ENHANCEMENT OF DIGITAL CROP SURVEY USING MULTI-PURPOSE AGRI UAV

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Abstract: An efficient and sustainable digital crop management requires modern utilization of incredible innovative methodology to monitor large yield areas. The activities like distribution of seeds, providing adequate moisture for seed germination, supply of essential nutrients to ensure the crop growth and yields, tracking the development of crops and detecting issues, monitoring and recording of crop yields are carried out by Enhanced Multi-purpose Unmanned Aerial Vehicle (EMUAV). It is proposed to develop an optimizing algorithm with AI and ML techniques. Internet of Things (IoT) based smart sensors are incorporated to improvethe yield of the crops. The yield surveying, monitoring and recording by the use of EMUAV with AI and IoT techniques is implemented in this proposed Digital Crop Survey (DCS) and by this, the entire yield profit is increased consistently and alsothe economic conservation of water is achieved. This proposed work ensures the crop security and promoting the sustainable farming methods in Tamil Nadu.

Keywords: Unmanned Aerial Vehicle, Artificial Intelligence, Internet of things, Digital Crop Survey.

I. Introduction

Tamil Nadu, renowned for its varied landscapes and rich cultural heritage, is also a key agricultural center in India. Agriculture plays a vital role in the state's economy, supporting both local food security and national sustenance. Tamil Nadu boasts several districts (Thanjavur, Erode, Coimbatore, Salem, Pudukkottai, Madurai, Vilupuram, Theni, Dindigul, Nagappattinam) that are highly productive in terms of agriculture. These regions are essential not only for the state's food supply but also for the livelihoods of millions of farmers who depend on them. Tamil Nadu has 130.33 lakh hectares of land, with a gross cropped area of around 59.42 lakh hectares.

Tamil Nadu Agricultural University have been enlisted to assist with a digital crop survey in Coimbatore and Tiruppur districts, as part of a statewide initiative led by the Department of Agriculture and Farmers' Welfare. In Coimbatore, the survey involves 194 Agriculture Department staff members and approximately 650 students from the university, who are tasked with mapping agricultural and horticultural land use across the region. The survey will cover an area of 1.62 lakh acres in Coimbatore district alone. The digital crop survey app offers a range of farmer-centric solutions, providing crucial information on crop planning, health, access to farm inputs, credit, insurance, and crop estimation. It also aids in market intelligence and supports the growth of the Agri-Tech industry and start-ups. This digital initiative helps clarify the types of crops being cultivated across all farmlands during different agricultural seasons.

A) Digital Crop Survey (DCS):

The Digital Crop Survey project for crop survey has been implemented by the Government of India in the year 2023-24. In this survey, the surveyor uses mobile application to collect crop details along with Geo-tagging photos of all survey numbers. In India, our government aims to gain a comprehensive understanding of the crops being cultivated and the irrigation methods employed across all farmlands in the state. The project's vision is to establish a unified, verified source of farmer and crop data that can be accessed and utilized by various departments and stakeholders within the agricultural ecosystem.

In Tamil Nadu, The Digital General Crop Estimation Survey (DGCES) will generate yield estimates through scientifically designed crop-cutting experiments. This initiative will be highly valuable in providing precise assessments of agricultural production. The digital crop survey is being launched in Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, Kerala, and Gujarat. Following the initial phase, it will be progressively expanded nationwide. The survey will gather data on various crops cultivated by farmers in their fields. This information will be obtained automatically using geo-referenced maps of farmland plots and remote sensing imagery.

B) Multi-Purpose Agri UAV:

Objective of Proposed Work:

- To spread the seeds uniformly in the agriculture land.
- To pour the water in the planted areas.
- To sprinkle the fertilizer on the crops.
- To monitor and survey the growth of the yields.

➢ Spreading Seeds Uniformly in Agricultural Land:

- **Objective:** Ensure even distribution of seeds to optimize crop density and yield.
- **Methods:** Aerial seeding (in large-scale operations or remote areas).

