

DESIGN AND DEVELOPMENT OF DRONE FOR SPRAYING PESTICIDES IN AGRICULTURAL LANDS

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree in
Mechanical Engineering.

by

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DEPARTMENT OF MECHANICAL ENGINEERING

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

**Accredited with Grade "A" by NAAC
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May- 2022



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DEPARTMENT OF MECHANICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **JOSHUA ANTHONY FERNANDES (38150045)**, **CYRUS MATHEW FRANK (38150025)** who carried out the project entitled “**DESIGN AND DEVELOPMENT OF DRONE FOR SPRAYING PESTICIDES IN AGRICULTURAL LANDS**” under my supervision from November 2021 to May 2022.

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DECLARATION

We, **JOSHUA ANTHONY FERNANDES (38150045)** and **CYRUS MATHEW FRANK (38150025)** hereby declare that the Project Report entitled “**DESIGN AND DEVELOPMENT OF DRONE FOR SPRAYING PESTICIDES IN AGRICULTURAL LANDS**” done by us under the guidance of **Dr. R. B. DURAIRAJ, M. Tech, Ph.D.** at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Mechanical Engineering.

DATE:

PLACE: Chennai

SIGNATURE OF THE CANDIDATES

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ABSTRACT

The design and development of a drone for spraying pesticides on agricultural lands have been described in this paper. The drone developed is a quadcopter integrated with a spraying mechanism. A quadcopter can be described as a mechanical device that can hover using propellers fitted into it is four arms. Hovering is achieved using one set of clockwise spinning propellers and another set of counter-clockwise spinning propellers that generate the thrust required to facilitate the taking off and hovering process. The agricultural industry contributes heavily to India's GDP, thus making it one of the chief sources of revenue. It is the foundation of India's economy and contributes to approximately one-fourth of its gross domestic product. It is inevitable that fertilizers and pesticides will be used to increase crop yields. However, few health-related problems can arise due to prolonged exposure to such chemicals during manual spraying. A few examples include mild skin irritation to congenital disabilities, changes in genetics, falling into a coma, or even death in severe cases. Drones have been used extensively in agriculture over the past few years. This paper describes the components required for the successful design and development of a quadcopter that can be utilized for spraying fertilizer on agricultural lands. The quadcopter is equipped with a container carrying a Direct Current water pump fitted with a pipe and nozzle arrangement. The liquid passes and is controlled using the instructions that the user provides the controller with.

TABLE OF CONTENTS

CHAP. NO.	TITLE	PAGE NO.
	ABSTRACT	v
	LIST OF TABLES	viii
	LIST OF FIGURES	ix
1	INTRODUCTION	1
	1.1 THE IMPORTANCE OF AGRICULTURE	1
	1.2 ROLE OF PESTICIDES IN AGRICULTURE	1
	1.3 TYPES OF DRONES	2
	1.4 WORKING OF A QUADCOPTER	3
	1.5 ROLE OF DRONES IN AGRICULTURE	3
	1.6 RESEARCH DONE ON SPRAYING MECHANISM	4
	1.7 RESEARCH DONE ON AGRICULTURAL QUADCOPTERS	5
	1.8 SPECIFICATION OF COMPONENTS USED	6
2	LITERATURE SURVEY	7
3	AIM AND SCOPE OF THE PRESENT INVESTIGATION	10
	3.1 AIM	10

3.2 SCOPE	10
4 MATERIALS AND METHODOLOGY USED	11
4.1 MATERIALS	11
4.1.1 A2212 1400KV BRUSHLESS MOTOR	11
4.1.2 PROPELLERS	11
4.1.3 ELECTRONIC SPEED CONTROLLERS	12
4.1.4 LITHIUM-ION POLYMER BATTERY	12
4.1.5 RADIO TRANSMITTER AND RECEIVER	13
4.1.6 FLIGHT CONTROLLER	15
4.2 METHODOLOGY	16
5 RESULTS AND DISCUSSION, PERFORMANCE ANALYSIS	17
6 SUMMARY AND CONCLUSION	20
REFERENCES	21

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1.1	SPECIFICATION OF COMPONENTS USED	6
4.1	PARTS OF THE RADIO TRANSMITTER	14
5.1	LIST OF COMPONENTS	18

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
4.1	A2212 1400KV BRUSHLESS DC MOTOR	11
4.2	PROPELLERS	12
4.3	ELECTRONIC SPEED CONTROLLERS (ESC'S)	12
4.4	LITHIUM-ION POLYMER BATTERY	13
4.5	RADIO TRANSMITTER	13
4.6	RADIO RECEIVER	15
4.7	FLIGHT CONTROLLER	15
4.8	BLOCK DIAGRAM OF WORKING PROCESS	16
5.1	SOLIDWORKS MODEL OF AGRICULTURAL QUADCOPTER WITH SPRAYING MECHANISM	17
5.2	DEVELOPED MODEL OF AGRICULTURAL QUADCOPTER WITH SPRAYING MECHANISM	17

CHAPTER 1

INTRODUCTION

1.1 THE IMPORTANCE OF AGRICULTURE

The agricultural industry is the foundation of India's economy and contributes to approximately one-fourth of the country's GDP. This project aims to develop a quadcopter capable of spraying pesticides on agricultural lands. 36.50 % of crops are lost to disease, pests, and weeds in the current global crop production system. Research indicates that developing countries lose about 1.8% to 2.2% of their total agricultural GDP due to economic losses [1] .Reports from the ACCII estimate that crop losses due to pests and diseases are approximately Rupees.50,000 crores [2].

