**Driver Drowsiness Detection System**

**Group 2**

**Test Case Report**

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# 1. Objective of the Test Case Report

The primary objective of this test case report is to validate the functionality and performance of the driver drowsiness detection system. This involves assessing the system's ability to accurately detect indicators of drowsiness using computer vision techniques, and to initiate appropriate alerts or actions in response. The report will cover several key aspects:

1. Accuracy: Measuring how accurately the system identifies drowsiness compared to actual data obtained from observations and annotations by human experts.
2. Reliability: Ensuring the system performs consistently under various conditions such as different lighting conditions, facial orientations, and occlusion.

Flags which have been used for indication purpose:

| Drowsiness Detected | |
|---|---|
| NOT Detected | |

# 1. Testcases for the Eye Aspect Ratio (EAR) Model

## 1.1 Threshold > 0.25

| How far the camera was placed? | Placement of Camera | Eye Position | Lighting | Drowsiness detection Flag | Working as expected or not |
|---|---|---|---|---|---|
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide open, looking straight at the camera | Day Light - bright | 🟥 | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the left | Day Light - bright | 🟥 | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the right | Day Light - bright | 🟥 | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking down | Day Light - bright | 🟩 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide open, looking straight at the camera | Day Light – bright | 🟥 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the left | Day Light – bright | 🟥 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the right | Day Light – bright | 🟥 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking down | Day Light - bright | 🟥 | No |
| Close to the face | Towards the right | Wide Open, looking towards the right | Day Light - bright | 🟥 | Yes |
| Close to the face | Towards the right | Wide Open, looking towards the right - down | Day Light - bright | 🟥 | Yes |
| Close to the face | Towards the left | Wide Open, looking | Day Light - bright | 🟥 | Yes |

Test Cases for the Driver Drowsiness Detection System – Group 2

| | | towards the left | | <span style="background-color:red"> </span> | |
|---|---|---|---|---|---|
| Close to the face | Towards the left | Wide Open, looking towards the left-down | Day Light - bright | <span style="background-color:red"> </span> | Yes |

## 2.2 Threshold < 0.25

| *How far the camera was placed?* | *Placement of Camera* | *Eye Position* | *Lighting* | *Drowsiness detection Flag* | *Working as expected or not* |
|---|---|---|---|---|---|
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide open, looking straight at the camera | Day Light - bright | 🟥 | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the left | Day Light - bright | 🟩 | No |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the right | Day Light - bright | 🟩 | No |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking down | Day Light - bright | 🟩 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide open, looking straight at the camera | Day Light – bright | 🟥 | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the left | Day Light – bright | 🟩 | No |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking towards the right | Day Light – bright | 🟩 | No |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Wide Open, looking down | Day Light - bright | 🟥 | No |
| Close to the face | Towards the right | Wide Open, looking towards the right | Day Light - bright | 🟥 | Yes |
| Close to the face | Towards the right | Wide Open, looking towards the right - down | Day Light - bright | 🟥 | Yes |
| Close to the face | Towards the left | Wide Open, looking towards the left | Day Light - bright | 🟥 | Yes |
| Close to the face | Towards the left | Wide Open, looking towards the left-down | Day Light - bright | 🟥 | Yes |

## 3. Testcases for Mouth Aspect Ratio (MAR) with threshold > 0.51:

| SI.NO | Objective | Test Condition | Expected Result | Result |
|---|---|---|---|---|
| 1 | Verify MAR calculation across facial orientations. | Run the algorithm on images/videos with the subject's face at various angles to the camera (slightly turned, looking up/down) | Accurate face detection and MAR calculation for a reasonable range of facial orientations | • 45 degrees to the left and right drowsiness detected but not at 90 degrees.<br>• Looking straight towards the camera, face right up drowsiness detected, but when looking down does not detect. |
| 2 | Assess performance with different facial expressions. | Introduce images/videos of subjects with varying facial expressions (smiling, frowning, neutral) | Correct identification of faces and computation of MAR, demonstrating adaptability to different mouth shapes | At times it works at times it doesn't |
| 3 | Test for multiple faces in the frame | Present images/videos with more than one person in view | Accurate detection of each face and individual MAR computation, | • When looking towards the camera, the facial landmarks its getting detected.<br>• 45 degrees towards |

