**Functional Testing**

**6.1 Overview**

Functional testing was conducted to ensure that each component of the Smart Sorting system—ranging from image upload to fruit classification output—performed as intended. The goal was to validate the system’s ability to deliver accurate and consistent results under expected usage scenarios.

**6.2 Test Objectives**

The testing focused on the following core functionalities:

* Image upload and preview
* Backend communication with the ML model
* Fresh/rotten prediction for supported fruits (Apple, Banana, Orange)
* Confidence score display
* Result rendering with image and label
* Error handling for unsupported formats or empty inputs

**6.3 Test Environment**

| Parameter | Description |
| --- | --- |
| Platform | Localhost (Flask server) |
| Frontend Technologies | HTML, CSS, Bootstrap |
| Backend Framework | Flask (Python) |
| ML Framework | TensorFlow with Keras (MobileNetV2 – transfer learning) |
| Browser Tested | Google Chrome, Microsoft Edge |
| Image Format Supported | JPG, JPEG, PNG |

**6.4 Test Cases**

| Test Case ID | Test Scenario | Test Steps | Expected Result | Pass/Fail |
| --- | --- | --- | --- | --- |
| TC-001 | Image Upload Valid | Upload a valid image of a fruit (e.g., apple.jpg) | Image preview is displayed | Pass |
| TC-002 | Classification Accuracy | Upload image of fresh apple | Output: “Fresh Apple” with confidence score | Pass |
| TC-003 | Classification Accuracy | Upload image of rotten banana | Output: “Rotten Banana” with confidence score | Pass |
| TC-004 | Error Handling – No File Selected | Submit without selecting an image | Show message: “Please upload an image” | Pass |
| TC-005 | Error Handling – Unsupported File Type | Upload a .txt or .pdf file | Show error or ignore with safe handling | Pass |
| TC-006 | UI Responsiveness | Use different screen sizes (mobile/tablet/desktop) | Layout adjusts properly; no overflow | Pass |
| TC-007 | Confidence Score Display | Upload any fruit image | Model returns confidence (e.g., 93.5%) | Pass |

**6.5 Observations**

* The application responded correctly to all valid inputs.
* The confidence scores varied appropriately based on image quality and fruit condition.
* Error messages for missing or unsupported files were clear and user-friendly.
* The model performed consistently with an average classification time of under 2 seconds per image.

**6.6 Summary**

The functional testing phase confirmed the system is reliable, interactive, and user-friendly. All features worked as expected under normal conditions, making the Smart Sorting application ready for deployment and real-world usage. Minor enhancements, such as image cropping or drag-and-drop upload support, can be considered for future versions.