1.2 ROLE OF PESTICIDES IN AGRICULTURE

Rainfall, humidity levels, and moisture content are some factors that control the agricultural yield that a particular piece of land produces. Utilization of fertilizers and pesticides is inevitable if you want to increase crop yield. However, few health-related problems can arise due to prolonged exposure to such chemicals during manual spraying. A few examples include mild skin irritation to congenital disabilities, changes in genetics, falling into a coma, or even death in severe cases. [3] Providing safe farming to the farmers is the key to improving agribusiness efficiency and productivity. The spraying of pesticides and application of fertilizer can be tedious processes. Agricultural pesticide spraying has become a requirement, but it also proves to be a dangerous procedure for farmers. They take many precautions, especially when spraying pesticides, such as wearing appropriate clothing, gloves, masks, and so on, to prevent any adverse effects. The pesticides cannot completely be avoided since the required outcome must also be achieved. Thus, using robots for these purposes provides the best of both productivity and efficiency solutions.

1.3 TYPES OF DRONES

Drones can be classified based on several criteria, according to Waats et al. (2012). Seven categories have been outlined below.

Micro Air Vehicles: Due to their small size, they are commonly referred to as Nano-Air aircraft, which enables military variants of these aircraft to be carried in soldiers' backpacks and enable unobtrusive surveillance in cramped places. These aircraft typically operate at lower altitudes, less than 330 meters.

Vertical take-off and landing: Due to these aircraft's inability to take off and land, they're typically used in situations where terrain constraint makes this type of aircraft necessary. Their flight heights vary depending on the mission profile, typically at lower altitudes and with long flight durations as hovering consumes a lot of battery power.

Low Altitude-Short Endurance: By eliminating the need for runways, miniature unmanned aerial systems are able to achieve rapid deployment and transportation to launch an aircraft from a catapult, you need to have less than three meters of wing spans and a weight of between 2 and 5 kilograms. As a result of weight and capacity tradeoffs, range and connectivity are typically reduced to 1-2 hours, but within a few kilometers of ground stations.

Low Altitude-Short Endurance Close: In this case, unmanned aircraft weighing and requiring greater runway capacity and weight will be considered tiny. They can fly for up to 1500m in altitude and have relatively high flight time.

Medium Altitude Long Endurance: drone of this type can carry a high weight at a relatively higher altitude for an extended period of time at an extreme upper end of their payload range.

Medium Altitude Long Endurance: It is common for these aircraft to fly at altitudes of up to 9,000 meters, flying thousands of kilometers from their base station through hundreds of flights lasting several hours. Military defense services use these extensively, and some areas of civil applications have also seen an escalation in their usage.

High Altitude Long Endurance: Featuring larger and more complicated aircraft than most commercial aircraft, these are the biggest and most complicated planes in the world. Several thousand kilometers can be covered, and flight time is in excess of

30 hours in space. These drones are capable of flying at 20,000 meters and beyond.

1.4 WORKING OF A QUADCOPTER

This project keeps the quadcopter lightweight and easy to control while also providing a solution needed to avoid manual spraying. The hovering of a quadcopter requires a certain number of points to be remembered to rotate it in the requested direction by changing motor speed on either side of the frame (left/right) while keeping the direction of the other two motors unchanged it will generate 'Yaw'. As a result, the second two movements - roll and pitch - are generated by varying the speed of the motors [4]. To elaborate, the quadcopter was defined by Hoang and Poon [5] as an aerial vehicle with four rotors rotated at a certain speed to provide steering, thrust, and stability. In 1907, the first quadcopter was built, though it was operated, and in the late 20th century, the Breguet brothers developed an autonomous version of the quadcopter [6]. The quadcopter utilizes a brushless motor to drive each rotor, which an electronic speed controller. The ESC receives signals from the battery-powered flight controller. Four rotors rotate clockwise and anticlockwise, with two diagonally opposite rotors rotating clockwise and two anticlockwise. The quadcopter's rotors produce torque about the center [7], the stabilizing effect of the quadcopter comes from two opposing motor pairs rotating against each other, giving rise to a net moment/torque of 0 at its center. A quadcopter will yaw, roll, or pitch as the angle of incidence of one or more rotors varies [8].