| | | | | the left and right facial landmarks are getting detected. |
|---|---|---|---|---|
| | | | | • 90 degrees towards the left and right the facial landmarks are not getting detected. |
| 4 | Evaluate system performance with face obstructions | Use images/videos where the subject's mouth or part of the face is partially obscured (e.g., hand over mouth, wearing glasses/mask) | System attempts to detect the face and calculate MAR, with an understanding that accuracy may decrease with significant obstruction | Transparent glasses – the facial landmark for eyes is getting detected. |

## 4. Testcases for Shaking and Nodding (Movement threshold = 10):

| *How far the camera was placed?* | *Placement of Camera* | *Shaking and Nodding* | *Shaking or Nodding Flag* | *Working as expected or not* |
|---|---|---|---|---|
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Shaking from left to right | Shaking | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Shaking from right to left | Shaking | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Nodding from up to down | Nodding | Yes |
| Close to the face | At an angle, Eye level (approx. 0 deg.) | Nodding from down to up | Nodding | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Shaking from left to right | Shaking | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Shaking from right to left | Shaking | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Nodding from up to down | Nodding | Yes |
| One arm distance | At an angle, Eye level (approx. 0 deg.) | Nodding from down to up | Nodding | Yes |

## 5. Testcases for Neural Network Model with multiple dense layers:

| *SI.NO* | *Placement of Camera* | *Eye Position* | *Drowsiness Detection Flag* | *Working as expected or NOT* |
|---|---|---|---|---|
| 1 | At an angle, eye level, 0 deg. | Wide open, looking straight at the camera | | Yes |
| 2 | At an angle, eye level, 0 deg. | Wide open, looking towards the left | | Yes |
| 3 | At an angle, eye level, 0 deg. | Wide open, looking towards the right | | Yes |
| 4 | At an angle, eye level, 0 deg. | Partially open, looking straight at | | Yes |

| | | the direction of the camera | | |
|---|---|---|---|---|
| 5 | At an angle, eye level, 0 deg. | Partially open, looking toward the left | <span style="background-color:red"> </span> | No |
| 6 | At an angle, eye level, 0 deg. | Partially open, looking towards the right | <span style="background-color:red"> </span> | No |
| 7 | At an angle, eye level, 0 deg. | Looking down | <span style="background-color:green"> </span> | Yes |

## 6. Testcases for Neural Network Model (second iteration) which includes dropout layers and batch normalization:

| SI.NO | Placement of Camera | Eye Position | Drowsiness Detection Flag | Working as expected or NOT |
|---|---|---|---|---|
| 1 | At an angle, eye level, 0 deg. | Wide open, looking straight at the camera | <span style="background-color:red"> </span> | Yes |
| 2 | At an angle, eye level, 0 deg. | Wide open, looking towards the left | <span style="background-color:red"> </span> | Yes |
| 3 | At an angle, eye level, 0 deg. | Wide open, looking towards the right | <span style="background-color:red"> </span> | Yes |
| 4 | At an angle, eye level, 0 deg. | Partially open, looking straight at the direction of the camera | <span style="background-color:green"> </span> | Yes |
| 5 | At an angle, eye level, 0 deg. | Partially open, looking toward the left | <span style="background-color:green"> </span> | Yes |
| 6 | At an angle, eye level, 0 deg. | Partially open, looking towards the right | <span style="background-color:green"> </span> | Yes |
| 7 | At an angle, eye level, 0 deg. | Looking down | <span style="background-color:green"> </span> | Yes |