UNIVERSITY OF THE WESTERN CAPE

MODULE: IFS 325

GROUP ASSIGNMENT

USER DOCUMENTATION

GROUP 3 –

CROP DEVELOPMENT VISION SYSTEM

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1. Introduction

1.1 Purpose of This Document

This user guide provides step-by-step instructions for operating the FarmEye system, from image capture on the Raspberry Pi device to viewing analysis results on the Flutter application dashboard.
It is intended for ARC farm managers, researchers, and greenhouse operators who will use the system for monitoring crop health, identifying diseases or pests, and tracking growth over time.

1.2 System Overview

FarmEye is an AI-powered crop monitoring solution that uses image analysis and environmental data to provide real-time insights into plant health and growth.
The system consists of three key components:

1. Raspberry Pi device (FarmEye Node) – captures crop images and performs AI analysis on-site.
2. Firebase Cloud Platform – stores images and model predictions.
3. FarmEye Flutter App – provides an intuitive interface for viewing results, tracking crop conditions, and receiving recommendations.

2. Getting Started

2.1 System Components

Component	Description
Raspberry Pi 5	Captures images, runs AI inference, and uploads results.
Camera Module	Attached to Pi; used for image capture.
Firebase Cloud	Stores captured images and predictions.
FarmEye App (Flutter)	Displays crop health, confidence scores, and recommendations.
Network Connection	Enables communication between Pi, Firebase, and Oracle Apex.

2.2 User Access Requirements

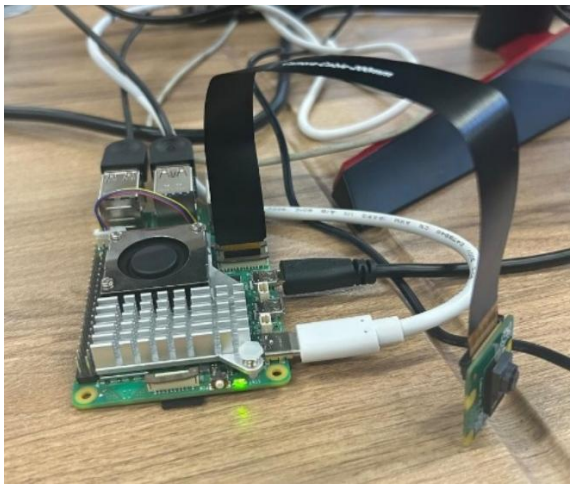
To use the FarmEye system, users need:

- A registered ARC account with assigned login credentials (provided by the ARC IT Administrator).
- Access to the ARC greenhouse where the FarmEye device is installed.
- Internet connectivity for cloud synchronization (offline mode also available in the app).

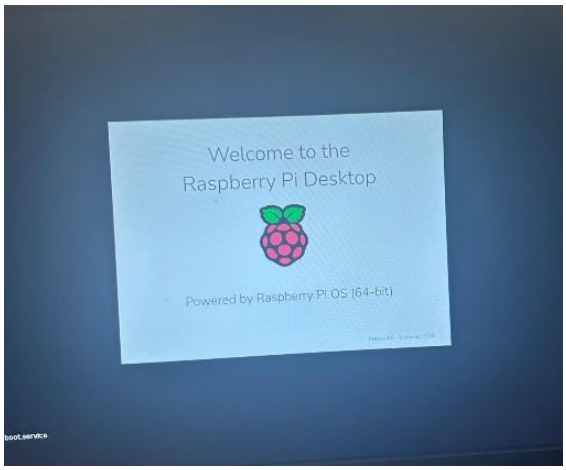
3. Using the FarmEye Raspberry Pi System

