



**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

Drowsy Driver Detection System

*Volkan Mazlum
201811045
Bahu Tongal
201811058
Mert Alp
Kuvandik
201911038*

Advisor: *Dr. Serdar ARSLAN*

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1. INTRODUCTION

1.1 Version Control

Version No	Description of Changes	Date
1.0	First Version	March 25, 2023

1.2 Overview

Drowsy Driver Detection System is a machine learning based application to detect drowsiness of driver. The use case of the system had been explained in the SRSdocument. The system will be tested according to these features in different environments.

1.3 Scope

This document includes the test plan of the use cases, test cases according to the test plan, and test design specifications. Therefore, the following sections will explain how we will implement test cases and what will be the test criteria.

1.4 Terminology

Acronym	Definition
SRS	Software System Requirements
SDD	Software Design Document
GUI	Graphical User Interface
Web Application	A software which is coded by team members, and it includes different modes and features of the system.

2. FEATURES TO BE TESTED

In this section, we will explain our test plan and provide general information regarding the features to be tested. Additionally, for each feature, there will be a Test Design Specification given at the end of this document.

2.1 Detecting Face, Eyes and Mouth

Drowsy Driver Detection System has a camera which can detect face, eyes, mouth and send the real time video to our web application. Therefore, users are capable of observing external threats around that environment.

2.2 Classification with ML Model

Drowsy Driver Detection System can make classification via Machine Learning model. For that purpose, the system uses the outputs that are received from its camera by being frame.

2.3 Alert System

Drowsy Driver Detection System can be operated via our web application. For that purpose, the system has a Bluetooth module to transmit videos to our app from camera.

2.4 Creating New Datasets with GANs

Drowsy Driver Detection System has a different module from another project. It creates new datasets not taken from articles, and they can be used to improve accuracy and similar metrics of ML model.

3. FEATURES NOT TO BE TESTED

In this section, we described features which we will not be tested.

3.1 Performance on different environments

Our app can be used when the environmental factors are regular. Therefore, we will not test Drowsy Driver Detection System under such circumstances.

4. ITEM PASS/FAIL CRITERIA

To be able to get success on this project, our app should detect drowsiness with high accuracy, and warn the user when drowsiness is detected. If any of the features are described in Section 2, we will consider the test as failed.

4.1 Exit Criteria

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

5. REFERENCES

- [1] CENG408_Group7_SRS, March 25, 2022. Available:
<https://github.com/CankayaUniversity/ceng-407-408-2022-2023-Drowsy-Driver-Detection-System/wiki/Software-Requirements-Specification>
- [2] CENG408_Group1_SDD, March 25, 2022. Available:
<https://github.com/CankayaUniversity/ceng-407-408-2022-2023-Drowsy-Driver-Detection-System/wiki/SDD>

6. TEST DESIGN SPECIFICATIONS

6.1 Detecting Face, Eyes and Mouth (DFEM)

6.1.1 Sub features to be tested.

6.1.1.1 Camera and Web Application Connection (DFEM.CWAC)

To be able to display detected face, eyes and mouth on the screen, the Camera and Web Application must be connected. After the connection is handled, we receive a real time video from camera on the screen. At this step, system is ready for detection procedure. In addition, to receive data from the camera, the user must first log into the system.

6.1.1.2 Database Connection (DFEM.DC)

To use the application, the driver does not need to log in after turning on the system first. Therefore, it should be tested whether it has a connection with the database.

6.1.1.3 Login Web Application (DFEM.LWA)

To use the application, the driver does not need to log in after turning on the system first. If it is not registered in the system, it must be registered in the system. Afterwards, the system will be directed to the camera system as the application screen.

6.1.1.4 Capturing Real-time Video (DFEM.CRTV)

To receive the video, you must first login to the system. Afterwards, communication with the camera should be established and after this process, the web application will display the video on the screen.

6.1.1.5 Capturing Frame and Detect Facial (DFEM.CFDF)

After the video is obtained, this video needs to be split into frames. It is necessary to detect the face, eyes, and mouth from the obtained frames.

6.1.2 Test Cases

In this section, we listed related test cases for feature Detecting Objects (DO).

TC ID	Requirements	Priority	Scenario Description
DFEM.CWAC.01	3.2.1.2.2	High	Connection with camera configuration is set.
DFEM.CWAC.02	3.2.1.2.2	High	Camera is detected by bluetooth.

TC ID	Requirements	Priority	Scenario Description
DFEM.DC.01	3.2.1.2.1	High	The database connection must be checked during the user's login or registration.
DFEM.DC.02	3.2.1.2.1	High	If the connection is correct, the operations should be continued.

TC ID	Requirements	Priority	Scenario Description
DFEM.LWA.01	3.2.1.2.1	High	Press “Login” or “Register” button on Web Application.
DFEM.LWA.02	3.2.1.2.1	High	User will give information of their self and login the system.

