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Smart Agricultural Insecticide Spraying Machine

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Abstract -*Lack of skilled worker is main problem of agricultural field in our country even though we have population of almost 1380 million and about 70% peoples are doing farming. This project is created to address the issue of skilled workers required for spraying insecticide in the farm. Using insecticide plays important role in farming which increases the corps yielding and speed of growth. Insecticides are pesticides that are used to kill insects or migrants that harm the corps and are toxic in the nature hence need to be sprayed skillfully. Food and vegetable farming which includes grapes, pomegranates, chili etc. need to be sprayed more in the month.*

Key Words: Helper Aerial Vehicle, ESC at mega 2560, pesticide mechanism

1. INTRODUCTION

Population of India and all over world is increasing as time lapses. Increasing population also leads to increased needs of basic things needed which includes food, clothes and shelter. Food and cloths demands can be fulfilled only by agricultural sector and it means agricultural sector must grow in proportion with increasing population. On contrary due to increasing shelter demands, agricultural land and forests lands are reducing rapidly and which due two which we need to increase the output of farming which is having less area. Another problem with farming is, it got often attacked by insects and migrants like whiteflies, grasshoppers, aphids, rootborer, pod sucking bugs etc. which almost destroys the whole corps if precautionary measures are not taken timely. Now a day's environmental conditions are changing drastically which leads to unhealthy environment and more population of such kind of insects. Insecticides are used to kill the insects, rodents, fungi, unwanted plants and taking control over the insect eggs and larvae. But insecticides are toxic and need to take care while spraying in the farm. There are many cases in which careless spraying of insecticides affects spraying persons like skin problems, unconsciousness, breathing problems, stinging eyes, nausea, dizziness, hormone disruption and in some cases death also.

As per the report of World Health Organization (WHO), more than 1 million case of insecticide are being recorded and from which around 1 Lakh peoples are suffering from heath problem.

To save the peoples from these health problems arising from careless spraying of insecticides, we suggested using unmanned helper aerial vehicle which saves man hours, money and material. It also helps to speed up the whole process of farming. The unmanned helper aerial vehicles we are using have multi rotors devices and ability to take off in vertical direction. It can be controlled remotely with the help of remote.

2. LITERATURE SURVEY

Mule et al. [1] proposed automatic way for pesticide spraying which reduces worker finding problem in remote areas. They used quad-copter mechanism with MPU 6050. Berenstein et al. [2] presented automatic and adjustable device for spraying which is targeted for site specific applications. They used single spray nozzle having adjustable spraying angle along with distance measurement sensor and camera. Cantelli et al. [3] proposed versatile electrical robot which is small in size and used in agricultural spraying autonomously. According to them, their system is sage and accurate for spraying operation. They used hydraulic subsystem and electronic control unit to achieve human machine interface. Kurkute et al. [4] presented technical report on use of drone in agricultural field. They proposed prototype which consists of BLDC motor, ESC wires, unmanned aerial vehicles with Arduino. Kanna et al. [5] used ultrasonic sensors and solitary splash siphon engine for their system which is mounted on pan tilt unit and aimed to target decreasing the measure of pesticide connected. In the proposed system they worked on directing the siphon spout to confront harvest, measuring separation of object to be harvest and finding object position. Gaponov et al. [6] proposed outline for quad-copter designing and implementation with the help of multi-disciplinary engineering approaches. Giles et al. [7] presented unmanned aircraft system with highly targeted spatial resolution which is mainly used in high value specialty corps in California. The