➢ Watering the Planted Areas:

- **Objective:** Provide adequate moisture for seed germination and crop growth.
- **Methods:** Use of sensors and automated systems for optimal water management.


➢ **Sprinkling Fertilizer on the Crops:**

- **Objective:** Supply essential nutrients to enhance crop growth and yields.
- **Methods:** Precision fertilization using soil tests to apply the right amount of urea's in the right places.

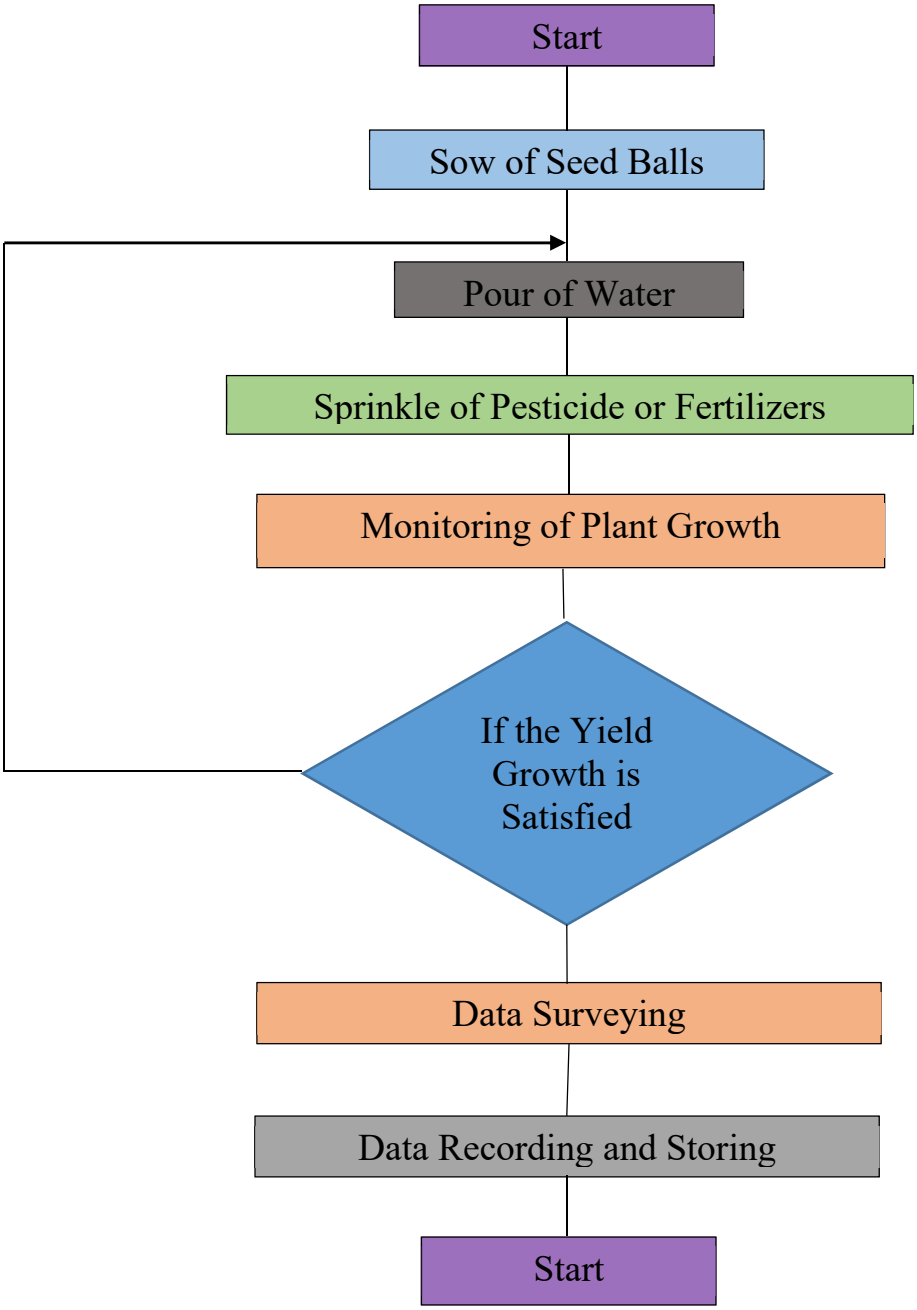

➢ **Monitoring and Surveying Crop Growth:**

- **Objective:** Track the development of crops and detect issues (pests, diseases, or deficiencies) early.
- **Methods:** Remote sensing technologies (satellites, UAVs, and drones).
