The rotation of motors changes as per the transmitted signal from the 6-channel transmitter.
5. The signal goes to ESC's which in turn control the speed of the motor.



Fig(2.3.2 Flowchart of Insecticide Spraying Drone)

2.4. Precautions:-

- Before switching ON the KK2.1.5 make sure the transmitter is in ON condition.
- Do the receiver test that is making sure the Aileron, Elevator, Rudder, Throttle, Aux pins are all equal to zero.
- At last, check if all the motors are rotating with equal speed or not if you are increasing the throttle value.
- Make sure that the LiPo battery is fully charged upto 11.1 V.
- LiPo batteries are highly dangerous, there is a chance for it to explode if they are overcharged. So be careful while charging them. Don't leave it unattended while charging.

2.5. Battery:-

Warnings concerning the use of the battery

- Lithium Polymer batteries are extremely hazardous and liable to cause serious injuries to persons or property. The user accepts liability for the use of a lithium polymer battery. As the manufacturer and the distributor cannot ensure the battery is used correctly (charging, discharging, storage, etc.) they cannot be held liable for damages caused to persons or property.

2.6. Charging:-

- Do not overcharge the battery. When the battery is fully charged, disconnect it from the charger. Do not put the devices back in the charger once charging has finished.
- Do not cover your product or its charger while the battery is charging.
- Recharge the battery at a temperature of between 0 and 40 degree.

2.7. Battery disposal :-

Discarding batteries in your general household waste can be harmful to the environment. Damaged or unusable batteries must be disposed of in a container specially reserved for this purpose. When disposing of the battery, follow appropriate local guidelines and regulations.

Chapter3:Results and Discussion

Results:-

With two methods of validation performed, we determine our model to be accurate and capable for further analysis. We derive the following calculation of our project.

Thrust calculation:

Thrust developed at 100% RPM can be three times larger than the total weight of the drone so that the drone has better maneuverability and the drone can climb higher altitudes with higher rate of climb.

Thrust produced by one propeller with one motor= 1000gms Total thrust

produced = 6*1000= 6000gms

Chapter4:Conclusion and Future Scope

Conclusion:

In this project, we have designed a drone with Insecticides Sprayer that can be hired to operate an agricultural use loop where the drone is sprayed with pesticide spray and insecticide spray to prevent crops from insects, weeds etc. Here we can reduce people's efforts not so much but a certain amount. This will help to prevent work being done in the agricultural sector in shorter period of time. This will reduce labour costs and also make the work more efficient. This is fully utilised by the radio transmitter and receiver because of the signal. The size and cost of these drones are reducing day by day. How-ever the application of multi-copter is continuously increasing in insecticide and pesticide spraying. Hexa-copter are a better option for spot spraying because of more stability in flight. This drone can also be used in spraying disinfectant liquids over buildings, water bodies and highly populated areas.

Future scope:

- Hexa-copter weight lifting capacity can be increased by increasing the number of engines or by increasing propeller size or by increasing engine rpm.
- Flight time can be extended by increasing the battery capacity.
- The capacity of the insecticide can be increased by increasing the size of the tank.
- Spraying angle can be controlled for proper spraying.
- Manual control can be changed into autonomous control with GPS technology and auto return home option.

REFERENCES

[1] A.A Sarangdhar, & Pawar, V. R. Machine learning regression technique for cotton leafdisease detection and controlling using IoT. Internationalconference of Electronics, Communication and Aerospace Technology,Vol. 2, pp. 449-454, 2017.

[2] Chebrolu, N.,Labe, T.,&Stachniss,C. Robust Long-Term Registration of UAV Images ofCrop Fields for Precision Agriculture. IEEE DRONES AND AUTOMATION LETTERS, Vol.3, No.4, pp.3097-3104, 2018.

[3] Duan, T., Chapman, S. C., Guo, Y., & Zheng, B. Dynamic monitoring of NDVI in wheatagronomy and breeding trials using an unmanned aerial vehicle. Field Crops Research, Vol.210, pp.71-80, 2017.

[4] Ferentions,K. Deep learning models for plant disease detection and diagnosis. Computersand Electronics in Agriculture, Vol.145, pp.311-318,2018.

[5] Ghosal, M., Bobade, A., & Verma, P. A Quadcopter Based Environment HealthMonitoring System for Smart Cities. Second International Conferenceon Trends inElectronics and Informatics (ICOEI) ,pp. 1423-1426, 2018.

[6] Kedari, S., Lohagaonkar, P., Nimbokar, M., Palve, G., & Yevale, P. Quadcopter-A SmarterWay of Pesticide Spraying. Imperial Journal of Interdisciplinary Research, Vol.2, No.6, 2016.

[7] Kabra, T. S., Kardile, A. V., Deeksha, M. G., Mane, D. B., Bhosale, P. R., & Belekar, A. M. Design. Development & Optimization of a Quad-Copter for Agricultural Applications.International Research Journal of Engineering and Technology, Vol. 04 No.07, 2017.

[8] Kerkech, M., Hafiane, A., & Canals, R. (2018). Deep leaning approach with

colorimetricspaces and vegetation indices for vine diseases detection in UAV images. Computers and
electronics in agriculture, 155, 237-243.

[9] Patel, P. N., Patel, M. A., Faldu, R. M., &Dave, Y. R. (2013). Quadcopter for agriculturalsurveillance. Advance in Electronic and Electric Engineering, 3(4), 427-432.

[10]Qin, W., Xue, X., Zhang, S., Gu, W., & Wang, B. (2018). Droplet deposition andefficiency of fungicides sprayed with small UAV against wheat powdery mildew. International Journal of Agricultural and Biological Engineering, 11(2), 27-32.

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Chapter5:Appendix

Glossary of terms:

- Spraying drone: Drones are used to spray insecticides and pesticides to prevent the spread of plant diseases.
- Payload: Drone payloads are additional sensors, devices or armaments that can be carried by UAV.
- Sensors: Drone utilize air pressure sensors to stabilize altitude, allowing hover capabilities.
- Propellers: Propellers are devices that transform rotary motion into linear thrust.
- FCB: It is the brain of a drone. A small box filled with intelligent electronics and software, which monitors and controls everything the drone does.