

# International Journal of Innovative Research in Science, Engineering and Technology

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## Drone Operated Chemical Fertilizer Sprinkler

Suraj Shetty<sup>1</sup>, Kamal Yadav<sup>2</sup>, Dipesh Jain<sup>3</sup>, Akash Soni<sup>4</sup>, Mainak Bhaumik<sup>5</sup>

U.G. Student, Dept. of Mechanical Engineering, MGM CET, Kamothe, Navi Mumbai, India<sup>1</sup>

U.G. Student, Dept. of Mechanical Engineering, MGM CET, Kamothe, Navi Mumbai, India<sup>2</sup>

U.G. Student, Dept. of Mechanical Engineering, MGM CET, Kamothe, Navi Mumbai, India<sup>3</sup>

U.G. Student, Dept. of Mechanical Engineering, MGM CET, Kamothe, Navi Mumbai, India<sup>4</sup>

Asst. Professor, Department of Mechanical Engineering, MGM CET, Kamothe, Navi Mumbai, India<sup>5</sup>

**ABSTRACT:** India is a country whose economy majorly depend upon its agriculture. Today, India ranks second worldwide in farm output. More research and development work is required to make remarkable growth in farming. In order to increase the productivity of agriculture pesticides are sprayed on crops for protection from insects. But its main disadvantage is that it affects the farmer's health while spraying this harmful pesticides. Hence the most effective and efficient way to overcome from this problem is a necessity. Therefore for this purpose we have developed a drone (quadcopter) which can be easily operated by farmer.

**KEYWORDS:** Flight controller, Nozzle sprayer, ESC, Brushless dc motor, Lippo battery

### I. INTRODUCTION

Much more attention is required to reduce the difficulties which are faced by the farmers so that it will be ultimately beneficial for farmers and country development. One of the most important problem is regarding health of the farmers which arises due to coming in direct contact with pesticide while spraying on crops. We developed a quadcopter type drone using brushless dc motor, Electronic Speed Controller (ESC), Flight Controller, Lithium polymer (lipo) battery, Nozzle, Centrifugal motor pump, Storage tank. The sprinkler and tank is attached at the bottom of drone setup, through which the pesticide is sprinkled on the crops.

### II. RELATED WORK

- 1) Prof Swati kale & Prof Shweta Gaikwad in this paper an algorithm is evaluated to adjust the UAV route under changes in wind intensity and direction. They evaluated the impact of number of communication messages between the UAV and to minimize the waste of pesticides.
- 2) Ph. DG. Srinivasan developed quadcopter UAV & sprayer model. And also discussed integration of sprayer model to quadcopter system.
- 3) Prof Sunil Kumar developed a UAV in which it is concluded spraying time of pesticides on quantity of pesticides to be sprayed.

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## III. OBJECTIVE

The frame of the drone used must be light weight as well as it should have high strength, toughness, impact strength etc. The drone which can be easily controlled & handled. The nozzle of the sprinkler should be of replaceable type according to the type of the field/crops. The drone must be cost efficient.

## IV. METHODOLOGY

The methodology consists of mathematical calculation to analyze weight carrying capacity of one moderate weight brushless D.C. Motor to provide sufficient power to the system to rotate the pump. After analyzing of weight and load carrying calculations the next focus is to select no of motors required for the purpose of driving the drone and to deliver power to the centrifugal pump and for the proper balancing of the system to fly in air without dropping down. Based on the material availability, the economy of the material, prototype model preparation, and actual set up construction with more capacity of spraying fertilizer to the plants without getting effected has been surveyed in the local area market and consulted with the farmers those are actually involved to grow crops in the field. Unique drawing and design carried manually and finalized the model set up outer look and appearance. Remote control with the sensors selected and installed to serve the automatic operation for a wide range of operation. The fabrication of the structure set up, motor and pump mounting on the structure, fertilizer carrying tank assembling with the pump carried out. Solid fertilizer mixed with the water in the tank the model set up tested to serve the purpose of remote controlled drone operated fertilizer sprinkler system.

## V. COMPONENT SELECTION AND CALCULATION

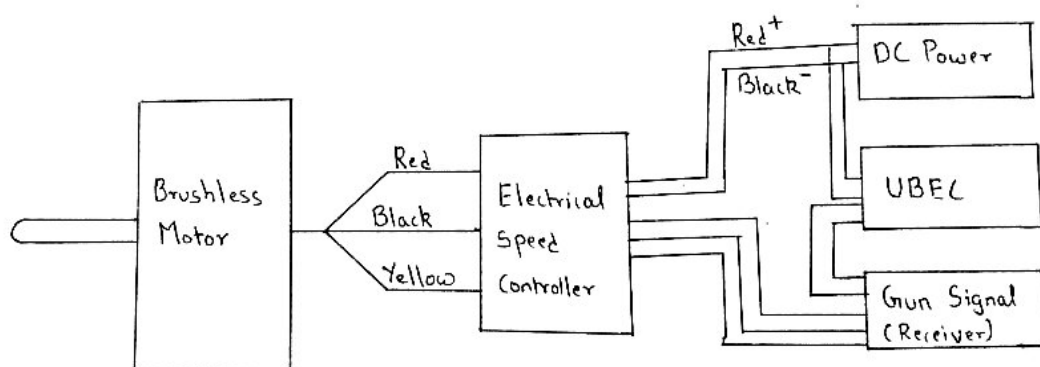


Fig (a): Block diagram of connection

The above figure (a) shows the complete connection of brushless DC motor with lithium polymer (Lipo) battery (UBEC, receiver through electrical speed controller (ESC)).

