ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Test Plan, Test Design Specifications and Test Cases

Version 1

CENG 408

Innovative System Design and Development II

LICENCE PLATE RECOGNITION SYSTEM

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1. INTRODUCTION

1.1 Version Control

Version No	Description of Changes	Date
1.0	First Version	April 1, 2022

1.2 Overview

Our project is License Plate Recognition System. The use cases of the system are explained in the SRS document. Accordingly, the features required for license plate recognition will be tested.

1.3 Scope

Scope of this document specifies test plan specifications according to the use cases found in the Software Requirements Specification Document. This document includes features that should be tested, features that will not be tested, test design features, and detailed test cases of use cases according to the test plan.

1.4 Terminology

Acronym	Definition
SRS	Software Requirements Specification
SDD	Software Design Document
CS	Character Segmentation
Licence Plate	A license plate is a sign that is placed on the front and back of a car and displays the vehicle's license number.
Licence Plate Recognition System	Technology that allows computers to read the license number of vehicles.
OCR	Optical Character Recognition
TP	Test Plan

2. FEATURES TO BE TESTED

This section lists and gives a brief description of all the main features of our project that will be tested. For each major feature there will be a Test Design Specification appended to the end of this document.

2.1 Detection Vehicles (DV)

License Plate Recognition System can recognize vehicles in order to detect license plates.

2.2 Detection Licence Plates (DLP)

License Plate Recognition System can detect plate through the software used in the system.

2.3 Optical Character Recognition (OCR)

License Plate Recognition System detects the characters on the plate using OCR method in plate detection.

3. FEATURES NOT TO BE TESTED

3.1 Working in Different Environmental Conditions

Since the License Plate Recognition System will take images with the camera and transfer them to the computer, it can detect license plates when the ambient conditions are good. Therefore, the operation of the License Plate Recognition System in different environmental and weather conditions will not be tested.

4. ITEM PASS/FAIL CRITERIA

License Plate Recognition System performs plate recognition by taking images in real time with the camera. If the camera is disconnected, it cannot detect the license plate due to the lack of image transmission.

4.1 Exit Criteria

- 100% of the test cases are executed
- 90% of the test cases passed
- All High and Medium Priority test cases passed

5. REFERENCES

[1] CENG408_Group21_SRS, April 1, 2022. Available https://github.com/CankayaUniversity/ceng-407-408-2021-2022-Licence-Plate-Recognition-System/wiki/Software-Requirements-Specification

[2] CENG408_Group21_SDD, April 1, 2022. Available https://github.com/CankayaUniversity/ceng-407-408-2021-2022-Licence-Plate-Recognition-System/wiki/Software-Design-Description

[3] CENG408_Group21_ProjectReport, April 1, 2022. Available https://github.com/CankayaUniversity/ceng-407-408-2021-2022-Licence-Plate-Recognition-System/blob/main/CENG%20407%20Licence%20Plate%20Recognition%20System%20Project%20Report.pdf

6. TEST DESIGN SPECIFICATIONS

6.1 Detection Vehicles (DV)

6.1.1 Subfeatures To Be Tested

6.1.1.1 Camera Connection (DV.CC)

In order to detect vehicles in the License Plate Recognition System, a real-time connection is provided with the ESP32 camera module using Wi-Fi. After the camera connection is established, image transfer is provided and vehicle detection becomes possible.

6.1.1.2 Vehicle Size (DV.VS)

While detecting vehicles in the License Plate Recognition System, whether the objects are vehicles or not is determined according to their dimensions and features.

6.1.2 Test Cases

Here are the system's test cases for the Detection Vehicles feature.

TC ID	Requirements	Priority	Scenario Description
DV.CC.01	3.1.2.2	H	ESP32 camera module works by providing Wi-Fi connection.
DV.CC.02	3.1.2.2	H	Detection software works over real time video with Wi-Fi connection.

TC ID	Requirements	Priority	Scenario Description
DV.VS.01	3.2.6	H	Real time video image works with ESP32 camera module.
DV.VS.02	3.2.6	H	Vehicle recognition is performed by dividing them by size from other objects.

6.2 Detection Licence Plates (DLP)

6.2.1 Subfeatures To Be Tested

6.2.1.1 Camera Connection (DLP.CC)

Real-time connection is provided with the ESP32 camera module using Wi-Fi for plate detection. After the camera connection is established, image transfer is provided and plate detection becomes possible.

6.2.1.2 Licence Plate Size (DLP.LPS)

After the vehicle is detected, the license plate recognition process is performed by considering the smallest rectangle with the plate size.

6.2.2 Test Cases

Here are the system's test cases for the Detection Licence Plates feature.

TC ID	Requirements	Priority	Scenario Description
DLP.CC.01	3.1.2.2	H	ESP32 camera module works by providing Wi-Fi connection.
DLP.CC.02	3.1.2.2	H	Detection software works over real time video with Wi-Fi connection.

TC ID	Requirements	Priority	Scenario Description
DLP.LPS.01	3.2.8	H	License plate recognition is performed to detect the smallest rectangle on vehicles.

6.3 Optical Character Recognition (OCR)

6.3.1 Subfeatures To Be Tested

6.3.1.1 Character Segmentation

After the license plate recognition process is performed in the License Plate Recognition System, the parts containing the characters are separated by the character segmentation method.

