SSRS Report

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Chapter 1: Requirement Set: SSRS

Description

Software Safety Requirement Specification for the Highway Lane Following Controller.

Attributes

Filepath***:*** C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_06\_SwSafReq\WPs\ISO\_6\_6\_5\_1\_SwSafReqSpec\SSRS.slreqx

Revision: 164

Created by: mohammad

Created on*:* 02-Jul-2020 17:16:21

Modified by***:*** mabualqu

Modified on*:* 03-Dec-2020 06:34:50

Custom Attribute Registries

|  |  |
| --- | --- |
| Name | ASIL |
| Type | Combobox |
| List | Unset,D,C,B,A,QM,D(D),C(D),B(D),A(D),QM(D),C(C),B(C),A(C),QM(C),B(B),A(B),QM(B),A(A),QM(A) |
| Description | The requirement inherits the ASIL level from the safety goals. |
| Name | Review comment |
| Type | Edit |
| Description | The reviewer comment. The reviewer should review the requirements based on the following characteristics of the requirements: a) unambiguous; b) comprehensible c)atomic d) internally consistent e) feasible and achievable f) verifiable g) necessary h) implementation free i) complete j) conforming |
| Name | Reviewer Name |
| Type | Edit |
| Description | The name of the reviewer, who should be independent from the author of the requirement. |
| Name | Safety-related |
| Type | Checkbox |
| Default value | true |
| Description | Whether the requirement is safety-related |
| Name | Status |
| Type | Combobox |
| List | Unset,proposed,assumed,accepted,reviewed,delivered |
| Description | The status of the requirement in the specification subphase. Proposed: initial requirement. Assumed: assumed for use (e.g. in SEOOC development). Accepted: final requirement Reviewed: independent review Delivered: delivered for verification Other Statuses like validated, verified or implemented can be derived. The defined values for status are examples and shall be adapted to the specific requirements lifecycle adopted in the project. |

Implementation Status

Total: 31, Implemented: 30, Justified: 0, None: 1

Verification Status

Total: 31, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 5, None: 26

Change Information No change issue detected.

1 Intended Functionality of the HLF

Requirement Type Informational

ID SW\_HLF#1

Description

The HLF system shall provide sufficient steering and acceleration/deceleration to the vehicle steering and braking systems, respectively, to keep the vehicle centered in the highway lane based on the following information:

\* Estimated lane boundaries detected by the lane detection component

\* Estimated position of other traffic participants (vehicles)

\* Velocity set by the ACC system

\* Measured vehicle velocity

Assumptions:

- The Lane Detection component shall detect the left and right boundaries of the current lane, assigning a strength metric of such detections.

- The Detection of other traffic participants shall detect and track all vehicles in the surroundings of the ego vehicle.

Revision Information

SID: 60

Revision: 159

Created by: mabualqu

Created on: 16-Sep-2020 06:52:29

Modified by: mabualqu

Modified on: 03-Dec-2020 05:20:47

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: accepted

Change Information No change issue detected.

2 HLF timing

Requirement Type Container

ID SW\_HLF#2

Description

The HLF controller shall run in realtime.

Revision Information

SID: 89

Revision: 154

Created by: mabualqu

Created on: 28-Sep-2020 14:24:11

Modified by: mabualqu

Modified on: 19-Oct-2020 07:06:19

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: accepted

Change Information No change issue detected.

Links

Artifact: [HighwayLaneFollowingController\_SW\_Arch.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [HighLaneFollowingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController_SW_Arch.slx%22,%22:18%22%5d) | Allocated to |

Implementation Status

Total: 1, Implemented: 0, Justified: 0, None: 1

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

2.1 HLF update time

Requirement Type Software Property

ID SW\_HLF#2.1

Description

The HLF controller shall update its outputs each 0.1 s.

Rationale

Control cycle of 0.1 s is sufficient to allow the vehicle to react to rapid changes in the environment.

Revision Information

SID: 78

Revision: 160

Created by: mabualqu

Created on: 22-Sep-2020 16:48:50

Modified by: mabualqu

Modified on: 03-Dec-2020 05:21:47

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: accepted

Change Information No change issue detected.

Links

Artifact: [DD\_HLF\_Configuration.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.Ts](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_Configuration.sldd%22,%22UUID_215d72c6-cf6b-4301-b92a-398d72d59d92%22%5d) | Related to |

Implementation Status

Total: 1, Implemented: 0, Justified: 0, None: 1

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

3 HLF Assumptions for Inputs

Requirement Type Container

ID SW\_HLF#4

Description

The HLF controller shall receive information about the lane boundaries and other vehicles in the surrounding in the following format:

Revision Information

SID: 62

Revision: 121

Created by: mabualqu

Created on: 22-Sep-2020 14:23:09

Modified by: mabualqu

Modified on: 19-Oct-2020 06:27:37

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: assumed

Change Information No change issue detected.

