AGRO VISIONARIES

Pioneering sustainable growth for generations

By Asteri

AGRO VISIONARIES

PROBLEM STATEMENT

Traditional farming practices suffer from inefficient resource use, leading to high costs and environmental impact. There is a need for an autonomous solution that optimizes resource application and enhances crop monitoring to improve efficiency and sustainability

UNIQUE CONTRIBUTION FOR 3 MAIN SDG INITIATIVES

Alignment with SDG 1: No Poverty

- Enhances productivity and reduces farming costs for small and marginal farmers.
- Improves the financial well-being of economically vulnerable communities.
- Supports poverty alleviation through cost-effective and efficient agricultural practices.

Alignment with SDG 12: Responsible Consumption and Production

- Minimizes fertilizer waste and overuse through precision agriculture.
- Promotes sustainable farming practices that protect soil health and the environment.
- Optimizes resource use and ensures environmentally friendly production.

Alignment with SDG 15: Life on Land

- Reduces chemical overuse, protecting soil health and biodiversity.
- Supports sustainable land management, ensuring long-term agricultural viability.
- Helps maintain healthy ecosystems critical for sustainable farming.

AGRO VISIONARIES

OBJECTIVES

Objective 01

1.Autonomous Crop Health Analysis: Enable the drone to autonomously scan and map the farm, assessing crop health using parameters such as leaf colour, growth patterns, and soil moisture, providing accurate and consistent crop monitoring.

Objective 02

2.Precision Resource Management: Optimize the application of fertilizers, water, nutrients, and pesticides by spraying only in specific tiles where needed, ensuring efficient resource usage and reducing waste.

Objective 03

3.Machine Learning-Driven Insights: Utilize Machine Learning to detect unhealthy crops and pest infestations, offering actionable insights based on trained datasets, improving early detection and timely intervention.

Objective 04

4.Predictive Analytics for Preventive Care: Provide farmers with predictive recommendations based on ongoing data collection, helping them take preventive actions to avoid future crop issues and improve yields.

Objective 05

Seamless Operation and Data Access via Mobile App: Allow farmers to manage drone operations, monitor real-time data, track resource usage, and access historical data through a user-friendly mobile app, ensuring informed decision-making.

Objective 06

Real-Time Weather Adaptation for Crop Care: Equip the drone with sensors to monitor real-time weather conditions like temperature, humidity, and wind, allowing it to adjust its flight paths, spraying patterns, and analysis strategies, ensuring optimal care under varying environmental conditions.

SOLUTION OVERVIEW

Autonomous Farm Mapping:

- The drone autonomously maps the farm, dividing it into manageable tiles based on area size, creating an optimized flight path.

<u>Machine Learning-Based Analysis:</u>

- **Crop Health Monitoring:** Evaluates crop health using ML by analysing leaf colour, growth patterns, and soil moisture.
- **Pest Detection:** Identifies harmful insects through object detection and sprays pesticides only if insect levels exceed a set threshold.

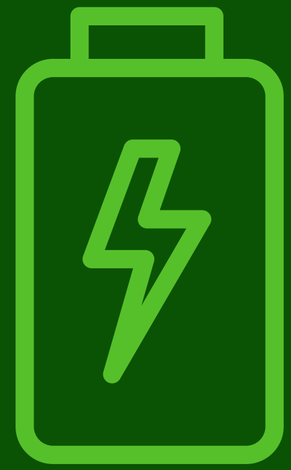
SOLUTION OVERVIEW

Precision Resource Application:

- The drone sprays **fertilizers**, **nutrients** precisely in tiles that need them, minimizing resource waste.

Battery Management:

- When battery drops below 10%, the drone returns to its docking station to **recharge** and **resumes** work after reaching full charge.



5.Data Collection and Insights:

- Collects data on **crop health**, **pest levels**, **water**, and **resource usage**, **providing farmers** with predictive insights and actionable recommendations.