TC ID	Requirements	Priority	Scenario Description
DFEM.CRTV.01	3.2.1.2.2	High	Press “Start” button on Web Application.
DFEM.CRTV.02	3.2.1.2.2.2	High	Receive real time video from camera.

TC ID	Requirements	Priority	Scenario Description
DFEM.CFDF.01	3.2.1.2.2.1	High	Converting Real-time video as frames
DFEM.CFDF.02	3.2.1.2.2.(3-4-5)	High	Detecting Face, Eyes and Mouth from frames

6.2 Classification with ML Model (CM)

6.2.1 Subfeatures to be tested

6.2.1.1 Training Machine Learning Model (CM.TMLM)

The model developed with the available datasets should be trained. Afterwards, accuracy and similar metrics should be checked by testing, and they should be trained again with a different model according to the results.

6.2.1.2 Detecting Status of Frames (CM.DSF)

The model obtained should be presented to the web application, and the application should detect the eye and mouth conditions of the driver in the frames obtained from the video obtained in real-time using this model.

6.2.2 Test Cases

In this section, we listed related test cases for feature Classification Module.

TC ID	Requirements	Priority	Scenario Description
CM.TMLM.01	3.2.1.2.2.8	High	The model should be developed and trained with the obtained datasets. The test results should be examined through different metrics in the developed model. A good model should be obtained by comparing the results.

TC ID	Requirements	Priority	Scenario Description
CM.DSF.01	3.2.1.2.2.8	High	The resulting model should be applied separately for each frame. According to the results, the system should be redirected to the other system to calculate the results.

6.3 Alert System (AS)

6.3.1 Subfeatures to be tested

6.3.1.1. Calculation of Status of Driver via Detection Result (AS.CSDR)

If drowsiness is detected according to the results obtained after the model is applied, the alarm should be activated, and the user should be warned. For this, the amount of yawning and the time the eyes are closed are the basic metrics.

6.3.1.2. Reporting Message and Display Alert (AS.RMDA)

When Drowsy Driver Detection System detects drowsiness while driving, it transmits a reporting

message to the screen of web application. This reporting message is displayed on the web application screen with error message.

6.3.2 Test Cases

In this section, we listed related test cases for feature Alert System (AS).

TC ID	Requirements	Priority	Scenario Description
AS.CSDR.01	3.2.1.2.2.8	High	The model result should be transmitted to the system, the amount of stretching and the duration of the eyes closed should be calculated continuously.
AS.CSDR.02	3.2.1.2.2.8	High	The alarm should be activated after the amount of yawning and the duration of the eyes closed exceed a certain threshold. The alarm should continue for a certain period of time and the user should be awakened.

TC ID	Requirements	Priority	Scenario Description
AS.RMDA.01	3.2.1.2.2.7	High	A error message is sent to the web app. The web application displays warning messages and alert.

6.4 Creating New Datasets with GANs (CND)

6.4.1 Subfeatures to be tested.

6.4.1.1 Testing GANs Model (CND.TGANM)

After training the model, it should be tested with different data and whether it can easily produce the datasets required for the application.

6.4.2 Test Cases

In this section, we listed related test cases for feature Creating New Datasets with GANs (CND).

TC ID	Requirements	Priority	Scenario Description
CND.TGANM.01	3.2.1.2.2	High	After the model is trained, datasets must be generated and tested. These datasets should be used in the system according to their suitability.

1. Detailed Test Cases

1.1 DFEM.CWAC.01

TC_ID	DFEM.CWAC.01
Purpose	Make Camera visible by for connection process.
Requirements	3.2.1.2.2
Priority	High.
Estimated Time Needed	20 seconds
Dependency	There must be Internet connection.
Setup	A computer and web app must be provided.
Procedure	[A01] Connect computer to the Internet.
	[A02] Open Network settings from computer.
	[A03] Press Bluetooth section.
Cleanup	Close Internet connection.

1.2 DFEM.CWAC.02

TC_ID	DFEM.CWAC.02
Purpose	Make Camera ready to stream.
Requirements	3.2.1.2.2
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CWAC.01 needs to work correctly.
Setup	Computer must be working.
Procedure	[A01] Power up the Camera.
	[A02] Power on the Bluetooth with configured settings.
	[A03] Open devices connected section.
	[V01] Observe Camera in the device list.
Cleanup	Disconnect power of Camera.

1.3 DFEM.DC.01

TC_ID	DFEM.DC.01
Purpose	Make Web application database ready for receiving driver data.
Requirements	3.2.1.2.1
Priority	High.
Estimated Time Needed	20 seconds
Dependency	DFEM.CWAC.01-02 need to work correctly.
Setup	Web app must be provided.
Procedure	[A01] Connect to the web app.
	[A02] Open Register Page
	[A03] Give Information of Driver and Satisfied
	[A04] Go Login Page
	[V01] Observe Database is working properly or not.
Cleanup	Close the web application.

