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- **Problem Statement ID – SIH1611**
- **Problem Statement Title- Drone-Based Intelligent System for Apple Orchard Management in Himachal Pradesh**
- **Theme-Agriculture, Food Tech & Rural Development**
- **PS Category- Hardware**
- **Team ID-14581**
- **Team Name-Harvest Hackers**

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OrchardSense

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Proposed Solution

- We are building **specialized attachments** for any drones to monitor, assess, analyze, give insights, and do action, for apple Orchards in Himachal Pradesh.

- **Orchard Sense has 2 Attachments:**
- 1. **MIDS**(Multispectral Imaging Drone System): A computer vision camera system equipped with IR NDVI sensors and capable of capturing HD footage provides a robust solution for estimating yield, monitoring production health, and detecting diseases in apple orchards
- 2. **RPAS**(Robotic Pesticide Application Systems): A robotic system for precise pesticide application in apple orchards. It features targeted spraying to minimize pesticide use, autonomous navigation with GPS, real-time monitoring through integrated sensors, and data collection for informed pest management. This innovative solution enhances crop health while promoting sustainable farming practices.

- **Farmers** will be provided with a **dashboard** on (Web App+Mobile Application) for the real-time data of their field mapped with details which they can utilize for action plans for the yield, pesticide, and health assessment of the trees and the fruit.

- We propose an end-to-end system with well-defined **Drone routines** for assessing and managing the Orchards.

Key Features

- **End-to-end system**: Easy-to-use hardware and software.
- **Farmer-friendly app**: Real-time data, simple reports, GUI mapping.
- **Edge computing**: Optimized onboard and ground processing for insights.
- Tree health assessment, stress detection, **apple quality** evaluation.
- **Yield estimation** and precise pesticide/nutrient recommendations.
- **Real-Time Harvesting Data** At Your Fingertips
- **Defined drone routines** & Intelligent Flight Modes for orchard assessment and management.
- **Early detection** of **tree health** issues (chlorophyll and moisture levels).

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TECHNICAL APPROACH

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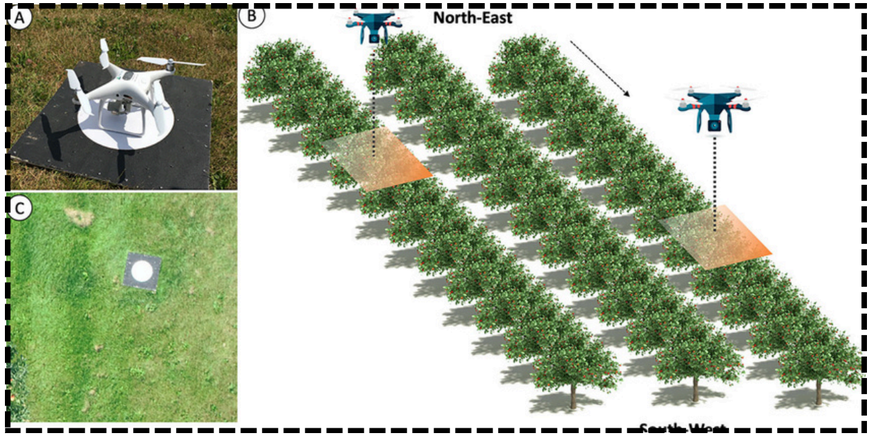
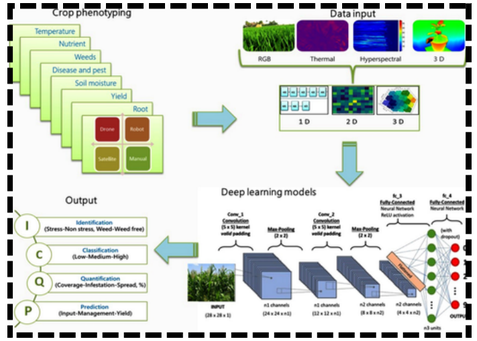
System Architecture

1. **Drone attachments** with multispectral and thermal cameras assess tree health and map the farm.
2. **Sensors:** IR and NDVI for tree health, apple quality, and yield.(LiDAR & (Vis/NIR) Sensors)
3. **Data Processing:** Edge computing for image capture and onboard computing. (Raspberry Pi 5)
4. **Data Integration:** Virtual mapping and precise recommendations. (Data channels through LoRA Wi-Fi)
5. **Compatibility:** Fits various drones , and integrates with farm management software. (3D printed)
6. **Real-time insights**, historical data, and better productivity. (Fine-tuned for accuracy)
7. **AI & ML**: CNN predicts disease, pest outbreaks, and yield. [SSD (Single Shot MultiBox Detector) & ORB (Oriented FAST and Rotated BRIEF)]
8. **Precision Spraying:** Targeted fertilizer and pesticide application. (Robotic Attachment)
9. **Insurance Claim:** Drone footage, blockchain for traceability, claim process from disaster.

Flow: Camera captures → Jetson analyzes → Arm sprays → Data to cloud/mobile.