SOLUTION OVERVIEW

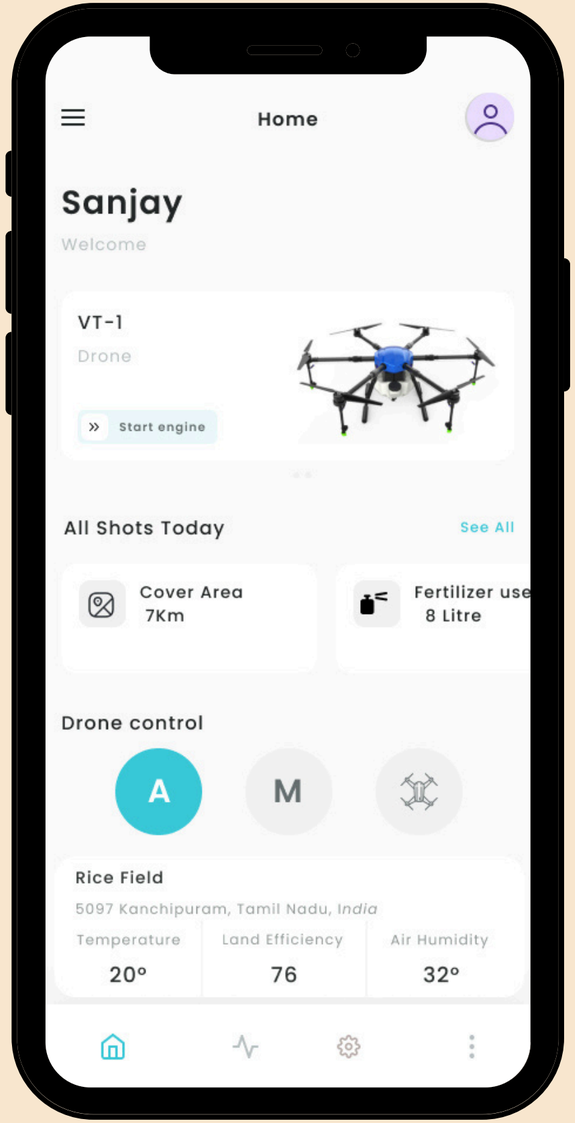
Mobile App for Real-Time Monitoring:

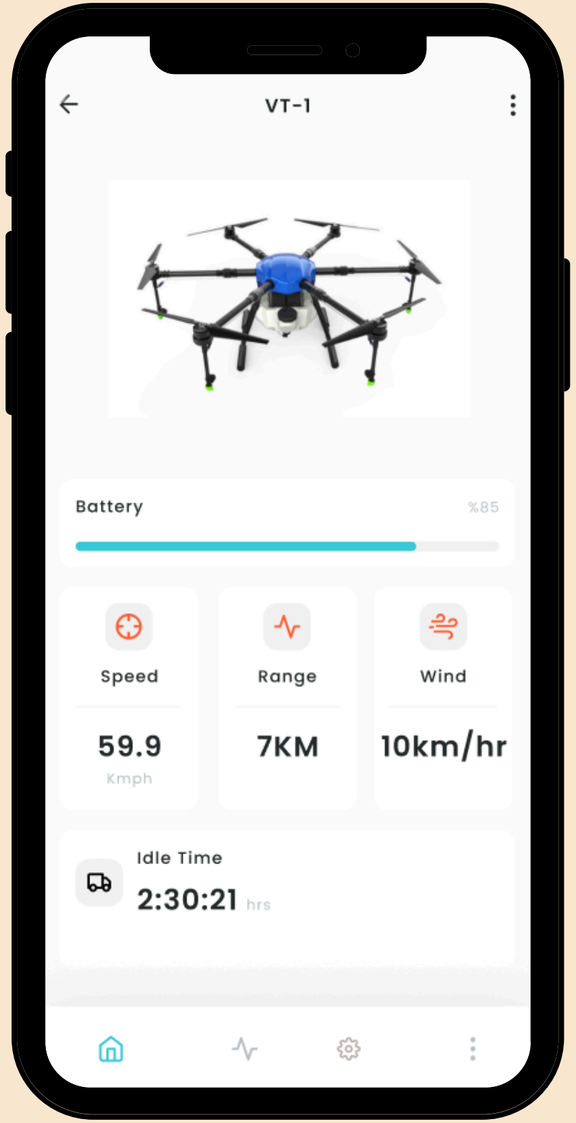
- Farmers can monitor real-time data, control the drone, view historical data, and track resource usage via a mobile app.

