Elektrobit

UDACITY

Safety Plan Lane Assistance

Document Version: 1.0

Template Version 1.0, Released on 2017-06-21

Document history

Date	Version	Editor	Description
20-Jun-18	1.0	Nikhil Sinnarkar	First Draft of Safety plan

Table of Contents

Introduction

Purpose of the Safety Plan

The Safety plan gives an overview of how to achieve a safe system. Among others this includes the system under consideration and to set up a goal for the project. It also includes the assignment of roles and responsibilities for the item’s functional safety.

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

This safety plan covers the Lane Assistance System which is an Advanced Driver Assistance system (ADAS). The Lane Assistance System alert the driver to potentially dangerous situations and take control over the vehicle to prevent accidents from occurring.

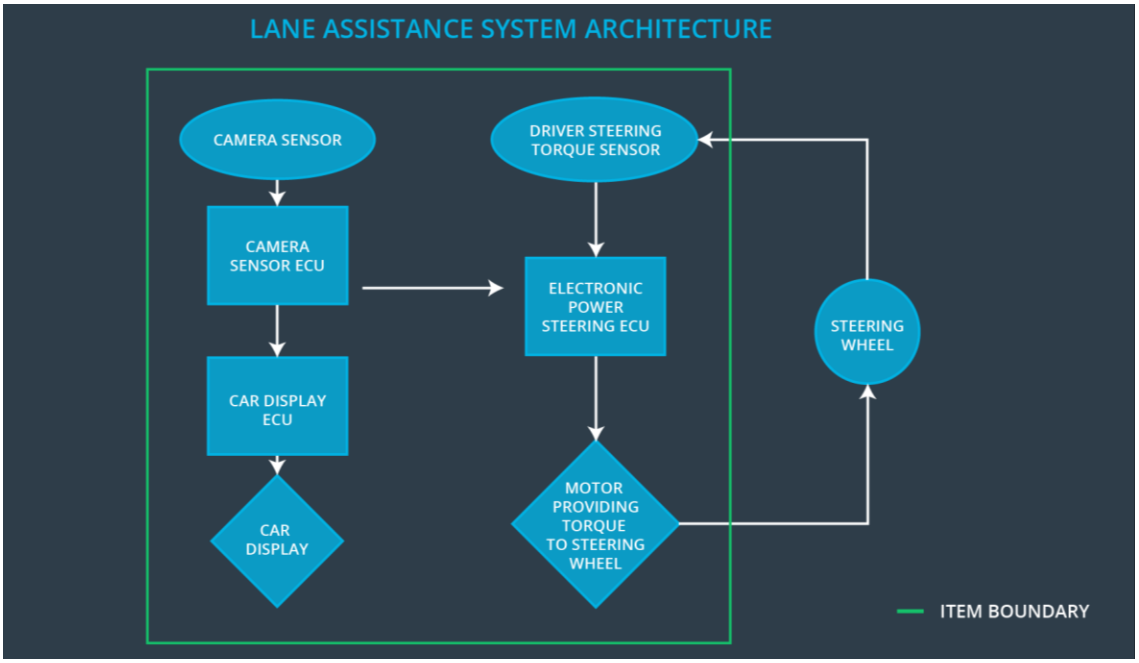
The two main function of this item are:

- **Lane departure warning function**: The Lane departure warning function vibrates the steering wheel in case the car drifts towards the edge of the lane.
- **Lane Keeping assistance function**: The Lane keeping assistance function moves the car turns back towards the center of the lane.

The item consists of three subsystems with their own components:

- Camera subsystem consisting of 2 components:
  - ➢ Camera sensor
  - ➢ Camera sensor with Electronic Control Unit (ECU)
- Electronic power steering subsystem consisting of 3 components:
  - ➢ Driver Steering Torque sensor
  - ➢ Electronic Power Steering
  - ➢ Motor providing torque to steering wheel
- Car Display subsystem consisting of 2 components:
  - ➢ Car Display ECU
  - ➢ Car Display

The following diagram shows the interaction between the 3 subsystems:


LANE ASSISTANCE SYSTEM ARCHITECTURE
CAMERA SENSOR
CAMERA SENSOR ECU
CAR DISPLAY ECU
CAR DISPLAY
DRIVER STEERING TORQUE SENSOR
ELECTRONIC POWER STEERING ECU
MOTOR PROVIDING TORQUE TO STEERING WHEEL
STEERING WHEEL
ITEM BOUNDARY

The camera subsystem is responsible for detecting and monitoring the position of the car in the ego lane and informing the car display and Electronic Power Steering subsystem if the car drifts towards the edge.
The Electronic Power Steering subsystem detects how much the driver is already turning the vehicle and add an extra torque to get the vehicle back towards the center.
The Car Display subsystem is only responsible for displaying the warning if necessary.

The Lane assistance system deactivates itself if the driver uses a turn signal or uses a button on the dashboard to turn off the system.

Other car subsystem like the steering wheel lie outside of this item.

Goals and Measures

Goals

This project goals are:

- Identify risk and hazardous situations in the Lane Assistance System components malfunction causing injuries to a person.
- Evaluate the risks of the hazardous situations.
- Lower the risk of the malfunctions to a reasonable levels acceptable by current society.

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 start of project
Tailor the safety lifecycle	Safety Manager	Within 4 weeks of start of project

Plan the safety activities of the safety lifecycle	Safety Manager	Within 4 weeks of start of 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 main assessment
Perform functional safety assessment	Safety Assessor	Conclusion of functional safety activities

Safety Culture

To increase functional safety our organization provides a safety culture. This includes the following characteristics:

- **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 from 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

For this project the safety plan is tailored. The following 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

The Development Interface Agreement (DIA) helps to avoid disputes during planning and development of the lane assistance system as it defines the above roles and responsibilities between the involved companies.
The OEM will be responsible for the overall vehicle safety and all ISO 26262 required functional safety actions. The companies agreed that the above tailored safety lifecycle is enough to fulfill the ISO 26262 norms for the Lane Assistance System.
Furthermore, all useful information which helps to achieve functional safety and concerns the Lane Assistance component will be shared through the appointed Functional Safety Managers.
The Tier-1 Supplier is accountable for the lane assistance component and not the other parts of the vehicle. Therefore, the Tier-1 Supplier will analyze various sub-systems of the Lane assistance component from a functional safety viewpoint.
The Tier-1 company will act and fix all the bugs which apply to the Lane Assistance System. All other issues have to investigated by the OEM.

Confirmation Measures

The *Confirmation measures* ensures that the applied processes comply with functional safety standards provided by ISO 26262 and that project execution is following the safety plan, therefore verifying if the design really does improve safety.

In particular, by providing *confirmation review*, during design and development of the product, compliance with ISO 26262 is assured by an independent person.

A *Functional Safety Audit* checks that the actual implementation of the project considers the safety plan.

Finally, *Functional Safety Assessment* confirms that plans, designs and developed products actually achieve functional safety.

A safety plan could have other sections that we are not including here. For example, a safety plan would probably contain a complete project schedule.

There might also be a "Supporting Process Management" section that would cover "Part 8: Supporting Processes" of the ISO 26262 functional safety standard. This would include descriptions of how the company handles requirements management, change management, configuration management, documentation management, and software tool usage and confidence.

Similarly, a confirmation measures section would go into more detail about how each confirmation will be carried out.