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Agricultural Spraying Drone

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Abstract - The Pilotless Aerial Vehicles square measure typically named as Drones, Quad rotors or Quad copters pass for communication. The aim of drone is to develop a quad-copter that carries pesticides to spray everywhere in the farm which reduces the work of farmers likewise because it finishes his work presently. The appliance of pesticides and fertilizers in agricultural areas is of prime importance for crop yields. This can be done to develop a user-friendly interface for the farmers. The Drone could be a chemical spraying quad copter for agricultural purpose that helps the farmer to spray the pesticides everywhere on his land so it reduces his work which might equally spray everywhere his farm. Here the farmer will manage the drone through a Flight Control Board-APM 2.8 and he will connect to the drone through a Flysky-2.4Ghz, 6 channels that is interfaced within the drone. It can precisely route the area of that exact farmer's land through Radio transmitter and receiver despite of the shape of the field and the sector and sort of the crop the chemical spraying drone will get the work done. Here we've used the IC: Atmega644 PA to balance the directions and orientations we've used the ACCELEROMETER / GYRO (MPU-6050) Ineven Sense Inc. MEMS 3-aixs accelerometer and 3-axis gyro values combined. Power provided: 3-5V and uses I2C protocol.

Key Words: Quad copter, UAV, Fertilizer, pesticides, spraying

1. INTRODUCTION

Agriculture in India constitutes quite 60% of occupation. It serves to be the backbone of Indian economy. it's very essential to enhance the productivity and efficiency of agriculture by providing safe cultivation of the farmer. the varied operations like spraying of pesticides and sprinkling fertilizer are vital. Though spraying of pesticides has become mandatory it also proves to be a harmful procedure for the farmers. Farmers especially once they spray urea, fancy many precautions like wearing appropriate outfit masks and gloves. it'll avoid any harmful effect on the farmers. Avoiding the pesticides is additionally not completely possible because the required result has got to be met. Hence fore, use of robots in such cases gives the simplest of the solutions for this sort of problems, alongside the specified productivity and efficiency of the merchandise consistent with survey conducted by WHO (world health organization) it's estimated that each year about 3 million workers are suffering from poisoning from pesticides from which 18000 die. This project aims to beat the ill-effect of the pesticides on citizenry and also use to spray pesticides over large area briefly intervals of your time compare to standard spraying by using automatic fertilizer sprayer. This device is essentially combination of spraying mechanism on a quad copter frame. This model is employed to spray the pesticides content to the areas that can't easily accessible by humans. The universal sprayer system uses to spray liquid also as solid contents which are done by the universal nozzle. As per the study conducted by our group and therefore the data acquired during that we came to a conclusion that manual spraying of pesticides and fertilizers are mainly liable for the rise within the number of chronic diseases. The potential health effects of pesticides include asthma, allergies, and hypersensitivity, and pesticide exposure is additionally linked with cancer, hormone disruption, and problems with reproduction and fatal development. use of aircrafts is becoming increasingly common in completing this task mainly due to reduction in farmland, labor shortage, unscientific and outdated method

1.2. LITERATURE REVIEW

Dongyan et al. (2015) [1] 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. (2015) [2] 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.

Yallappa et al. (2017) [3] developed an hexacopter with 6 BLDC motors and two LiPo batteries of 6 cells- 8000 mAh. Their study also involves performance evaluation on discharge and pressure of spray liquid, spray liquid loss and determination of droplet size and density. Through their project, they finally made a drone capable of carrying 5.5 L of liquid with an endurance time of 16 min

Kurkute et al. (2018) [4] worked on quadcopter UAV and its spraying mechanism using simple cost-effective equipment. The universal sprayer system is used to spray for both liquid and solid 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.

Rahul Desale et al. (2019) [5] described an architecture based on UAV that could be employed for agricultural applications. Their UAV was designed not only for spraying but also for monitoring agricultural fields with the use of cameras and GPS. Their design was optimized for cost and weight. They used a microcontroller kk 2.1.5 which has inbuilt firmware. Prof. B. Balaji et al. (2018) [6] developed an 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.

2. Work Methodology

Drone could be a device of intense mixture of Electrical, Electronics, and Mechanical and chiefly on the principle of aviation. The Drone has four motors whose speed of rotation and also the direction of rotation changes as to the users need to maneuver the device in a very specific direction (i.e. Takeoff motion, Landing motion, forward motion, backward motion, Left motion, Right motion.) The rotation of motion changes as per the transmitted signal received from transmitter. Every rotor produces each thrust and force regarding its center of rotation, still as drag force opposite to the vehicle's direction of flight. The goal of this project is to make, modify, and improve an existing drone kit to get stable flight, gather and store and GPS information, and perform automotive vehicle commands, such as auto-landing.