Links

Artifact: [HighwayLaneFollowingController\_SW\_Arch.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [HighLaneFollowingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController_SW_Arch.slx%22,%22:18%22%5d) | Allocated to |

Implementation Status

Total: 2, Implemented: 2, Justified: 0, None: 0

Verification Status

Total: 2, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 2

3.1 Lanes Information

Requirement Type Software Interface

ID SW\_HLF#4.1

Description

The Lane Detection component shall pack information about the detected lanes detailing for each side:

* CurvatureDerivative:
* Curvature
* HeadingAngle
* LateralOffset
* Strength
* XExtent
* BoundaryType

The first four attributes are the parametrization coefficients for each lane side as a third order polynomial (ax^3+bx^2+cx+d).

Strength refers to the strength of the detection.

XExtent and BoundaryType may not be used by the HLF system.

The lane detection shall assume ISO 8855 compliant coordinate system (i.e., x in the direction of travel, y to the left of the vehicle and z points upwards from the ground).

Revision Information

SID: 67

Revision: 119

Created by: mabualqu

Created on: 22-Sep-2020 14:30:14

Modified by: mabualqu

Modified on: 19-Oct-2020 06:27:17

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: assumed

Change Information No change issue detected.

Links

Artifact: [DD\_HLF\_DataTypes.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.LaneSensor](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_4c6afa2b-6a72-419c-a249-5f1e43bdc3c5%22%5d) | Related to |
| [Design.LaneSensorBoundaries](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_8cf59850-3cd8-440b-8cc2-7dee09d119b8%22%5d) | Related to |

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [LaneDetections](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:19%22%5d) | Implemented by |

Artifact: [FindLeadCar.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [lane](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22FindLeadCar.slx%22,%22:20%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

3.2 Detected Traffic Participants

Requirement Type Software Interface

ID SW\_HLF#4.2

Description

The traffic participants detection component shall detect other traffic participants detailing for each participant its

State: [x,vx,y,yx,z,vz] where [x,y,z] is the 3D position of each participant velocity [Vx,Vy,Vz]

TrackID: for identification and tracking

The traffic participants detection component shall assume ISO 8855 compliant coordinate system (i.e., x in the direction of travel, y to the left of the vehicle and z points upwards from the ground).

Revision Information

SID: 64

Revision: 120

Created by: mabualqu

Created on: 22-Sep-2020 14:23:59

Modified by: mabualqu

Modified on: 19-Oct-2020 06:27:25

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: assumed

Change Information No change issue detected.

Links

Artifact: [DD\_HLF\_DataTypes.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.BusMultiObjectTracker](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_3e232323-8aad-4e9a-8196-7698e6042c36%22%5d) | Related to |
| [Design.BusMultiObjectTrackerTracks](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_0935e792-0375-4d76-b3d0-5455131ef395%22%5d) | Related to |
| [Design.BusRadarDetectionsObjectAttributes](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_d3d64ad9-25bb-4c8a-8895-d964ad7b8be6%22%5d) | Related to |

Artifact: [FindLeadCar.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [confirmedTracks](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22FindLeadCar.slx%22,%22:19%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4 HLF Input Conditioning

Requirement Type Container

ID SW\_HLF#5

Description

Inputs to the HLF system shall be conditioned to be forwarded to the MPC controller.

Revision Information

SID: 58

Revision: 133

Created by: mabualqu

Created on: 16-Sep-2020 06:50:16

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:03

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [HighwayLaneFollowingController\_SW\_Arch.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [HighLaneFollowingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController_SW_Arch.slx%22,%22:18%22%5d) | Allocated to |

Implementation Status

Total: 8, Implemented: 8, Justified: 0, None: 0

Verification Status

Total: 8, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 8

4.1 Lane Center Estimation

Requirement Type Container

ID SW\_HLF#5.1

Description

The HLF software shall estimate the lane centerline from the detected lane boundaries and their parametrizations,

Revision Information

SID: 69

Revision: 161

Created by: mabualqu

Created on: 22-Sep-2020 15:58:39

Modified by: mabualqu

Modified on: 03-Dec-2020 05:26:06

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [DetectMIOLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [EstimateLaneCenter](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DetectMIOLaneCenter.slx%22,%22:31%22%5d) | Implemented by |

