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TITLE PAGE

- **Problem Statement ID –** SIH25015
- **Problem Statement Title-** Intelligent Pesticide Sprinkling System Determined by the Infection Level of a Plant
- **Theme-** Agriculture, FoodTech & Rural Development
- **PS Category-** Hardware
- **Team ID-** SIHH01
- **Team Name –** Neuro Verse

Problem Understanding & Importance

Problem Statement

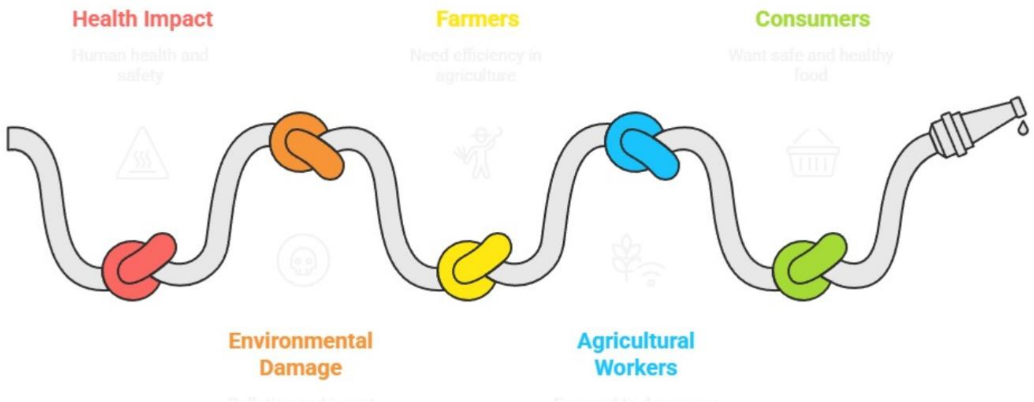
An intelligent system is required to recognize pest or disease infection in individual plants and regulate the amount of pesticide sprayed. This ensures optimal use of chemicals, reduces environmental impact, and promotes sustainable agriculture.

Why is it Important?

- **Health impact**: Excess pesticides affect human health and food safety.
- **Environmental damage**: Pollutes soil, water, and kills beneficial insects.

Who Faces this Problem?

- **Farmers** → Want cost-effective and efficient spraying.
- **Agricultural workers** → Exposed to harmful chemicals.
- **Consumers** → Want safe, pesticide-free food.



Current Gaps in Existing Solutions

- **Manual spraying** → Non-uniform, wasteful, and risky for workers.
- **Traditional sprayers/drones** → Spray entire fields, lack disease detection.

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Proposed Solution (Overview)

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AI-Powered Raspberry Pi System

- Detects plant leaf disease in real-time & auto-triggers preventive action

Core Features:

- Live video feed for monitoring
- Lightweight model crops leaf region
- Cloud/local API for disease classification
- Automated spray/pump control
- Data logging for analysis

Problem Solved:

- Farmers miss early signs → yield loss
- Real-time detection + instant action ensures timely treatment

Key Differentiator:

- Runs end-to-end on Raspberry Pi (live video + detection + auto-response)
- Low-cost, portable & farmer-friendly (no manual uploads needed)

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Innovation & Uniqueness

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Novelty in Approach

- Moves from **blanket spraying** to **AI-driven targeted spraying**.
- Integrates **disease detection + pesticide action + dashboard monitoring** in one pipeline.

How It Is Different from Existing Solutions

- Existing AI tools → only detect diseases, no action.
- Our system → **detect + decide + act** (complete loop).

Innovative Technology/Method Used

- **Computer Vision + Machine Learning** for real-time disease detection.
- **Precision spraying mechanism** controlled by AI signals.

Long-term Potential of Idea

- Scalable to **different crops and climates**.
- Integration with **fertilization & irrigation systems** for smart farming.

