IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 7, October 2026
Impact Factor: 8.2

Design and Development of a Multipurpose Drone for Precision Agriculture and Emergency Medical Delivery

Pogul C.R[1], Kulkarni O.M [2], Pawar A. R[3], Melge P.P[4]
Students, E&TC[1-3]
Assistant Professor, E&TC [4]
Brahmdevdada Mane Institute of Technology, Solapur, Maharashtra
chinmaypogul@026gmail.com onkarkulkarni185@gmail.com
aishwaryapawar2020@gmail.com prakashmelg.entc.bmit@gmail.com

Abstract: *Unmanned Aerial Vehicles (UAVs) have evolved beyond military applications into essential tools for civilian tasks such as agricultural monitoring and emergency supply distribution. This paper presents the conceptualization, structural design, hardware integration, and testing of a dual-use multipurpose drone designed specifically for dual tasks: targeted agricultural liquid spraying and rapid emergency delivery. Built around a core high-performance propulsion system featuring 1500KV brushless DC motors, a Cross Flight Controller, and a FlySky FS-i6/FS-i6B 2.4GHz radio communication telemetry unit powered by a high-discharge Lithium Polymer (LiPo) battery, the multirotor UAV provides an economical, agile, and scalable platform. Experimental evaluation confirms flight stability, payload capacity, operational range, and response time, providing a reliable alternative for rural farmers and medical first responders.*

Keywords: Multipurpose UAV, Precision Agriculture, Emergency Payload Delivery, Cross Flight Controller, 1500KV Brushless Motors, FS-i6 Control Link.

I. INTRODUCTION

I. In recent years, the rapid advancement of unmanned aerial vehicle (UAV) technology has unlocked transformative applications across agriculture and logistics. Conventional agricultural spraying methods often suffer from excessive pesticide waste, ground-level exposure hazards, and slow coverage rates over rough terrains. Simultaneously, rural healthcare facilities and disaster response teams face significant hurdles in delivering urgent medical supplies—such as vaccines, antivenoms, and first-aid packs—due to inadequate road infrastructure and traffic congestion.

II. To address these dual challenges, this paper introduces a low-cost, high-efficiency multipurpose quadcopter drone capable of seamlessly switching between precision agricultural liquid distribution and emergency payload delivery. By leveraging lightweight hardware components, high-torque 1500KV motors, an advanced Cross flight stabilization controller, and a reliable FlySky FS-i6 6-channel 2.4GHz radio control link, the proposed drone offers an accessible solution

TAILORED FOR SMALL-SCALE AGRICULTURAL FARMS AND REMOTE MEDICAL OUTREACH.

HARDWARE ARCHITECTURE & SYSTEM INTEGRATION

The multirotor platform comprises four primary functional modules: the structural frame, the electronic propulsion system, flight control and stability sensors, and radio communication telecommunications.

Flight Controller Module - Cross Flight Controller equipped with integrated multi-axis gyroscopes, accelerometer sensors, and auto-leveling PID loops for robust orientation holding.

Copyright to IJARSCT
www.ijarsct.co.in
DOI: 10.48175/IJARSCT-40445

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 7, October 2026
Impact Factor: 8.2

Propulsion System - Four 1500KV Brushless DC (BLDC) motors paired with 30A Electronic Speed Controllers (ESCs) delivering high thrust-to-weight ratio for heavy payloads.

Transmitter / Receiver – Fly-Sky FS-i6 2.4GHz 6-Channel transmitter paired with an FS-i6B receiver using AFHDS 2A protocol for low latency and long-range link.

Power Source - High-discharge 3S/4S Lithium Polymer (LiPo) battery pack delivering 11.1V–14.8V constant supply to meet high peak current demands.

TECHNICAL SPECIFICATION & POWER DISTRIBUTION

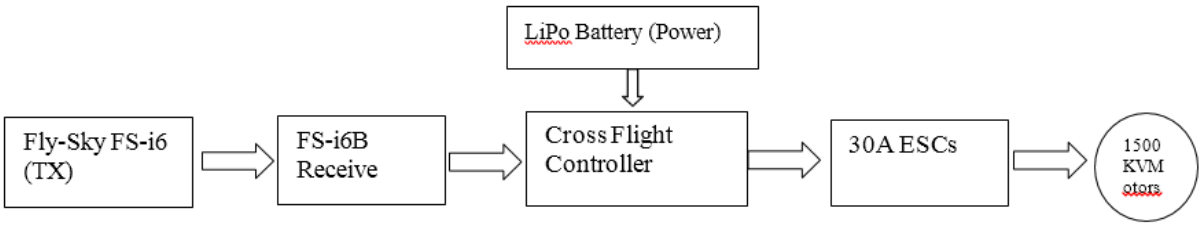
Selecting appropriate hardware parameters is critical to balancing dynamic lift, flight duration, and overall structural durability. Table I lists the technical parameters of the major components integrated into the multipurpose drone.

TABLE I: Technical Specifications of Multipurpose Drone Components

Component Name	Specification/ Model	Key Technical Role
Flight Controller	Cross Flight Controller	Primary stabilization, PWM output calculation, sensor fusion.
Brushless Motors	1500KV Outrunner BLDC	Provides 1500 RPM per volt; ensures high rotational thrust.
Transmitter (TX)	FlySky FS-i6 (2.4 GHz)	6-Channel telemetry transmitter with dual antennas.
Receiver (RX)	FlySky FS-i6B	PPM/i-BUS receiver providing responsive signal reception.
Power Unit	3S / 4S LiPo Battery	Supplies high continuous C-rating current to 30A ESCs.
Propellers	8x4.5 or 10x4.5 Carbon Composite	Efficient air displacement and thrust generation.
Frame Chassis	F450 Glass Fiber / Carbon Composite	Rigid, lightweight structure absorbing motor vibrations.