Implementation Status

Total: 5, Implemented: 5, Justified: 0, None: 0

Verification Status

Total: 5, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 5

4.1.1 Lane Centerline

Requirement Type Software Functional

ID SW\_HLF#5.1.1

Description

The lane centerline shall be parametrized as a third order polynomial (a\*x^3+b\*x^2+c\*x+d) where:

a denotes CurvatureDerivative of the centerline

b denotes Curvature of the centerline

c denotes HeadingAngle of the centerline

d denotes LateralOffset of the centerline

Revision Information

SID: 53

Revision: 162

Created by: mabualqu

Created on: 15-Sep-2020 17:35:30

Modified by: mabualqu

Modified on: 03-Dec-2020 05:27:00

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: assumed

Change Information No change issue detected.

Links

Artifact: [DD\_HLF\_DataTypes.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.BusLaneCenter](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_DataTypes.sldd%22,%22UUID_bc742a74-0166-4527-999c-7fd655f4e2a2%22%5d) | Related to |

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [LaneCenter](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:91%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.1.2 Estimate lane center

Requirement Type Container

ID SW\_HLF#5.1.2

Description

Depending on the detection strength of each lane side, one of the following estimation methods shall be selected:

Revision Information

SID: 52

Revision: 135

Created by: mabualqu

Created on: 15-Sep-2020 17:35:30

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:25

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [DetectMIOLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [EstimateLaneCenter](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DetectMIOLaneCenter.slx%22,%22:31%22%5d) | Implemented by |

Implementation Status

Total: 4, Implemented: 4, Justified: 0, None: 0

Verification Status

Total: 4, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 4

4.1.2.1 Estimate Lane Center from Left and Right Boundaries

Requirement Type Software Functional

ID SW\_HLF#5.1.2.1

Description

When detection strength of left and right lanes are above accepted threshold, the EstimateLaneCenter shall interpolate the centerline from parametrized curves for both sides.

Revision Information

SID: 70

Revision: 136

Created by: mabualqu

Created on: 22-Sep-2020 16:07:12

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:33

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [CenterFromLeftAndRight](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:40%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.1.2.2 Estimate Lane Center from Left Boundaries

Requirement Type Software Functional

ID SW\_HLF#5.1.2.2

Description

When only the detection strength of left lane boundary is above accepted threshold, the EstimateLaneCenter shall estimate the centerline from parametrized curves for left side only.

Revision Information

SID: 71

Revision: 136

Created by: mabualqu

Created on: 22-Sep-2020 16:07:40

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:38

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [CenterFromLeft](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:20%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.1.2.3 Estimate Lane Center from Right Boundaries only

Requirement Type Software Functional

ID SW\_HLF#5.1.2.3

Description

When only the detection strength of right lane boundary is above accepted threshold, the EstimateLaneCenter shall estimate the centerline from parametrized curves for left side only.

Revision Information

SID: 72

Revision: 136

Created by: mabualqu

Created on: 22-Sep-2020 16:07:44

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:44

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [CenterFromRight](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:65%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.1.2.4 Estimate Lane Center without reliable lane boundary detections

Requirement Type Software Functional

ID SW\_HLF#5.1.2.4

Description

In absence of reliable information about lane boundaries, the lane center at any point shall be assumed to be equivalent to the previous estimate.

Revision Information

SID: 73

Revision: 137

Created by: mabualqu

Created on: 22-Sep-2020 16:07:47

Modified by: mabualqu

Modified on: 19-Oct-2020 06:44:52

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [EstimateLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [CenterFromNone](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22EstimateLaneCenter.slx%22,%22:61%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.2 LaneCenter Conditioning for Coordinate systems

Requirement Type Functional

ID SW\_HLF#5.2

Description

The HLF component shall convert the centerline parametrization coefficient from the ISO 8855 (x in direction of travel and y to the left) to SAE J670E coordinate systems (x in the direction of travel and y to the right of the vehicle).

Note: This basically means to apply a unary minus to all lane coefficients.