1.5 ROLE OF DRONES IN AGRICULTURE

Soil and field assessment: Assessment of fields and soil: Drone-collected data regarding soil analysis is used before and after crop planting for planning the species and patterns of crops to be sown, how to plant and when to sprinkle nutrient and irrigation solutions. It is possible to enhance farm production through management decisions taken at the farm level.

Crop monitoring: Crop production faces challenges caused by unpredictable weather extremes, which are major obstacles to monitoring crop performance. A

major benefit of unmanned drones for surveillance of crops and agricultural land is their simplicity and efficiency.

Crop Spraying: Drones equipped with sensors can be used for site-specific crop spraying, which scans the cropped area in real time and ensures that the right amount of liquid is sprayed once the precise location has been identified. Aerial spraying by drones can be up to five times faster than conventional spraying, experts estimate. Spraying is more accurate, and it reduces input costs and farmer's time.

Irrigation: Thermal-sensing drones can be used to offer a whole new perspective, providing irrigation application insight into particular troubled areas of the farm. With thermal digital cameras, a number of insights can be monitored from low moisture stressed conditions to areas flooded with water, enabling irrigation management decisions to be made according to soil water status. Field irrigation is made more precise with its application.

Planting: In recent years, sowing crops has become a tedious and costly task because of labour shortages that requires a lot of human labour. Crop planting with drones is simplified on a large scale with the highest degree of precision and accuracy within a short time.

Crop health assessment: Detecting diseases of crops, bacteria, and fungi requires regular monitoring of crop health. Drones can be used to scan crops over time and space, using green and near-infrared light to detect disease incidence and its variations in space and time based on crop reflectance. In order to reduce damage to crops, it is necessary to detect disease early before intervening.

1.6 RESEARCH DONE ON SPRAYING MECHANISM

In this paper we design and develop a quadcopter to aid in crop spraying in agricultural lands. A backpack sprayer can be fitted with a harness to allow the operator to carry the sprayer on their back. About 20 liters of liquid can be accommodated in the tank. The backpack sprayer keeps pressure with a hand lever, whereas handheld sprayers use a trigger, which produces a smoother output. Backpack sprayers that are simple and inexpensive produce low pressure and lack many features, such as a high-pressure pump, pressure regulation, and gauge [9]. Engines are more reliable at generating consistent outputs, creating more uniform

spray swaths. Hand-operated sprayers are also available, although they are not commonly used in agriculture. Furthermore, motorized sprayers also can spray at a higher pressure to provide greater coverage compared to manual sprayers that work at a constant speed [10].

1.7 RESEARCH DONE ON AGRICULTURAL QUADCOPTERS

Chen et al. [11] selected and then compared the performance of three nozzles to demonstrate how pesticide spraying per area can be reduced to make agricultural drones last longer. There is insufficient research on spray systems based on the existing studies, which have focused exclusively on nozzle performance. Therefore, more research is needed to develop spraying systems for agricultural drones. Professor B. Balaji et al. (2018) [12] tested a hexacopter UAV that sprays pesticides while monitoring crops and the environment using Raspberry Pi's running Python. DH11, LDR, and Water Level Monitoring sensors are also on their UAV. Researchers concluded from their experiment that that UAVs could be used in agricultural fields to save up to 90% of water, chemicals, and labour cost. Sharda et al. [13] To reduce environmental pollution, a nozzle with an automatic selectivity control can be used to regulate the application of pesticides locally and cost. Rashul Desale et al. (2019) developed an approach to agricultural applications based on UAVs. In addition to spraying, their UAVs are also used to monitor agricultural fields via cameras and GPS. Cost and weight were taken into account in their design. This microcontroller was equipped with inbuilt firmware - kk 2.1.5 [14]. Kurkute et al. [15] developed a simple yet cost-effective spraying mechanism for a quadcopter UAV. Spraying can be accomplished with the universal sprayer for both liquids and solids. A quadcopter system equipped with Atmega644PA has been found to be the most suitable for agricultural purposes because of its efficient implementation in their research. In essence, aerial agricultural vehicles are low-cost drones with better and more advanced sensors and imaging systems. An aerial spraying mechanism with an f450 quadcopter frame is the basic idea behind this device. Spraying pesticides to places that human cannot easily reach are achieved using this model. Spraying of liquid contents is done by the nozzle spraying system [16].

1.8 SPECIFICATION OF COMPONENTS USED

Table 1.1: Specification of components used

Sl. No.	Components	Model	Quantity
1.	Quadcopter Frame	F450 1045	1
2.	Propeller	(2CW + 2CCW)	4
3.	Brushless Motor	A2212 1400KV	4
4.	Electronic speed controller (ESC)	30A	4
5.	Li-Po Battery	2200mAh 3S	1
6.	Flight controller	KK 2.1.5	1
7.	Radio transmitter	FS-CT6B	1
8.	Radio Receiver	FS-R6B	1
9.	Mini water pump	12V DC	1
10	Servo Motors	SG90	1

CHAPTER 2

LITERATURE SURVEY

(Shivaji, et al. 2017) have detailed the implementation of an agricultural quadcopter with an automatic spraying mechanism. This paper describes the components used to develop a lightweight and cost-effective quadcopter, with a description of PIC microcontrollers that can be used to control the agricultural quadcopter.

