Elektrobit

UDACITY

Safety Plan Lane Assistance

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Document history

Date	Version	Editor	Description
20-Nov-17	0.1	My safetyplan	Initial draft

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Introduction

Purpose of the Safety Plan

A safety plan is a document that enumerates the safety culture of an organization, the safety lifecycle, safety management roles and responsibilities, development interface agreements and confirmation measures.
Vehicles have a number of different systems including hydraulic, mechanical, electrical, electronic, and chemical. Functional safety is a part of overall automotive safety and specifically refers to reducing risks in electrical and electronic systems. It looks at what happens when the system does something that it was not supposed to do, which is called a malfunction. Functional safety standards for the automotive industry in systems engineering - ISO 26262, is used to methodically reduce risk in passenger vehicle's electric/electronic systems.

The safety plan forces the project team to define roles, then outline the steps that would be taken to achieve functional safety (absence of unreasonable risks).

The safety plan gives an overview of how you are going to achieve a safe system. A few of the major elements include:

- Description of the system under consideration
- Goal of the project
- High-level steps that would be taken to ensure safety
- Roles and personnel involved in the project
- Project timeline

As the project passes through the design, implementation, and production phases, the output will be checked against the safety plan.

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

Key points about the system:
Advanced driver assistance systems (ADAS) constantly monitor the vehicle surroundings as well as the driving behavior to detect potentially dangerous situations at an early stage. In critical driving situations, ADAS systems has two functions.

- Alert the driver to potentially dangerous situations
- Take control over the vehicle to prevent accidents from occurring

Here are a few examples of ADAS systems that are found in passenger vehicles today:

- Adaptive Cruise Control
- Automatic Parking
- Blind Spot Monitoring
- Lane Departure Warning
- Lane Keeping Assistance
- Tire Pressure Monitoring
- Pedestrian Protection

What is the item in question, and what does the item do?
Lane assistance item is the part of the vehicle under consideration.

What are its two main functions? How do they work?
A lane assistance item generally has two functions:

- **lane departure warning function** – Whenever a driver steers off the lane, the Lane Departure Warning function will signal this to the driver by causing vibration of the steering wheel. Lane Departures are detected by a camera subsystem which will cause the Power Steering subsystem to generate the torque to vibrate the steering wheel.
- **lane keeping assistance function** - Whenever a driver is steering off the lane, the Lane Keeping Assistance function will help the car get back on the lane by applying some amount of torque for a duration of time.

Which subsystems are responsible for each function?

Lane departure Warning

If a driver departs a lane without using a turn signal, the system assumes that the driver has become distracted and did not mean to leave the lane. When the **camera** senses that the vehicle is leaving the lane, the camera sends a signal to the **electronic power steering** system asking to turn and vibrate the steering wheel. The camera sensor will also request that a warning light turn on in the **car display dashboard**. That way the driver knows that the lane assistance system is active. The system will vibrate the steering (lane departure warning).

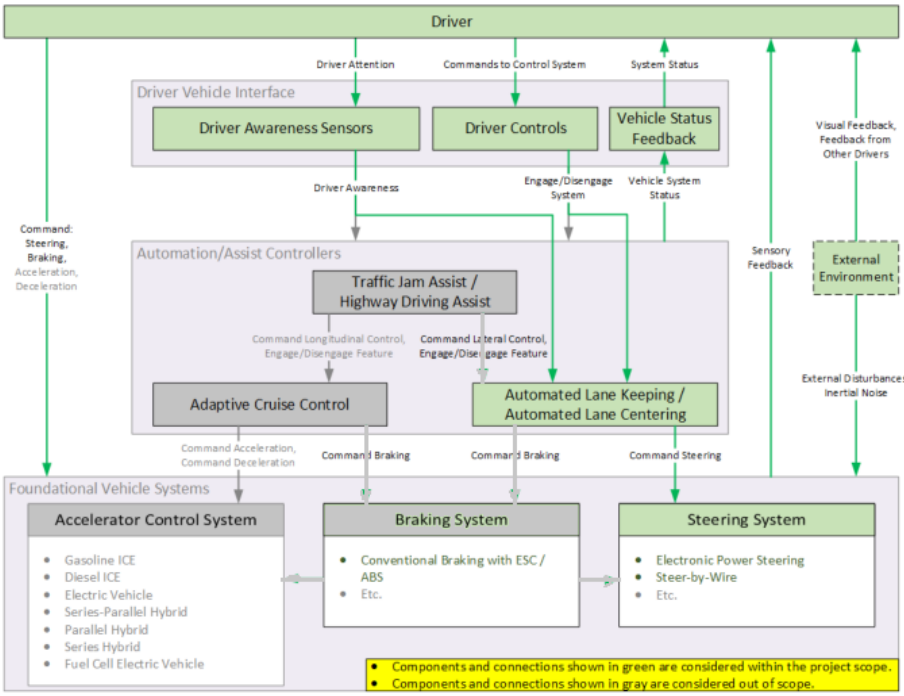
Lane Keeping Assistance

The lane keeping assistance function will merely add the extra torque required to get the car back towards center. The extra torque is applied directly to the steering wheel via a motor. The driver is still expected to have both hands on the steering wheel at all times. The **electronic power steering** subsystem has a sensor to detect how much the driver is already turning.

