



“Fabrication Of Unmanned Aerial Vehicle (UAV) For Agricultural Purposes”

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Abstract : *There are too many technologies involved in today's Agriculture, out of which spraying pesticides using drones is one of the emerging technologies. Manual pesticide spraying causes many harmful side effects for the personnel involved in the spraying process. Birth defects, cancers, genetic changes, blood and nerve disorders, endocrine disturbance, coma, and death are also potential side effects of exposure. The World Health Organization estimates that one million cases of disease have been affected by the manual spraying of pesticides in the crop field. This paved the way to design a drone mounted with spraying mechanism having 12 V pump, 2 Litre storage capacity tank, 4 nozzles to atomize in fine spray, an hex copter configuration frame, suitable landing frame, 6 Brushless Direct Current (BLDC) motors with suitable propellers to produce required thrust about 12 KG(at 100% RPM) and suitable Lithium Polymer (LI-PO) battery of current capacity 8000 MAH and 14.4 V to meet necessary current and voltage requirements. This pesticide spraying drone cuts down on pesticide application time, labour, and expense. By adjusting the flow discharge of the pump, this sort of drone may also be used to spray disinfectant liquids over houses, water sources, and densely populated areas. The Unmanned Aerial Vehicles (UAV) reduces the direct handling of pesticides by human beings and helps to protect them from any injury which will give to them by pesticides. Also, the entire area chosen by the drone is sprayed and covered very well. There are many processes to fabricate a UAV for the use of agricultural activities. The processes like drilling, CNC milling, 3D printing are required to fabricate the above model.*

Keywords -Unmanned Aerial Vehicles (UAV), Drones, Hex copter, Sprayer, ESC, Spraying system, Agriculture, Payload, Sensors, Ppump, Spray.

I. INTRODUCTION

Agriculture is India's main source of economic growth. Products produced by farmers depend on different environmental conditions, such as rainfall, temperature, weather conditions, etc. Biological factors have an effect on farm crops as well. Pests or any crop disease will damage crops that reduce the productivity and quality of the product. The pesticides or fertilizers help to avoid the damage of crops which will do by the biological factors. Handling the pesticides manually will not be safe to the human beings as it effects on the nervous system of human beings. Therefore the drones or UAVs will always help to the farmers to spray the pesticides or fertilizers on crops by avoiding direct handling. The agriculture drone sprayer is designed to minimise the harmful effects of pesticides on humans while still spraying a wide area in a limited period of time. The large area is also get covered by the drone to spray the pesticides in short timing. As if we observe that, the time require for spraying fertilizers by drone is very less than the time require to spray that manually with the help of any worker. Basically this device is the combination of the quad copter and the spraying mechanism. The UAV helps to fly over the device on crops and the spraying mechanism will help to spray the pesticides on the crops. The control of drone or UAV is manually and gets operated by the operator which will make the drone fly over the sky. The UAV has the plus or X configuration of frames in quad copters, on which the propellers are placed, with the help of that propellers rotating motion the drone starts to fly. The spraying mechanism is connected to that drone which 2 is get programmed and by giving commands to that mechanism, the spraying system is get operated and we get able to spray the pesticides or fertilizers on the crops. The

batteries and electronic speed controllers i.e. ESCs are also used to control the speed and for the other operations. The key part of the unit and the spraying process is controlling the UAV. This chapter gives a brief introduction about spraying mechanism and drone system. Spraying Mechanism Up to the date, the pesticides are spraying by the conventional methods by using the hand pumps on the back or by manually by throwing using hands. So these approaches are very time consuming and harmful to human health because humans are constantly in contact with pesticides, which is very dangerous to human health, and it is also not always possible to reach each and every crop sapling for pesticide application. Spraying mechanism gives less amount of time to spray pesticides over a larger area. Every few months, fresh innovation and major investment bring more sophisticated drones to market. Unmanned aerial vehicle technology encompasses everything from the drone's aerodynamics to the materials used in its design, as well as circuit boards, chipsets, and software. Unmanned aerial vehicles are referred to by a number of names, all of which apply to the same thing. The processes used in fabrication of UAV and spraying mechanism are 3D printing , Welding, CNC Milling, Drilling, etc.

II. LITERATURE REVIEW

B. Balaji et al. [1] developed a90- hexacopter UAV with the purpose of spraying pesticides as well as crop and environment monitoring using Raspberry Pi that run on python language. Their UAV also contains multiple sensors like DH11, LDR, Water Level Monitoring sensors. From this experiment, they finally concluded that with proper implementation of UAVs in the agricultural field almost 20%- 90% savings in terms of water, chemical maltreatments and labor can be expected.