(Auat, Cheein and Carelli 2013) have described that a backpack sprayer can be equipped with a harness to place the sprayer on the operator's back. The maximum amount of liquid that could be carried in the tank is approximately 20 litres. A hand lever is used to continuously maintain pressure and thus make the output of the backpack sprayer smoother than the output of the handheld sprayer mechanism. A simple and inexpensive backpack sprayer produces low pressure and mostly lacks a high-pressure pump, pressure regulation, and gauge features.

(Zhang 2012) has stated that sprayers operated via engines create more consistent outputs, and they also cover the spray swath more uniformly. There are various other hand-operated sprayers that are not extensively utilized in agriculture. They are also found to work at a constant speed and provide noticeably more uniform coverage than manual spraying, where motorized sprayers can also spray at a higher pressure to give better coverage.

(Desale 2019) has published a paper entitled "Quadcopter UAV based Fertilizer and Pesticide Spraying System", in which they give a brief idea about the UAV pesticides sprayer.

(Natu and Kulkarni 2016) published a paper on the adoption and utilization of drones for advanced precise farming. They give an idea about the scope and future strategies for improving the farming and guide to the farmers.

(Gopalakrishnan, Quadcopter flight mechanics model and control algorithms 2017) succeeded in developing a nonlinear dynamic Quadcopter model and linearizing it for the given linearization point. The linear and nonlinear models were validated and the outcome was more than satisfactory.

(Kurkute 2018) studied and described the different types of agricultural drone systems based on micro-controller 8051, agricultural drone systems using Atmega328 microcontrollers, and agricultural drone systems using GPS devices are presented. Ultimately, it is concluded that if the system design incorporates the use of Atmega644PA, then it will be the most efficient implementation. Further implementation may be achieved with the results of further experimentation.

(Hanafi 2013) studied the quadcopter and its GUI controllers. In test results, the GUI controller sent control signals to the quadcopter controller and the quadcopter controller translated the signals to ensure the quadcopter remained balanced and stable. In hovering position, the Quadcopter was able to accommodate a load disturbance up to 250 grams.

(Patel 2013) in his paper, discussed the use of quadcopters for reconnaissance, as well as demonstrating that small scale UAVs have a broad range of applications, such as safety inspection of construction tools, traffic monitoring, search and rescue operations, and temperature and altitude measurements.

(Chen 2020) in his paper, concluded that during the Tillering and Flowering stages of rice plants, the same spraying volume was used to compare the effects of different nozzle treatments on droplet deposition and rice planthopper control. There is a significant difference between the droplet density between the nozzles, as shown by the results.

(Balaji 2018) outlined a method of implementing a control loop for agricultural applications in which unmanned aerial vehicles (UAVs) spray chemicals on crops and monitor the environment both in agricultural fields and the environment at large.

(Sharda 2011) Presented and discussed the effects of nozzle flow stabilization characteristics under simulated field conditions of a sprayer control system.

(Rehman 2016) concluded that the amount of pesticide sprayed will determine how long it will take for the pesticide to be sprayed. As a result, to spray more pesticide, the quadcopter's weightlifting capacity must be increased. This is achieved by choosing Brushless DC electric motors with higher specifications. For longer flight times, we need to choose lithium polymer batteries with higher specifications.

(Abbe and Smith 2016) discussed structural, system, propulsion, aerodynamic, and integration-related issues associated with solar-powered aircraft. Further, in the case of solar aircraft, the technological status includes structural materials, photovoltaic systems, batteries, and power management systems.

(Zhang 2012) describes in this paper, various methods to extract and store energy are discussed, and their performance is compared to desirable features on solar-powered models, and some guidance is offered on how to select appropriate methods.

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

3.1 AIM

Our aim is to design and develop a quadcopter capable of spraying pesticides in agricultural lands.

3.2 SCOPE

The following are the key goals:

- To develop a cost-effective solution in order to support a payload carrying capacity of 500 grams using a remote-controlled quadcopter.
- To design and develop a flight-capable light weight remote operated quadcopter.
- To integrate the assembled quadcopter with a spraying mechanism.
- To spray pesticides on agricultural lands using a safer and cost-effective method as compared to manual spraying.

To summarize the scope of this paper, the development of a cost-effective quadcopter that can support a payload of 500 grams by using a remote controller is discussed. The quadcopter is equipped with a spraying mechanism, which will be used to spray pesticides on agricultural lands, thus making it a safer and more cost-effective method than manual spraying. The spraying is controlled by using a servo motor that is connected to the sixth channel of the receiver, which controls the pump's discharge through the nozzle.

