AN AUTOMATICALLYCONTROLLED DRONEBASEDAERIALPESTICIDE SPRAYER

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INTRODUCTION:
The main source of Indian economy is agriculture. The agriculture production depends on various environmental parameters like temperature, rain, etc. It is also affected by other major biological factors such as pests, diseases, etc. These biological factors can be controlled by human beings with the help of pesticides, ultimately increasing the productivity. Pesticide exposure affects the human health in various ways and causes neurological and skin diseases. According to survey conducted by WHO (World Health Organization) it is estimated that every year about 3 million workers are affected by poisoning from pesticides from which 18000 die.

This projects aims to overcome the ill effects of the pesticides on human beings and also used to spray pesticide over large areas in short interval of time compared to conventional spraying by using an automated aerial pesticide sprayer. This device is basically a combination of spraying mechanism on a quad copter frame.

OBJECTIVES:
The Main objectives include:

1. To assemble the drone using necessary components.
2. To design a mechanism for spraying and controlling various parameters like spraying speed control, monitoring tank status, fixing the sprayer at specific altitude and location etc.
3. To spray chemicals or pesticides aerially.

METHODOLOGY:
The Automatically Controlled Drone Based Aerial Pesticide Sprayer mainly consists of two parts. The Quadcopter and the Spraying Mechanism.

Quadcopter

Initially Quadcopter is assembled using necessary components such as Flight Controller Board (FCB), GPS, Brushless DC Motors,Electronic Speed Controller (ESC), Wireless Transceiver, Frame, Propellers and Battery etc.
Fig 1: Block Diagram of an Automatically Controlled Drone Based Aerial Pesticide Sprayer

Flight controller board is used to control the functions of the drone such as movement, lifting, positioning, etc. FCB will be programmed for handling different sensors such as GPS, barometer, accelerometer, gyroscope etc. and components such as motors. The drone will can be programmed for two modes i.e. Manual mode and autonomous mode.

Following are some of the functions of the Flight Controller of the quad copter. As shown in the Fig 1.

**Altitude control:**

Initially drone will be hovered at required altitude, and then it is switched to Altitude Hold mode, which maintains the same altitude until it is switched back. For sensing the current altitude barometer is used. For more accurate altitude measurements additional sensor such as sonar can be used.

**Stability Control:**

The stability of the drone is maintained by the sensors such as accelerometer and gyroscope through the program.

**GPS control:**

It is used only in autonomous mode. In this mode, the FCB through feedback mechanism compares stored GPS parameters with the acquired GPS; so as to change speed of motors for navigating the given path. After reaching the last location drone is landed safely.

**Motor Speed Control:**

According to the changes in the values of various sensors the speed of the motors can be varied to achieve required task.
Spraying Mechanism:

![Spraying Mechanism diagram]

The spraying mechanism mainly consists of an Arduino UNO microcontroller which is programmed to perform various functions. It also contains a tank of 250ml capacity to which a water pump is connected. To this water pump, a splitter is connected which spits the pesticide to the two nozzles which are connected at the two opposite ends and spraying is achieved. It also contains a motor driver circuit to control speed of spraying and pesticide level indicator circuit with buzzer, for detecting when the pesticide is empty.

The spraying mechanism performs the following functions.

**Pump ON/OFF control:**
It is used to turn On/Off the water pump which is used to spray. This is done by sending 5V control signal to the motor driver circuit from Arduino.

**Spraying Speed Control:**
The speed of spraying is achieved by sending a PWM signal to the motor driver IC. Based on the t\textsubscript{ON} time of this signal, speed of spraying can be controlled.

**Tank status:**
The status of the tank will be monitored using water level sensor. If the pesticide level reaches below the threshold, say 25ml in the prototype it can be notified to operator by sending a control signal to the Arduino which in return turns on the buzzer. Hence when the buzzer is heard by the operator he can land the quadcopter for refilling.

**CONCLUSIONS:**
By successful implementation of such project affective spraying of pesticide can be achieved. The exposure of highly toxic pesticide to humans can be prevented. This can also be used in places where laborers are hard to find. One can hasten the pesticide spraying process and cover large area in short time. Encounters with venomous snakes, which can be found regularly in fields can be prevented. As spraying is done from lower altitude, environmental pollution can be reduced.
FUTURE SCOPE:

1. Weight lifting capacity of the quadcopter can be increased by increasing the number of motors or by increasing the propeller size or by increasing the rpm of the motor.
2. Flight time can be increased by increasing the battery capacity.
3. Pesticide carrying capacity can be increased by increasing the size of the tank.
4. Larger area can be covered by using more nozzles which can be arranged in the form of array.
5. Angle of spraying can be controlled for accurate spraying.