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Technical Approach (Part 1)

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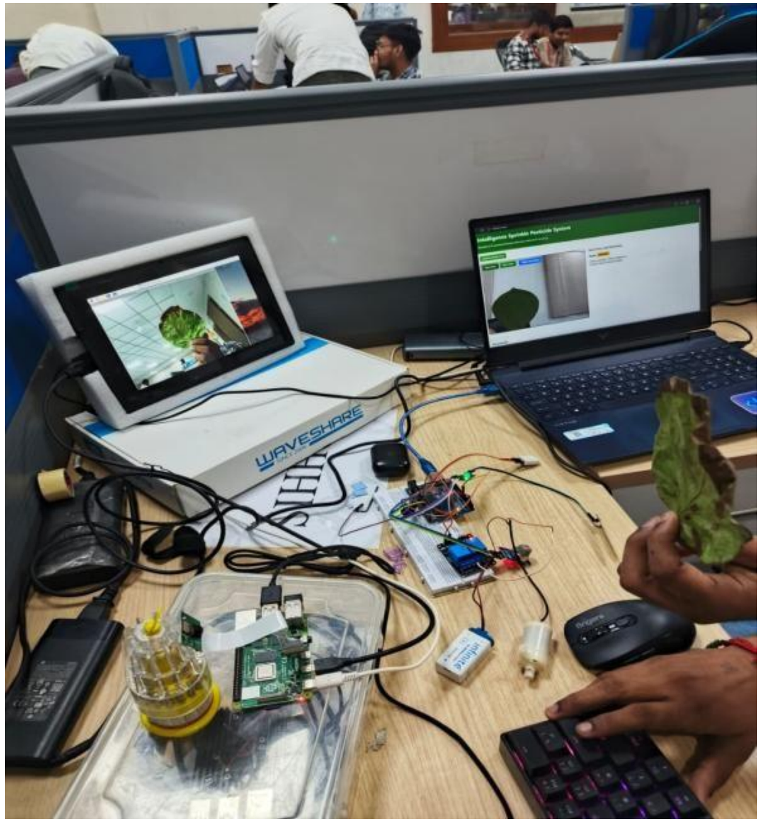
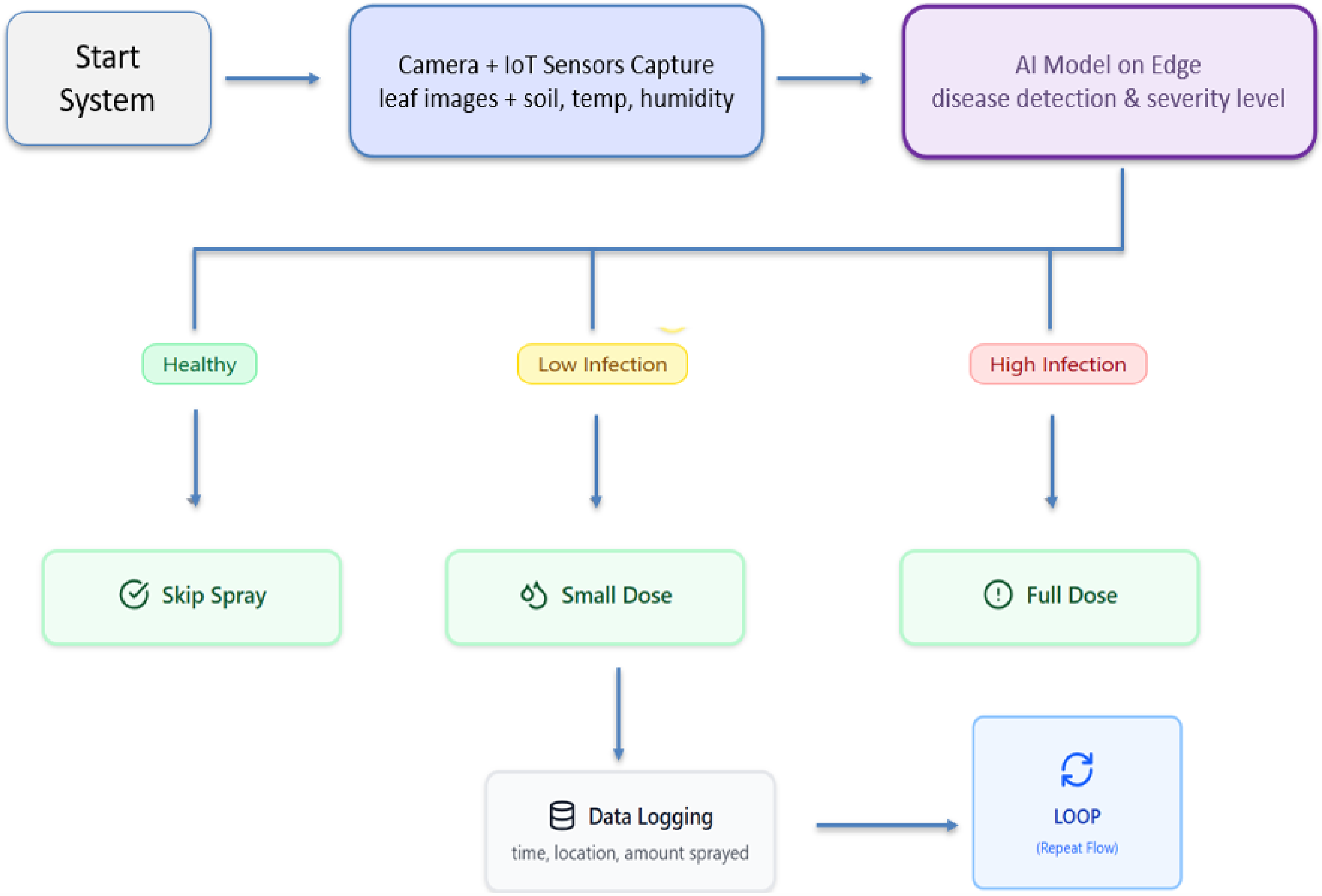
Automated crop monitoring and precision spray system