3.1 Starting the System

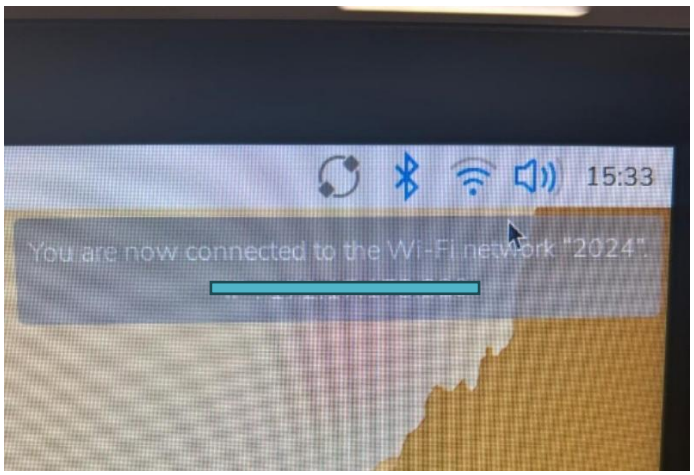
1. Power on the Raspberry Pi and ensure the camera module is connected.



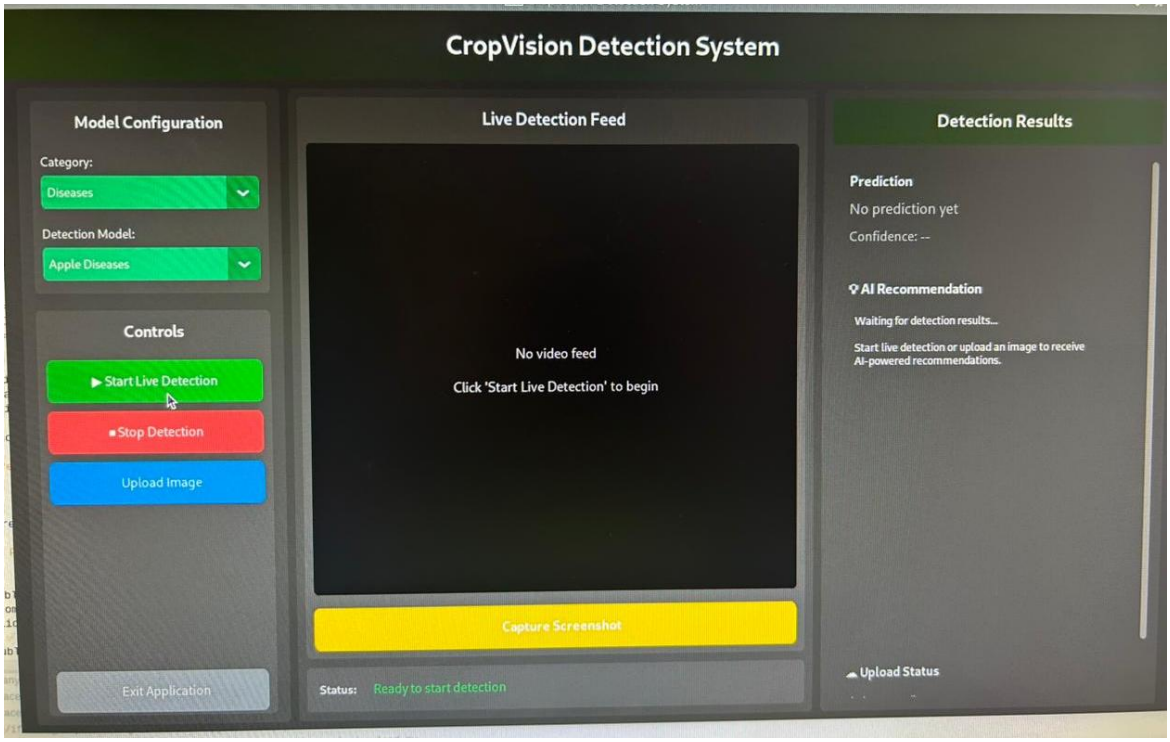
2. Wait for the system to boot



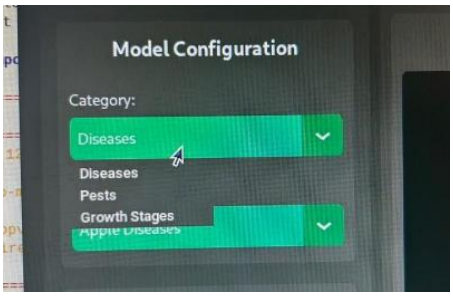
3. Check that Wi-Fi connectivity is active (look for the network icon on the top-right corner, make sure it is the same as the broker team).



