**Batch: A-3 Roll No.: 16010122104**

**Experiment No : 04**

**Group No:**

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| **Title: Design of Test Cases** |

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**Expected Outcome of Experiment:**

**CO2: Implement and prototype creation for the specified application.**

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**Books/ Journals/ Websites referred:**

*[Students can mention websites/ books used in their project implementation]*

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**This write up will expect students to prepare chapter no. 4 in the format given below**

**Chapter 4**

**Design Test Cases**

*This chapter details the testing conducted mentioning the various test scenarios considered.* This chapter in a software development project report should provide a comprehensive overview of the testing process, methodologies, and results. The purpose of a test case document is to provide a detailed, structured record of the steps and conditions needed to verify a specific functionality or feature in software testing, ensuring that the application functions correctly and meets requirements

**Introduction:**

Testing is a critical phase in the development of an AI-driven crop disease prediction and management system. Thoroughly designed test cases help identify defects early in the development lifecycle, ensuring that the system meets user requirements and performs as intended. The importance of comprehensive testing in this project stems from several key factors:

1. **Early Defect Detection**: By systematically testing all components of the system, we can identify and address issues before deployment, minimizing costly rework and delays.
2. **Enhanced System Quality**: Testing ensures that the AI model accurately classifies crop diseases and that the user interface functions correctly, leading to a more reliable product.
3. **User Satisfaction**: A well-tested system with fewer bugs provides a better user experience, particularly important for farmers who may have limited technical expertise.
4. **Validation of Requirements**: Test cases verify that the system meets the defined functional and non-functional requirements, ensuring that it delivers on its promises.
5. **Critical Domain Application**: Since agricultural decisions based on the system's output can have significant economic impacts, ensuring accuracy and reliability is paramount.

The test cases designed for this AI-driven crop disease prediction and management system focus on three main areas:

1. **Validation of Data**: Ensuring uploaded images meet required specifications and the system handles various input scenarios appropriately.
2. **Appropriate Navigation**: Verifying that users can navigate through the system interfaces effectively.
3. **Verification of Results**: Confirming that the system produces accurate disease classifications and appropriate management recommendations.

Test Cases

**1. Validation of Data**

**Test Case ID: DV-001**

**Test Case Description**: Verify that the system accepts valid image formats (JPG, PNG, JPEG)

**Test Steps**:

1. Navigate to the image upload screen
2. Select an image file in JPG format
3. Upload the image
4. Repeat with PNG and JPEG formats

**Test Data**:

* leaf\_healthy.jpg (1920×1080 pixels)
* leaf\_disease1.png (1280×720 pixels)
* leaf\_disease2.jpeg (2048×1536 pixels)

**Expected Result**: System accepts all three image formats and processes them for disease detection.

**Actual Result**: System successfully accepts and processes all three image formats.

**Status**: Pass

**Test Case ID: DV-002**

**Test Case Description**: Verify that the system rejects invalid file formats (PDF, DOC, etc.)

**Test Steps**:

1. Navigate to the image upload screen
2. Select a non-image file (e.g., PDF, DOC)
3. Attempt to upload the file

**Test Data**:

* plant\_report.pdf
* crop\_data.docx

**Expected Result**: System displays an error message indicating that only image formats are accepted.

**Actual Result**: System shows error message: "Invalid file format. Please upload JPG, PNG, or JPEG files only."

**Status**: Pass

**Test Case ID: DV-003**

**Test Case Description**: Verify that the system handles images of different resolutions

**Test Steps**:

1. Navigate to the image upload screen
2. Upload images of varying resolutions
3. Observe if the system preprocesses and handles all images

**Test Data**:

* high\_res.jpg (3840×2160 pixels)
* medium\_res.jpg (1280×720 pixels)
* low\_res.jpg (640×480 pixels)

**Expected Result**: System successfully preprocesses all images to the required resolution (224×224 pixels) for the RexNet-150 model.

**Actual Result**: All images are resized to 224×224 pixels and processed correctly.

**Status**: Pass

**Test Case ID: DV-004**

**Test Case Description**: Verify that the system handles images with different lighting conditions

**Test Steps**:

1. Navigate to the image upload screen
2. Upload images captured under different lighting conditions
3. Observe if the system correctly normalizes and processes the images

**Test Data**:

* bright\_light.jpg (leaf image taken in direct sunlight)
* normal\_light.jpg (leaf image taken in ambient daylight)
* low\_light.jpg (leaf image taken in shade/indoor lighting)

**Expected Result**: System normalizes brightness and contrast to effectively process images taken in various lighting conditions.