- Sensors and IoT devices (soil moisture, temperature, and nutrient sensors.
- Data analytics and AI for predicting crop health and yield.

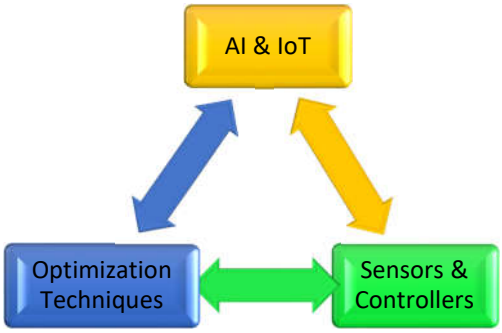

II. Methodology

Multi-purpose Agri UAV Methodology:

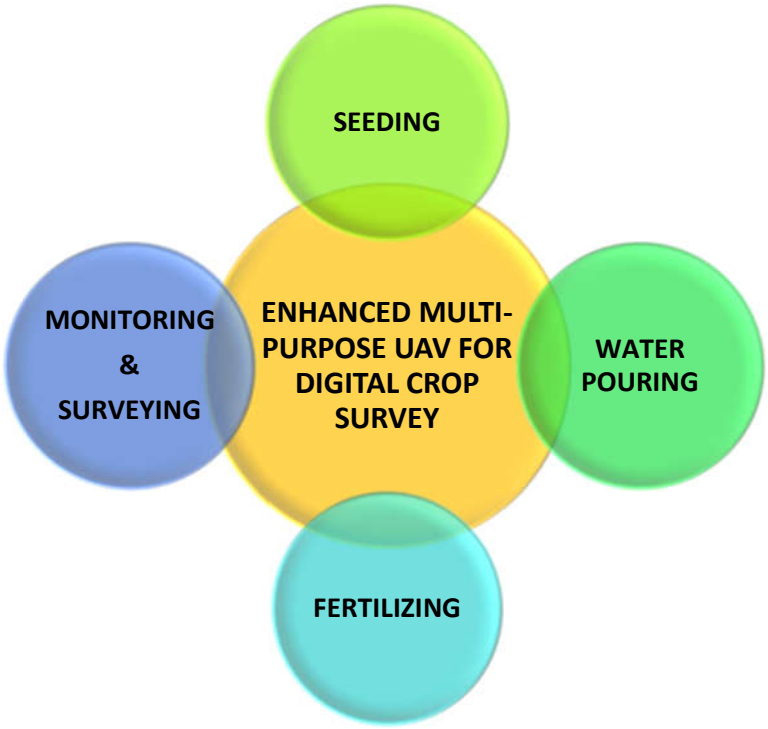
Sl. No	Description	Nature of Work	Techniques	Optimizing Algorithms
1	Seeding	Sowing Seeds	Artificial Intelligence (AI)	Swarm Optimization Algorithm
2	Watering	Pouring Waters		Flower Pollination Algorithm
3	Fertilizing	Sprinkling of Fertilizers or Urea's		
4	Surveying	Yield Surveying, Monitoring and Recording	Artificial Intelligence (AI) and Internet of Things (IoT)	Machine Learning Algorithm