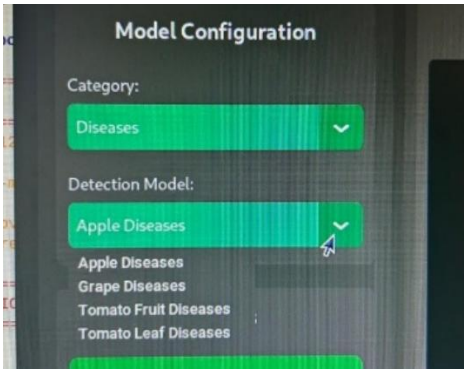
3.2 Live Detection Mode



1. From the dropdown menu, **select the category** you want to analyse:
    - Growth Stage
    - Disease Detection
    - Pest Detection

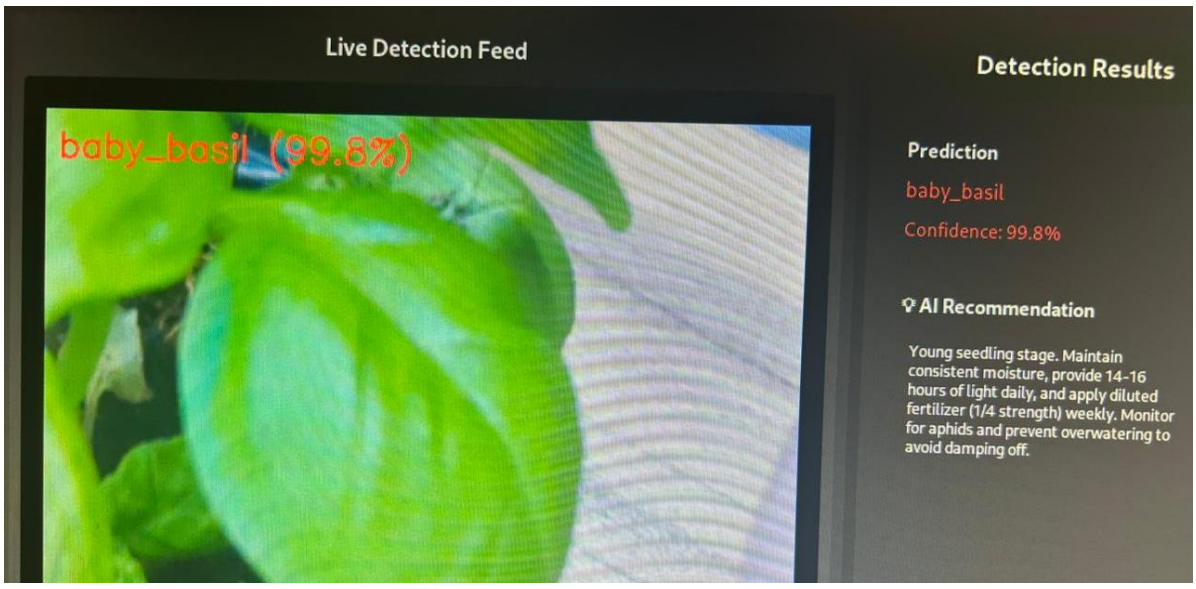


2. Select the **specific crop model** (e.g., Tomato, Lettuce, Basil).



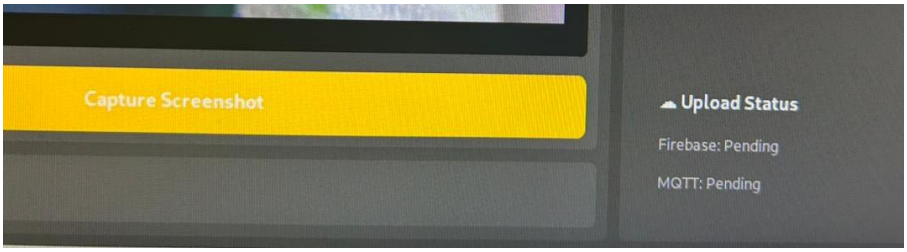
3. Click **Start Live Detection**.
4. The camera feed will open - the AI system will process images in real time.