1.4 DFEM.DC.02

TC_ID	DFEM.DC.01
Purpose	Make Web application database ready for logging.
Requirements	3.2.1.2.1
Priority	High.
Estimated Time Needed	20 seconds
Dependency	DFEM.CWAC.01-02 and DFEM.DC.01 need to work correctly.
Setup	Web app must be provided.
Procedure	[A01] Connect to the web app.
	[A02] Go to MongoDB Page
	[A03] Give Information
	[A04] Control Information registered is in the database.
Cleanup	Close the database connection.

1.5 DFEM.LWA.01

TC_ID	DFEM.LWA.01
Purpose	Make Driver register in the system.
Requirements	3.2.1.2.1
Priority	High.
Estimated Time Needed	15 seconds
Dependency	DFEM.CWAC.01-02, and DFEM.DC.01-02 need to work correctly.
Setup	Web app must be provided.
Procedure	[A01] Connect to the web app.
	[A02] Open Register Page
	[A03] Give Information
	[A04] Go Login Page
Cleanup	Close the web application.

1.6 DFEM.LWA.02

TC_ID	DFEM.LWA.01
Purpose	Make Driver login in the system.
Requirements	3.2.1.2.1
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CWAC.01-02, and DFEM.DC.01-02 need to work correctly.
Setup	Web app must be provided.
Procedure	[A01] Connect to the web app.
	[A02] Go Login Page
	[A03] Give Information and Press Login Button
	[V01] Observe Camera System Page
Cleanup	Close the web application.

1.7 DFEM.CRTV.01

TC_ID	DFEM.CRTV.01
Purpose	Going to web page for observing real time video stream from camera.
Requirements	3.2.1.2.2
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CWAC.01-02, and DO.CAAC.02 need to work correctly.
Setup	Android app must be provided.
Procedure	[A01] Stream is receiving from camera.
	[A02] START button is pressed.
	[V01] Going to Real-time Video Screen
Cleanup	Close web app to block display of stream.

1.8 DFEM.CRTV.02

TC_ID	DFEM.CRTV.02
Purpose	Make Web application ready for observing real time video stream from camera.
Requirements	3.2.1.2.2.2
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CRTV.01 needs to work correctly.
Setup	All the set up in DFEM.DC and DFEM.LWA must be provided.
Procedure	[A01] Stream is receiving from camera in Real-time video screen.
	[V01] Observe the stream on the computer's screen.
Cleanup	Close the application.

1.9 DFEM.CFDF.01

TC_ID	DFEM.CFDF.01
Purpose	Convert Real-time video stream to frames
Requirements	3.2.1.2.1
Priority	High.
Estimated Time Needed	Not estimated.
Dependency	DFEM.CRTV.01-02 need to work correctly.
Setup	All the set up in DFEM.DC and DFEM.LWA must be provided.
Procedure	[A01] Get Real-time video from DFEM-CRTV part.
	[A02] Apply Algorithms to get frames
	[A03] Store frames in system.
Cleanup	Close the real-time video page to return main page.

1.10 DFEM.CFDF.02

TC_ID	DFEM.CFDF.02
Purpose	Detecting face, eyes, and mouth from frames
Requirements	3.2.1.2.2.(3-4-5)
Priority	High.
Estimated Time Needed	Not estimated.
Dependency	DFEM.CRTV.01-02 and DFEM.CFDF.01 need to work correctly.
Setup	All the set up in DFEM.DC and DFEM.LWA must be provided.
Procedure	[A01] System starts to detect face, eyes and mouth from every frames.
	[A02] Get all frames one by one
	[A03] Detection algorithm is run for every frames
	[V01] Observe detected frames.
Cleanup	Close the real-time video page to return main page.

1.11 CM.TMLM.01

TC_ID	CM.TMLM.01
Purpose	To test training of model in the system to detect drowsiness
Requirements	3.2.1.2.2.8
Priority	High.
Estimated Time Needed	10-15 minutes
Dependency	-
Setup	-
Procedure	[A01] Datasets are taken.
	[A02] Apply ML model.
	[A03] Specify categories or labels
	[A03] Test the model via metrics
	[V01] Observe the detection machine learning model.
Cleanup	Press STOP button again to stop training.

1.12 CM.DSF.01

TC_ID	CM.DSF.01
Purpose	To apply ML model to detect drowsiness of driver
Requirements	3.2.1.2.2.8
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CFDF.01-02 and CM.TMLM.01 need to work correctly.
Setup	All the set up in CM.TMLM.01 must be provided.
Procedure	[A01] Get frames from system.
	[A02] Apply ML model.
	[A03] Detect the status of driver.
	[A04] Direct system to calculate time of closing eye and yawning number.
	[V01] Observe status of frames.
Cleanup	Disconnect camera system of Bluetooth module or close the application.