Revision Information

SID: 59

Revision: 163

Created by: mabualqu

Created on: 16-Sep-2020 06:50:35

Modified by: mabualqu

Modified on: 03-Dec-2020 05:28:10

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [LaneCenterCoordChange.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [LaneCenterCoordChange](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22LaneCenterCoordChange.slx%22,%22%22%5d) | Implemented by |

Artifact: [DetectMIOLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [CoordinateChange](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DetectMIOLaneCenter.slx%22,%22:30%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.3 Leading Car Detection

Requirement Type Container

ID SW\_HLF#5.3

Description

The HLF shall identify the leading vehicle among other traffic participants producing

Revision Information

SID: 54

Revision: 139

Created by: mabualqu

Created on: 15-Sep-2020 17:35:30

Modified by: mabualqu

Modified on: 19-Oct-2020 06:45:08

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [DetectMIOLaneCenter.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [FindLeadCar](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DetectMIOLaneCenter.slx%22,%22:32%22%5d) | Implemented by |

Implementation Status

Total: 2, Implemented: 2, Justified: 0, None: 0

Verification Status

Total: 2, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 2

4.3.1 Identification of leading car

Requirement Type Functional

ID SW\_HLF#5.3.1

Description

The HLF system shall identify the leading vehicle among other traffic participants within the same lane boundaries based on the relative distance to ego vehicle.

Revision Information

SID: 55

Revision: 140

Created by: mabualqu

Created on: 16-Sep-2020 06:45:26

Modified by: mabualqu

Modified on: 19-Oct-2020 06:45:51

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [FindLeadCar.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [FindLeadCar](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22FindLeadCar.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

4.3.2 Information about Leading Car

Requirement Type Functional

ID SW\_HLF#5.3.2

Description

The HLF system shall compute the distance and velocity of the leading vehicle relative to the ego vehicle.

Revision Information

SID: 56

Revision: 140

Created by: mabualqu

Created on: 16-Sep-2020 06:46:50

Modified by: mabualqu

Modified on: 19-Oct-2020 06:45:56

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [FindLeadCar.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [FindLeadCar](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22FindLeadCar.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

5 HLF Path Planning

Requirement Type Container

ID SW\_HLF#6

Description

The HLF component shall predict future waypoint based on current lane information.

Revision Information

SID: 57

Revision: 140

Created by: mabualqu

Created on: 16-Sep-2020 06:49:35

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:01

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [HighwayLaneFollowingController\_SW\_Arch.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [HighLaneFollowingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController_SW_Arch.slx%22,%22:18%22%5d) | Allocated to |

Artifact: [HighwayLaneFollowingController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [EstimatePathDeviations](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController.slx%22,%22:55%22%5d) | Implemented by |

Implementation Status

Total: 2, Implemented: 2, Justified: 0, None: 0

Verification Status

Total: 2, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 2

5.1 Preview Curvature

Requirement Type Functional

ID SW\_HLF#6.1

Description

The CurvaturePrediction shall predict future lane curvature ahead of the ego vehicle for PredictionHorizon based on measured longitudinal velocity and estimated centerline Curvature and Curvature Derivative according to following equation:

previewdCurvature = Curvature+CuvatureDerivative\*longitudinalVelocity\*t

where t = 0:Ts:Ts\*PredictionHorizon

Revision Information

SID: 74

Revision: 164

Created by: mabualqu

Created on: 22-Sep-2020 16:25:27

Modified by: mabualqu

Modified on: 03-Dec-2020 05:29:39

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [PreviewCurvature.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [PreviewCurvature](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22PreviewCurvature.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

5.2 Preview Curvature Horizon

Requirement Type Functional

ID SW\_HLF#6.2

Description

The curvature preview shall produce predictions for up to 3 seconds.

Revision Information

SID: 79

Revision: 141

Created by: mabualqu

Created on: 22-Sep-2020 16:50:49

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:16

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [DD\_HLF\_Configuration.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.PredictionHorizon](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_Configuration.sldd%22,%22UUID_eb735f32-de1d-4eb0-80db-cc70edab4626%22%5d) | Related to |
| [Design.PredictionNumSteps](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_Configuration.sldd%22,%22UUID_2ed656be-d4d5-4dae-a962-f05f8832ffcd%22%5d) | Related to |
| [Design.PredictionTimeSteps](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_HLF_Configuration.sldd%22,%22UUID_d1fe0ff1-2b4b-4688-bc63-a782e82c0751%22%5d) | Related to |

Artifact: [PreviewCurvature.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Gain](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22PreviewCurvature.slx%22,%22:26%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6 HLF Controllers

Requirement Type Container

ID SW\_HLF#7

Description

The HLF Controller shall determine the steering and acceleration commands to be sent to the vehicle foundational systems.