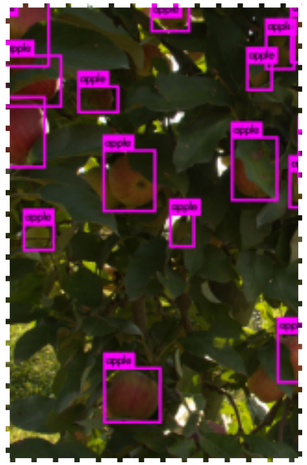


3.1 Digitising the farm

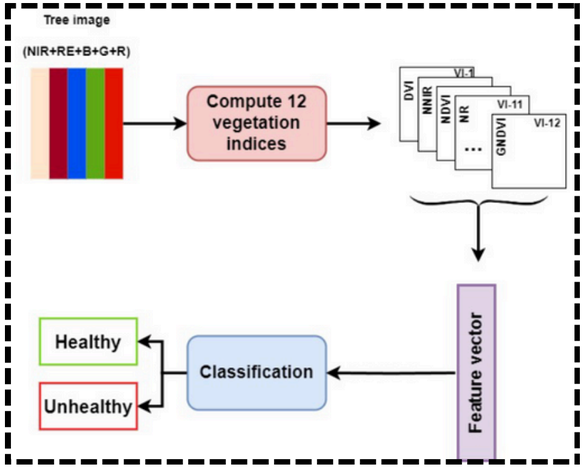


3.2 Img processing of Agri Indiced footage

3.3 MIDS(CV attachment)



3.4 Apple detection



3.5 Segmentation &classification

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FEASIBILITY AND VIABILITY

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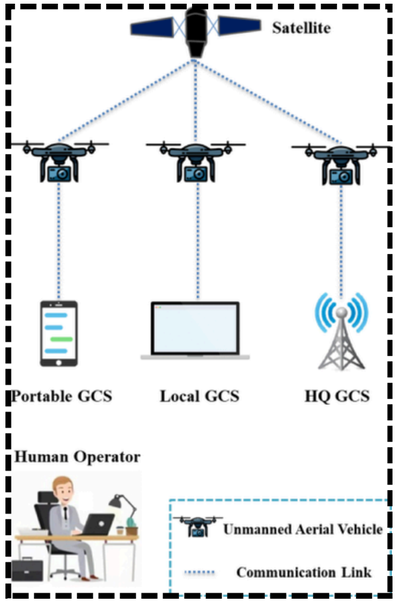
Viability

- **Regional Requirements**: The agricultural difficulties of hilly regions include inaccessibility and erratic weather. Administration monitoring systems which would function without human intervention would be especially helpful to the farmers of this region.
- **Adoption Rate**: Now, progressive farmers in these areas are developing an increased interest in precision agriculture though adoption will take a bit more time as this technology is more costly and has fewer infrastructural facilities.
- **Development Costs**: Being a product from the country, it is not expensive.
- **Pricing Strategy**: Finance or subsidy packages are introduced in the form of price adjustment to what the farmer needs.
- **Financial Benefits**: more apples produced, higher income; demonstration projects could be attractive.

Feasibility

- **Competitive Environment**: Niche Market: orchards of specific characteristics, can be expanded for other Horticulture such as Mango and Peaches.
- **Technological Feasibility**: Most conditions can be tolerated by drones equipped with IR and NDVI sensors which can be used in hilly/mountainous terrain. Ruggedized data processing equipment to be used.
- **Development and Production**: The system needs to be tested at high altitude. Local manufacturing or assembly will help solve logistical problems while local technology will make its production in-country possible.
- **Regulatory & Market Feasibility:**Complies with drone and pesticide regulations.High adoption potential in orchards, with competitive advantages in precision and efficiency.



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IMPACT AND BENEFITS

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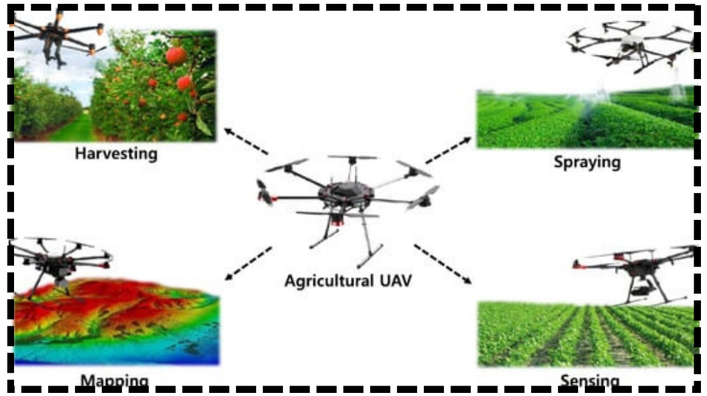
Well, for large orchards, the Apple Orchard Owner and Farmer will no longer need to test Horticulture health and yield in person; the drones with attachments will do this plus the Harvesting.

- **Early Detection**: sensors spot plant stress and diseases, enabling prompt action.
- **Continuous Tracking**: Monitors tree health, enhancing orchard management.
- Yield Estimation:
- **Precise Data**: Offers accurate apple yield estimates for improved harvest planning and resource use.
- **UAVs optimize pesticide and nutrient use**, cutting waste and costs.
- **Cost Savings**: Reduces chemical and fertilizer costs, lowering environmental impact.
- **Fruit Counting**: It detects and counts apples for yield estimation and quality control.
- **Quality Monitoring**: Evaluates apple quality remotely, reducing manual inspection.
- **Terrain Navigation**: UAVs fly through rugged Himachal Pradesh terrain to collect reliable data.
- **Accessibility**: Covers hard-to-reach areas comprehensively.
- **Real-Time Insights**: Merges aerial data and ground observations for a full health overview.
- It provides actionable recommendations for better orchard management.
- **Time Savings**: Cuts down inspection time.
- **Environmental Impact**: Promotes healthy practices while reducing pesticide and fertilizer use.



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