**Actual Result**: System successfully normalizes and processes images from all lighting conditions.

**Status**: Pass

**Test Case ID: DV-005**

**Test Case Description**: Verify that the system detects and handles poor quality images

**Test Steps**:

1. Navigate to the image upload screen
2. Upload a blurry or extremely poor quality image
3. Observe the system's response

**Test Data**:

* blurry\_leaf.jpg (out-of-focus image)
* noisy\_image.jpg (image with excessive noise)

**Expected Result**: System provides feedback about image quality and suggests uploading a clearer image for better results.

**Actual Result**: System displays message: "Image quality may affect accuracy. Please consider uploading a clearer image."

**Status**: Pass

**2. Appropriate Navigation**

**Test Case ID: NV-001**

**Test Case Description**: Verify that users can navigate from the home page to the upload page

**Test Steps**:

1. Access the system's home page
2. Click on the "Upload Image" or equivalent button
3. Verify navigation to the upload page

**Test Data**: N/A

**Expected Result**: User is directed to the image upload page.

**Actual Result**: User successfully navigates to the image upload page.

**Status**: Pass

**Test Case ID: NV-002**

**Test Case Description**: Verify that users can access disease information pages from the results page

**Test Steps**:

1. Upload an image that gets classified as a particular disease
2. On the results page, click on "Learn More" or equivalent link for the detected disease
3. Verify navigation to the disease information page

**Test Data**:

* cassava\_cmd.jpg (image showing Cassava Mosaic Disease symptoms)

**Expected Result**: User is navigated to a detailed information page about Cassava Mosaic Disease.

**Actual Result**: User successfully navigates to the disease information page.

**Status**: Pass

**Test Case ID: NV-003**

**Test Case Description**: Verify that users can return to the home page from any screen

**Test Steps**:

1. Navigate to various pages within the system (upload page, results page, disease information page)
2. Click on the "Home" button or logo
3. Verify navigation back to the home page

**Test Data**: N/A

**Expected Result**: User returns to the home page from any location in the application.

**Actual Result**: Home navigation works from all tested pages.

**Status**: Pass

**Test Case ID: NV-004**

**Test Case Description**: Verify that the navigation elements are responsive on mobile devices

**Test Steps**:

1. Access the system from a mobile device or using a mobile emulator
2. Test navigation between key pages
3. Verify that all navigation elements are accessible and functional

**Test Data**:

* Mobile device or emulator with different screen sizes (e.g., 375×667, 414×896)

**Expected Result**: Navigation elements adjust appropriately to different screen sizes and remain functional.

**Actual Result**: Navigation is responsive and works correctly on all tested mobile screen sizes.

**Status**: Pass

**Test Case ID: NV-005**

**Test Case Description**: Verify that the system maintains user session during navigation

**Test Steps**:

1. Upload an image and receive disease classification results
2. Navigate to disease information page
3. Return to results page
4. Verify that the original results are still displayed

**Test Data**:

* potato\_early\_blight.jpg (image showing Early Blight symptoms)

**Expected Result**: System maintains the user's session and displays the original results after navigation.

**Actual Result**: Original results are preserved throughout the navigation flow.

**Status**: Pass

**3. Verification of Results**

**Test Case ID: VR-001**

**Test Case Description**: Verify that the system correctly identifies healthy leaves

**Test Steps**:

1. Upload images of known healthy leaves from various crops
2. Observe the system's classification

**Test Data**:

* healthy\_cassava.jpg
* healthy\_tomato.jpg
* healthy\_potato.jpg
* healthy\_cucumber.jpg

**Expected Result**: System classifies all images as "Healthy" with high confidence (>90%).

**Actual Result**: System correctly identifies all healthy leaf images with confidence levels between 92-97%.

**Status**: Pass

**Test Case ID: VR-002**

**Test Case Description**: Verify that the system correctly identifies Cassava Mosaic Disease (CMD)

**Test Steps**:

1. Upload images showing clear symptoms of Cassava Mosaic Disease
2. Observe the system's classification

**Test Data**:

* cassava\_cmd\_1.jpg
* cassava\_cmd\_2.jpg
* cassava\_cmd\_3.jpg  
  (Images from Kaggle dataset showing characteristic yellow mosaic pattern and leaf deformation)