6.3.2 Test Cases

Here are the system's test cases for the Optical Character Recognition (OCR) feature.

TC ID	Requirements	Priority	Scenario Description
OCR.CS.01	3.2.10	H	Image segmentation is applied to the image inside the plate to find the characters within the detected plate.
OCR.CS.02	3.2.10	H	Characters are recognized using the OCR method.

7. Detailed Test Cases

7.1 DV.CC.01

TC_ID	DV.CC.01
Purpose	Provide the Wi-Fi connection for the ESP32 camera module to work.
Requirements	3.1.2.2
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	Internet connection required.
Setup	ESP32 camera module and computer should be ready for operation.
Procedure	[A01] Provide internet connection for computer.
	[A02] Power up the ESP32 camera module.
	[A03] Connect the computer and the ESP32 camera module with a Wi-Fi connection.
	[V01] Observe that the ESP32 camera module is running.
Cleanup	Turn off ESP32 camera module and Wi-Fi connection.

7.2 DV.CC.02

TC_ID	DV.CC.02
Purpose	Run the detection software over live video.
Requirements	3.1.2.2
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	The ESP32 camera module and computer must be connected and ready to work.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Video transfer takes place from the ESP32 camera module to the computer.
	[A02] Real time video is taken from the computer.
	[A03] The software for vehicle detection works.
	[V01] Observe that vehicle detection is successful.
Cleanup	Close the software.

7.3 DV.VS.01

TC_ID	DV.VS.01
Purpose	Provide live video transmission via ESP32 camera module.
Requirements	3.2.6
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	Internet connection required.
Setup	ESP32 camera module and computer should be ready for operation.
Procedure	[A01] Provide internet connection for computer.
	[A02] Power up the ESP32 camera module.
	[A03] Connect the computer and the ESP32 camera module with a Wi-Fi connection.
	[A04] Video transfer takes place from the ESP32 camera module to the computer.
	[A05] Real time video is taken from the computer.
	[V01] Observe live video streaming.
Cleanup	Turn off ESP32 camera module and Wi-Fi connection.

7.4 DV.VS.02

TC_ID	DV.VS.02
Purpose	Perform vehicle recognition.
Requirements	3.2.6
Priority	High.
Estimated Time Needed	25 Seconds
Dependency	The DV.VS.01 operation should be successful.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Provide video transmission with the ESP32 camera module.
	[A02] The vehicle image is converted to gray scale format.
	[A03] The image is binarized to reveal the plate.
	[A04] All contours of the vehicle image are found.
	[V01] Observe that vehicle recognition is successful.
Cleanup	Close the software.

7.5 DLP.CC.01

TC_ID	DLP.CC.01
Purpose	Provide the Wi-Fi connection for the ESP32 camera module to work.
Requirements	3.1.2.2
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	Internet connection required.
Setup	ESP32 camera module and computer should be ready for operation.
Procedure	[A01] Provide internet connection for computer.
	[A02] Power up the ESP32 camera module.
	[A03] Connect the computer and the ESP32 camera module with a Wi-Fi connection.
	[V01] Observe that the ESP32 camera module is running.
	Turn off ESP32 camera module and Wi-Fi connection.
	20 Seconds
Cleanup	Internet connection required.

7.6 DLP.CC.02

TC_ID	DLP.CC.02
Purpose	Run the detection software over live video.
Requirements	3.1.2.2
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	The ESP32 camera module and computer must be connected and ready to work.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Video transfer takes place from the ESP32 camera module to the computer.
	[A02] Real time video is taken from the computer.
	[A03] The software for vehicle detection works.
	[V01] Observe that vehicle detection is successful.
Cleanup	Close the software.

7.7 DLP.LPS.01

TC_ID	DLP.LPS.01
Purpose	Perform licence plate recognition.
Requirements	3.2.8
Priority	High.
Estimated Time Needed	25 Seconds
Dependency	The DLP.CC.01 and DLP.CC.02 operations should be successful.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Provide video transmission with the ESP32 camera module.
	[A02] Provide DV.VS.02 operation.
	[A03] The bounding rectangle of each contour in the vehicle image is found.
	[A04] Comparisons are made according to average plate sizes.
	[A04] Plate detection is provided by taking the smallest rectangle.
	[V01] Observe that plate recognition is successful.
Cleanup	Close the software.

7.8 OCR.CS.01

TC_ID	OCR.CS.01
Purpose	Provide image segmentation for character recognition.
Requirements	3.2.10
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	Vehicle detection and license plate detection operations should be carried out.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Provide video transmission with the ESP32 camera module.
	[A02] Provide DV.VS.02 and DLP.LPS01 operations.
	[A03] Image segmentation is applied to the image within the validated contour.
	[V01] Observe that image segmentation is successful.
Cleanup	Close the software.

7.9 OCR.CS.02

TC_ID	OCR.CS.02
Purpose	Enable character recognition with OCR.
Requirements	3.2.10
Priority	High.
Estimated Time Needed	20 Seconds
Dependency	OCR.CS.02 operation should be carried out.
Setup	ESP32 camera module, computer and software should be ready for operation.
Procedure	[A01] Provide OCR.CS.01 operation.
	[A02] OCR method is used.
	[A03] Characters are recognized separately.
	[V01] Observe that the characters on the license plates of the vehicles.
Cleanup	Close the software.

8. Test Results

Test implementations are ongoing and will be added later.