Revision Information

SID: 75

Revision: 142

Created by: mabualqu

Created on: 22-Sep-2020 16:36:15

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:29

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [HighwayLaneFollowingController\_SW\_Arch.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [HighLaneFollowingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HighwayLaneFollowingController_SW_Arch.slx%22,%22:18%22%5d) | Allocated to |

Implementation Status

Total: 18, Implemented: 18, Justified: 0, None: 0

Verification Status

Total: 18, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 5, None: 13

6.1 Path following Controller

Requirement Type Container

ID SW\_HLF#7.1

Description

Revision Information

SID: 76

Revision: 143

Created by: mabualqu

Created on: 22-Sep-2020 16:37:41

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:37

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Implementation Status

Total: 8, Implemented: 8, Justified: 0, None: 0

Verification Status

Total: 8, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 8

6.1.1 Leading Vehicle Limiters

Requirement Type Functional

ID SW\_HLF#7.1.1

Description

When the leading car is found to be further than 1000m, the relative velocity of the leading car input to the MPC controller shall be set to 0 and the relative distance is set to 200m.

Revision Information

SID: 80

Revision: 144

Created by: mabualqu

Created on: 22-Sep-2020 16:54:23

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:44

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [InValueLimiters](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22:43%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.2 Longitudinal Velocity Limiters

Requirement Type Functional

ID SW\_HLF#7.1.2

Description

Longitudinal Velocity shall be limited to the range [0.00001, 100] m/s.

Revision Information

SID: 83

Revision: 144

Created by: mabualqu

Created on: 22-Sep-2020 16:57:20

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:50

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [InValueLimiters](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22:43%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.3 Time Gap

Requirement Type Functional

ID SW\_HLF#7.1.3

Description

Time Gap shall be set to 1.5 seconds.

Revision Information

SID: 82

Revision: 145

Created by: mabualqu

Created on: 22-Sep-2020 16:55:55

Modified by: mabualqu

Modified on: 19-Oct-2020 06:46:57

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [DD\_PFC\_Configuration.sldd](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Design.time\_gap](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22DD_PFC_Configuration.sldd%22,%22UUID_b2a5265a-608a-410b-a7f8-a9772ae545b6%22%5d) | Related to |

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Constant](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22:26%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.4 MPC Path Following Controller

Requirement Type Functional

ID SW\_HLF#7.1.4

Description

The HLF component shall use the Path Following Controller from the MPC toolbox to provide steering and acceleration commands based on:

* SetVelocity
* LongitudinalVelocity
* Curvature
* LateralDeviation
* RelativeYawAngle
* RelativeDistanc
* RelativeVelocity
* TimeGap

Revision Information

SID: 81

Revision: 146

Created by: mabualqu

Created on: 22-Sep-2020 16:54:44

Modified by: mabualqu

Modified on: 19-Oct-2020 06:47:06

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [PathFollowingControlSystem](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22:40%22%5d) | Implemented by |

Implementation Status

Total: 5, Implemented: 5, Justified: 0, None: 0

Verification Status

Total: 5, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 5

6.1.4.1 Default spacing

Requirement Type Functional

ID SW\_HLF#7.1.4.1

Description

The path following controller shall maintain a safe distance between the ego vehicle and lead vehicle. This distance shall be default\_spacing.

Revision Information

SID: 90

Revision: 147

Created by: mabualqu

Created on: 28-Sep-2020 15:06:27

Modified by: mabualqu

Modified on: 19-Oct-2020 06:47:23

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [MPCController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.4.2 Vehicle Model

Requirement Type Functional

ID SW\_HLF#7.1.4.2

Description

The path following controller shall consider the vehicle parameters as defined in the system level

Revision Information

SID: 91

Revision: 148

Created by: mabualqu

Created on: 28-Sep-2020 15:08:08

Modified by: mabualqu

Modified on: 19-Oct-2020 06:47:30

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [MPCController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.4.3 Operational Limits

Requirement Type Software Functional

ID SW\_HLF#7.1.4.3

Description

The HLF shall have the following operational limits:

Minimum steering angle (rad): min\_steer

Maximum steering angle (rad): max\_steer

Minimum longitudinal acceleration (m/s^2): min\_ac

Maximum longitudinal acceleration (m/s^2): max\_ac

Revision Information

SID: 92

Revision: 164

Created by: mabualqu

Created on: 28-Sep-2020 15:16:06

Modified by: mabualqu

Modified on: 03-Dec-2020 05:30:20

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [TSRS.slreqx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [SYS\_HLF#6.1.4 Maximum Acceleration](http://127.0.0.1:31415/matlab/feval/rmi.navigate?arguments=%5b%22linktype_rmi_slreq%22,%22TSRS.slreqx%22,%2246%22,%22%22%5d) | Derived from |

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [MPCController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.1.4.4 Vehicle dynamics model

Requirement Type Functional

ID SW\_HLF#7.1.4.4

Description

The MPC Controller shall consider a vehicle dynamics model consistent with the car model specified in system requirements.