5. Detected results (disease/pest name/growth stage and confidence percentage) will appear on screen.

6. Recommendations will also appear in the right column on the screen



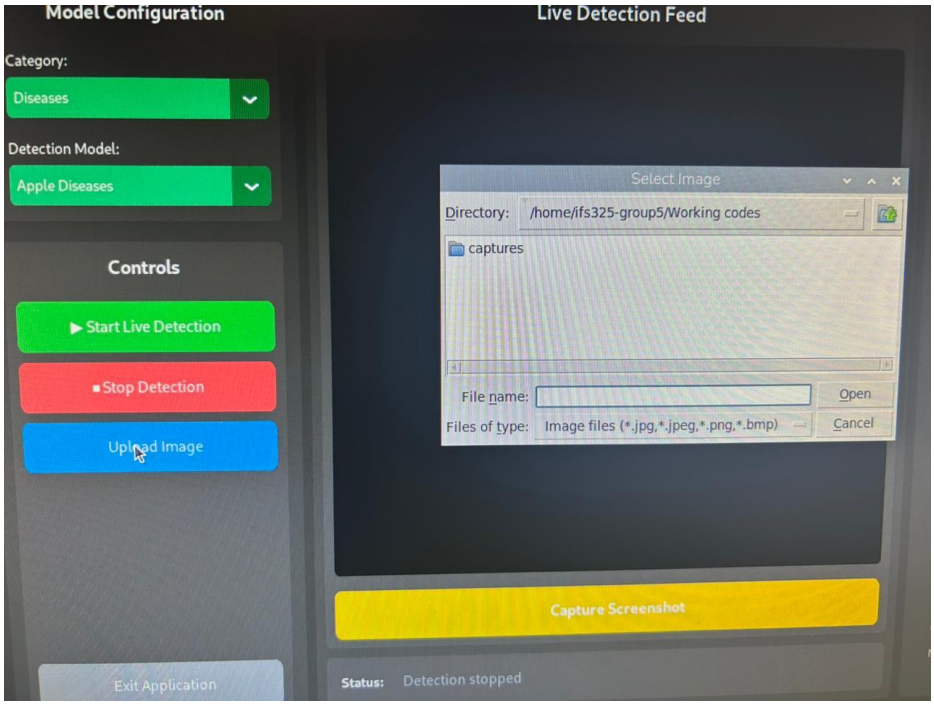
3.3 Capturing and Uploading an Image

1. While live detection is active, click **Capture Screenshot**.
2. The captured image will:
    - Be saved locally on the device.
    - Upload automatically to **Firebase Storage**.
    - Send prediction data to the **Data Management Team via MQTT**.