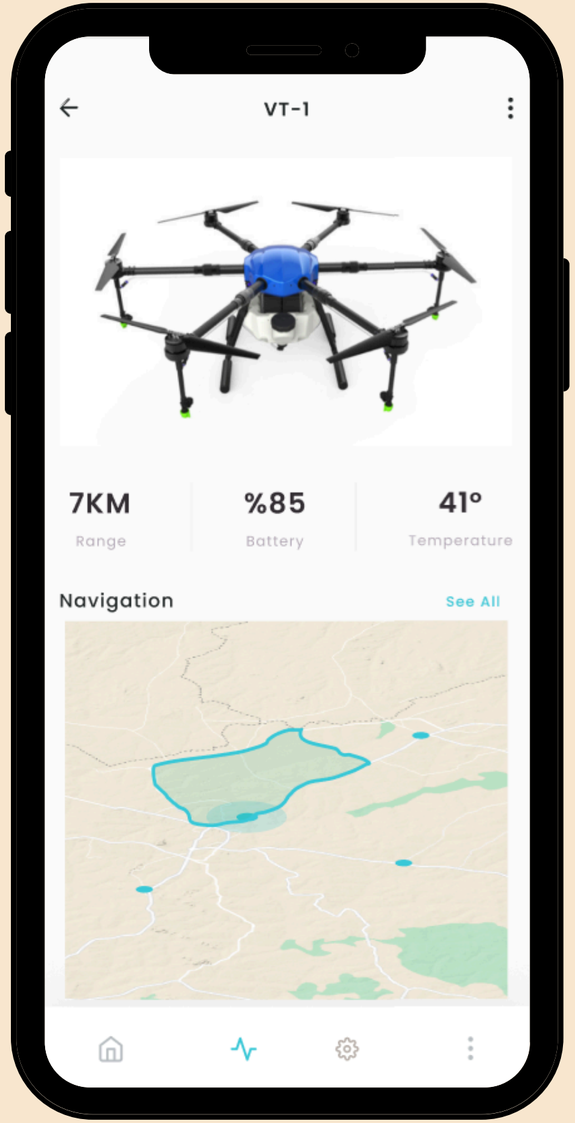
Weather Monitoring for Safe Operation:

- The system continuously **monitors weather conditions** (e.g., wind speed, rain) to ensure **safe operation**.