If the driver uses a turn signal, then the lane assistance system deactivates so that the vehicle can leave the lane. The driver can also turn off the system completely with a button on the dashboard.

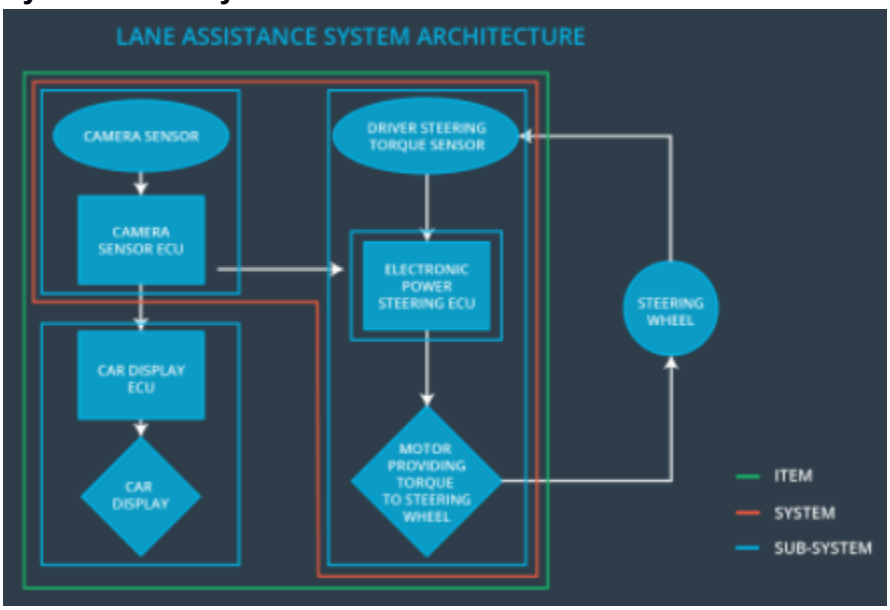
What are the boundaries of the item? What subsystems are inside the item? What elements or subsystems are outside of the item?

Boundary of the item



Source: US DOT Functional Safety Analysis of Automated Vehicle Lane Centering Control Systems.pdf

Systems / Subsystems inside the item



From the above diagram, item boundary includes three sub-systems:

- Camera system
- Electronic Power Steering system
- Car Display system

Other car subsystems like the steering wheel lie outside of this system.

Goals and Measures

Goals

The goal in functional safety is to avoid accidents by reducing risks to acceptable levels. This is done by,

1. Identifying hazards that could cause potential harm
2. Evaluating risks of these hazards
3. Using systems engineering, find ways to lower the risk to levels, acceptable by society

Functional safety standards for the automotive industry in systems engineering - ISO 26262, is used to methodically reduce risk in passenger vehicle's electric/electronic systems.

Measures

Measures and Activities	Responsibility	Timeline
Follow safety processes	All Team Members	Constantly
Create and sustain a safety culture	Safety Manager	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 Assessor	3 months prior to main assessment
Perform functional safety assessment	Safety Assessor	Conclusion of functional safety activities

