

Table of Contents

Table of Contents.....	1
1. Introduction	3
1.1 Overview	3
1.2 Test Approach	3
2. Test Plan.....	4
2.1 Features to Test	4
2.2 Features Not to Test	5
2.3 Test Environment and Tools	5
3.1 Scenario-1 - Notification of the Nearest Object.....	6
3.1.1 Objective	6
3.1.2 Inputs	6
3.1.3 Expected Results & Pass/Fail Criteria	6
3.1.4 Test Procedures	7
3.1.5 Conclusion	7
3.2 Scenario-2 - Audio Feedback Format and Timing	7
3.2.1 Objective	7
3.2.2 Inputs	7
3.2.3 Expected Results & Pass/Fail Criteria	7
3.2.4 Test Procedures	8
3.2.5 Conclusion	8
3.3 Scenario-3 - Stop / Resume Feature.....	9
3.3.1 Objective	9
3.3.2 Inputs	9
3.3.3 Expected Results & Pass/Fail Criteria	9
3.3.4 Test Procedures	9
3.3.5 Conclusion	10
3.4 Scenario-4 - Testing Power On and Vibration Notifications	10
3.4.1 Objective	10
3.4.2 Inputs	10
3.4.3 Expected Results & Pass/Fail Criteria	10
3.4.4 Test Procedures	11
3.4.5 Conclusion	11
3.5 Scenario-5 - Voice Notification without Delay (Response Time Test)	11
3.5.1 Objective	11
3.5.2 Inputs	12
3.5.3 Expected Results & Pass/Fail Criteria	12
3.5.4 Test Procedures	12
3.5.5 Conclusion	13
3.6 Scenario-6 - Keeping Voice Notification Up-to-Date (Delayed Data Non-Disclosure Test)....	13

3.6.1 Objective	13
3.6.2 Inputs	13
3.6.3 Expected Results & Pass/Fail Criteria	13
3.6.4 Test Procedures	14
3.6.5 Conclusion	14
4. Test Result Report	14
4.1 Test Scenarios Results Summary	14
4.2 General Evaluation	15
4.3 Conclusion	15

1. Introduction

This document has been prepared to document the software testing process of the "*Object Detection for the Visually Impaired (ViNET)*" mobile application.

The application aims to perform object detection and depth estimation on images taken from the environment through the camera and present this information to the user as audio feedback.

This test document details the tests performed to evaluate the conformance of the system to functional requirements, to detect defects and to verify the reliability of the system.

A manual testing approach was adopted and the functional correctness of the application was tested on the real device. The testing process was structured around requirements-based scenarios.

1.1 Overview

The test studies were conducted on three main functionalities of the system:

1. **Object Detection:** At certain intervals (every 2 seconds), it is checked whether the object detection is done correctly in the images taken from the environment.
2. **Depth Estimation:** Evaluates whether the distance between the detected objects and the device is estimated approximately correctly.
3. **Audio Feedback:** Tests whether detection and prediction results are communicated to the user in the correct sentence format and in a timely manner.

The test plan contains scenario-based test steps for each of these functionalities. Each scenario is structured as purpose, inputs, expected results, procedure and test results.

1.2 Test Approach

The following testing approach was adopted in this project:

- **Manual Functional Testing:** Separate, manually triggered test scenarios were applied for each feature.
- **Testing on a Real Device:** Tests were performed on an iPhone 11 with iOS 18.4.1.
- **Positive and Negative Test Cases:** Both successful and failed operation scenarios are planned.

- **Observational Validation:** Results were verified through audio feedback and interface output.
- **Test Pass/Fail Criteria:** The system should produce the expected output in each scenario and inform the user with an audible warning in case of errors.

This approach will evaluate whether the system works reliably and correctly in user scenarios.

2. Test Plan

This section describes which features are included and which are excluded in the testing process, the environment in which the testing will be performed and the tools used.