CHAPTER 4

MATERIALS AND METHODOLOGY USED

4.1 MATERIALS

4.1.1 A2212 1400Kv Brushless DC motor

Frequently used in the making of quadcopters, brushless DC motors use a ferrite magnet that rotates along a stationary armature in the motor. It produces more torque, has a substantially longer battery life, makes reduced noise, and is efficient for low weight use. Brushless DC motors are rated in kV. The motor selected for the quadcopter we designed and fabricated is rated 1400Kv.

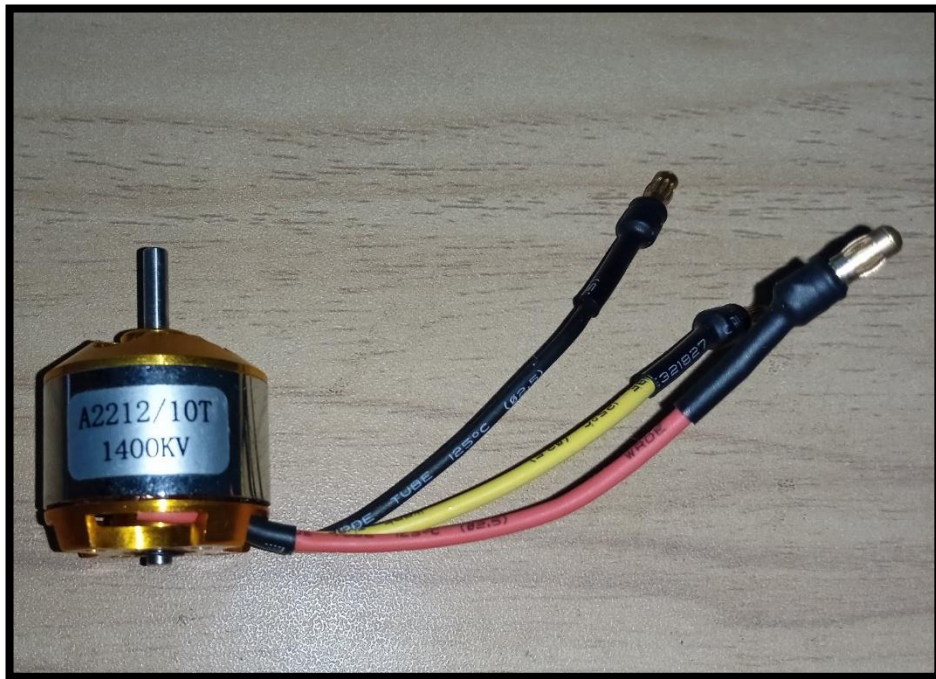


Fig:4.1 : A2212 1400Kv Brushless DC motor

4.1.2 Propellers

The quadcopter's thrust is generated by propellers, which translate rotary motion into linear motion; therefore, propellers are involved in lifting the quadcopter. It is possible to adjust propeller speeds by altering the voltage that is being supplied to the propeller motor, which is what an Electronic Speed Controller does. In order to produce lift, the quadcopter uses 1 set of clockwise and another set of counter-clockwise rotating propellers. The propellers selected for this quadcopter design and

development are the 10 x 4.5 propellers.



Fig:4.2 : Propellers

4.1.3 Electronic Speed Controllers

ESCs provide speed control for the motors, which change according to the power supplied by the battery. ESC selection is based on the motor's current rating and is made based on hooking the brushless DC motors to the female pins of the ESC. The ESC selected for this quadcopter is the 30 A ESC.



Fig:4.3 : Electronic Speed Controllers

4.1.4 Lithium-Ion Polymer Battery

The primary component of Lithium-Ion Polymer Batteries is polymer electrolyte: a rechargeable polymer battery that uses lithium-ion technology. In quadcopters, these batteries are commonly used. It takes completely two hours for full charging. In quadcopters, depending on the payload, a fully charged battery can operate for 15-20 minutes. The Li-Po battery selected for this quadcopter is the 2200mAh 35C 3S1P 11.1V Li-Po Battery Pack.



Fig:4.4 : Lithium-Ion Polymer Battery

4.1.5 Radio transmitter and receiver

This 6-channel receiver features a 2.4 GHz frequency technology. This receiver has 6 channel receiver pins. The first four-channel pins of receiver are connected to the controller input pins using servo wires. Using the joystick movement input provided by the user, the receiver transmits the signal to the controller.