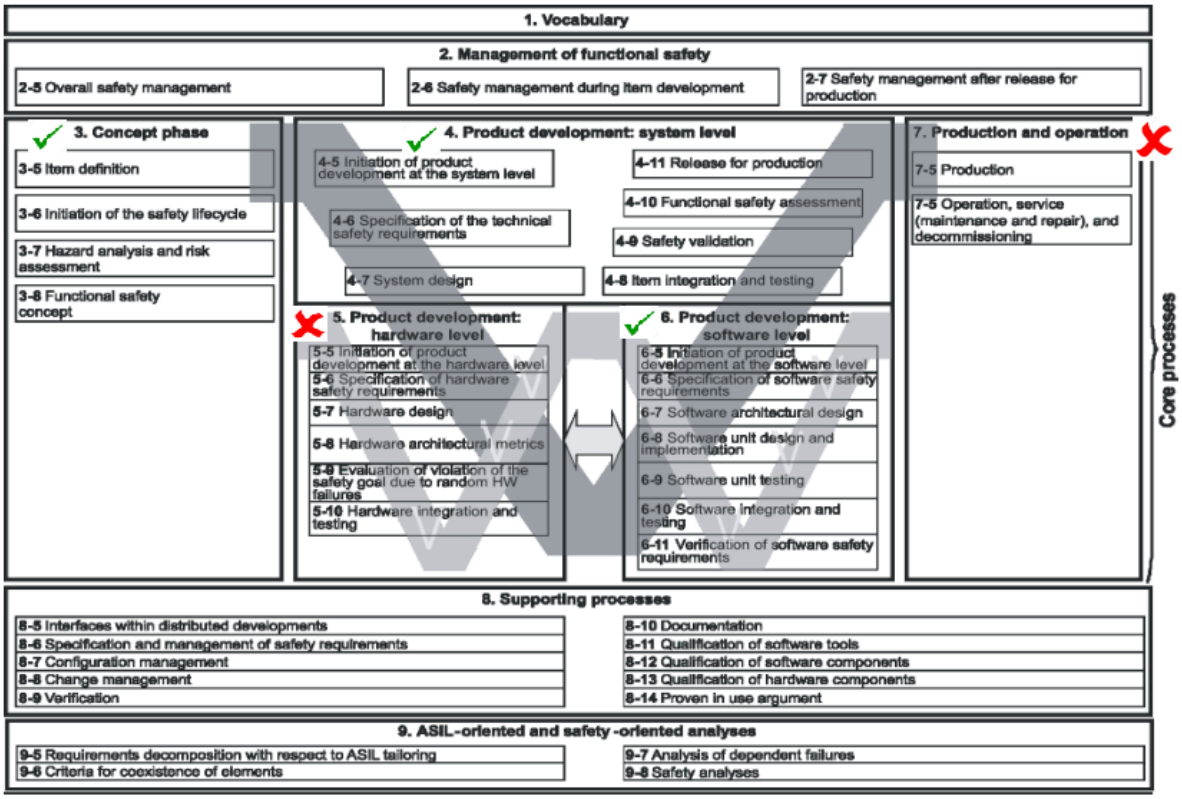
Safety Culture

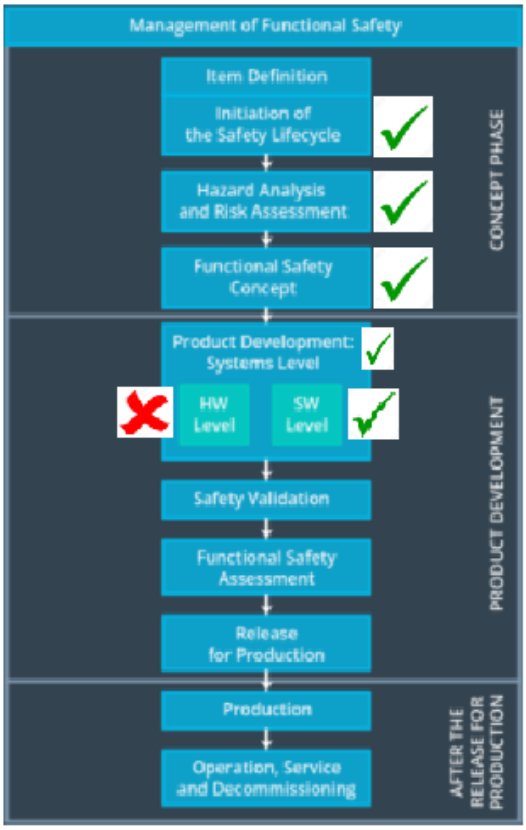
Here are some characteristics of THIS Company's safety culture:

- **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

This release cycle affects modification of an existing product. Hence, only a few steps in the ISO-26262 standards are applicable.
Safety life-cycle is tailored to include applicable sections as shown below.





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

1. What is the purpose of a development interface agreement?

A DIA (development interface agreement) defines the roles and responsibilities between companies involved in developing a product, e.g. between the OEM and the Tier 1 supplier or between the Tier 1 supplier and the Tier 2 supplier. 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.

The ultimate goal is to ensure that all parties are developing safe vehicles in compliance with ISO 26262.

Here are major sections of a DIA:

- Appointment of customer and supplier safety managers
- Joint tailoring of the safety lifecycle
- Activities and processes to be performed by the customer; activities and processes to be performed by the supplier
- Information and work products to be exchanged
- Parties or persons responsible for each activity in design and production
- Any supporting processes or tools to ensure compatibility between customer and supplier technologies

2. What will be the responsibilities of your company versus the responsibilities of the OEM?

- OEM provides requirements or preliminary design to THIS Company.
- THIS company develops the sub-system based on requirements or preliminary design and hands-over the developed functionality to OEM after independent testing.
- OEM integrates the developed sub-system with the overall system and tests the functionality for completeness.

Confirmation Measures

1. What is the main purpose of confirmation measures?

Confirmation measures ensure that people who design the product and people who review the design are independent.

Confirmation measures serve two purposes:

- A functional safety project conforms to ISO 26262, and
- The project really does make the vehicle safer.
- The steps taken have actually reduced the risk to levels acceptable by society

2. What is a confirmation review?

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.

3. What is a functional safety audit?

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

4. What is a functional safety assessment?

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

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.