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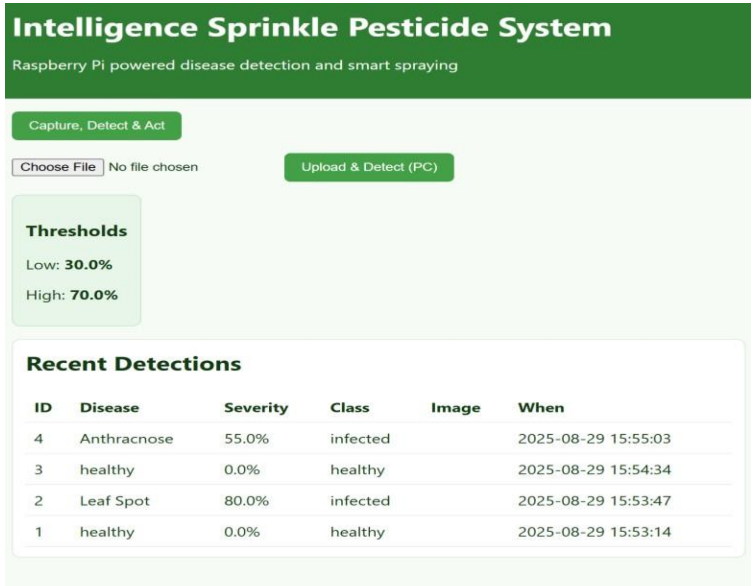
Technical Approach (Part 2)

Stage	Technology / Tool	Purpose
Video Input	**OpenCV (cv2)**	Capture live video stream from camera
Detection Model	**YOLO-Nano / SSD MobileNet (lightweight)**	Detect and crop leaf regions from video
Image Preprocessing	**OpenCV + NumPy**	Crop, resize, and prepare image for API
API Communication	**Requests (Python)**	Send cropped leaf image to disease classification API
Classification	**Custom API / Flask / FastAPI**	Runs trained model to predict healthy vs infected
Hardware Control	**Raspberry Pi GPIO**	Trigger motor/pump for spraying if disease detected
Data Logging	**SQLite / CSV**	Store detection results for record keeping
Deployment Device	**Raspberry Pi**	Runs detection, sends to API, controls GPIO



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Feasibility & Viability

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Practical Feasibility of Execution

- Prototype can be built using **readily available hardware** (Raspberry Pi, cameras, spraying units).
- Open-source **datasets and AI models** available for training.