DRONE MONITORING APP







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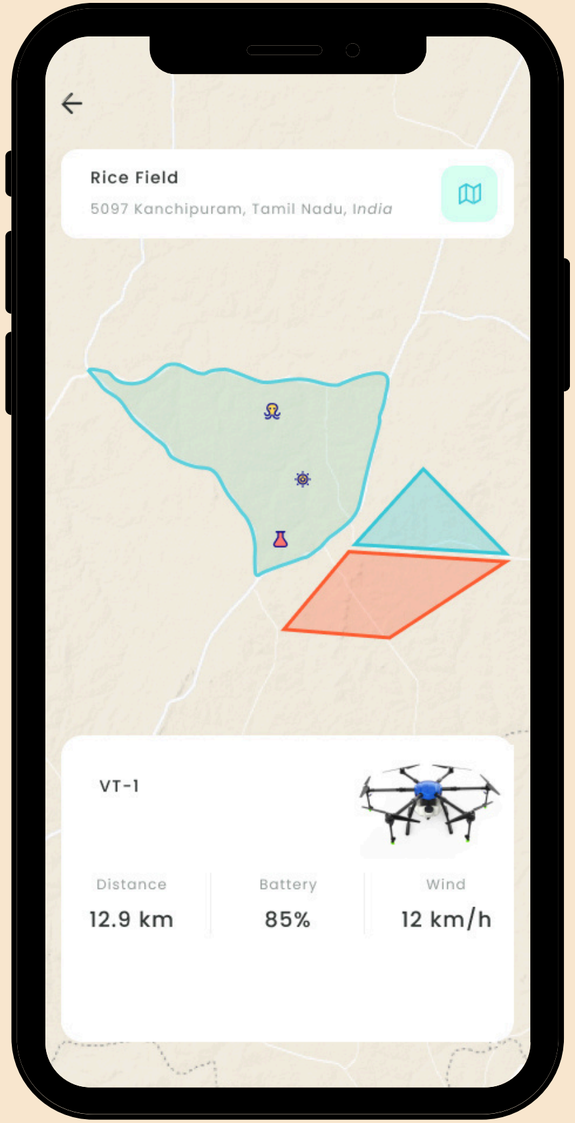
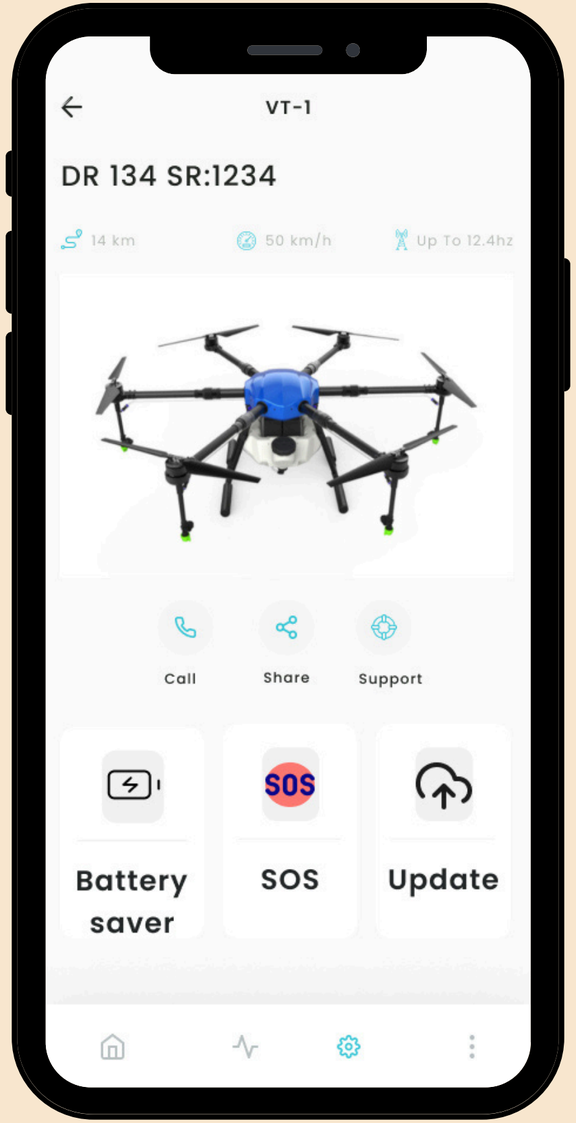
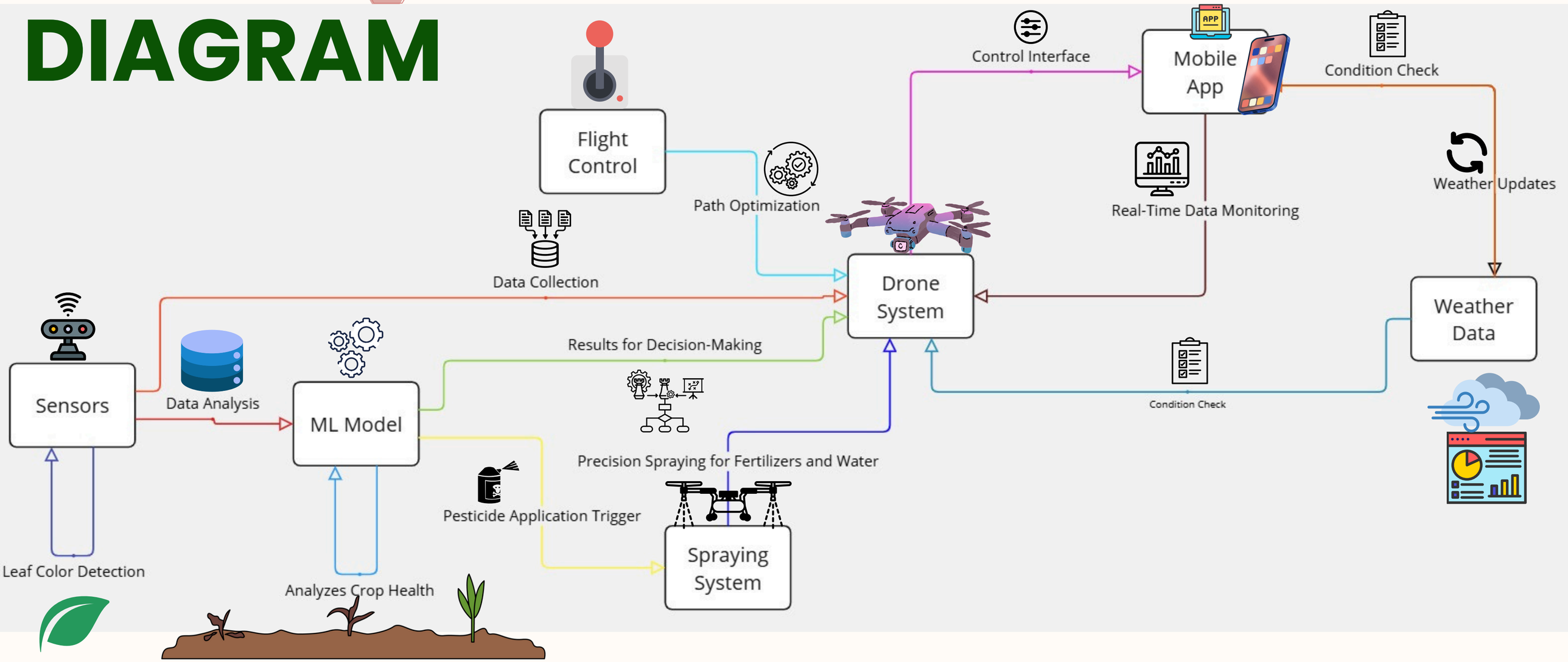