main objective behind the project was deploying an petrol powered unmanned aircraft for spraying. Their spray application rate is around 10 to 50 liter per hectare with 2 to 5 hectare per hour. Huang et al. [8] developed a spray system of unmanned aerial vehicle which have vector control in the remote areas which is accurate and site specific. They used two rotor motion's unmanned autonomous vehicles. SR200 which is gasoline powered and SR20 which is battery powered. According to them their system is best suited for small crop plots with more site specific accuracy. Madhu et al. [9] proposed design of quad-copter for pesticide spraying with the objectives like reducing labor required, reducing system size and ease the spraying method. They used ardupilot mega 2.8 flight controller board and flysky trans-receiver circuit. Meivel et al. [10] demonstrate the quad copter using flight controller this ad pilot control all operation which commanded by user. Author used X cross configuration in quad copter configuration. This quad copter net payload was 4 kg to navigate that UAV GPS system was used Sprayer controlled by RF transmitter remote which is operated by user.Prasad Reddy et al. [11] proposed the system HAV which controlled by radio controller and spray kept continuously on which waste lots of fertilizer. Patel et al.[12] demonstrate the Quadcopter for agriculture surveillance in which the author. Used an infrared camera for taking image. In this image temperature sensing of plants by infrared thermography is done. Then using image disease is detected and for that specific area fertilizer are sprays over it. Kedari et al. [13] developed a Quadcopter which is used for pesticides spraying and this quad-copter is handle by an android application.

3. HARDWARE USED

3.1 Electronics speed controller (ESC):

Electronics speed controller is used to regulate the speed of electric circuit. ESC regulates the speed obtained from joystick, throttle level and manually input signal.

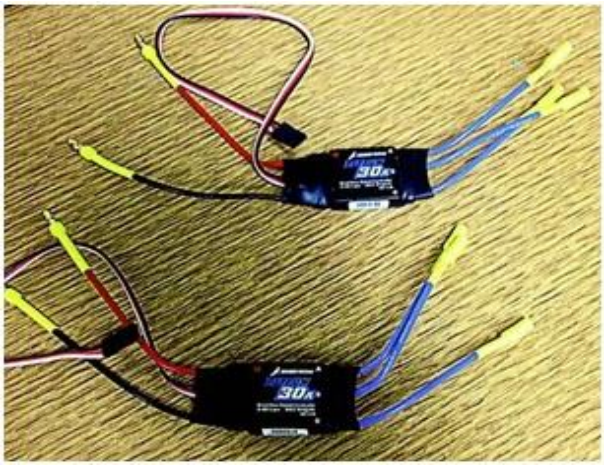

Fig -1: 30A Hobby Wing Fly fun brushless ESC

ESC generates three high frequency signals with different controllable phase continually to keep the motor turning. These ESC are able to push current of 30 amperes and can push current up to 40 amperes for ten seconds based on voltage output. It can handle speeds up to 210,000 rotations per minute (RPM).

3.2 Brushless DC motor (BLDC):

Brushless DC motor is outer runner motor which is specially made for quad-copter and multirotor. These BLDC motors can run at maximum efficiency at 15 amp. of current and can handle currents of up to 18 amp. for up to sixty seconds. The maximum rpm per volt is 980 kpv and the maximum amount of power the motors can handle is 200 watts. These motors are also relatively light, weighing about 500 grams.

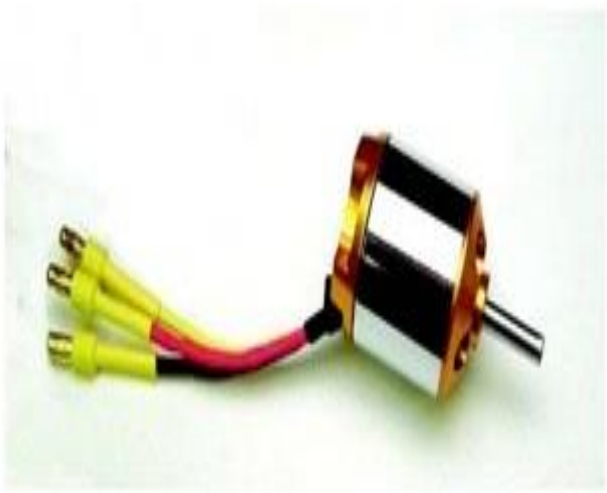

Fig -2: A2212 electric brushless motor

It is 1400Kv motor. Feature of the motor is 3.2 mm hardened still shaft , dual ball bearing and has 3.5 mm gold spring male connector is already attached and include three female connector for speed control . It provides high performance super power and brilliant efficiency i.e. 80% 30 A electronics speed controller can be used to drive motor.