3. Proposed Working

Quad copter system works on the principle of air lifting phenomena with high atmospheric pressure. The propellers force the air in downward with high atmospheric pressure because of that an uplift force is made and as a result action reaction law is applied on the total system. When this uplift force dominates the earth's gravitational attraction, the total system begins flying within the air. However, there's a tangle with the rotation of propellers. If we tend to rotate the propellers in clock wise direction then because of this rotation, a force are going to be applied over the total system in one direction. And equally if we tend to the propellers in anti- clock wise direction then additionally a force is going to be applied over the total system and also the whole system can begin rotating anticlockwise.

To beat this downside we tend to rotate 2 propellers in dextrorotatory direction and remaining 2 propellers in anticlockwise direction. This development produces force in other way and that they get balanced and also the system remains stable while flying. 2 basic phenomena are used for movement of quad copter, thrust and force. Quad-copter uses its four propellers to motors that produce thrust and facilitate quad copter to elevate high. Motion of quad copter is outlined supported on the input values (x, y, z, θ, ϕ, ψ) given to that. Out of 4 motor connected with propellers, two motors rotate in dextrorotatory (CW) direction whereas different 2 in counter dextrorotatory (CCW) direction. Motion of quad copter is therefore controlled chieflyby 3 movements.

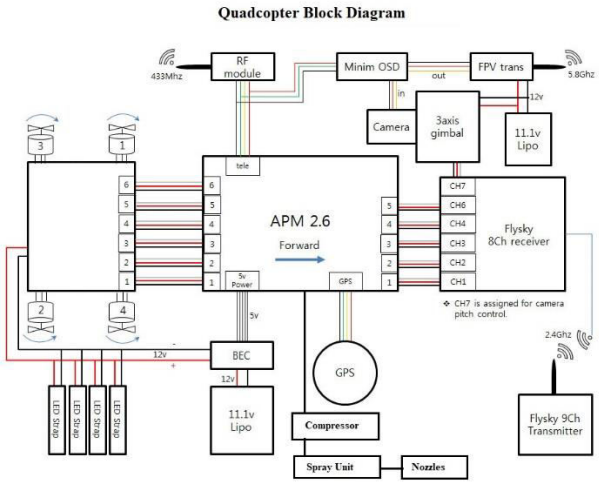

Fig -1: Block Diagram

2. COMPONENTS:

2.1 Flight Controller:

Fig -2: Apm 2.8

The flight controller is the brain of a drone. A small box filled with intelligent electronics and software, which monitors and controls everything the drone does. And just like the brains of

different organisms flight controllers also vary in sizes and complexity.The flight controller is connected to a set of sensors. These sensors give the flight controller information about like its height, orientation, and speed. Common sensors include an Inertial Measurement Unit (IMU) for determining the angular speed and acceleration, a barometer for the height, and distance sensors for detecting obstacles. Just like how we perceive as humans, the drone filters a lot of this information and fuses some to get more efficient and precise information. Advanced flight controllers can sense more precisely and detect differences more quickly.

Features of the APM 2.8
Ports: MUX (UART0, UART2, mnnI2, and OSD are optional, OSD is the defaulted output).
Input Voltage (V): 12~16 VDC
Sensors:
3-Axis Gyro meter
Accelerometer
High-performance Barometer

2.2 Battery:

Fig -3: Battery

The 3000mAh 3S 30C/60C Lithium polymer battery Pack (LiPo) batteries are heavy-duty discharge leads to minimize resistance and sustain high current loads. Stand up to the punishing extremes of aerobatic flight and RC vehicles. Each pack is having with gold coat connectors and JST-XH style balance connectors. All Lithium Polymer batteries packs are assembled using IR matched cells.

Features:
3 Cells
The LiPo battery has matched resistance.

2.3 Balance Charger:

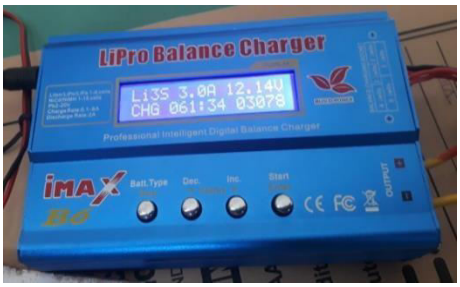

Fig -4: Balance Charger

The IMAX B6 is an advanced multi- function charger, able to charge, balance and discharge Lion, LiPo, and Life (A123), NiCad and NiMH batteries. It also can be accustomed charge Lead Acid (Pub) batteries. It's a good style of voltage settings for charging varied cell count batteries, further as a zero.1 amp adjustable charge rate of up to five amps.