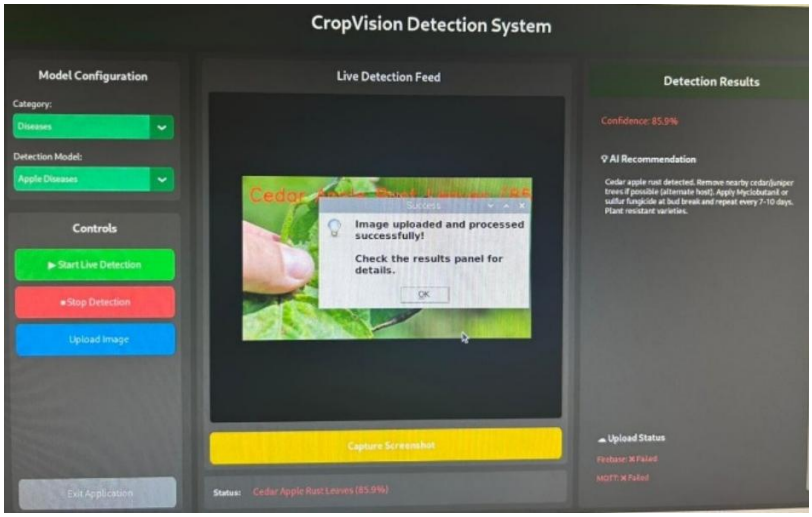


3.4 Uploading an Image Manually

1. Click **Upload Image**.
2. Choose an image file (JPG, PNG, BMP) from the local device.

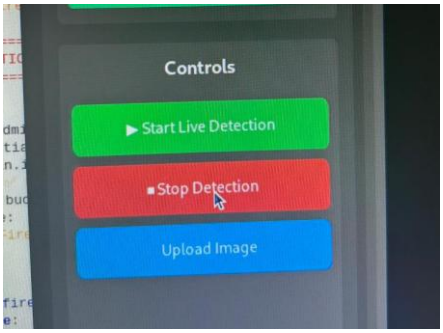


3. The AI model will process the uploaded image and display:
    - Prediction label
    - Confidence score (%)
    - Recommended action



3.5 Stopping Detection

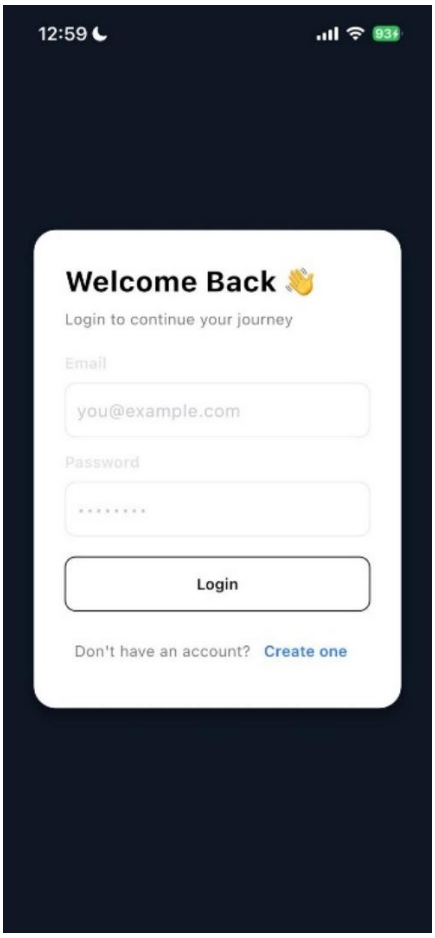
- Click **Stop Live Detection** to pause the system and close the camera feed.
- It's recommended to stop detection before shutting down the Raspberry Pi.



4. Using the FarmEye App (Flutter Dashboard)

4.1 Accessing the Dashboard

1. Open the **FarmEye App** on your mobile device or browser.
2. Sign in using your credentials.



4.2 Dashboard Overview

Section	Description
Timeline / Gallery	Displays all uploaded crop images with timestamps and crop labels.
Confidence Indicator	Shows how confident the model is about its detection (e.g., 92% certain of early blight).
Recommendations Panel	Provides advice for treatment, irrigation, or growth optimization.
Analytics Dashboard	Displays soil temperature, humidity, and moisture data from Group 3's sensors.
Offline Mode	Allows users to view previously stored results without internet access. Data syncs once reconnected.

4.3 Viewing Detection History

1. Navigate to the **History** tab.
2. Each record displays:
    - Crop image
    - Disease/Pest label
    - Confidence score
    - Date & time captured

    - Tap an entry to view full details, Recommendation summary or compare historical data trends.