2.1 Features to Test

The following system functions are within the scope of testing:

- **Object Detection Success**
The application should be able to detect objects on images taken from the environment, identify the nearest object and prepare this information for audio notification.
(Note: Your model time time wrong Classification that he can do eye taken into account).
- **Depth Estimation Accuracy**
The approximate distance of the detected object to the user must be successfully estimated and this distance information must be included in the voice notification.
- **Validating Model Selection (Performance Benchmarking)**
The YOLOv8s (object detection) and MiDaS Small (depth estimation) models used in the application were selected during the development process by comparing them with alternative models in terms of performance and accuracy.
The correct operation of these choices will be verified on a scenario basis through the operation of the system without delay and with sufficient accuracy.
- **Audio Feedback Format and Timing**
Object name, location and distance information must be spoken in the correct order. Voice output should work smoothly, without interruption or delay.
- **Notifying Only the Nearest Object**
The application should only provide information about the nearest object. Even if more than one object is detected, only the closest one will be checked to see if it is reported.

- **Stop and Resume Feature**
The application should be stopped with a double tap on the screen and resumed with a single tap. During the pause, the voice message should be allowed to complete.
- **Start and Stop Feedbacks**
There should be an audible opening notification when the application is opened and vibration feedback when it is paused.
- **User Interface Visualization**
Check that the screen shows only the camera image and the text ""Double-click the screen to stop, and single-click to continue.""

2.2 Features Not to Test

The following features are outside the scope of the test:

- **LIDAR Support:** iPhone 11 is not equipped with LIDAR hardware, so this feature is outside the scope of testing.
- **Multi-Device Compatibility:** Only iPhone 11 will be tested. Other iOS devices are not evaluated in this test cycle.
- **Network Connection / Online Functions:** The application is designed to work completely offline. Any structure that requires internet has not been tested.
- **Off Rear Camera Use:** Only the default (rear) camera will be used. Front camera is not supported.
- **Model Development Process:** The training process of the models to be used is not evaluated within the scope of this test.

2.3 Test Environment and Tools

The test environment and tools are given in Table 1.

Component	Details
Test Device	iPhone 11, iOS 18.4.1
Test Method	Manual (manually triggered scenarios)
Test Environment	In real environment (daylight, in areas with objects such as tables, chairs)

Tools Used	Xcode 16.3, Apple CoreML, AVFoundation, AVSpeechSynthesizer
Artificial Intelligence Models	YOLOv8s (Object Detection), MiDaS Small (Depth Estimation)
Voice Feedback	iOS Text-to-Speech API
Interface Test	Real device display controls

Table 1 - Test Environment and Tools

3.1 Scenario-1 - Notification of the Nearest Object

3.1.1 Objective

To verify that the system only gives an audible notification about the closest object, even if more than one object is detected.

3.1.2 Inputs

- 2 or more objects positioned at different distances in the test environment (for example: table 1 meter, chair 2 meters).
- Directing the camera towards these objects after the app is launched.

3.1.3 Expected Results & Pass/Fail Criteria

The criteria and passing conditions are given in Table 2.

Criteria	Pass Condition
Object detection	The camera must detect at least two objects.
The right choice	Only the audio output for the nearest object should be produced.
Output format	It should contain accurate location, distance and class information, such as "A table is 75 centimeters to the right".
Single notification	No information should be given about other objects.

Table 2 - Criteria and Passing Conditions for the Nearest Object Reporting Test

Pass: Only if the nearest object is declared

Remains: If more than one object is reported at the same time, or if a different object is reported but not the closest one

3.1.4 Test Procedures

1. The app opens and objects are placed in the camera's field of view at different distances.
2. The camera is held still and detected for 3 seconds.
3. The generated audio notification is listened to carefully.
4. It is visually checked whether the reported object is indeed the nearest object.
5. If necessary, the test is repeated in different combinations (e.g. chair forward, table back).

3.1.5 Conclusion

 **Passed**

3.2 Scenario-2 - Audio Feedback Format and Timing

3.2.1 Objective

To verify that the system provides the user with complete and delay-free audio feedback about the detected object in the correct format.

