PROJECT ABSTRACT

Agricultural Crop-Spraying Drone with Precision Flow Control

A quadcopter crop-spraying drone with a 2-litre tank, pump-and-nozzle spray boom and PWM precision flow control tied to flight speed. Delivered built-to-order with assembled airframe, tuned firmware, calibration guide, report, PPT and viva kit.

Project type: Hardware

Availability: Built to order

Suitable branches: IoT & Embedded

Technologies: Quadcopter flight controller, brushless motors, 2L spray tank, diaphragm pump, spray nozzles, PWM flow control, GPS, LiPo power

Price: Request a quotation

Prepared by Projectech · projectech.in — for academic project reference.

01. Title

Agricultural Crop-Spraying Drone with Precision Flow Control

02. Introduction / Background

Manual pesticide spraying exposes farm workers to chemicals and applies them unevenly; tractor sprayers cannot enter wet or tall-crop fields. Spray drones solve access and exposure, but cheap builds spray at a fixed rate — overdosing when slow, missing strips when fast. The engineering that matters is precision flow control: modulating pump output with flight speed so the application rate stays constant per hectare. This project builds a quadcopter spray drone with a 2-litre tank, a diaphragm pump feeding a nozzle boom, and PWM flow control linked to the flight controller's speed estimate, plus the calibration procedure that maps PWM duty to litres per minute.

03. Problem Statement

Conventional spraying is hazardous and uneven, while basic spray drones dose blindly. The project addresses this with a student-built quadcopter sprayer whose pump flow is modulated in proportion to ground speed — holding the application rate constant — with tank-level monitoring, low-level return behavior and a documented flow-calibration procedure, demonstrating precision-agriculture control on a real airframe.

04. Objectives

- Build a stable quadcopter airframe carrying a 2-litre spray tank and nozzle boom.
- Implement PWM precision flow control tied to the flight controller's speed estimate.
- Calibrate pump duty cycle against measured flow rate with the included procedure.
- Monitor tank level and trigger low-level return-to-launch behavior.
- Demonstrate uniform swath coverage with water-only test sprays.
- Deliver the complete student kit: airframe, firmware, calibration docs, report, PPT and viva Q&A.;

05. Proposed Methodology

The drone is developed in three stages. (1) Airframe: a quadcopter with a tuned flight controller, GPS and a 2-litre tank slung low for a stable center of gravity, feeding a diaphragm pump and a two-nozzle boom. (2) Flow control: firmware reads the flight controller's ground-speed estimate and modulates pump PWM so flow per hectare stays constant; the student calibrates duty-vs-flow with a measuring cylinder and programs the resulting curve. (3) Mission logic: tank-level sensing drives low-level alerts and automatic return-to-launch, and test flights run water-only spray passes over a marked grid to verify swath uniformity.

06. System Architecture / Working

The flight controller stabilizes the quadcopter along the spray pass while the spray controller reads ground speed and sets pump PWM from the calibrated flow curve — faster flight, higher flow — keeping litres per hectare constant. The diaphragm pump pressurizes the nozzle boom; the tank-level sensor tracks remaining liquid and triggers a low-level alert and return-to-launch before the tank empties. All spray testing is performed with water only, and the report documents the calibration and uniformity results from the student's own test grid.

07. Hardware / Software Requirements

- Quadcopter frame with brushless motors and ESCs
- Flight controller with GPS (Betaflight/ArduPilot class)
- 2-litre spray tank with diaphragm pump and nozzle boom
- PWM pump driver and tank-level sensor
- RC transmitter/receiver link

- High-capacity LiPo battery with monitor
- Flow-calibration kit (measuring cylinder, test grid)
- Firmware sources (flight + spray controller)

08. Expected Outcomes

- A flying spray drone with speed-compensated precision flow control.
- A student-calibrated duty-vs-flow curve documented in the report.
- Water-only swath-uniformity test results from a marked grid.
- Low-tank alert and return-to-launch behavior demonstrated.
- A complete report, PPT and viva Q&A; on spray-drone control and calibration.

09. Applications

- Demonstrating precision-agriculture spraying concepts.
- Teaching UAV payload integration and closed-loop dosing control.
- Classroom demos of calibration-driven embedded control.

10. Future Scope

- Waypoint mission planning for autonomous spray passes.
- Variable-rate spraying from prescription maps.
- Larger tank and multi-nozzle booms for wider swaths.
- Drift-reduction nozzle studies as an added module.