Cost/Time/Resource Considerations

- **Initial cost:** Medium (hardware, sensors, camera, spraying system).
- **Ongoing cost:** Low (maintenance, cloud services, pesticide refills).
- **Time:** MVP can be built in **3–6 months**; scaling may take longer.
- **Resources:** Requires expertise in **AI, IoT, robotics, agriculture input**.

Risk Factors Identified

- **Model inaccuracy** → Wrong disease detection or over/under spraying.
- **Hardware failure** → Sensors/camera malfunction in field conditions.

Risk Mitigation Strategies

- **Model retraining** with local crop datasets for better accuracy.
- **Robust hardware design** to withstand dust, water, and heat.

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Impact & Benefits

Direct Beneficiaries (Who Gains from It)

- **Farmers** → reduced costs, better crop yield.
- **Consumers** → healthier, chemical-free food.
- **Agri-businesses** → more efficient supply chain.

Social, Economic, Environmental Benefits

- **Social** → improves farmer livelihood, reduces manual labor risks.
- **Economic** → lowers pesticide usage & costs, increases profit margins.
- **Environmental** → minimizes soil/water contamination, promotes sustainability.

Short-Term and Long-Term Impact

- **Short-term** → immediate reduction in pesticide use, higher accuracy in spraying.
- **Long-term** → healthier ecosystems, improved public health, adoption of smart farming practices.

Potential for Large-Scale Adoption

- Scalable across **different crops, climates, and regions**.
- Aligns with **government policies on sustainable farming.**

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Research & References

Research Papers / Case Studies

- **AGRO Rover:** AI-powered precision farming (ML + CV) *(arXiv)*
- **Mini Rover:** IoT sensors for temp, humidity, air quality *(ResearchGate)*
- **Harvesting Rover:** YOLOv5 for crop detection & soil analysis *(PMC)*

Govt / Industry Reports

- **NSF & USDA:** Innovation in agri-robotics *(NSF)*
- **Market Report:** Survey rover market → $6.24B by 2033 *(Growth Market Reports)*

Competitive Benchmarking

Others (Existing Solutions)	Our Idea (Proposed System)
Expensive robots/drones, complex hardware, not easily accessible to small farmers.	Low-cost Raspberry Pi + camera system, simple setup, affordable for small-scale farmers.
Focus on spraying or specific crop diseases, limited flexibility.	General disease detection via API, adaptable to multiple crops & scalable for broader use.

Links and Citations

- IEEE Access 2022 – https://ieeexplore.ieee.org
- MDPI Sensors 2025 – https://www.mdpi.com/journal/sensors

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Conclusion & Team

Summary of the Idea

- AI-powered **Intelligent Pesticide Sprinkling System** that detects plant diseases and sprays only where requirements.

Vision for Scaling Further

- Expand to **different crops and regions**, adapting to local conditions.
- Integrate with **fertilization, irrigation, and farm management systems**.

Team Introduction (Roles & Contributions)

- **Member 1 – Project Lead, AI/ML(**Leads team, builds disease detection model.)
- **Member 2 – Robotics & IoT(**Handles rover/drone control, sensors, hardware.)
- **Member 3 – Dashboard Dev(**Creates web/mobile interface & data visualization.)
- **Member 4 – Research & Testing(**Collects studies, benchmarks, and testing protocols.)
- **Member 5 – Backend & API(**Builds APIs, manages database & integration.)
- **Member 6 – Documentation & Presentation(**Prepares pitch, reports, and final demo.)

Why Our Team is Best Suited

- Combined expertise in **AI, IoT, robotics, and agriculture**.
- Experience in **prototyping, software development, and system integration**.