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 3, February 2026
Impact Factor: 8.2

Smart Agriculture Drone

Riya Amol Wabale, Sanika Milind Mane, Shreyash Uttam Sonalkar
Pranav Pradip Katmande, Ms. Pooja Sangale
Department of Electronics and Telecommunication
Jaywantrao Sawant Polytechnic, Hadapsar, Pune, India
riya28wabale@gmail.com, manesanika272@gmail.com, sonalkarshreyash@gmail.com
pranavkatmande@gmail.com, pvsangale_entc@jspmjspoly.edu.in

Abstract: *Agriculture is one of the most important sectors in India, but traditional farming methods require high labor, time, and cost. Manual spraying of pesticides and fertilizers is harmful to farmers' health and does not ensure uniform distribution. To overcome these problems, this project presents a Smart Agriculture Drone using a hexacopter frame integrated with IoT-based monitoring and spraying system.*

The drone is divided into two main parts: flight control system and smart monitoring system. The flight system ensures stable flying using KK2.1.5 flight controller and FlySky transmitter. The monitoring system uses ESP32, DHT11 sensor, soil moisture sensor, relay module, water pump, and ESP32 camera. The ESP32 creates a WiFi network and hosts a webpage where users can monitor environmental data and control the spraying pump wirelessly.

This system reduces manual effort, improves safety, and provides precision spraying for better crop productivity.

Keywords: Agriculture Drone, ESP32, Hexacopter, IoT, Smart Farming, Precision Spraying

I. INTRODUCTION

Agriculture plays a major role in the Indian economy. Farmers often face problems like uneven spraying, water wastage, and health risks due to chemical exposure. Manual spraying requires physical effort and consumes more time. To solve these problems, drone technology can be used in farming.

A drone can fly over crops and spray water or pesticides evenly. By integrating IoT technology, farmers can also monitor crop conditions in real-time.

This project introduces a Smart Agriculture Drone that combines stable flight control with wireless monitoring and spraying system. It is low-cost, easy to operate, and suitable for small and medium-scale farmers.

II. LITERATURE SURVEY

Many researchers have worked on agricultural drones and smart farming systems. Some projects use GPS-based autonomous drones for large farms. Others use IoT sensors for monitoring soil and weather conditions.

Most advanced systems are expensive and require complex programming. Some systems depend completely on internet connectivity, which may not be reliable in rural areas.

From previous research, it is clear that combining a simple flight controller with ESP32-based IoT monitoring can create a low-cost and efficient agricultural solution. Therefore, this project focuses on building a semi-automatic smart agriculture drone using affordable components.

III. PLATFORM TECHNOLOGY USED

The main technologies used in this project are:

- KK2.1.5 Flight Controller – Controls drone stability
- FlySky CT6B Transmitter & Receiver – Provides RF communication

• ESP32 Microcontroller – Handles IoT monitoring and web server
• WiFi Access Point Mode – Creates local hotspot for webpage access

ESP32 is selected because it has built-in WiFi, good processing power, and supports camera streaming and web server functionality.

IV. PROBLEM STATEMENT

Traditional pesticide spraying methods are time-consuming, labor-intensive, and harmful to farmers' health. Uniform spraying over large agricultural fields is difficult.

There is a need for a low-cost, wireless, and efficient system that can perform aerial monitoring and controlled spraying without requiring complex automation or internet dependency.

Hence, this project focuses on developing a smart agriculture drone that provides stable flight, real-time monitoring, and wireless spraying control.

V. AIM AND OBJECTIVES

Aim

To design and develop a Smart Agriculture Drone with flight control and IoT-based monitoring system for precision spraying.

Objectives

• To design a stable hexacopter drone
• To implement RF-based flight control
• To integrate ESP32 for real-time monitoring
• To measure temperature, humidity, and soil condition
• To develop a webpage for wireless pump control
• To reduce manual labor and improve spraying efficiency

VI. SYSTEM ARCHITECTURE

The system is divided into two independent parts:

Flight System Architecture

User → Transmitter → RF Signal → Receiver → KK2.1.5 →ESC → Motors

The flight controller processes PWM signals and controlsmotor speed for stable flying.