3.3 Radio Receiver:

It receives 2.4 GHz signal from transmitter It has 10 channels that are independent to receive the signal from transmitter and send it to the controller to further processing. It has low current consumption and excellent receiver selectivity along with blocking performance. It has current consumption less than 40 mA and works on 5 V power supply.

Fig -3: Spectrum DX7S receiver (left) and transmitter (right)

3.4 MPU 6050:

MPU 6050 sensor has combination of accelerator and gyroscope chip .It has 16 bit analog to digital conversion hardware channel to each other it catches x, y and z channels at the inn same time. MPU6050 Sensor combine 3 axis accelerometers and 3 axis gyroscope on same silicon chip It is together with on board digital motion processor which process 6 axis motion fusion algorithm, I2C bus is used to interface with controller

3.5 Lithium polymer batteries (LIPO):

Lithium polymer batteries are generally used as power sources in many electric modelers. It offers high energy storage ratio, weight ratio and high discharge rate LIPO battery is in a single cell 2.2 V to in a pack in cells is connected in series 37 V . F or Quad –copter 3 cells are connected in series as one parallel which give us 12 V Supply. It has 4 stages and fully automatic charging process which is controlled by MCU. It has 100% full load burn-in test it has high efficiency, long and high reliability.

Fig -4: Battery and Balancer

3. SYSTEM DEVELOPMENT

In the quad-copter, term quad means four that means four motor are used in this system. Mainly there are two types are available in quad-copter, one is '+ type configuration' and second is 'x type configuration'. For our model, we used x type configuration .The Quad-copter module turns on by remote which is remotely located far away. The system mainly divided into two part i.e. transmitter and receiver. Objective of our system is to spray insecticide in 100 meter square area with the help of quad-copter and it is activated by module which is in placed in user location advantage of this system is quad-copter is activated by user with help of module and wireless communication is done between transmitter and receiver

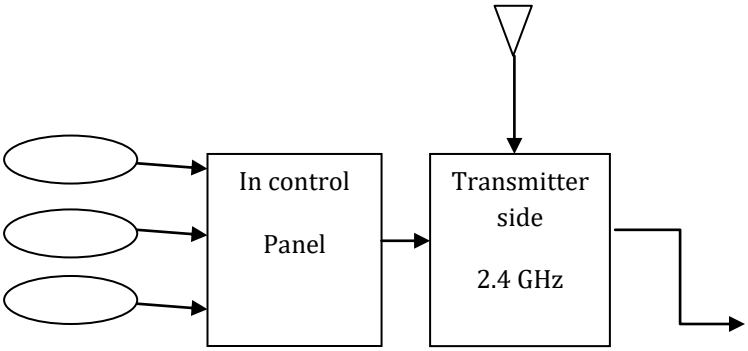

Fig -5: Block diagram of transmitter section

Figure 5 shows the block diagram of transmitter section In the transmitter section user have a remote to control the system which generated a signal according to movement of switch on remote. In the input side potentiometer is varies between 0 to 5 kΩ It gives signal to the ADC i.e. Analog to digital converter. It has 10 bit resolution. As per input given to the ADC the value is convert into 1 byte, Transmitter transmits the signals in the form of channels. No. of channels are transmitted through transmitter the transmitter section consist of control panel in which mechanical switches, joystick is including. Transmission rate of the transmitter is 2.4 GHz.

