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- **Problem Statement ID – 25015**
- **Problem Statement Title- Intelligent Pesticide Sprinkling System Determined by the infection Infection level of Plant**
- **Theme- Agriculture, Foodtech & Rural Development**
- **PS Category- Hardware**
- **Team ID-**
- **Team Name (Registered on portal)**

AgriShield IoT Rover

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Proposed Solution

- AI-powered IoT Rover scans plants, detects infection, and sprays only infected ones.
- Programmable with farm dimensions. Navigates row by row
- Dashboard shows real-time health, alerts, and reports.
- Cuts excess pesticide use -> saves cost & protects environment.
- Automates spraying -> saves farmer/ labor time.
- Accurate detection -> better yield & safer food.
- Plant-level precision spraying
- Affordable, modular rover than that of drones
- IoT + AI + Solar-Powered design -> sustainable & farmer-friendly

TECHNICAL APPROACH

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Step 1 – Data Capture

- Onboard **Camera** captures plant leaf images in real time.
- **Sensors (GPS, IMU, Ultrasonic, Encoders)** track rover position & obstacles.

Step 2 – AI Processing

- **Raspberry Pi** runs trained **CNN model** to detect infection level (Healthy, Mild, Severe).
- Disease data tagged with **GPS location**.

Step 3 – Decision & Control

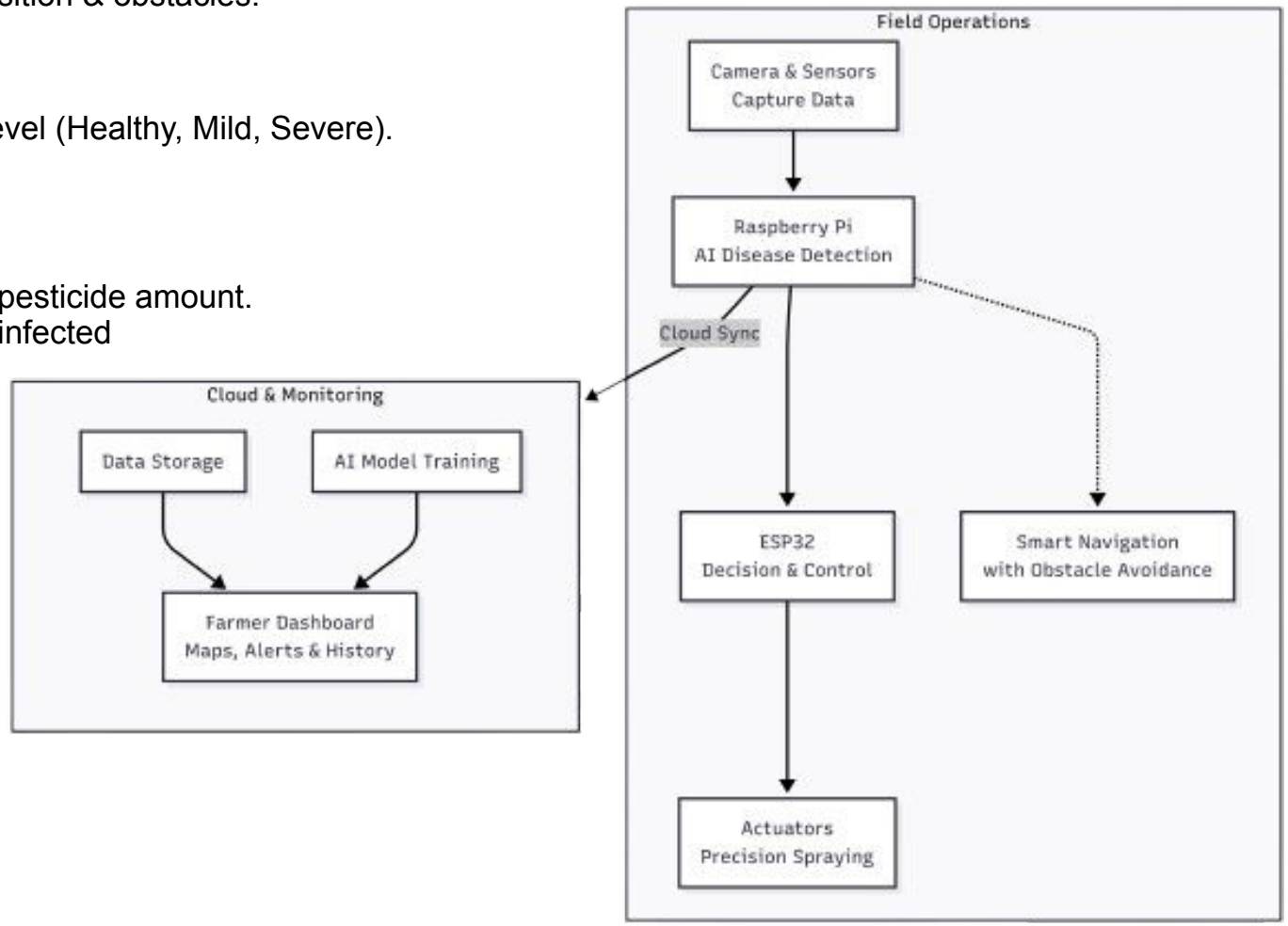
- **ESP32 microcontroller** receives infection level → decides pesticide amount.
- **Relay + Pump + Solenoid Valve** activate spraying only on infected plants.