4.4 Viewing Analytics

- Tap the **Dashboard** tab to access visual charts for:
    - Soil moisture levels
    - Temperature variation
    - Crop condition trends over time

4.5 Receiving Recommendations

When the AI detects an issue:

- A **recommendation card** appears under the detection result (e.g., *"Apply copper-based spray to control early blight."*).
- Severe detections are highlighted in red for quick attention.

5. System Notifications

FarmEye automatically generates alerts for:

- New detections uploaded to Firebase.
- Unhealthy crop conditions (low confidence or disease detected).
- Updates from ARC administrators or researchers.

Notifications can be viewed in-app or through push alerts (if enabled).

6. Troubleshooting

Issue	Possible Cause	Solution
No image displayed	Camera not connected or disabled	Check camera cable and run sudo raspi-config to enable camera.
Firebase upload fails	Incorrect API key or weak internet	Verify Firebase credentials and reconnect to Wi-Fi.
Model not loading	Missing or renamed model file	Confirm model file paths and naming in the configuration.
App not updating	Offline mode enabled	Refresh the dashboard or reconnect to the internet.

7. Maintenance and Updates

- AI Model Updates: ARC's technical team will periodically update the AI models with improved versions.
- App Updates: Users should install the latest version of the FarmEye app to access new features and bug fixes.
- Device Cleaning: Ensure the camera lens is clean and unobstructed for accurate image capture.
- Network Check: Regularly verify Wi-Fi stability within the greenhouse.

8. Safety and Best Practices

- Do not disconnect the Raspberry Pi power supply while in operation.
- Avoid exposing the camera module to direct water or sunlight.
- Store captured images responsibly, they may contain sensitive research data.
- Always shut down the device properly using the on-screen Shutdown option.

9. Support and Contact Information

For assistance, contact the ARC Technical Support Team
Or reach out to **Group 5 Crop Vision Development Team**