Revision Information

SID: 100

Revision: 158

Created by: mabualqu

Created on: 19-Oct-2020 07:12:06

Modified by: mabualqu

Modified on: 19-Oct-2020 07:14:11

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [TSRS.slreqx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [SYS\_CarModel#1 Car Model Specs](http://127.0.0.1:31415/matlab/feval/rmi.navigate?arguments=%5b%22linktype_rmi_slreq%22,%22TSRS.slreqx%22,%2271%22,%22%22%5d) | Derived from |

Artifact: [MPCController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [PathFollowingControlSystem](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22MPCController.slx%22,%22:40%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.2 Watchdog Controller

Requirement Type Container

ID SW\_HLF#7.2

Description

The watchdog controller shall only intervene in transient conditions to avoid a collision by monitoring the relative distance and relative velocity of the leading vehicle.

Revision Information

SID: 77

Revision: 150

Created by: mabualqu

Created on: 22-Sep-2020 16:37:44

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:03

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [LF\_Controller.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [WDGBrakingController](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22LF_Controller.slx%22,%22:27%22%5d) | Implemented by |

Implementation Status

Total: 9, Implemented: 9, Justified: 0, None: 0

Verification Status

Total: 9, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 4, None: 5

6.2.1 Time to Collision Calculation

Requirement Type Software Functional

ID SW\_HLF#7.2.1

Description

The watchdog controller shall compute Time to collision (time needed to collide with the leading vehicle) as

(distanceToLeadingVehicle-headwayOffset)/|relativeVelocityOfLeadingVehicle|, where |.| denotes the absolute value.

Revision Information

SID: 84

Revision: 150

Created by: mabualqu

Created on: 22-Sep-2020 17:02:20

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:10

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGTTCCalculation.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [WDGTTCCalculation](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGTTCCalculation.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.2.2 Time to Collision guard against division by zero

Requirement Type Software Property

ID SW\_HLF#7.2.2

Description

The calculation of the time to collision shall put limits on the relative velocity of the leading car to guard against division by zero and implausible values. These values shall be [0.01, 100].

Revision Information

SID: 87

Revision: 151

Created by: mabualqu

Created on: 22-Sep-2020 17:19:36

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:19

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGTTCCalculation.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [Saturation](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGTTCCalculation.slx%22,%22:24%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.2.3 Stopping Time Calculations

Requirement Type Software Functional

ID SW\_HLF#7.2.3

Description

The watchdog controller shall compute at each step four critical times based on the measure longitudinal velocity

FCWStoppingTime = timeToReact + egoVelocity/driver\_decel

PB1StoppingTime = timeMargin + egoVelocity/PB1\_decel

PB2StoppingTime = timeMargin + egoVelocity/PB2\_decel

FBStoppingTime = timeMargin + egoVelocity/FB\_decel

respectively, computing at each time step the required time to stop the vehicle if

- the driver is warned considering time to react

- an automatic deceleration is applied with PB1\_decel

- an automatic deceleration is applied with PB2\_decel

- an automatic deceleration is applied with full brake (FB\_decel).

Revision Information

SID: 85

Revision: 151

Created by: mabualqu

Created on: 22-Sep-2020 17:02:42

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:25

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakeTimeCalc.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [WDGBrakeTimeCalc](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakeTimeCalc.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.2.4 Watchdog Braking Logic

Requirement Type Container

ID SW\_HLF#7.2.4

Description

The watchdog controller shall issue one of the following deceleration commands (0, PB1\_decel, PB2\_decel, FB\_decel) depending on time to collision and computed Stopping times.

Revision Information

SID: 86

Revision: 152

Created by: mabualqu

Created on: 22-Sep-2020 17:09:15

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:33

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [TSRS.slreqx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [SYS\_HLF#6.3.3 Transient Conditions and Collision Avoidance](http://127.0.0.1:31415/matlab/feval/rmi.navigate?arguments=%5b%22linktype_rmi_slreq%22,%22TSRS.slreqx%22,%2255%22,%22%22%5d) | Refined by |

Artifact: [WDGBrakingController.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [WDGBrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingController.slx%22,%22:26%22%5d) | Implemented by |

Implementation Status

Total: 6, Implemented: 6, Justified: 0, None: 0

Verification Status

Total: 6, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 4, None: 2

6.2.4.1 Driver warning

Requirement Type Functional

ID SW\_HLF#7.2.4.1

Description

The watchdog controller shall request no deceleration if the user is able to avoid a collision when warned assuming a time to react.