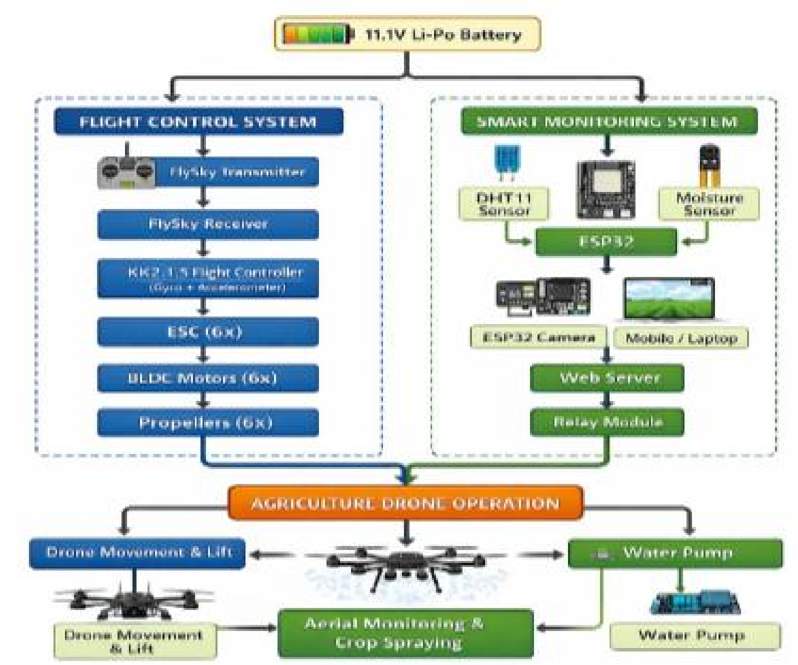
Monitoring System Architecture

Sensors → ESP32 → Web Server → Relay → Pump

ESP32 reads sensor data and displays it on a webpage.When the pump button is pressed, ESP32 activates the relay to start spraying.

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 3, February 2026
Impact Factor: 8.2

1.1 Block Diagram



The Smart Agriculture Drone system is powered by an 11.1VLi-Po battery and is divided into two main parts: Flight Control System and Smart Monitoring & Spraying System.

1. Flight Control System

The FlySky transmitter is used by the user to control the drone.
Control signals are received by the FlySky receiver.
The KK2.1.5 flight controller processes these signals using gyro and accelerometer sensors to maintain balance and stability.
ESCs (Electronic Speed Controllers) control the speed of each motor.
BLDC motors and propellers generate lift and movement of the drone.
This system is responsible for drone movement, lift, and stable flight.