BLOCK DIAGRAM



TECHNICAL IMPLEMENTATION

1. **Modified DJI Phantom 4 with a sprayer attachment:** This is a versatile and cost-effective solution for small-scale agricultural spraying and crop monitoring. Although the Phantom 4 drone is not originally designed for agricultural tasks, its popularity and adaptability make it a great platform for modifications. By adding a custom-built sprayer attachment and upgrading some key components, the Phantom 4 can be turned into an affordable yet functional drone for spraying fertilizers, pesticides, and water, as well as monitoring crop health.

Hardware Components to be integrated in the Modified DJI Phantom 4:

- **Motors**: More powerful motors provide higher thrust for better lift capacity.
- **Frame Reinforcement**: Carbon fiber components are often used for structural support without increasing the overall weight.
- **Battery Options**: Aftermarket batteries with a higher capacity (6000mAh to 10000mAh) are typically used.
- **Pump Options**: Peristaltic pumps or diaphragm pumps are commonly used.
- **Camera Types**: RGB or multispectral cameras for monitoring plant health.
- **Altitude Sensors**: Lidar or ultrasonic sensors help maintain a consistent spraying height.
- **Mobile App**: Custom made App which has special functions and

Software Technical Details for Modified DJI Phantom 4 with Sprayer Attachment:

2.) DJI SDK (Software Development Kit):

DJI SDK allows you to access and modify the drone's flight settings and control functions programmatically. With this, you can write custom code to automate the drone's operations, such as:

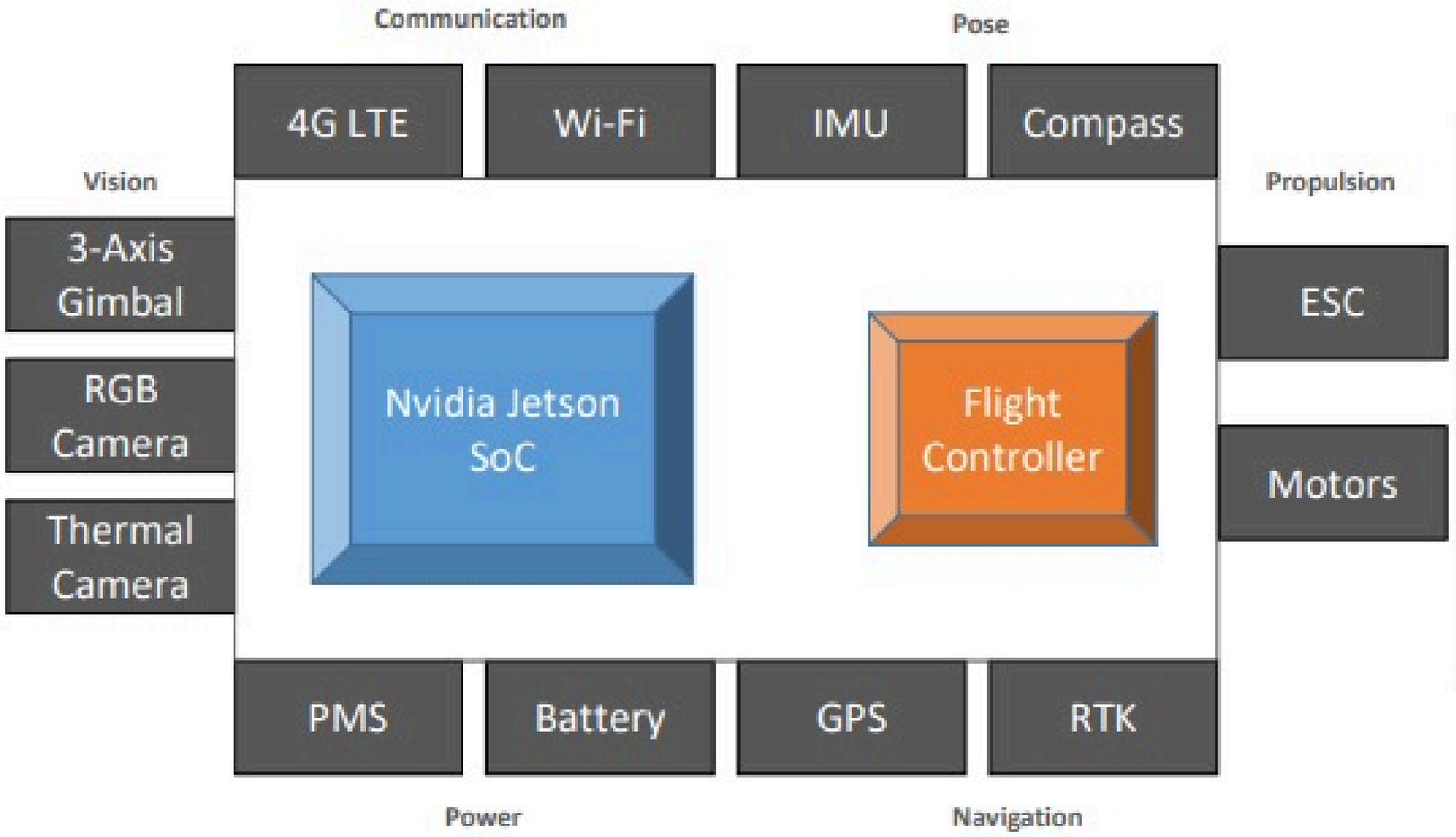
- **Waypoints:** For automated flight paths and route planning based on a map.
- **Altitude control:** Ensuring a consistent altitude for spraying.
- **Return-to-home (RTH):** Automatically bringing the drone back home in case of low battery or other emergencies.
- **Battery and motor monitoring:** Constant monitoring of power usage to avoid unexpected shutdowns during spraying.