Step 4 – Smart Navigation

- Rover follows **field boundary commands** (entered via dashboard).
- Obstacle avoidance via **ultrasonic sensors**.

Step 5 – Monitoring & Alerts

- Data uploaded to **Cloud Server**.
- **Farmer Dashboard** shows:
  - Field map with infection hotspots
  - Spray history & pesticide usage
  - Alerts for unusual infection spread



TECHNICAL APPROACH

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Hardware:

- **Raspberry Pi 4B** → Runs AI model, image processing, and IoT dashboard client.
- **ESP32** → Controls motors, pump, and sensors; sends data to Pi.
- **Pi Camera v3** → Captures leaf images for infection detection.
- **Ultrasonic Sensor (HC-SR04)** → Detects obstacles during navigation.
- **IMU (MPU-6050)** → Provides orientation and movement tracking.
- **GPS Module (NEO-6M)** → Field localization and geotagging of infections.
- **Motor Driver (L298N)** → Drives the rover's DC motors.
- **Relay** → Switches pump and solenoid valve.
- **Diaphragm Pump (12V)** → Provides pesticide flow.
- **Flow Sensor** → Monitors liquid usage and ensures correct dosage.
- **12V Battery Pack ($LiFePO_4$)** → Powers the entire system.

AI/ML: Python, TensorFlow Lite / PyTorch, OpenCV (leaf disease detection)

Web / Mobile Stack:

- **Frontend**: React + Tailwind (Web); Flutter / React Native (Mobile)
- **Backend / API**: Node.js / Flask / FastAPI (REST + MQTT bridge)
- **Database**: MongoDB / Firebase (plant health logs, telemetry)
- **Real-time Updates**: WebSocket / MQTT
- **Map & Visualization**: Leaflet / Mapbox for farm mapping & heatmaps

FEASIBILITY AND VIABILITY

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- Technically feasible with low-cost IoT + AI hardware.
- Affordable, scalable, and farmer-friendly compared to drones
- Prototype can be built with off-the-shelf components
- Model accuracy in varying light/crop types.
- Rover navigation on uneven farm terrain.
- Limited internet in rural areas.
- Farmer adoption & training.
- Use lightweight ML models + augment dataset for accuracy.
- Add GPS + sensors + rugged wheels for terrain.
- Support offline mode with local data sync.
- Simple dashboard, local language UI, farmer training modules

IMPACT AND BENEFITS

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Potential impact on the target audience

- Empowers farmers with affordable precision farming.
- Reduces dependency on manual spraying & guesswork.
- Builds trust in safe, eco-friendly food production.

Benefits of the solution

- **Economic**: 30–40% savings on pesticides, higher yield.
- **Environmental**: Less soil/water pollution, protects pollinators.
- **Social**: Healthier produce, improved farmer livelihood, rural tech adoption.
- **Plant Health**: Timely, targeted treatment → stronger, healthier crops.

RESEARCH AND REFERENCES

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- **Earth.Org – The Environmental and Health Impacts of Pesticides:** https://earth.org/the-environmental-and-health-impacts-of-pesticides/
- **Earth.Org – Environmental & Health Impacts of Pesticides:** https://earth.org/the-environmental-and-health-impacts-of-pesticides/
- **Wikipedia – Environmental Impact of Pesticides:** https://en.wikipedia.org/wiki/Environmental_impact_of_pesticides
- **EPA – Human Health Issues Related to Pesticides:** https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/human-health-issues-related-pesticides
- **Wikipedia – Health Effects of Pesticides:** https://en.wikipedia.org/wiki/Health_effects_of_pesticides