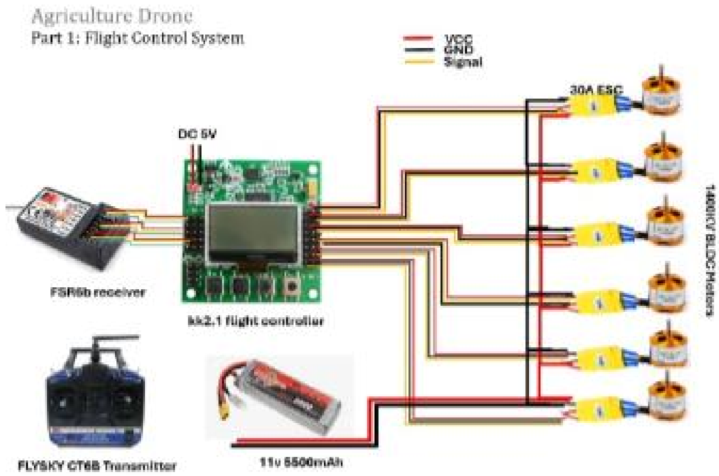
2. Smart Monitoring & Spraying System

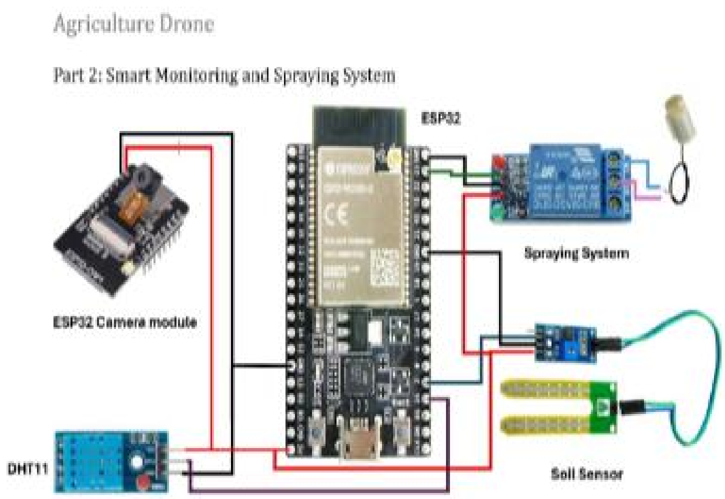
DHT11 sensor measures temperature and humidity.
Soil moisture sensor checks soil condition.
All sensor data is processed by the ESP32 microcontroller.
ESP32 camera provides live video monitoring of crops.
ESP32 hosts a web server, which can be accessed using a mobile or laptop.
Through the web interface, the relay module is controlled to switch the water pump ON or OFF.

DOI: 10.48175/IJARSCT-31333

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 3, February 2026
Impact Factor: 8.2

1.2 Circuit Diagram





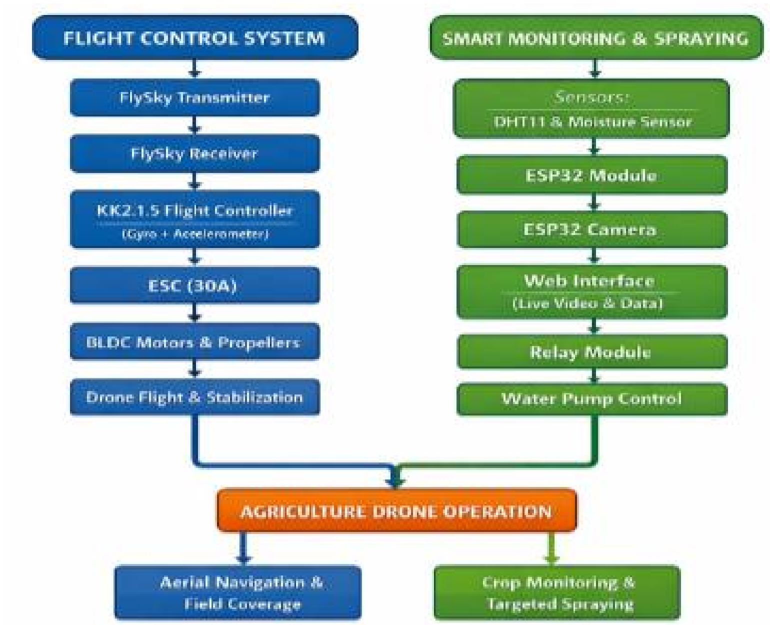
Part 1: Flight Control System (Drone Movement)
The user moves the joystick on the FlySky transmitter
The transmitter sends RF signals.
The receiver receives these signals and sends PWMsignals to the KK2.1.5 flight controller.
The flight controller controls ESCs and motors
Control actions include:
Throttle – up and down
Roll – left and right movement
Pitch – forward and backward
Yaw – rotation

Part 2: Smart Monitoring & Spraying System
When powered ON, the ESP32 creates a WiFi hotspot
The user connects a mobile or laptop to this WiFi

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 3, February 2026
Impact Factor: 8.2

By opening 192.168.4.1, the user can:
See temperature and humidity
Check soil condition (wet or dry)
Watch live video of crops
Turn water pump ON or OFF
The camera has a separate IP 192.168.4.50 for livestreaming.
When the pump button is pressed, the relay activatesthe water pump.
This allows remote spraying during flight.

1.3 Flow Chart



The drone is powered ON using the Li-Po battery.
The flight control system activates and the drone starts flying based on remote control inputs.
At the same time, ESP32 starts the smart monitoring system.
Sensors continuously collect temperature, humidity, and soil moisture data.
The ESP32 camera streams live video of the field.
All data is displayed on a web interface.
When spraying is required, the user turns ON the pump through the webpage.
The relay activates the water pump, and spraying starts during flight.
As a result, the drone performs aerial navigation, crop monitoring, and targeted spraying.