1.13 AS.CSDR.01

TC_ID	AS.CSDR.01
Purpose	To apply ML model to detect eyes are open or not and yawn, no yawn
Requirements	3.2.1.2.2.8
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CFDF.01-02 and CM.TMLM.01 need to work correctly.
Setup	All the set up in CM.TMLM.01 must be provided.
Procedure	[A01] Get frames from system
	[A02] Apply ML model
	[A03] Detect the status of driver
	[A04] Direct results to the detection system to decide status of driver.
	[V01] Observe status of eyes, mouth
Cleanup	Disconnect camera system of Bluetooth module or close the application.

1.14 AS.CSDR.02

TC_ID	AS.CSDR.02
Purpose	To clarify driver is drowsy or not, while calculating eyes closing time and number of yawning
Requirements	3.2.1.2.2.8
Priority	High.
Estimated Time Needed	10 seconds
Dependency	DFEM.CFDF.01-02 and CM.TMLM.01 need to work correctly.
Setup	All the set up in AS.CSDR.01 must be provided.

Procedure	[A01] Get categories of frames from AS.CADR.01 module
	[A02] Calculate time of eyes closing
	[A03] Calculate number of yawning
	[A04] If drowsiness, direct decision system to alert system
	[V01] Observe status of driver (drowsy or not)
Cleanup	Disconnect camera system of Bluetooth module or close the application.

1.15 AS.RMDA.01

TC_ID	AS.RM.01
Purpose	To create error message and alert according to status of driver
Requirements	3.2.1.2.2.7
Priority	High.
Estimated Time Needed	10 seconds
Dependency	AS.CSDR.01 needs to work correctly.
Setup	All the set up in AS.CSDR.02 must be provided.
Procedure	[A01] After observing status of driver, create error message.
	[A02] Create alert and display error message.
	[A03] Put text on web app's screen.
	[V01] Observe alert and error message
Cleanup	Disconnect the camera supply or close the application.

1.16 AD.TGANM.01

TC_ID	AD.TGANM.01
Purpose	To test GANs model to create new datasets and improve accuracy and metrics.
Requirements	3.2.1.2.2
Priority	High.
Estimated Time Needed	20 minutes
Dependency	-
Setup	GANs model is created.
Procedure	[A01] Get GANs model and apply to datasets
	[A02] Test result to get higher accuracy and frames for app.
	[V01] Observe new datasets, including frames (based on eyes, mouth)
Cleanup	Stop the testing GANs model.

7. Test Results

Test implementations are completed.

TC ID	Priority	Date Run	Run By	Result	Explanation
DFEM.CWAC.01	High	23.03.2023	Volkan Mazlum	Pass	Make visible connection of camera.
DFEM.CWAC.02	High	23.03.2023	Volkan Mazlum	Pass	Make Bluetooth is setted.
DFEM.DC.01	High	25.03.2023	Volkan Mazlum	Pass	Set connection of database for register, login.
DFEM.DC.02	High	20.03.2023	Volkan Mazlum	Pass	Control connection of database.
DFEM.LWA.01	High	01.04.2023	Bahu Tongal	Pass	Control buttons of Login, Register on Web App.
DFEM.LWA.02	High	01.04.2023	Bahu Tongal	Pass	Control setting information of driver to Web App.
DFEM.CRTV.01	High	01.04.2023	Bahu Tongal	Pass	Control button of start to start system.
DFEM.CRTV.02	High	09.04.2023	Volkan Mazlum	Pass	Make receivable real time video from camera.
DFEM.CFDF.01	High	20.04.2023	Bahu Tongal	Pass	Control converting real-time video to frame.
DFEM.CFDF.02	High	20.04.2023	Bahu Tongal	Pass	Control detection of face, mouth, and eyes.
CM.TMLM.01	High	04.05.2023	Volkan Mazlum	Pass	Make classification process is workable.
CM.DSF.01	High	04.05.2023	Volkan Mazlum	Pass	Control classification is applied to all frames.
AS.CSDR.01	High	15.05.2023	Bahu Tongal	Pass	Control result of classification and number of counters.
AS.CSDR.02	High	15.05.2023	Bahu Tongal	Pass	Control warning system to wake up.
AS.RMDA.01	High	15.05.2023	Bahu Tongal	Pass	Make error message sending to users.
CND.TGANM.01	High	18.03.2023	Volkan Mazlum	Pass	Test GANs model to create new datasets.

In Figure 1, Test Result for Drowsy Driver Detection System

8. Summary of Test Results

Priority	Number of TCs	Executed	Passed
High	16	16	16
Medium	0	0	0
Low	0	0	0
TOTAL	16	16	16

In Figure 2, Summary for Test Result