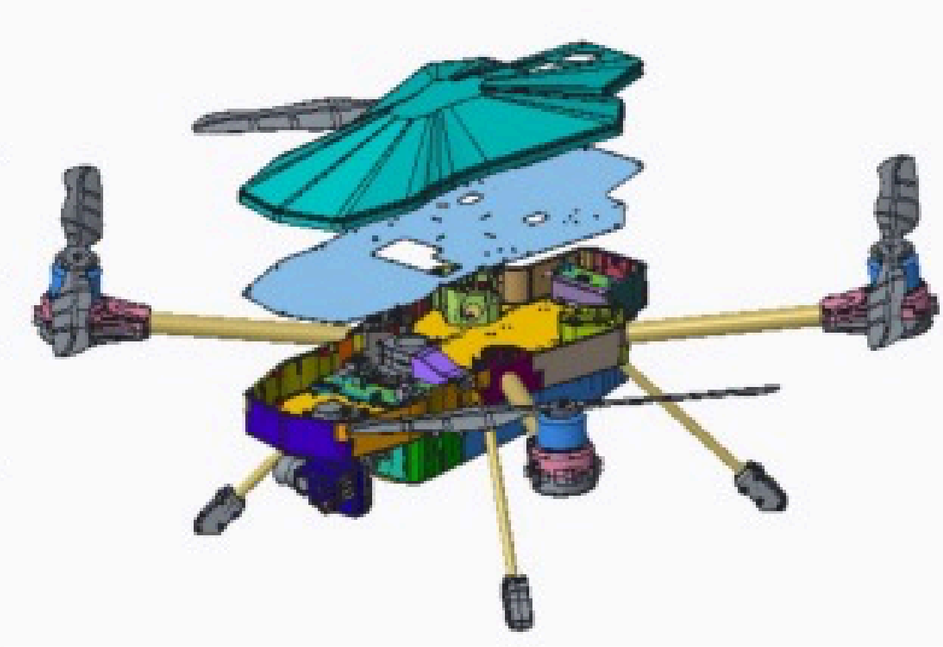
3.) Sprayer System Control Software:

To control the sprayer system, a relay switch or microcontroller (Arduino or Raspberry Pi) is used to trigger the pump. This system can either be controlled manually through a mobile app or automated to activate during specific conditions, such as when the drone is over certain zones.

- **Geofencing or GPS coordinates**: The sprayer system can automatically activate when the drone flies over a designated area. This can be configured in the flight control software.
- **Microcontroller:** Manages the sprayer system's activation based on instructions from the flight control software
- **Pre-programmed flight paths:** Ensure that the sprayer only operates during specific parts of the flight path.

Dive into Hardware Design





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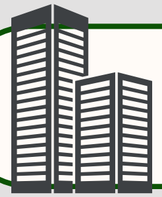
TARGET AUDIENCE

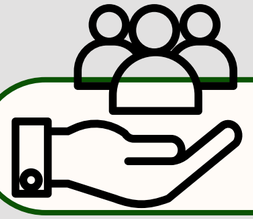
Large-Scale and Commercial Farmers

Farmers with extensive acreage who need efficient, automated solutions to monitor and maintain crop health.



Agribusiness Corporations

Farmers with extensive acreage who need efficient, automated solutions to monitor and maintain crop health.



Agricultural Service Providers

Companies offering farm management, crop consulting, or spraying services that could integrate drone technology into their offerings.

Agricultural Cooperatives

Groups of farmers pooling resources to afford advanced technology that individual members might not be able to purchase alone.

Agricultural Researchers and Universities

Institutions studying advanced farming methods, crop health, or pest control who could use the drone for research and field experiments.

Tech-Savvy and Progressive Farmers

Early adopters in the agriculture sector who are open to using emerging technology, such as drones and machine learning, to optimize operations.

BUSINESS MODEL CANVAS

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Key Partners

- Local drone manufacturers and suppliers
- Agricultural extension services
- Fertilizer companies
- Tamil Nadu Agricultural University and other research institutions
- Government agriculture and rural development departments
- NGOs focused on sustainable farming

Key Activities

- Research and development of drone technology for agriculture
- Manufacturing and assembling drones
- Testing and regulatory compliance
- Maintenance and repair services
- Training programs for farmers on drone usage
- Marketing and promotion

Key Resources

- Skilled R&D team for drone development
- Partnerships with local fertilizer experts
- Financial resources for scaling up production and outreach
- Agricultural datasets to optimize drone performance
- Manufacturing and service facilities

