PROJECT TIMELINE

Week 1: Last Week of September (Start)

Initial Setup & Resource Allocation

- Kick-off meeting with team members and stakeholders.
- Assign roles and responsibilities.
- Finalize component procurement (e.g., Raspberry Pi Camera, Multispectral Filters, LoRa modules).
- Prepare a detailed project plan and finalize milestones.

Week 2: 1st Week of October

Component Integration & Initial Assembly

- Receive and inspect the ordered components.
- Assemble the drone's physical structure (install frame, motors, propellers).
- Begin integration of flight controller (Pixhawk PX4) and GPS module.
- Test power systems (batteries, power distribution board).
- Set up the microcontroller (Raspberry Pi 4/5) and basic sensor calibration.

Week 3: 2nd Week of October

Multispectral Camera and Sensor Integration

- Install the Raspberry Pi Camera and custom multispectral filters (Hoya R72, Schott RG630, Wratten 58).
- Ensure the multispectral camera is functional and capture initial test images.
- Integrate thermal imaging camera (Waveshare MLX90640).
- Connect other minor sensors (DHT22, BMP280, MH-Z19).
- Set up the LoRa communication module and test the connection range.

Week 4: 3rd Week of October

Drone Flight Tests and Calibration

- Conduct initial flight tests and calibrate the flight controller.
- Test flight stability and battery life with the full component load.
- Verify real-time data transmission (using LoRa modules) during flight.
- Perform multispectral and thermal imaging tests in-flight to ensure proper functioning.

Week 5: 4th Week of October

Data Collection and Deep Learning Model Setup

- Begin collecting data from the test flights (multispectral, thermal, and RGB images).
- Preprocess the image data for plant health assessment.
- Set up the deep learning model for disease/pest detection and yield prediction.
- Integrate VRT (Variable Rate Technology) for fertilizer spraying, if required.

Week 6: 1st Week of November

Final Testing & Debugging

- Refine the flight control and image processing algorithms.
- Conduct full drone missions in an apple orchard to collect data and test functionalities.
- Evaluate the deep learning model's accuracy for disease/pest prediction.
- Final adjustments to the camera settings, filters, and communication range.

Week 7: 2nd Week of November

Project Finalization & Presentation

- Prepare the final project report, presentations, and documentation.

- Conduct a demonstration of the drone system.
- Present the project outcomes to stakeholders, highlighting the technical solutions and benefits (e.g., disease detection, yield prediction).
- Address any last-minute issues before final submission.

Final Deliverables

- **Functional Drone**: Fully assembled and tested with multispectral and thermal imaging capabilities.
- **Data Processing Model**: Demonstrating disease/pest detection and yield prediction.
- **Final Report**: Complete with data, analysis, and future scope suggestions.
- **Presentation/Demo**: Showcase the drone's capabilities in real-time.

PROJECT BACKUP TIMELINE

This timeline is presented in case we present the ROS simulation of the drone to showcase the functionality.

Week 1 (Last week of September)

- **Project Initialization:**
    - Finalize the project objectives, roles, and responsibilities.
    - Set up the development environment for ROS and simulation tools (e.g., Gazebo).
    - Install required ROS packages and libraries for drone control, camera simulation, and sensor data handling.

Week 2 (First week of October)

- **Multispectral Imaging System Setup (Simulation):**
    - Implement simulated cameras (RGB and Multispectral) using filters in the Gazebo simulation environment.
    - Configure camera models to simulate different spectral bands (NIR, Red, Red Edge, Green).
    - Set up ROS nodes for processing multispectral camera data.
- **Sensor and Communication Simulation Setup:**
    - Implement simulated minor sensors (temperature, humidity, CO2, etc.) in ROS.
    - Simulate LoRa-based long-range communication between the drone and ground station.

Week 3 (Second week of October)

- **Deep Learning Integration:**
    - Begin integrating plant health monitoring algorithms into the ROS environment.
    - Set up pipelines for processing simulated multispectral images to generate plant health indices (NDVI, GNDVI, etc.).
    - Implement ROS nodes for yield prediction using deep learning models.
- **Flight Control Simulation:**
    - Implement flight control system using ROS and Gazebo, focusing on basic navigation and waypoint following.
    - Test simple automated flight paths for monitoring apple orchards using pre-defined waypoints.

Week 4 (Third week of October)

- **Advanced Control System and Autonomous Navigation:**
    - Implement and test more advanced control algorithms for precision navigation over the orchard.
    - Simulate Variable Rate Technology (VRT) for targeted spraying of fertilizers based on plant health data.

- **Optimize Data Processing:**
    - Optimize image processing and deep learning model performance for real-time plant health monitoring and decision-making.
    - Integrate ROS communication nodes to relay live data to the simulated ground station interface.

Week 5 (Fourth week of October)

- **Testing and Validation (Simulation):**
    - Run full-scale simulated missions in the virtual orchard environment, collecting multispectral data and executing VRT-based spraying.
    - Validate plant health predictions, yield estimates, and efficiency of the spraying system using the simulated environment.

Week 6 (First week of November)

- **Refinement and Debugging:**
    - Fine-tune flight control algorithms, sensor integration, and communication nodes.
    - Conduct final tests of the entire drone system, ensuring all components (multispectral imaging, plant health monitoring, yield prediction, VRT) are working in sync.
- **Documentation Preparation:**
    - Complete technical documentation for the project, including system architecture, algorithms used, and simulation results.
    - Prepare the final presentation.

Week 7 (Second week of November)

- **Final Presentation and Project Submission:**
    - Finalize the project report and prepare a detailed presentation.
    - Submit the project, including simulations, technical documentation, and performance results.