Revision Information

SID: 94

Revision: 152

Created by: mabualqu

Created on: 28-Sep-2020 16:08:51

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:40

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [BrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22:29%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.2.4.2 Partial Braking Level 1

Requirement Type Functional

ID SW\_HLF#7.2.4.2

Description

The Watchdog controller shall apply PB1\_decel if

* computed time to collision goes less that time needs to stop the car if applying PB1\_decel
* leading vehicle is slower than ego vehicle

Revision Information

SID: 95

Revision: 152

Created by: mabualqu

Created on: 28-Sep-2020 16:10:43

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:46

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [BrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22:29%22%5d) | Implemented by |

Artifact: [WDGBrakingLogic\_Test.mldatx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [TC1](http://127.0.0.1:31415/matlab/feval/rmitmnavigate?arguments=%5b%22WDGBrakingLogic_Test.mldatx%22,%2207a90954-8d32-4f7b-9ddd-475f92082bf3%22%5d) | Verified by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 1, None: 0

6.2.4.3 Partial Braking Level 2

Requirement Type Functional

ID SW\_HLF#7.2.4.3

Description

The Watchdog controller shall apply PB2\_decel if

* computed time to collision goes less that time needs to stop the car if applying PB2\_decel
* leading vehicle is slower than ego vehicle

Revision Information

SID: 96

Revision: 152

Created by: mabualqu

Created on: 28-Sep-2020 16:13:24

Modified by: mabualqu

Modified on: 19-Oct-2020 06:54:52

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [BrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22:29%22%5d) | Implemented by |

Artifact: [WDGBrakingLogic\_Test.mldatx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [TC1](http://127.0.0.1:31415/matlab/feval/rmitmnavigate?arguments=%5b%22WDGBrakingLogic_Test.mldatx%22,%2207a90954-8d32-4f7b-9ddd-475f92082bf3%22%5d) | Verified by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 1, None: 0

6.2.4.4 Full Braking

Requirement Type Functional

ID SW\_HLF#7.2.4.4

Description

The Watchdog controller shall apply Full braking if

* computed time to collision goes less that time needs to stop the car if applying full brake
* leading vehicle is slower than ego vehicle

or when distance to leading vehicle drops below default spacing

Revision Information

SID: 97

Revision: 153

Created by: mabualqu

Created on: 28-Sep-2020 16:15:29

Modified by: mabualqu

Modified on: 19-Oct-2020 06:55:02

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [BrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22:29%22%5d) | Implemented by |

Artifact: [WDGBrakingLogic\_Test.mldatx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [TC1](http://127.0.0.1:31415/matlab/feval/rmitmnavigate?arguments=%5b%22WDGBrakingLogic_Test.mldatx%22,%2207a90954-8d32-4f7b-9ddd-475f92082bf3%22%5d) | Verified by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 1, None: 0

6.2.4.5 Idle state

Requirement Type Functional

ID SW\_HLF#7.2.4.5

Description

The Watchdog controller shall apply no braking if the vehicle has stopped or current velocity does not lead to a collision.

Revision Information

SID: 98

Revision: 153

Created by: mabualqu

Created on: 28-Sep-2020 16:17:41

Modified by: mabualqu

Modified on: 19-Oct-2020 06:55:07

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [BrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22:29%22%5d) | Implemented by |

Artifact: [WDGBrakingLogic\_Test.mldatx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [TC1](http://127.0.0.1:31415/matlab/feval/rmitmnavigate?arguments=%5b%22WDGBrakingLogic_Test.mldatx%22,%2207a90954-8d32-4f7b-9ddd-475f92082bf3%22%5d) | Verified by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 1, None: 0

6.2.4.6 Stopped Vehicle

Requirement Type Functional

ID SW\_HLF#7.2.4.6

Description

The Watchdog controller shall consider a velocity < 0.1 as a stopped vehicle.

Revision Information

SID: 99

Revision: 153

Created by: mabualqu

Created on: 28-Sep-2020 16:21:13

Modified by: mabualqu

Modified on: 19-Oct-2020 06:55:14

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [WDGBrakingLogic.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [WDGBrakingLogic](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22WDGBrakingLogic.slx%22,%22%22%5d) | Implemented by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 0, None: 1

6.3 Controller Mode Selection

Requirement Type Functional

ID SW\_HLF#7.3

Description

The Controller Mode Selection shall decide upon the acceleration to be forwarded to vehicle foundational components based on the status of watchdog controller, its required deceleration and required acceleration computed by the MPC controller.