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## Selection of brushless dc motor:

Table 1

Model	Volts	KV	Max Pull	Weight	Motor size	Max Power	Esc(A)
D2826-6	7.4-11.1 V	2200	960g	50g	D27.7*26 mm	342 W	40 A
D2826-10	7.4-11.1 V	1400	780g	50g	D27.7*26 mm	205 W	40 A
D2826-13	7.4-11.1 V	1000	660g	50g	D27.7*26 mm	150 w	40 A

The above table 1 shows specification of brushless dc motors with respect to above parameters based on which the suitable motor is selected.

- Weight of complete drone setup(assumed) = 2 kg
- Thus thrust required by each motor to lift the drone = 500 grams
- Hence the most suitable motor for this model is 1400 Kv motor.

## Selection of battery:

One 4200 mAh lipo battery to provide power supply for motors & one 1000 mAh battery for the sprinkler set up.



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### Selection of frame material:

Aluminium material is selected as frame material because of its lighter weight with density of  $2800 \text{ kg/cm}^3$  and modulus of elasticity is  $68.3 \text{ Pa}$ .

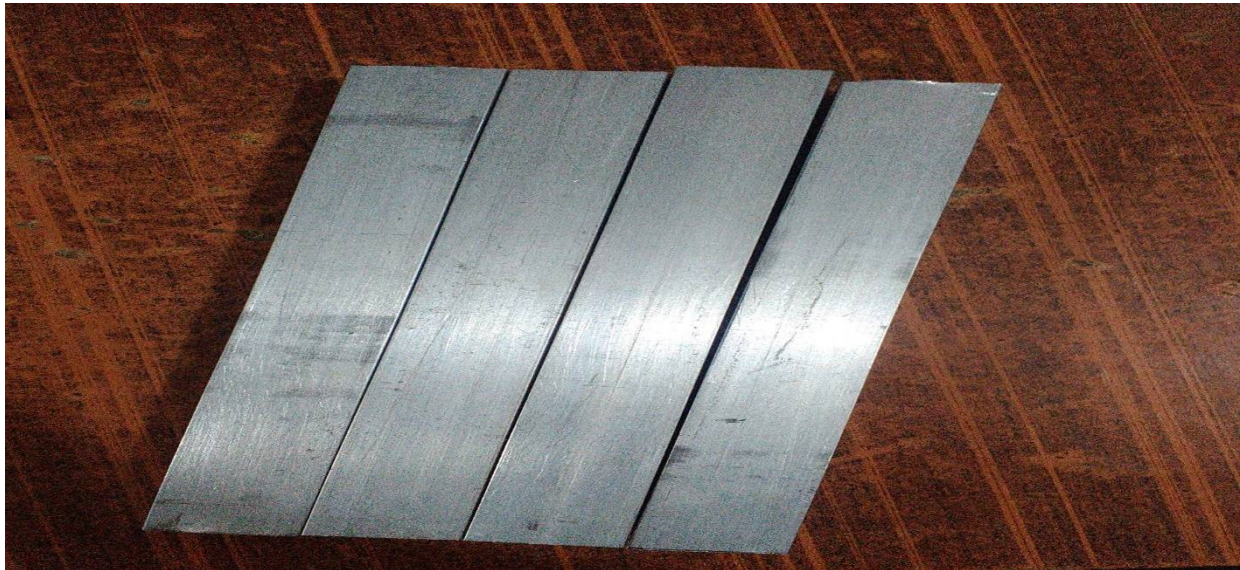


Fig (b): Aluminium arm material

### Selection of centre plate & base plate material:

Plywood of 5 mm thickness is selected

### Selection of sprayer pump:



Fig (c): Centrifugal Pump

Centrifugal pump of 12 volts & 1.2 amp has been selected for the requirement of the pumping of the liquid fertilizer to the plant to cover optimum area in minimum interval of time with effective spaying ability of the prototype drone operated model fertilizer sprinkler system.

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## VI. RESULT & DISCUSSION

Table of sprinkler setup performance:

Table 2

Sprayed volume in (ml)	Time taken for spraying in (sec)	Discharge (m <sup>3</sup> /sec)	Battery consumption in (mV)
50	15	3.33	0.03125
100	38	2.63	0.0625
150	60	2.5	0.09375
200	85	2.35	0.125
250	110	2.27	0.15625
300	140	2.16	0.1875
350	160	2.14	0.21875
400	190	2.1	0.25

From above table discharge rate of nozzle = 2.439 m<sup>3</sup>/sec

The above table represents the data which is obtained during testing of sprinkler setup while spraying 400ml of liquid pesticide.