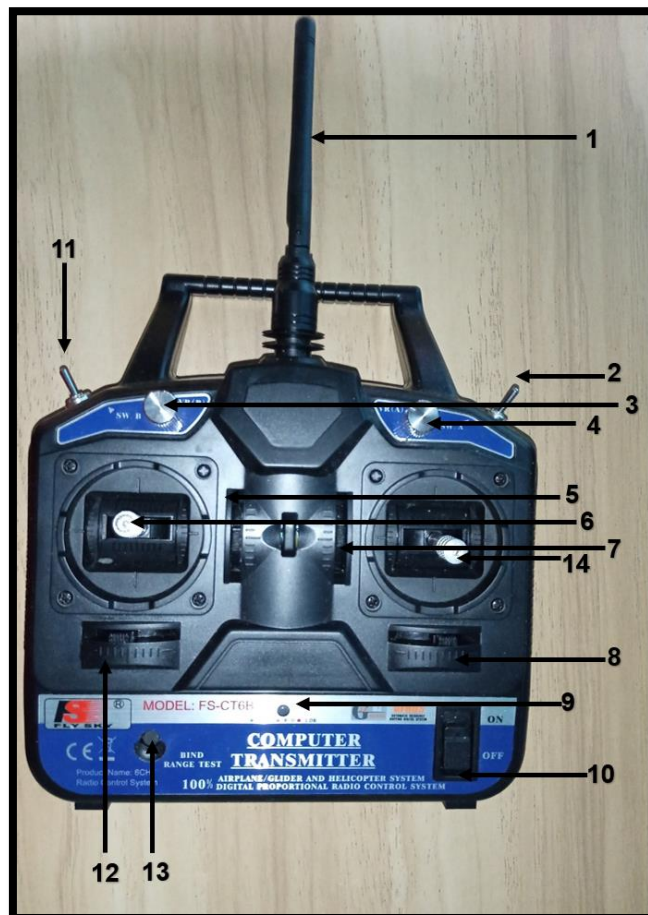


Fig:4.5 : Radio transmitter

Table 4.1 : Parts of the radio transmitter

Item	Part name
1	Antenna
2	Switch A
3	Channel 5
4	Channel 6
5	Throttle trim
6	Rudder (Left-Right) Throttle (Up-Down)
7	Elevator trim
8	Aileron trim
9	Power indicator
10	Power switch
11	Switch B
12	Rudder trim
13	Bind button
14	Aileron (Left-Right) Elevator (Up-Down)



Fig:4.6 : Radio receiver

4.1.6 Flight controller

This quadcopter uses the KK2.1.5 Flight Control Board as its flight controller having Atmel 644PA and 6050MPU. Installing and setting up the device is made easy using the screen and software in-built in it. It also includes many multi-rotors craft types. These are pre-installed. Propeller direction can also be verified on this flight controller. The on-screen prompts are intuitive, clear and easy to understand. KK Boards with 6050 MPU have the most stability, and it has an auto-leveling feature. It is powered by an ATMEL Mega 644PA 8-bit microcontroller.

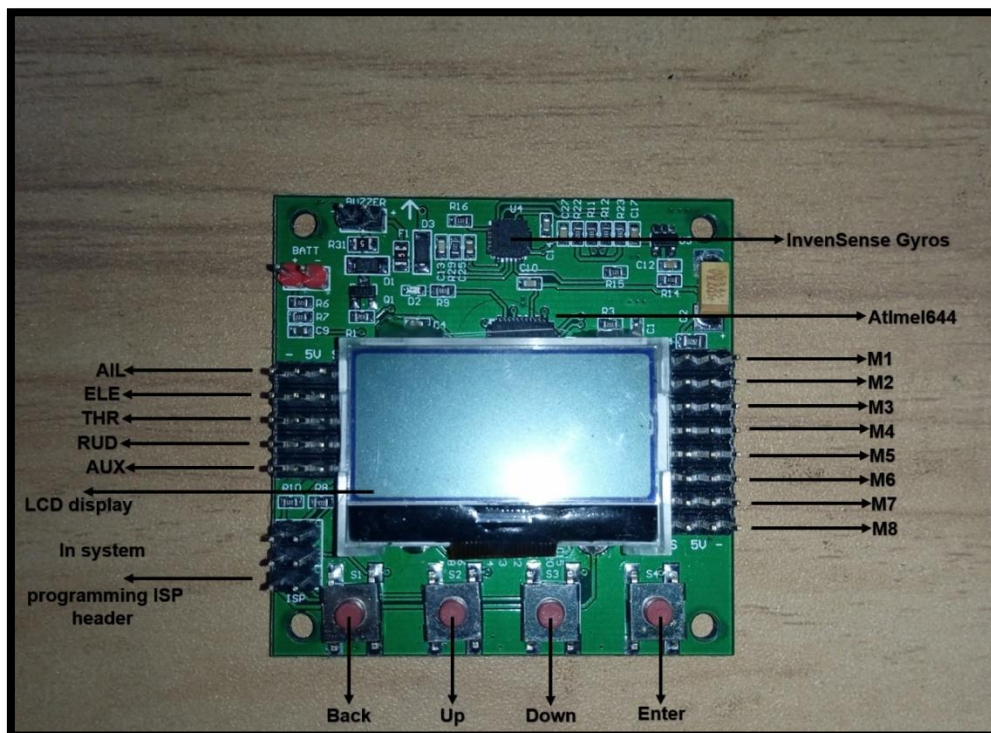


Fig:4.7 : Flight Controller

4.2 METHODOLOGY

A description of the quadcopter's design methodology follows. Both the transmitter and receiver are mounted on the quadcopter, and the receiver receives the signals sent by the transmitter. An accelerometer and a gyroscope sensor are used to process the signal after it is received by the receiver and passed to the flight controller. After being processed, the signal is sent to the electronic speed controller, which makes a switch and allows a specific amount of current to flow to the motor, depending on what signal it receives. The mechanical linkage between the motors and propellers generates thrust when they rotate—now, coming to the spraying mechanism. Water is pumped using the current provided by the Li-Po 3S quadcopter battery and pressurized in the storage tank with the help of the water pump. Pressure causes the liquid inside the pipeline to flow through the pipeline and enter the nozzle, where it gets sprayed. It is possible to vary the input current of the transmitter, controlling the flow rate of the pump, therefore, controlling the intensity of the stream.