3.2.2 Inputs

- A clear and perceptible object in front of it (for example: table, 1.5 meters away)
- Application running, not paused
- Test is carried out in a noiseless environment (to hear the voice notification clearly)

3.2.3 Expected Results & Pass/Fail Criteria

The criteria and passing conditions are given in Table 3.

Criteria	Pass Condition
Voice output production	Audio output should be produced after detection
Format conformity	The notification must include the complete object name, direction and distance (e.g. "A table is 75 centimeters to the right")
Message integrity	Sentence should be completed naturally and clearly, without interruptions
Timing	Maximum 2 seconds delay between detection and audible notification

Table 3 - Criteria and Passing Conditions for Audio Feedback Test

Passes: If voice notification is provided in the correct format, in a clear and timely manner

Remains: If the notification is late, interrupted or information is missing

3.2.4 Test Procedures

1. The application is launched and the object is placed in the camera's field of view.
2. Wait a few seconds until the system detects the object.
3. The audio output is carefully listened to and transcribed.
4. Format conformity (direction+ object name+ distance) is checked.
5. The time between detection and audible notification is measured with a stopwatch.
6. The test is repeated with different combinations of objects and distances.

3.2.5 Conclusion

 **Passed**

3.3 Scenario-3 - Stop / Resume Feature

3.3.1 Objective

To verify that the app can be stopped with a double tap and r e s u m e d with a single tap, and that audio output is not interrupted.

3.3.2 Inputs

- Double-tap the screen while the application is active (stop)
- One touch after a few seconds (continue)
- While this is being done, the system should be enabled to produce an audible notification (for example, an object should be seen in advance)

3.3.3 Expected Results & Pass/Fail Criteria

The criteria and passing conditions are given in Table 4.

Criteria	Pass Condition
Stop Reaction	The system should stop making new detections after a double tap
Continuation Response	Detection should restart after a single touch
Voicemail Protection	During a pause, the current voice message must be allowed to complete
Silence During Stop	The system should not generate new audible notifications when in stop mode

Table 4 - Criteria and Passing Conditions for Stop / Resume Test

Passes: Remain if the system stops, waits and resumes correctly: If it responds incorrectly/incompletely to touches, if the voice output is interrupted, or if the system performs an operation without waiting

3.3.4 Test Procedures

1. Run the application, place an object to be detected in front of it.

2. When the system detects the object and starts to output audio, the screen is double-tapped.
3. Check whether the current voice notification has ended.
4. If the system stops, wait 3-4 seconds and there should be no voice message.
5. One touch restarts the system.
6. The system must re-detect and generate a new voice notification.

3.3.5 Conclusion

 **Passed**

3.4 Scenario-4 - Testing Power On and Vibration Notifications

3.4.1 Objective

To test whether the app gives an audible opening notification at startup and notifies the user via vibration when a stop or resume command is received.

3.4.2 Inputs

- The application is just started (cold start).
- After the start of operation, the system is stopped by double tapping the screen.
- In a stopped program, the program is resumed by touching the screen once.

3.4.3 Expected Results & Pass/Fail Criteria

The criteria and passing conditions are given in Table 5.

Criteria	Pass Condition
Opening notification	An opening sound should be heard when the application is launched
Stop/resume notification	When stopping or resuming, the device will vibrate to alert the user

	must inform
Delay	Notifications must be instantaneous (max. within 1 second)
Repeatability	The process must work consistently every time it is repeated

Table 5 - Criteria and Passing Conditions for Testing of Opening and Vibration Notifications

Resumes: Sound notification at startup and the device vibrates after pause or resume

Remain: If any of these do not happen, are delayed or work inconsistently

3.4.4 Test Procedures

1. The application is launched when it is completely closed.
2. The onset sound is observed and checked for audibility.
3. Once the app has started running, it is stopped with a double tap.
4. The tester is used to check whether the device vibrates or not.
5. A stopped application is resumed with a single touch.
6. The tester is used to check whether the device vibrates or not.
7. The test is repeated 3 times to assess its stability.

3.4.5 Conclusion

 **Passed**

3.5 Scenario-5 - Voice Notification without Delay (Response Time Test)

3.5.1 Objective

To test whether the app generates the audible notification within the maximum acceptable time after detecting an object.

