Elektrobit

UDACITY

Safety Plan Lane Assistance

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Document history

Date	Version	Editor	Description
2019-03-12	1.0	Sergey Morozov	Completed all document sections

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Introduction

Purpose of the Safety Plan

The safety plan gives an overview of how to achieve a safe system. It specifies what system is under consideration, the goal of the project, what steps will be taken to ensure safety, the roles and personnel involved in the project, and the project timeline.

Scope of the Project

For the lane assistance project, the following safety lifecycle phases are in scope:

- Concept phase
- Product Development at the System Level
- Product Development at the Software Level

The following phases are out of scope:

- Product Development at the Hardware Level
- Production and Operation

Deliverables of the Project

The deliverables of the project are:

- Safety Plan
- Hazard Analysis and Risk Assessment
- Functional Safety Concept
- Technical Safety Concept
- Software Safety Requirements and Architecture

Item Definition

The item in question is a Lane Assistance System which is a kind of an Advanced Driver Assistance Systems (ADAS). The main functions of an ADAS are to (1) alert the driver to potentially dangerous situations and (2) take control over the vehicle to prevent accidents from occurring. In case of a lane assistance system, the (1) and (2) functions can be restated as

(1') Lane Departure Warning function and
(2') Lane Keeping Assistance function.

The Lane Departure Warning function shall apply an oscillating steering torque to provide haptic feedback for the driver.

The Lane Keeping Assistance function shall apply the steering torque when active in order to stay in ego lane. (Ego lane refers to the lane in which the vehicle currently drives.)

The Lane Assistance System contains three sub-systems:

- Camera sub-system,
- Electronic Power Steering sub-system, and
- Car Display sub-system.

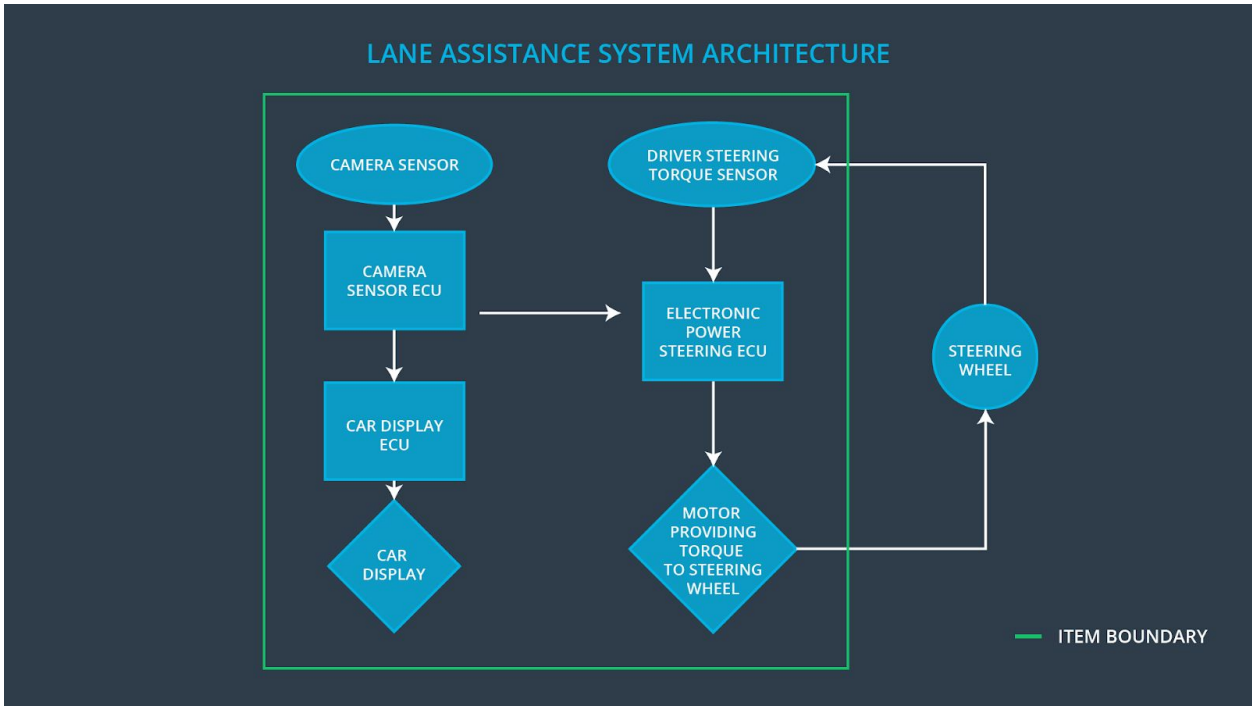
Camera sub-system is responsible for detecting lane lines and determining when the vehicle leaves the lane by mistake.

Electronic Power Steering sub-system is responsible for measuring the torque provided by the driver and then adding an appropriate amount of torque based on a lane assistance system torque request.

Car Display sub-system is responsible for providing visual notifications to the driver.

The Camera and Electronic Power Steering sub-systems are involved in providing the Lane Keeping Assistance function while the Camera and Car Display sub-systems are involved in providing the Lane Departure Warning function.