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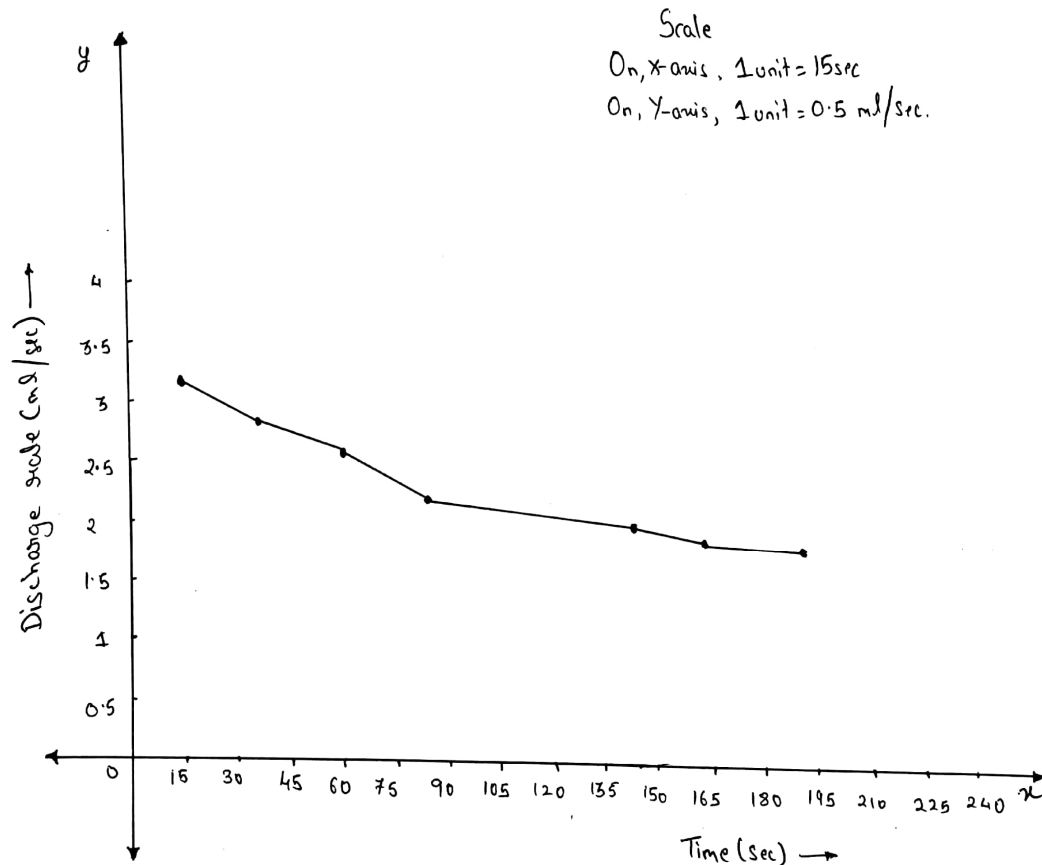


Fig (d): Variation of discharge rate versus time

The above graph represents the performance of variation of discharge of liquid through nozzle with respect to time

## VII. CONCLUSION

This technology will help farmers to stay away from harmful pesticides while spraying which leads to damage health of farmers. The farmers who are physically disabled to move from one place to another by using these technology pesticides can be sprayed. Also this drone will be helpful in a place where there is hard to find workers. This method is in its initial stages, advancement of this technology will lead to improve the productivity of farming. Scope of this technology is to provide effective and efficient way to enhance the growth in farming.

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## BIOGRAPHY



1. Suraj Chitresh Shetty BE Mechanical final year student in MGM College of Engineering and Technology, Kamothe Navi Mumbai



2. Kamal Rajesh Yadav BE Mechanical final year student in MGM College of Engineering and Technology, Kamothe Navi Mumbai

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3. Dipesh Dinesh Jain BE Mechanical final year student in MGM College of Engineering and Technology, Kamothe Navi Mumbai



4. Akash Mahesh Soni BE Mechanical final year student in MGM College of Engineering and technology, kamothe Navi Mumbai.



5. Mainak Bhaumik, B.E (Mechanical), M.E. (Thermal), is working as an Assistant Professor in MGM College of Engineering and technology, Kamothe, Navi Mumbai, India. The author is having three years of experience in Deepak Fertilizers and Petrochemical Corporation Ltd., Navi Mumbai, India as an Assistant Manager, one year teaching experience in Sardar Patel College of Engineering, Andheri (W), Mumbai India as a Lecturer in Mechanical Engg. Dept., one year teaching experience in Rizvi College of Engineering, Bandra (W), Mumbai, India as a Lecturer in Mechanical Engg. Dept. one year teaching experience in Saboo Siddik College of Engineering, Byculla (W), Mumbai, India as a Lecturer in Automobile Engg. Dept, New Panvel, Navi Mumbai – 410206, Maharastra, India. Mb. +919819568377