Dongyan et al. [2] experimented on effective swath width and uniformity of droplet distribution over aerial spraying systems like M-18B and Thrush 510G. These agricultural planes flew at height of 5 m and 4 m respectively and with this experiment they reach to conclusion that flight height leads to the difference in swath width for M-18B & Thrush 510G. Huang et al. [3] made a low volume sprayer which is integrated into unmanned helicopters. The helicopter has a main rotor diameter of 3 m and a maximum payload of 22.7 kg. It used to require at least one gallon of gas for every 45 minutes. This study paved the way in developing UAV aerial application systems for crop production with higher target rate and larger VMD droplet size.

J. Kurkute et al. [3] worked on quadcopter UAV and its spraying mechanism using simple costeffective equipment. The universal sprayer system is used to spray for both liquid and solid 5 content. In their research, they have also compared different controllers needed for agricultural purposes and concluded that quadcopter system with Atmega644PA is the most suitable due to its efficient implementation.

K. Korlahalli et al. [4] published a paper entitled "An Automatically Controlled Drone based Aerial Pesticide Sprayer". In this paper authors has given detail about implementation of Agriculture Wonder Drone System. In this paper, the wireless drone system based on flight controlled board (FCB), GPS, Brushless DC motor, electronic speed control (ESC), wireless tranceiver, frame, propellers and battery, etc. They used flight controller board for controlling the function of drone such as movement, lifting, positioning, etc. FCB is programmed in this project for handling different sensors such as GPS, Barometer, Accelerometer, Gyroscope, etc. and components such as motors. This drone was programmed for two modes that are manual mode and autonomous mode.

S. Kedari et al. [5] proposed the hex copter (HC) system which is low cost, and lightweight. The quadcopter is also known as Unmanned Aerial Vehicle (UAV). These quadcopter is small size, and this system can be used for indoor crops as well as outdoor crops. Quadcopter is an autonomous flight for spraying pesticides and fertilizer using the android device. Between the quadcopter and android device communication is done by Bluetooth device in real time operation. This system is used to reduce agriculture field related problems, and also increases the yield of agriculture.

III. METHODOLOGY

The methodology is a broad research approach that outlines how research will be carried out and, among other things, describes the techniques that will be used. In this process of developing a spraying mechanism . There are various processes involved such as modelling, testing on Ansys, fabrication which involves 3D modelling, CNC milling, drilling, cutting, bending, and then the Actual testing. 12 The flow chart given below gives the information of the methodology.

3.1 3D Printing : 3D printing, or additive manufacturing, is the construction of a three-dimensional object from a CAD model or a digital 3D model .The term "3D printing" can refer to a variety of processes in which material is deposited, joined or solidified under computer control to create a three dimensional object, with material being added together, typically layer by layer.3D printing-different small parts of UAV and motor mounting will also be made by using 3D printing.

3.2 Welding : Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool. Welding is most widely used on metals and

thermoplastics, but it can also be used on wood. Different types of parts are welded together to make the model firmly.

3.3 CNC Milling : CNC milling, or computer numerical control milling, is a machining process which employs computerized controls and rotating multi-point cutting tools to progressively remove material from the workpiece. To satisfy the fabrication specifications, a computer numerical control (CNC) system must be used. Because it offers precision and accuracy in shaping complex geometries compared to manual means of arranging 2D sections and DIY machine. Center plate will be done by using CNC Milling.

3.4 Drilling : Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is normally a multi-point rotary cutting tool. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute. The Forces Cutting chips from the cavity as it is drilled with the cutting edge against the workpiece. Drilling will be used for different fastening holes.

3.5 Cutting : Cutting is manufacturing by removal of material Particles of material, the chips, are mechanically removed from the raw material or from an unfinished part by cutting edges of a tool. The tool has one or more cutting edges, which can be geometrically defined by number, shape and position. Cutting will be done to the various components of the spraying system and also for the frames for the proper material dimensions.

3.6 Bending Bending is a manufacturing process that produces a V-shape, U-shape, or channel shape along a straight axis in a ductile materials, most commonly sheet metal. The residual stresses in the material cause it to spring back to its original position after bending, so the sheet must be overbent to achieve the correct bend angle. The amount of spring back is determined by the material and the forming process. Bending process can be done to the frames for appropriate construction of base of the model, as well as for the other components of spraying mechanism.