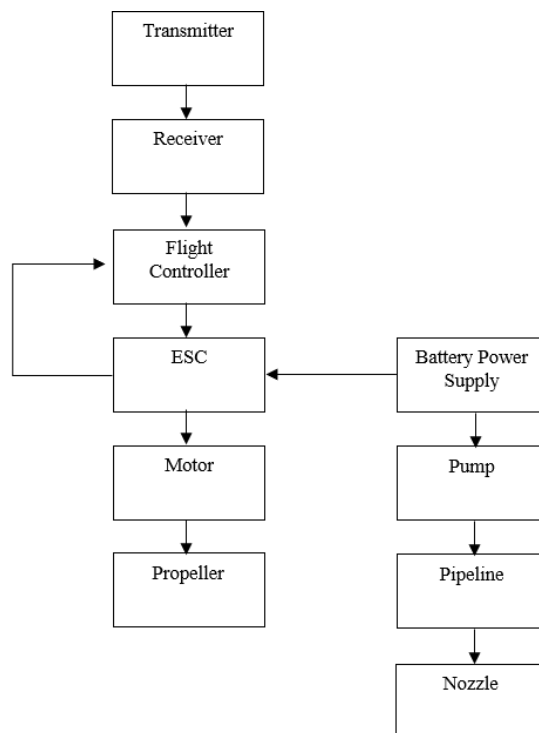


Fig:4.8 : Block diagram of working process

CHAPTER 5

RESULTS AND DISCUSSION, PERFORMANCE ANALYSIS

SolidWorks 2020 is the application used for modelling of the developed quadcopter.

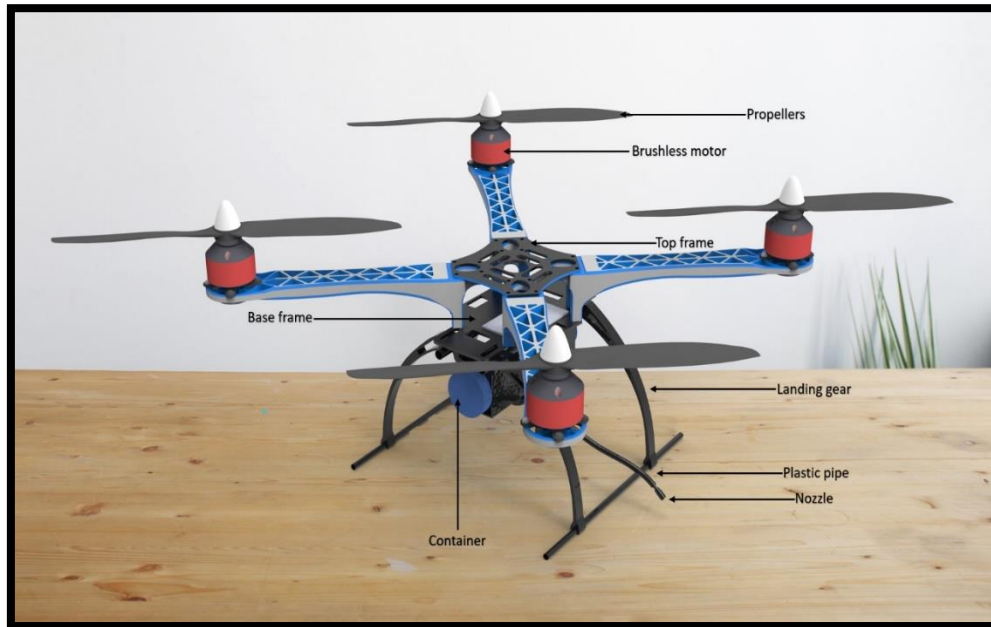


Fig:5.1 : SolidWorks model of agricultural quadcopter with spraying mechanism.