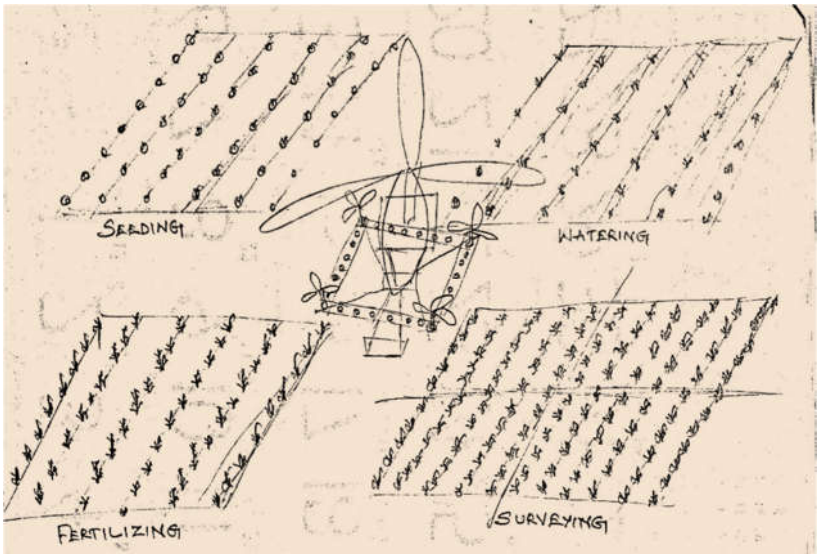
Flow Chart for Proposed Work



Digital Crop Management



Enhanced Performance of Digital Crop Survey using Multi-purpose UAV



III. Multi-Purpose UAV for Digital Survey

Statistics about the Digital Crop Survey (DCS) in India:

Sl. No.	Statistics	Challenges	Benefits
1	The DCS was piloted in 11 states in 2023-24.	The DCS data may be inconsistent, fragmented due to technical difficulties and lack of uniformity in coverage.	The DCS data can help government agencies provide services to farmers.
2	The DCS was intended to cover 400 districts in 2024-25.	The DCS data may be inaccurate due to weather interference, variability in satellite readings.	The DCS data can help government agencies provide direct cash benefits to farmers.
3	The DCS is expected to be fully implemented nationwide by 2025-26.	The DCS data may not reflect actual crop conditions.	The DCS data can help government agencies sanction credits to farmers.
4	The DCS uses a mobile app and portal to collect crop details and geotagged photos.		The DCS data can help government agencies provide crop insurance to farmers.
5	The DCS data will help government agencies with crop insurance, credit card-linked crop loans, and fertilizer use.		The DCS data can help government agencies provide other schemes to farmers.
6	The DCS data will also help with MSP-based procurement.		
7	The DCS data will help with developing systems for balanced fertilizer use.		

Output Calculation:

Sl. No	Description	Quantity
1	Total area of agricultural land	Acres
2	Area utilized for crops	Acres
3	Ball of seeds used	Kgs
4	Volume of water	Liters
5	Fertilizers or pesticides utilized	Kgs
6	Amount of crop yield growths	Rs.
7	Plant diseases locations	Sq.mtr.
8	Total cost invested	Rs.
9	Total amount gained	Rs.
10	Comparison of percentage by the usage of Manual and Digital Survey UAV	%

Conclusion:

In conclusion, agricultural UAVs are revolutionizing modern farming by integrating cutting-edge technologies such as artificial intelligence, robotics, and big data are utilized for Digital Crop Survey. Their diverse applications, ranging from precision pesticide spraying to crop growth assessment, highlight their growing importance in achieving sustainable and efficient farming practices. As the market for these technologies continues to expand, it is crucial to address challenges related to their deployment, such as regulatory constraints, cost barriers, and technological limitations. In this work, it completely provides more efficiency and provides data

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