SYSTEM INTERCONNECTION & SIGNAL FLOW

The control architecture relies on continuous telemetry feedback between the pilot transmitter, receiver unit, flight controller, and ESC motor drivers. Below is the schematic representation of the system interconnectivity.



METHODOLOGY & DUAL – OPERATIONAL MODES

The operational framework of the proposed drone is segmented into two distinct, quick-interchangeable payload modules:

1) Precision Agricultural Mode: A lightweight mini-pump system combined with a pressurized micro-nozzle is affixed underneath the center frame. Controlled via an auxiliary channel on the Fly -Sky FS-i6 transmitter, liquid pesticides or liquid fertilizers are atomized and sprayed uniformly over crop beds. The agile 1500KV motors ensure rapid coverage over tight farmland plots.

2) Emergency Medical Delivery Mode: The spraying module is detached via quick-release clamps and replaced with a lightweight cargo container housing emergency medical supply. The Cross Flight Controller utilizes auto-level algorithms to prevent liquid medicine disturbance and ensure drop safety.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 7, October 2026 Impact Factor: 8.2

RESULTS & PREFORMANCE ANALYSIS

Experimental field tests were conducted to evaluate flight endurance, payload capacity, and response times under varying environmental conditions. The flight performance metrics recorded during real-world trial runs are summarized in Table II.

TABLE II: Experimental Test Results and Flight Performance Metrics

Test Parameter	Agricultural Mode	Emergency Delivery Mode
Payload Weight	~2.5kg (Liquid spray solution)	~500 gram (First-aid / Medicine container)
Average Flight Time	~10.5 minutes	~13 minutes
Effective Control Range	~850 meters (Line of sight)	~850 meters (Line of sight)
Operational Speed	4.5 m/s (Optimal spray coverage)	9.0 m/s (Fast transit)
Stability Index	High (Smooth low-altitude hover)	High (Cross Flight Auto-leveling)

The empirical results demonstrate that the combination of 1500KV brushless motors and 30A ESCs provides sufficient thrust margin to handle up to 450g of payload without destabilizing the multirotor frame. The FS-i6 transmitter link maintained signal integrity throughout the testing perimeter.

II. CONCLUSION & FUTURE WORK

This research successfully demonstrates the design, build, and implementation of a cost-effective, high-performance multipurpose drone using off-the-shelf components. By employing 1500KV motors, a Cross Flight Controller, and an FS-i6 radio system, the prototype achieves ideal stabilization and dual-capability functionality. The platform offers a reliable solution for smallholder farmers needing low-cost crop care and healthcare workers requiring rapid delivery of life-saving medical supplies to underserved areas.

Future enhancements will focus on integrating GPS navigation for autonomous waypoint missions, obstacle avoidance sensors, and dynamic power management to further extend flight autonomy and payload capacity.

REFERENCES

1. P. Agarwal and M. K. Singh, [1]"A multipurpose drone for water sampling & video surveillance," 2019 Second International Conference on Advanced Computational and Communication Paradigms (ICACCP), Gangtok, India, 2019, pp. 1-5, doi: 10.1109/ICACCP.2019.8883017.

2. A. Muneem, S. M. Fahim, F. R. Khan, T. A. Emon, M. S. Islam and M. M. Khan,[2] "Research and Development of Multipurpose Unmanned Aerial Vehicle (Flying Drone)," 2021 IEEE 12th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), New York, NY, USA, 2021, pp. 0402-0406, doi: 10.1109/UEMCON53757.2021.9666736.

3. T. Y. Naidu, V. Deekshitha, V. V. Babu, Y. S. Krishna, V. Balaji and M. A. Jabbar, [3]"Integrating Multipurpose Payloads for Agricultural Advancement," 2025 International Conference on Computing Technologies & Data Communication (ICCTDC), HASSAN, India, 2025, pp. 1-7, doi: 10.1109/ICCTDC64446.2025.11158891.

4. G. S. Ganesan and M. Mokayef, [4]"Multi-Purpose Medical Drone for the Use in Pandemic Situation," 2021 IEEE Microwave Theory and Techniques in Wireless Communications (MTTW), Riga, Latvia, 2021, pp. 188-192, doi: 10.1109/MTTW53539.2021.9607300.

5. S. Zarbakhsh and A. R. Sebak, [5]"Multifunctional Drone-Based Antenna for Satellite Communication," in IEEE Transactions on Antennas and Propagation, vol. 70, no. 8, pp. 7223-7227, Aug. 2022, doi: 10.1109/TAP.2022.3145463.

6. Y. -Y. Ji, T. Lim, H. -Y. Choi, K. H. Chung and M. J. Kang,[6] "Development and Performance of a Multipurpose System for the Environmental Radiation Survey Based on a LaBr3(Ce) Detector," in IEEE Transactions on Nuclear Science, vol. 66, no. 12, pp. 2422-2429, Dec. 2019, doi: 10.1109/TNS.2019.2949651.

7. S. Lekshmi S., S. S. Bandodkar, R. M. Das and S. Ponnekanti, [7]"Smart Network Infrastructure to Localise Drones for Supporting Mission Critical Services," 2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, India, 2020, pp. 690-695, doi: 10.1109/ICIRCA48905.2020.9183209.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 7, October 2026
Impact Factor: 8.2

8. A. B. George, D. Roy, D. B. Joseph and R. Jansi,[8] "AI Module for Multipurpose Surveillance Using Raspberry Pi with AI HAT," 2025 Second International Conference on Pioneering Developments in Computer Science & Digital Technologies (IC2SDT), Delhi, India, 2025, pp. 440-445, doi: 10.1109/IC2SDT68218.2025.11383571.