10. Appendix

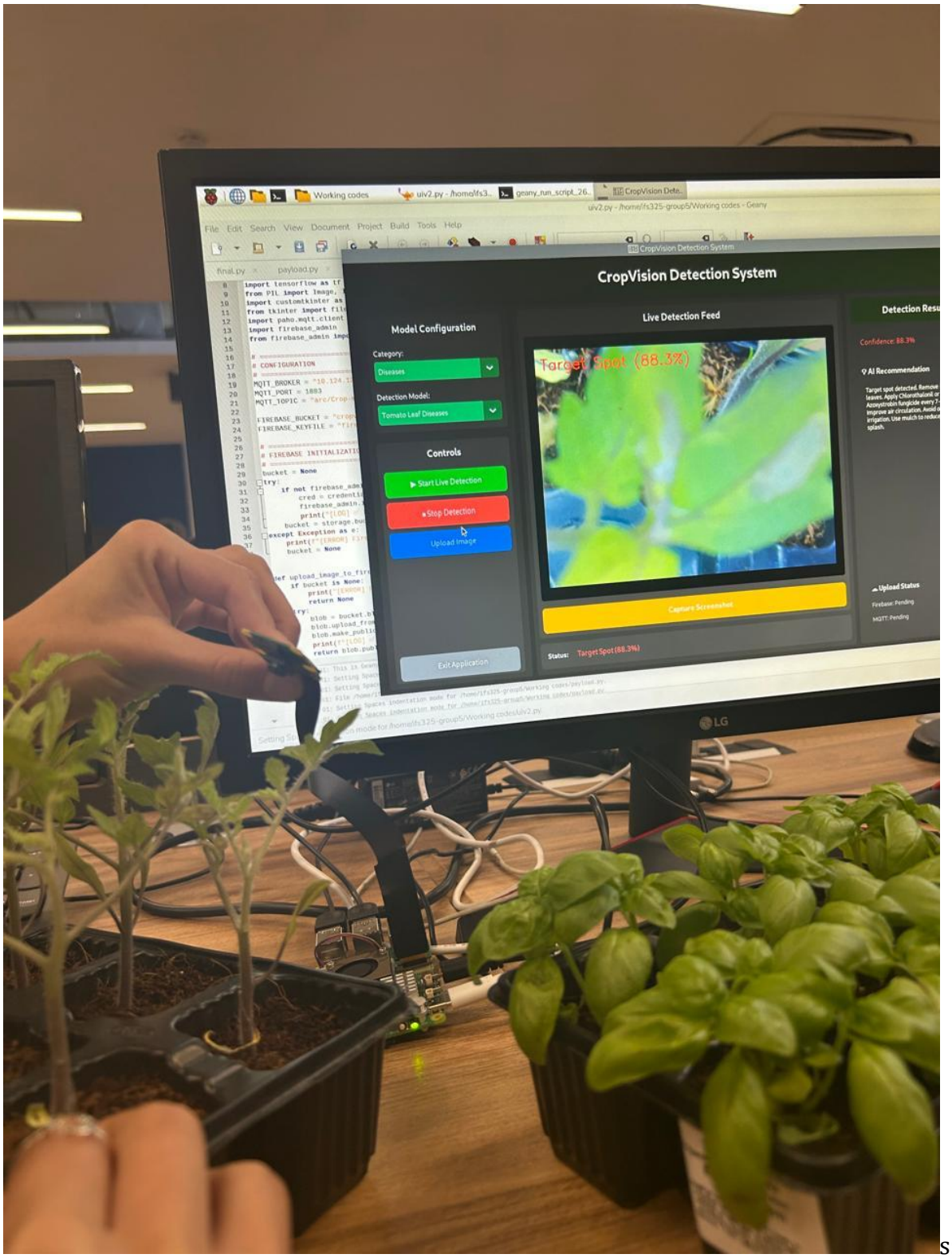
10.1 Quick Reference Commands

Function	Command
Run application	python3 crop_vision_app.py
Activate virtual environment	source cropvision_env/bin/activate
Check camera	libcamera-still -o test.jpg
Test Firebase connection	python3 test_firebase.py

10.2 Glossary

Term	Definition
Inference	The process where the AI model analyses an image and outputs predictions.
Confidence Score	Indicates how sure the model is about its prediction (0–100%).
Firebase	Cloud storage service used to store captured images and data.
MQTT	Messaging protocol used to send data from Raspberry Pi to the Data Management platform.
Oracle Apex	Database platform that stores structured detection results for analysis.

10.3 Additional Images



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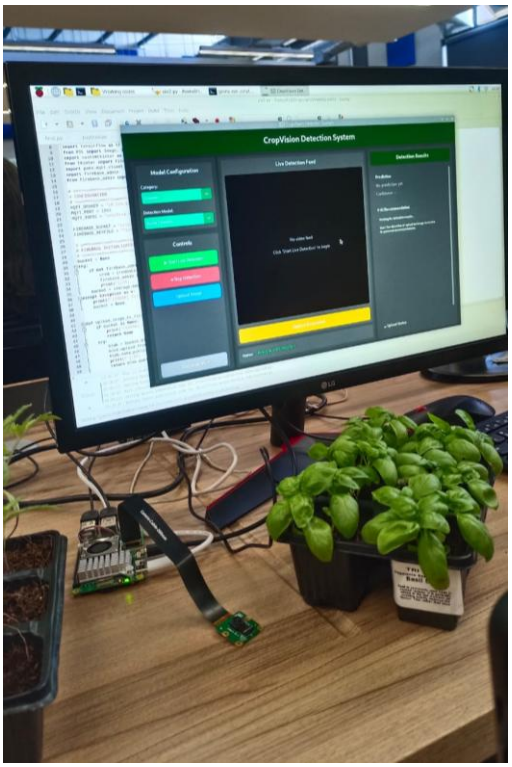
CropVision Detection System
Model Configuration
Live Detection Feed
Controls
Detection Results