VII. COMPONENTS/MATERIALS

Hexacopter Frame
The hexacopter frame holds all drone components securely and provides structural strength, stability, and proper motor alignment during flight.

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 3, February 2026
Impact Factor: 8.2

11.1V 5000mAh Li-Po Battery
This battery supplies power to motors and electronics, providing sufficient backup and stable voltage for smooth drone operation.

1400KV BLDC Motors
Brushless DC motors convert electrical energy into mechanical rotation to spin propellers and generate lifting thrust.

30A Electronic Speed Controller (ESC)
ESC controls motor speed by adjusting power supplied to motors according to flight controller signals.

ESP32 Microcontroller
ESP32 processes sensor data, creates WiFi network, hosts webpage, and controls relay and pump wirelessly.

DHT11 Sensor
DHT11 measures temperature and humidity from surrounding air and sends digital data to ESP32.

Soil Moisture Sensor
This sensor detects soil wet or dry condition to help decide irrigation requirement.

Relay Module
Relay acts as an electronic switch to safely control water pump using low-voltage ESP32 signals.

Water Pump
The water pump sprays water or pesticide over crops during drone flight for irrigation and protection.

ESP32 Camera Module
Camera module provides live video streaming of crops for real-time monitoring and inspection.

KK2.1.5 Flight Controller
The flight controller stabilizes the drone by processing receiver signals and controlling motor speed for balanced flight.

FlySky CT6B Transmitter
The transmitter sends RF control signals based on joystick movement for throttle, pitch, roll, and yaw control.

10×4.5 Propellers
Propellers rotate using motor force to generate lift and allow stable upward, forward, and directional movement.

VIII. WORKING

When powered ON, the drone flight system becomes active through RF communication. The user controls movement using throttle, roll, pitch, and yaw.
Simultaneously, ESP32 creates a WiFi hotspot. The user connects to the WiFi and enters IP address 192.168.4.1 to open the webpage.
The webpage displays:
• Temperature
• Humidity
• Soil Status

DOI: 10.48175/IJARSCT-31333

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 3, February 2026 Impact Factor: 8.2

• Pump ON/OFF control
The ESP32 camera provides live video streaming at 192.168.4.50.
When the pump button is pressed, the relay activates the water pump and spraying begins. This allows controlled irrigation during flight.

IX. FUTURE SCOPE

The proposed Smart Agriculture Drone can be further improved by adding advanced technologies such as GPS-based autonomous navigation for automatic field mapping and route planning. Artificial Intelligence can be integrated for crop disease detection and health analysis using camera images. The system can also be upgraded with a mobile application for easier control and monitoring from anywhere. Automatic spraying based on soil and environmental conditions can be implemented to reduce human intervention. In future, higher-capacity batteries and solar charging systems can be used to increase flight time. These improvements will make the system more efficient, intelligent, and suitable for large-scale farming.

X. CONCLUSION

The Smart Agriculture Drone successfully combines stable flight control with IoT-based monitoring and precision spraying. The system provides real-time environmental data, live video streaming, and wireless pump control through a simple webpage interface. It reduces manual labor, saves water and pesticides, and improves farmer safety. The use of low-cost components makes the system affordable and practical for small and medium-scale farmers. Experimental testing shows stable performance and reliable operation of both flight and monitoring systems. Overall, this project demonstrates an effective and scalable solution for modern smart farming applications.

REFERENCES

[1] P. Tripicchio, M. Satler, G. Dabisias, E. Ruffaldi, and C. A. Avizzano, "Towards smart farming and sustainable agriculture with drones," IEEE Aerospace and Electronic Systems Magazine, vol. 30, no. 5, pp. 2–10, 2015.
[2] J. Zhang and K. Kovacs, "The application of small unmanned aerial systems for precision agriculture: A review," Precision Agriculture, vol. 13, no. 6, pp. 693–712, 2012.
[3] Espressif Systems, "ESP32 Series Datasheet," Espressif Systems, 2023.
[4] HobbyKing, "KK2.1.5 Multi-Rotor LCD Flight Control Board Manual," HobbyKing Technical Documentation, 2022.
[5] DHT11 Temperature & Humidity Sensor Datasheet, Aosong Electronics Co., Ltd., 2022.