Value Propositions

- Increased crop yield through precise fertilizer application
- Reduced labor costs and improved efficiency
- Environmentally friendly by reducing fertilizer wastage
- Accessible for small and marginal farmers in Tamil Nadu
- User-friendly interface for easy adoption by farmers
- Enhanced monitoring of crop health

Customer Relationships

- Dedicated customer support for maintenance and troubleshooting
- Educational workshops and demonstrations
- Regular feedback collection to improve services
- Collaboration with farmers for improvement
- Digital platform for direct engagement and support

Channels

- Direct sales through agricultural expos and fairs
- Partnerships with local agricultural cooperatives
- Collaboration with government schemes to subsidize drones for farmers

Customer Segments

- Small to medium-sized farmers in Tamil Nadu
- Large-scale agricultural cooperatives
- Government and agricultural organizations promoting modern farming
- Agri-tech enthusiasts interested in precision agriculture

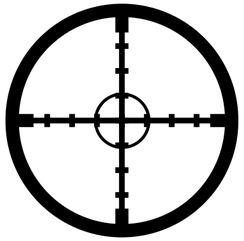
Cost Structure

- Research and development costs for drone technology
- Manufacturing and assembly costs
- Marketing and farmer training expenses
- Cost of partnerships and regulatory compliance
- Maintenance and repair infrastructure
- Customer support system costs

Revenue Streams

- Sales of autonomous fertilizer drones
- Subscription-based maintenance and support service
- Training and consulting services for farmers and cooperatives
- Revenue from data collected (if offered as a value-added service)
- Government subsidies or grants for agricultural innovation
- Partnership revenue with fertilizer companies for bundled products

FUTURE SCOPE



- **Advanced AI Analytics for Precision Farming:** Improving machine learning algorithms to accurately detect specific crop diseases, nutrient deficiencies, and soil health issues would allow farmers to take early, targeted actions, reducing crop loss and optimizing yield potential.

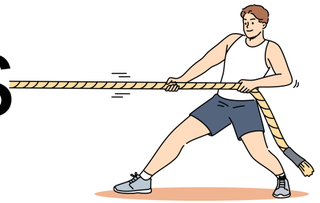
- **Swarm Drone Technology for Large-Scale Operations:** Developing autonomous swarm drones to work collaboratively can significantly increase efficiency on large farms. Coordinated drones could handle tasks simultaneously (e.g., monitoring, spraying, watering) across vast areas, reducing labor costs and increasing productivity.

FUTURE SCOPE

- **Integration with IoT Sensors for Real-Time Data Collection: Connecting drones with ground-based IoT sensors** (e.g., for soil moisture, pH, and temperature) would provide a comprehensive view of field conditions. This integration would lead to precise and data-driven crop management based on specific environmental needs.

- **Self-Sustaining Power Solutions:** Introducing solar-powered drones or mobile solar charging stations could extend operational time in remote locations. Renewable energy solutions would make the system more sustainable and reduce dependency on frequent charging.

Challenges



1. Technical Feasibility and Development

- Developing a drone system with sufficient autonomy and functionality, including integrating the sprayer system, crop health monitoring, and precise spraying mechanisms, all while working within the limitations of the DJI Phantom 4's hardware. Achieving this within the constraints of the project timeline and resources could be a significant challenge.

2. Cost Constraints

- Building a cost-effective drone system that can be proposed as a viable solution for poor farmers. Balancing the need for advanced sensors, software, and hardware with the project's limited budget may force us to prioritize features and make trade-offs.

3. Limited Access to Resources

- Access to specialized components, such as high-quality sensors for crop health monitoring or custom sprayer attachments, may be limited due to budget restrictions or lack of local suppliers. This can hinder the development of your solution.

4. Data Collection and Processing

- Gathering sufficient and accurate data from real-world farming conditions, especially if you do not have access to a farm or test site. Additionally, processing large amounts of sensor data and ensuring it integrates with the drone system for actionable insights may be more complex than anticipated.

5. Integration of Components

- Challenge: Integrating multiple hardware components (e.g., the drone, sprayer system, sensors, and payload controllers) into a cohesive system that works smoothly. Ensuring that the sprayer attachment triggers correctly based on GPS data and flight parameters can be technically difficult and time-consuming.


THE
END