Figure 6 shows the block diagram of radio receiver section which consists of RF 2.4 GHz, BLDC, GPS, Compass, ATMEGA 2560 and water spray unit. It receives the signal through 2.4 GHz RF signal in form of string. In that string the channel is separate by 5 bytes. The channel is pitch, roll tthrottle, yaw, pump, an inertial measurements unit recognizes the difference in pitch, roll and saw used by gyroscope. IMU unit consist of gyroscope and accelerometer sensor.

Transmitter control assists the measurement sensor like gyroscope and accelerometer as per input send to signal to the electronics speed controller GPS is used to show the location and compass sensor shows direction It hold the position x,y axis Sensor give the signal to the controller It controls System .Controller gives 20 Ma current and single phase PWM to the electronics speed controller

In this system we lift 2kg weight hence ESC gives 30 A current and 3 phase PWM signal to the motor .ESC give the power to control the speed of motor

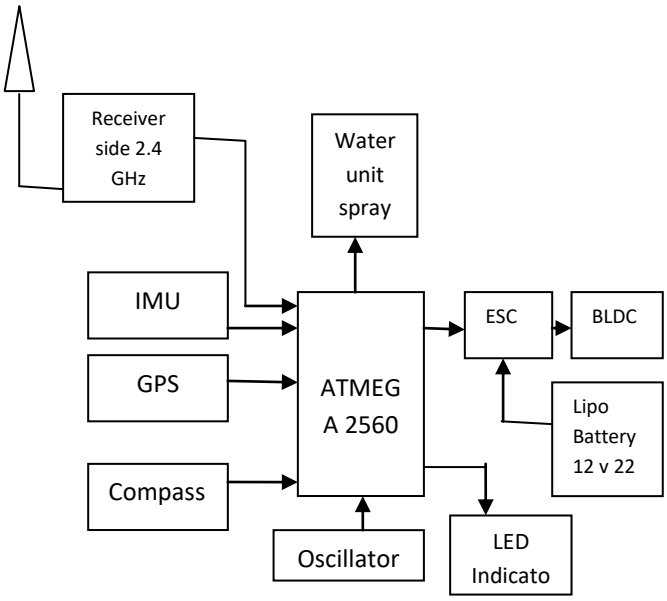

Fig -6: Block diagram of Receiver

For the pesticide spraying mechanism we use pesticide tank of capacity 300 -400 mg. 12 V dc water pump single inlet 1.5 A battery switch pipes fitted to T- split and nozzles. When the brushless motor is turned on, pesticides through the pipe with the help battery spread through the nozzles on define particular agricultural area

5. Result

Our smart insecticide spraying system using Quad copter provides optimal results by covering major area for spraying of pesticides. This system is used to avoid insecticide applicator contact with pesticides which contains high content of chemicals and toxic in nature. This system also helps to reduce overall spraying time. To increase the quantity of pesticides, we need to increase capacity of tank. With the height of around 5 feet, we can able to spray insecticides. Table 1 gives an idea about results of different parameters.

Fig -7: Output image

Table -1: Result parameter

Sr. No.	Parameters	Results
1	Height of Quad-copter	5 feet
2	Direction of landing	Vertical
3	Motor load	12 V
4	Area covered by Quad copter	10 m in square area
5	Direction of landing	2 kg
6	Average flight time	5 to 10 min

Fig -8: Fly Spray Machine

6. CONCLUSIONS

This project improves safety and required time for spraying in farming. If we compare traditional method like tractor spraying, hand pumping etc. our system will give better output in terms of man hours, time, overall cost and required material. Recently weight of our spraying machine is approximately 2100 grams & time to flight is 5 to10 minutes. Systems range is up to 320 m and can be controlled by using remote.

The Implementation of system can provide better output with the help of spraying pesticide on farming. This project required not only to interface and program the components of the Spraying Machine, but also exposed them to mechanical components and reality of project management to accomplish the project objectives to use in farms. In future, solar panels mounted on system can be used as power source which will increase the flight time and in turns spraying time also. Digital camera can also be used for real time observation and monitoring purpose.

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