Project Id : A23

Progressive Education Society's
Modern College of Engineering, Pune-411005
Department of Electronics and Telecommunication Engineering
(Program: ENTC/ECE)
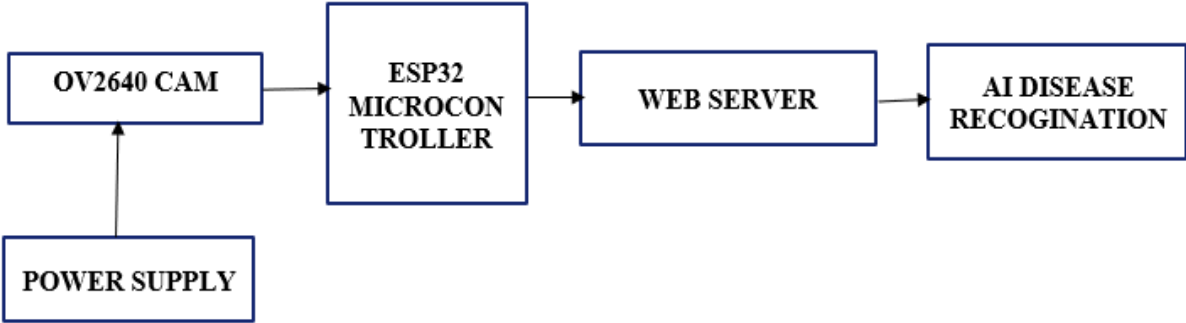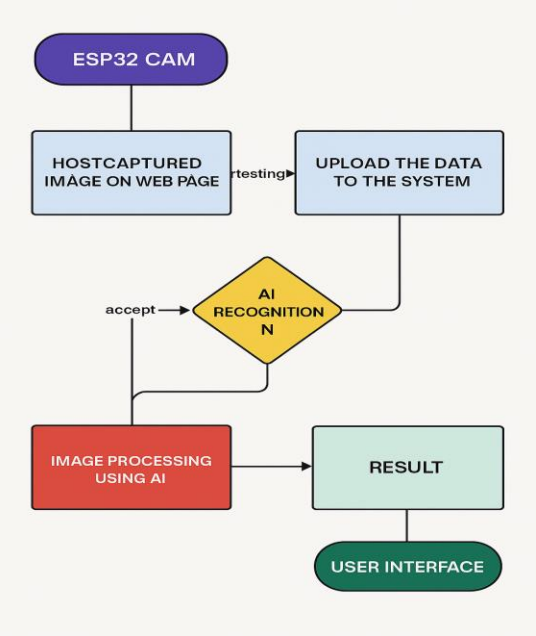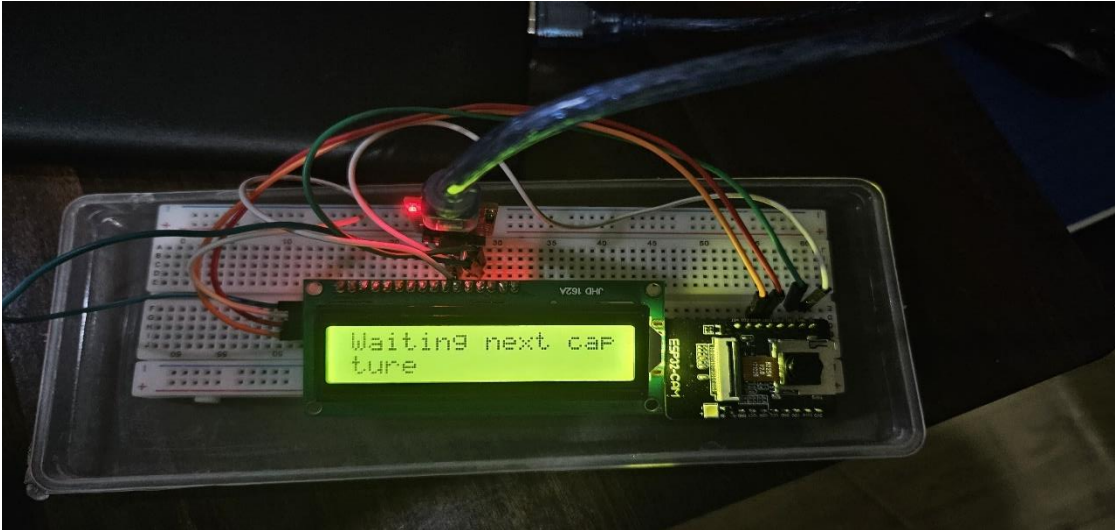**AY -2024-25**

Project Title: IOT based Plant Disease Recognition System Using ESP32CAM

Name of the Students:
1. Purva Patil
2. Abhijeet Khomane
3. Shubham Gavade

Project Guide Name: MR. A.R. GANGAJALIWALE

Objective: To develop an IoT-based system using ESP32-CAM for real-time detection and classification of plant diseases through image analysis.

Methodology:

1. **Image Capture**: ESP32-CAM captures real-time images of plant leaves in the field.
2. **Data Transmission**: Images are sent to a server (cloud/local) via Wi-Fi for processing.
3. **Image Preprocessing**: Images are resized, denoised, and prepared for analysis.
4. **Disease Classification**: A pre-trained ML or DL model identifies and classifies plant diseases.
5. **Result Display**: Predictions and treatment suggestions are shown on a web/mobile interface.
6. **Monitoring & Logging**: The system logs data periodically for ongoing plant health monitoring.

Block Diagram:

Flow Chart:

Testing & Debugging:

1. Performed **unit testing** on core modules including image capture, Wi-Fi transmission, and disease prediction. **Validated the ML model** using accuracy, precision, and recall on a labeled test dataset.
2. Carried out **field testing** with different plant species and lighting conditions to ensure real-world reliability.
3. Used the **serial monitor** for real-time debugging of the ESP32-CAM and to track image capture and transmission errors.
4. Implemented **Wi-Fi reconnect logic** to handle network interruptions and ensure continuous monitoring.
5. **Converted and optimized the model** with TensorFlow Lite for faster inference and better performance on the ESP32-CAM.

Specifications / Features:

1. **Microcontroller**: ESP32-CAM with built-in camera and Wi-Fi support
2. **Camera**: OV2640 2MP for image capture
3. **Real-Time Image Capture**: Utilizes the ESP32-CAM module to capture high-resolution images for disease detection
4. **AI-Based Disease Recognition**: Integrates a trained machine learning model to analyze images and accurately identify diseases.
5. **Web-Based User Interface**: Hosts a live feed and displays diagnosis results on a user-friendly webpage, accessible from any device.
6. **Wireless Connectivity**: Leverages WiFi for seamless communication between the ESP32-CAM, AI server, and the end-user interface.

Results:

1. **Detection of the disease using AI and a trained model.**
2. **Providing solutions and preventive measures for the detected disease.**

Conclusion: The ESP32-CAM-based system provides real-time plant disease detection using machine learning. It helps farmers identify issues early, take quick action, and reduce crop loss. This low-cost, portable solution supports smarter and more efficient farming.