AI for AgriTech Hackathon – Stage 1 Submission Report

Project Title :-

Smart Agriculture Garden: AI-Driven Sustainable and Protected Farming System

1. Abstract:

This project envisions a Smart Agriculture Garden equipped with AI and modern technologies to address challenges in sustainable farming, plant health, soil monitoring, pest protection, livestock integration, and student learning. Using Computer Vision (CNN), the system can detect plant diseases from leaf images, analyze soil conditions, and display the garden's status digitally. It also features a smart night-time protection circuit against pests like rats and rabbits. This prototype aims to serve farmers, researchers, and students with real-time insights and automation.

2. Problem Statement:

Traditional farming faces numerous challenges such as unpredictable disease outbreaks, inefficient irrigation, and lack of modern protection systems. Additionally, farmers often lack digital tools to monitor plant health and environmental conditions. The goal is to develop a multi-layered intelligent system that monitors, protects, and educates through a real-time AI-powered garden ecosystem.

3. Objective:

- Detect plant diseases using CNN models from leaf images.
- Display real-time soil, plant, and livestock data on digital screens.
- Protect crops at night using AI-powered detection circuits.
- Create a sustainable cycle using homemade natural fertilizers.
- Educate B.Sc, B.E, B.Tech Agriculture students and research scholars.
- Enable a smart, affordable solution deployable in rural gardens.

4. Proposed System:

Modules:

1. Plant Disease Detection (CNN-Based)
    - Input: Leaf image
    - Output: Detected disease or healthy status

2. Smart Soil Monitoring
    - Moisture & fertility analysis
    - IoT sensors interfaced with AI models

3. Digital Dashboard Display
    - Shows live garden condition

4. Smart Night Protection Circuit
    - Detects rats, rabbits using infrared and AI vision
    - Triggers sound/light deterrent

5. Natural Fertilizer Production
    - Composting organic waste to fertilizers

6. Livestock Integration
    - Health and movement monitoring for goat, pig, cow, horse, dog

7. AI Education Platform
    - Teaches smart agriculture to students and researchers

5. CNN Model Architecture (for Disease Detection):

- Input: Leaf image (128x128 or 224x224 pixels)
- Model Used: Transfer learning with MobileNetV2 / ResNet50
- Layers:
    1. Conv2D → MaxPooling → Conv2D → Flatten → Dense → Output
    2. Framework: TensorFlow / Keras.

6. Why this Architecture:

MobileNetV2 was chosen for its lightweight nature, faster training time, and efficiency in embedded systems. It provides high accuracy in image

classification tasks even on low-powered devices, making it suitable for rural deployment.

7. Model Evaluation Metrics:

Metric	Value (Example)
Accuracy	92.4%
Precision	91.2%

Recall	93.1%
IoU	0.89
mAP	0.87
SSIM	0.92
PSNR	28.5
Confusion Matrix	Attached below
MSE	0.038

8. Optimization Techniques Used:

- Data Augmentation (flip, rotation, brightness change)
- Transfer Learning (MobileNetV2 pre-trained)
- Hyperparameter tuning (Batch size, learning rate)
- Dropout layers to prevent overfitting
- Early stopping during training to avoid excess training

9. Conclusion:

The Smart Agriculture Garden system provides a sustainable, scalable, and AI-driven solution to modern farming needs. This prototype bridges the gap between traditional agriculture and intelligent technologies, helping both farmers and future agri-technologists to thrive.

10. Future Scope:

- Deploy real-time drone surveillance

- AI chatbot for farmers in regional languages
- Expand to large-scale farming systems
- Mobile app for remote monitoring
- Solar-powered system for energy efficiency.

Attachments :-

- Python mode; code (.py or .ipynb)
- GitHub repo link (To be added)
- Architecture Diagram (To be added)
- Sample dataset and predictions (To be added).