3.5.2 Inputs

- A new object (e.g. water bottle) is suddenly placed in the field of view
- The application must be open and running
- Response time is measured using a stopwatch

3.5.3 Expected Results & Pass/Fail Criteria

Criteria and passing conditions are given in Table 6.

Criteria	Pass Condition
Detection period	When the system recognizes the object, the process should start
Voice response time	The audible notification must start within a maximum of 2 seconds from the detection
Voice notification completion time	The sentence must be completed fluently, the system must not pause or delay
Consistency	When the same test is performed with different objects, the results should be of similar duration

Table 6 - Criteria and Passing Conditions for the No Delay Test for Voice Notification

Passes: If audio feedback starts within 2 seconds and is consistent

Remains: If the delay exceeds 2 seconds or the system sometimes does not react

3.5.4 Test Procedures

1. All objects are removed from in front of the camera while the app is running.
2. A new object is quickly placed in the field of view.
3. At this moment the stopwatch is started.
4. The duration is stopped as soon as the voice notification starts.
5. Check if the duration exceeds 2 seconds.

6. The same test is repeated at least 3 times with different objects and the average time is evaluated.

3.5.5 Conclusion

■ Passed

3.6 Scenario-6 - Audio Keeping Notification Up-to-Date (Delayed Data Do Not Tell Test)

3.6.1 Objective

To verify that when the system detects a large number of objects or when detections occur in succession, it only provides audio feedback on the most recent (current) detected object and cancels previous (overdue) object notifications.

3.6.2 Inputs

- Different objects are placed in quick succession in the camera field (e.g. first a chair, then a table).
- The system must repeatedly detect these objects
- The user should only hear a voice notification of the last object at this time

3.6.3 Expected Results & Pass/Fail Criteria

Criteria and passing conditions are given in Table 7.

Criteria	Pass Condition
Notification timeliness	Only the last seen object should be reported
Disposal of old data	Verify that the previous object's voice notification was canceled
Consistency	The same process should be repeated to obtain stable results

Table 7 - Criteria and Passing Conditions for the Voice Notification Stay Current Test

Pass: Only if the system reports the last object information by voice

Remains: If old objects are also voiced respectively or if delayed notification occurs

3.6.4 Test Procedures

1. The camera is first aimed at an object (e.g. a chair).
2. Immediately afterwards, another object is brought into the field of view (e.g. a table).
3. Attention is paid to the voice notification from the system.
4. If only information about the end (table) is given, the test passes.
5. The same test is repeated 3 times with different object pairs to check consistency.

3.6.5 Conclusion





 **Passed**

4. Test Result Report

This section summarizes the results of all scenarios specified in the test plan and evaluates the overall test status of the system.

The tests were carried out manually on the iPhone 11 device and the accuracy of the voice notifications and system behaviors were checked observationally.

4.1 Test Scenarios Results Summary

Scenario No	Test Name	Conclusion
3.1	Notification of the Nearest Object	 Passed
3.2	Audio Feedback Format and Timing	 Passed
3.3	Stop / Resume Feature	 Passed
3.4	Testing Power On and Vibration Notifications	 Passed

3.5	Voice Notification Without Delay	▣ Passed
3.6	Keeping Voice Notification Up-to-Date	▣ Passed

4.2 General Evaluation

All test scenarios were successfully completed and the application worked in accordance with the specified functional requirements.

The system provides audio feedback in a timely and accurate format, providing information only about the most recent object and reacting as expected to stop/resume commands.

It also clearly notifies the user of system states such as startup, stop and resume via sound/vibration.

The depth estimation and object detection modules are not perfect due to performance and model limitations, but provide sufficient accuracy in practical use.

The model choices (YOLOv8s and MiDaS Small) were found to be successful due to their high speed and low latency during the testing process.

4.3 Conclusion

As a result of the tests, the application:

- Successfully fulfilled its basic functions,
- Voice feedback is effective and timely,
- It was observed to work reliably in terms of user interaction.

Overall test result: SUITABLE / SUCCESSFUL