2.4 TRANSMITTER:

As its name implies, the general purpose of a transmitter is to transmit signals. These signals contain information, which can be audio, video, or data. In essence, a transmitter launches signals into the air via a transmitting antenna. A Drone Radio Transmitter is an electronic device that uses radio signals to transmit commands wirelessly via a set radio frequency over to the Radio Receiver, which is connected to the drone being remotely controlled. ... An FPV Drone Radio Transmitter transmits commands via channels.
How do drone transmitters work?
The Components of a Drone. The transmitter enables the user to control the aircraft from a distance, using 2.4 gigahertz spread spectrum radio signals. Receivers are electric devices with built in antennas that intercept the radio signals from the transmitters, and convert them into alternating current pulses.

Fig -5: Transmitter.

2.5. BLDC Motor:

Fig -6: BLDC Motor.

As the name implies, BLDC (Brushless DC) motors don't use brushes for commutation. They're

electronically commutated & the benefits are higher speed vs. force characteristics, High potency with quiet operation & terribly high speed vary with longer life. You would need an Electronic Speed Controller management of the motor. As there are not any brushes to wear out the lifetime of BLDC motor is way much longer. There's no sparking and far less electrical noise.

2.6. Pump and Nozzle:

To pressurize the liquid a 12 V DC water pump can be used which has 2.5 L/min capacity can be used. Then the pressurized 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 palace at 45cm distance between each other

Fig -8: Pump.

Fig -9: Nozzle.

2.6. Propeller:

Fig -10: Propeller.

These Propellers are light in weight and high strength propeller has a 15° angle design at the end of the propeller to avoid whirlpool while the multi-copter is flying. They are useful in drones as well as in multi-copters.

2.7. Camera:

Fig -7: Camera.

The camera that can be used is HD FPV camera 1200 TVL, it has 2.8mm Lens, auto/color/ black & white Day and night format.TS5828 32CH mini transmitter can be connected to the camera for transmission of video signals to receiver at ground.

3. CONCLUSIONS

In this paper we have described a design of a drone 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 drone can also be used in spraying disinfectant liquids over buildings, water bodies and highly populated areas.

4. FUTURE SCOPE

In this paper we have described a design of a drone 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 drone can also be used in spraying disinfectant liquids over buildings, water bodies and highly populated areas.

REFERENCES

[1] Zhang Dongyan, Chen Liping, Zhang Ruirui, Xu gang, Lan Yubin, Wesley Clint Hoffmann, Wang Xiu, Xu Min, “Evaluating effective swath width and droplet distribution of aerial spraying systems on M-18B and Thrush 510G airplanes”, April 2015, Int J. Agric. & Bio Eng, Vol 8 No.21.

[2] Huang, Y. Hoffmann, W.C. Lan, Y. Wu and Fritz,

B.K, "Development of a spray system for an unmanned aerial vehicle platform", Dec 2015, Applied Engineering in Agriculture, 25(6):803-809.

[3] Yallappa D., M. Veerangouda, Devanand Maski, Vijayakumar Palled and M. Bheemanna, "Development and Evaluation of Drone mounted sprayer for Pesticides Applications to crops." Oct. 2017, Research Gate, Conference paper.

[4] S.R. Kurkute, B.D. Deore, Payal Kasar, Megha Bhamare, Mayuri Sahane, "Drones for Smart Agriculture: A Technical Report", April 2018, IJRET, ISSN: 2321-9653.

[5] Rahul Desale, Ashwin Chougule, Mahesh Choudhari, Vikrant Borhade,
S.N. Teli, "Unmanned Aerial Vehicle for Pesticides Spraying" April 2019, IJSART, ISSN: 2395-1052.

[6] Prof. B.Balaji, Sai Kowshik Chennupati, Siva Radha Krishna Chilakalapudi, Rakesh Katuri, kowshik Mareedu, "Design of UAV (Drone) for Crops, Weather Monitoring and For Spraying Fertilizers and Pesticides.", Dec 2018, IJRTI, ISSN: 2456-3315.

[7] Prof. P. Mone, Chavhan Priyanka Shivaji, Jagtap Komal Tanaji, Nimbalkar Aishwarya Satish, "Agriculture Drone for Spraying Fertilizers and Pesticides", Sept 2017, International Journal of Research Trends and Innovation, ISSN 2456-3315, Volume 2, Issue 6.

[8] F. G. Costa, J. Ueyama, T. Braun, G. Pessin, F. S. Osorio, P. A. Vargas, "The Use of Unmanned Aerial Vehicles and Wireless Sensor Network in Agriculture Applications", 2012, IEEE International Geoscience and Remote Sensing Symposium 2012.

[9] Spoorthi, S., Shadaksharappa, B., Suraj, S., Manasa, V.K.,"Freyr drone: Pesticide/fertilizers spraying drone-an agricultural approach.", 2017, IEEE 2nd International Conference on In Computing and Communications Technologies, pp. 252-255.

[10] G. Ristorto, F. Mazzetto, G. Guglieri, and F. Quagliotti, "Monitoring performances and cost estimation of multirotor unmanned aerial systems in precision farming." ,2015, International Conference on Unmanned Aircraft Systems (ICUAS), pp. 502–509.