Revision Information

SID: 61

Revision: 153

Created by: mabualqu

Created on: 16-Sep-2020 06:54:18

Modified by: mabualqu

Modified on: 19-Oct-2020 06:55:20

Custom Attributes

ASIL: D

Review comment:

Reviewer Name:

Safety-related: true

Status: proposed

Change Information No change issue detected.

Links

Artifact: [ControllerModeSelector.slx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [ControllerModeSelector](http://127.0.0.1:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22ControllerModeSelector.slx%22,%22%22%5d) | Implemented by |

Artifact: [ControllerModeSelector\_Test.mldatx](#ArtifactListTable)

|  |  |
| --- | --- |
| Linked Item | Link Type |
| [TC1](http://127.0.0.1:31415/matlab/feval/rmitmnavigate?arguments=%5b%22ControllerModeSelector_Test.mldatx%22,%22a46b21c8-7cab-4301-9f44-248553c8d886%22%5d) | Verified by |

Implementation Status

Total: 1, Implemented: 1, Justified: 0, None: 0

Verification Status

Total: 1, Passed: 0, Justified: 0, Failed: 0, Unexecuted: 1, None: 0

Appendix

Artifact List

Simulink Requirement Set files:

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Folder | Revision |
| 1 | TSRS.slreqx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_04\ISO\_4\_6\_5\_1\_TechSafReqSpec | 196 |

Simulink models:

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Folder | Version |
| 1 | HighwayLaneFollowingController\_SW\_Arch.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_07\_SwArcDes\WPs\ISO\_6\_7\_5\_1\_SwArcDesSpec | 4.0 |
| 2 | EstimateLaneCenter.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\EstimateLaneCenter | 4.0 |
| 3 | FindLeadCar.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\FindLeadCar | 4.0 |
| 4 | DetectMIOLaneCenter.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_10\_SwIntgr\WPs\ISO\_6\_10\_5\_2\_SwEmb\DetectMIOLaneCenter | 4.0 |
| 5 | LaneCenterCoordChange.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\LaneCenterCoordChange | 4.0 |
| 6 | HighwayLaneFollowingController.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_10\_SwIntgr\WPs\ISO\_6\_10\_5\_2\_SwEmb\HighwayLaneFollowingController | 4.0 |
| 7 | PreviewCurvature.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\PreviewCurvature | 4.0 |
| 8 | MPCController.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\MPCController | 4.0 |
| 9 | LF\_Controller.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_10\_SwIntgr\WPs\ISO\_6\_10\_5\_2\_SwEmb\LF\_Controller | 4.0 |
| 10 | WDGTTCCalculation.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\WDGTTCCalculation | 4.0 |
| 11 | WDGBrakeTimeCalc.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\WDGBrakeTimeCalc | 4.0 |
| 12 | WDGBrakingController.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_10\_SwIntgr\WPs\ISO\_6\_10\_5\_2\_SwEmb\WDGBrakingController | 4.0 |
| 13 | WDGBrakingLogic.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\WDGBrakingLogic | 4.0 |
| 14 | ControllerModeSelector.slx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_08\_SwU\WPs\ISO\_6\_8\_5\_1\_SwUnDesSpec\ControllerModeSelector | 4.0 |

Simulink Test files:

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Folder | File timestamp |
| 1 | WDGBrakingLogic\_Test.mldatx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_09\_SwUVer\WPs\ISO\_6\_9\_5\_1\_SwVerSpec\WDGBrakingLogic | 24-Sep-2021 07:12:18 |
| 2 | ControllerModeSelector\_Test.mldatx | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_09\_SwUVer\WPs\ISO\_6\_9\_5\_1\_SwVerSpec\ControllerModeSelector | 24-Sep-2021 07:12:18 |

Simulink data dictionaries:

|  |  |  |  |
| --- | --- | --- | --- |
| # | Name | Folder | File timestamp |
| 1 | DD\_HLF\_Configuration.sldd | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_07\_SwArcDes\WPs\ISO\_6\_7\_5\_1\_SwArcDesSpec\data | 24-Sep-2021 07:12:20 |
| 2 | DD\_HLF\_DataTypes.sldd | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_07\_SwArcDes\WPs\ISO\_6\_7\_5\_1\_SwArcDesSpec\data\_types | 24-Sep-2021 07:12:20 |
| 3 | DD\_PFC\_Configuration.sldd | C:\Users\mabualqu\zip\iso26262CaseStudy\ISO\_06\_07\_SwArcDes\WPs\ISO\_6\_7\_5\_1\_SwArcDesSpec\data | 24-Sep-2021 07:12:20 |