IV. LIST OF FIGURES AND TABLES

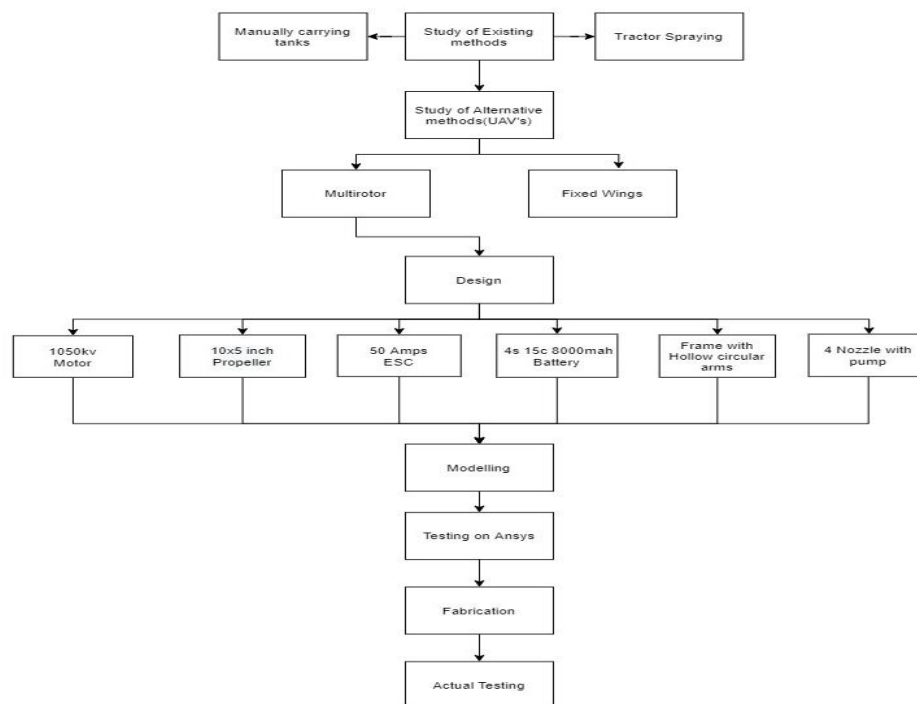


Fig 1 - Flow chart of proposed methodology

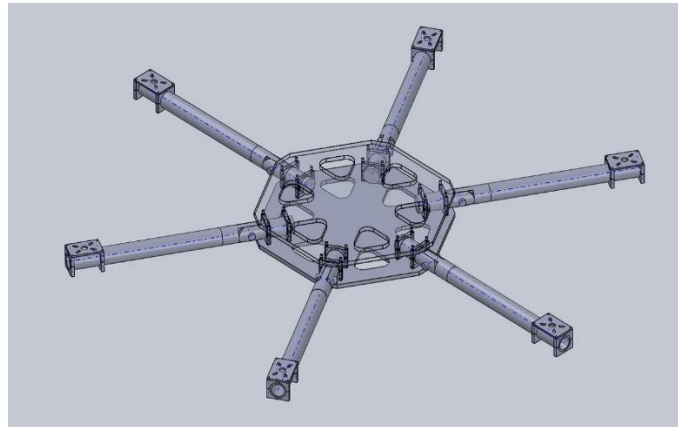


Fig 2 - 3D modelling on solid works

V. CONCLUSION

In the last decade, the latest technology has been integrated into precision agriculture to improve crop productivity. These technologies are useful where human interventions are not possible for spraying of chemicals on crops and scarcity of the labor. It also makes spraying simpler and quicker. We have described a design of unmanned aerial vehicle (UAV) mounted spraying mechanism for Agricultural purpose and for spraying disinfectants. This method of spraying pesticides on Agricultural fields reduces the number of labours, time, cost and the risk involved to the personnel involved in spraying the liquids. This Hexacopter can also be used in spraying disinfectant liquid or sanitizer over buildings, water bodies and highly populated areas.

Acknowledgements

We would like to express a deep sense of gratitude towards our guide .Prof Chinmay Pingulkar , Mechanical Engineering Department for her constant encouragement and valuable suggestions. The work that we are able to present is possible because of his timely guidance. We would like to pay gratitude to the panel of examiners Prof Pratik Raut, Prof Chaya Patil, Prof Priyank Vartak for their time, effort they put to evaluate our work and their valuable suggestions time to time. We would like to thank Project Head of the Mechanical Engineering Department, Prof Pratik Raut for her support and coordination. We would like to thank the Head of the Mechanical Engineering Department, Prof. Niyati Raut for her support and coordination. We are also grateful to the teaching and the non-teaching staff of the Mechanical Engineering Department who lend their helping hands in providing continuous support.

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