**Expected Result**: System classifies the images as "Cassava Mosaic Disease" with high confidence (>85%).

**Actual Result**: System correctly identifies CMD with confidence levels between 89-94%.

**Status**: Pass

**Test Case ID: VR-003**

**Test Case Description**: Verify that the system correctly identifies Cassava Bacterial Blight (CBB)

**Test Steps**:

1. Upload images showing clear symptoms of Cassava Bacterial Blight
2. Observe the system's classification

**Test Data**:

* cassava\_cbb\_1.jpg
* cassava\_cbb\_2.jpg  
  (Images from Kaggle dataset showing water-soaked angular leaf spots and leaf wilting)

**Expected Result**: System classifies the images as "Cassava Bacterial Blight" with high confidence (>85%).

**Actual Result**: System correctly identifies CBB with confidence levels between 87-92%.

**Status**: Pass

**Test Case ID: VR-004**

**Test Case Description**: Verify that the system correctly identifies Tomato Early Blight

**Test Steps**:

1. Upload images showing clear symptoms of Tomato Early Blight
2. Observe the system's classification

**Test Data**:

* tomato\_early\_blight\_1.jpg
* tomato\_early\_blight\_2.jpg  
  (Images from Kaggle dataset showing characteristic concentric rings on leaves)

**Expected Result**: System classifies the images as "Tomato Early Blight" with high confidence (>85%).

**Actual Result**: System correctly identifies Tomato Early Blight with confidence levels between 86-93%.

**Status**: Pass

**Test Case ID: VR-005**

**Test Case Description**: Verify that the system provides appropriate management recommendations

**Test Steps**:

1. Upload an image that gets classified as a specific disease
2. Review the management recommendations provided

**Test Data**:

* potato\_late\_blight.jpg (image showing Late Blight symptoms)

**Expected Result**: System provides relevant and accurate management recommendations for Late Blight, including fungicide options, application timing, and preventive measures.

**Actual Result**: System displays appropriate management recommendations including "Apply copper-based fungicides", "Remove and destroy infected leaves", and "Ensure proper plant spacing for ventilation".

**Status**: Pass

**Test Case ID: VR-006**

**Test Case Description**: Verify that the system handles ambiguous cases appropriately

**Test Steps**:

1. Upload images with ambiguous or mixed disease symptoms
2. Observe the system's classification and confidence level

**Test Data**:

* mixed\_symptoms.jpg (image showing symptoms that could be attributed to multiple diseases)
* early\_stage\_disease.jpg (image showing very early, subtle symptoms)

**Expected Result**: System either provides multiple possible diagnoses with confidence levels or indicates uncertainty when appropriate.

**Actual Result**: System displays multiple potential diseases with respective confidence levels and a message indicating some uncertainty in the diagnosis.

**Status**: Pass

**Test Case ID: VR-007**

**Test Case Description**: Verify that the system correctly processes images with background elements

**Test Steps**:

1. Upload images of diseased leaves with varying backgrounds (soil, other plants, hands, etc.)
2. Observe the system's ability to focus on the leaf and provide accurate classification

**Test Data**:

* leaf\_with\_soil\_background.jpg
* leaf\_held\_in\_hand.jpg
* leaf\_among\_other\_plants.jpg

**Expected Result**: System successfully isolates the target leaf and provides accurate disease classification despite background elements.

**Actual Result**: System correctly isolates and classifies the target leaves with only a slight reduction in confidence levels (3-5%).

**Status**: Pass

**Conclusion:**

The comprehensive testing of the AI-driven crop disease prediction and management system has verified its ability to handle various image inputs, provide an intuitive navigation experience, and generate accurate disease classifications with appropriate management recommendations. The system successfully handles different image formats, qualities, and backgrounds, while maintaining high accuracy in disease identification.

The test results demonstrate that the RexNet-150 model implementation effectively distinguishes between healthy and diseased crop leaves, and accurately identifies specific diseases. The system's user interface provides clear navigation paths and maintains session data appropriately. Management recommendations are relevant and actionable, providing valuable guidance to users.

Some areas for potential improvement include enhancing the system's performance with very early-stage disease symptoms and further refining the confidence reporting for ambiguous cases. Overall, the testing confirms that the system meets its core requirements and is ready for deployment, with the potential to significantly benefit agricultural disease management by enabling early detection and intervention.