The Item (Lane Assistance System), its sub-systems, and their components are represented on the following diagram.



The Car Display sub-system is composed of the following components: Car Display Electronic Control Unit (ECU) and Car Display itself. The Camera sub-system is composed of Camera Sensor and Camera Sensor ECU. The Electronic Power Steering sub-system is composed of Driver Steering Torque Sensor, Electronic Power Steering ECU, and Motor Providing Torque to Steering Wheel.

Notice that the Steering Wheel itself is not the part of the Item definition.

Goals and Measures

Goals

The goal of this functional safety case is to reduce risks connected to the Lane Assistance System to levels acceptable by society and current legislation in major auto markets. The goal is achieved by following the ISO 26262 standard guidelines.

Measures

Measures and Activities	Responsibility	Timeline
Follow safety processes	All Team Members	Constantly
Create and sustain a safety culture	All Team Members	Constantly
Coordinate and document the planned safety activities	Safety Manager	Constantly
Allocate resources with adequate functional safety competency	Project Manager	Within 2 weeks of the start of the project
Tailor the safety lifecycle	Safety Manager	Within 4 weeks of the start of the project
Plan the safety activities of the safety lifecycle	Safety Manager	Within 4 weeks of the start of the project
Perform regular functional safety audits	Safety Auditor	Once every 2 months
Perform functional safety pre-assessment prior to audit by external functional safety assessor	Safety Manager	3 months prior to the main assessment
Perform functional safety assessment	Safety Assessor	The conclusion of functional safety activities

Safety Culture

To maintain a good safety culture the guiding principles from the list below must be followed:

- High priority: safety has the highest priority among competing constraints like cost and productivity
- Accountability: processes ensure accountability such that design decisions are traceable back to the people and teams who made the decisions
- Rewards: the organization motivates and supports the achievement of functional safety
- Penalties: the organization penalizes shortcuts that jeopardize safety or quality
- Independence: teams who design and develop a product should be independent of the teams who audit the work
- Well defined processes: company design and management processes should be clearly defined
- Resources: projects have necessary resources including people with appropriate skills
- Diversity: intellectual diversity is sought after, valued and integrated into processes
- Communication: communication channels encourage disclosure of problems

Safety Lifecycle Tailoring

All phases of safety lifecycle mentioned in Scope of the Project section need to be considered since the Lane Assistance System is a new product, not a modification of an existing one. The safety lifecycle phases are restarted here again.

The following safety lifecycle phases are in scope:

- Concept phase
- Product Development at the System Level
- Product Development at the Software Level

The following phases are out of scope:

- Product Development at the Hardware Level
- Production and Operation

Roles

Role	Org
Functional Safety Manager - Item Level	OEM
Functional Safety Engineer - Item Level	OEM
Project Manager - Item Level	OEM
Functional Safety Manager - Component Level	Tier-1
Functional Safety Engineer - Component Level	Tier-1
Functional Safety Auditor	OEM or external
Functional Safety Assessor	OEM or external

Development Interface Agreement

A DIA (development interface agreement) defines the roles and responsibilities of companies involved in developing a product. All involved parties need to agree on the contents of the DIA before the project begins. The DIA also specifies what evidence and work products each party will provide to prove that work was done according to the agreement. DIA helps avoid disputes between companies. It clarifies who will be responsible for any safety issues in post-production. The ultimate goal is to ensure that all parties are developing safe vehicles in compliance with ISO 26262.

The OEM is responsible for supplying a functioning lane assistance system. The Tier-1 supplier is responsible for analyzing and modifying various sub-systems from a functional safety viewpoint.

The responsibilities for specific roles are presented below.

- Functional Safety Manager - Item Level: maintains the Safety Plan for the Item, plans, coordinates, and documents the development phase of the safety lifecycle on the Item level, performs pre-audits of the overall system before the Safety Auditor.
- Functional Safety Engineer - Item Level: integrates sub-systems combining them into the Item and performs tests at a system level.
- Project Manager - Item Level: appoints safety manager, acquires and allocates resources needed for the functional safety activities.
- Functional Safety Manager - Component Level: plans, coordinates, and documents of the development phase of the safety lifecycle on the sub-systems level, monitors progress against the Safety Plan and performs pre-audits of the sub-systems before the Safety Auditor.
- Functional Safety Engineer - Component Level: develops sub-systems and tests them at hardware and software levels.
- Functional Safety Auditor: ensures that the design and production implementation conform to the Safety Plan and ISO 26262.
- Functional Safety Assessor: judges as to whether functional safety is being achieved via a functional safety assessment.

Confirmation Measures

Confirmation measures serve two purposes:

- that a functional safety project conforms to ISO 26262, and
- that the project really does make the vehicle safer.

The people who carry out confirmation measures need to be independent of the people who actually developed the project.

Confirmation review ensures that the project complies with ISO 26262. As the product is designed and developed, an independent person would review the work to make sure ISO 26262 is being followed.

Checking to make sure that the actual implementation of the project conforms to the safety plan is called a functional safety audit.

Confirming that plans, designs, and developed products actually achieve functional safety is called a functional safety assessment.