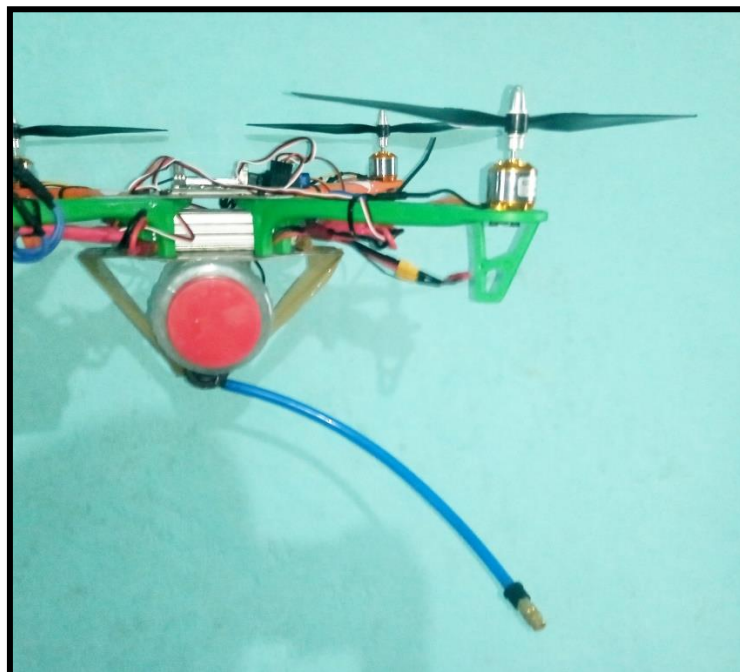


Fig:5.2 : Developed model of agricultural quadcopter with spraying mechanism.

An F450 frame structure was used for the design and quadcopter development process. The dimensions needed for the product design were gathered from the user manual and other works. We calculated the total weight the quadcopter will need to carry and tabulated it in Table 5.1

Table 5.1 : List of components

Sl. No	Components	Quantity	Mass(kg)
1.	Quadcopter Frame	1	0.312
2.	Propeller	4	0.052
3.	Motor	4	0.208
4.	Electronic speed controller (ESC)	4	0.108
5.	Li-Po Battery	1	0.205
6.	Flight controller	1	0.021
7.	Mini water pump	1	0.400
8.	Liquid	1	0.500
	Total		1.806

Thrust that the motor generates is given using the below formula

$$T_m = \sqrt[3]{2 \times \pi \times (P \times \eta_h)^2 \times r_p^2 \times \rho_{air}}$$

Where, η_h = propeller hover efficiency = 0.7-0.8

P= shaft power = current X voltage X motor efficiency

R = Propeller radius (meters)

ρ_{air} = Air density = 1.22kg/m³

V= Voltage = 10 V

I = Current = 16 A

η_h = Motor efficiency = 75 % = 75/100 = 0.75

$$T_m = \sqrt[3]{2 \times \pi \times (P \times \eta_h)^2 \times r_p^2 \times \rho_{air}}$$

$$T_m = \sqrt[3]{2 \times \pi \times (0.7 \times 10 \times 16 \times 0.75)^2 \times 0.1252 \times 1.225}$$

$$T_m = 9.467 \text{ N}$$

Therefore, Thrust calculated $T_m = 9.467 \text{ N}$

$$T_m = 9.467/9.81$$

$$T_m = 965 \text{ g}$$

Therefore, each motor will generate 965 g of thrust.

Since there are 4 motors present in the following quadcopter, total thrust generated is given by $T_m \times 4$.

$$\text{Total thrust} = T = 965 \times 4 = 3860 \text{ g}$$

$$T = 3.86 \text{ kg}$$

While working with less efficiency in motors, factor of safety needs to be considered.

Let's take efficiency to be 0.7

Thrust T is given by:

$$T = 3.86 \times 70/100$$

$$T = 2.702 \text{ kg}$$

Thus, minimum thrust generated by all the motors present is 2.702 kg

Now, since we have calculated minimum thrust generated by all the motors present, we then proceed with thrust calculation of quadcopter with spraying mechanism. Here the spraying apparatus is also taken into account while performing thrust calculations as opposed to a standalone quadcopter.

Thrust calculation of quadcopter (with spraying mechanism)

Required thrust upon assembling the sprayer apparatus to the quadcopter. It will be given by T_2 .

$$T_2 = (\text{wt. of the quadcopter} + \text{wt. of spraying apparatus}) \times 2/4$$

$$T_2 = (906 + 900) \times 2/4$$

$$T_2 = 1806/2$$

$$T_2 = 903 \text{ g}$$

Since thrust generated by a single motor is 965 g, and this thrust is greater than the amount of thrust required with the union of drone and spraying mechanism. We can conclude that the quadcopter will be in safe condition for successful operation and will therefore work as intended.

CHAPTER 6

SUMMARY AND CONCLUSION

Agricultural UAVs show immense potential in agriculture. Drones have been rapidly growing over the past two decades, and they have revolutionized the Military, Agriculture sector and other sectors. In addition, this paper presents a technical specification for the drones used for spraying on agricultural lands and the importance of drones in Agriculture. The paper mainly demonstrates using a lightweight, cost-efficient quadcopter to improve yield and thus increase crop quality. However, there remain many limitations and shortcomings in these early stages of research and development, which will be worked on and improved upon in the future.

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