

Safety Plan Lane Assistance

**Document Version: 1.0**



# Document history

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# Introduction

## Purpose of the Safety Plan

Define the roles, responsibilities and steps required to achieve functional safety of the **lane assistance system** of a car.

## 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 lane assistance system is a new sub-system in a car that shall detect when the car is veering far from the lane’s center without a turn signal activated and either: vibrate the steering wheel when small deviations are detected to let the driver know there is an issue, or gently steer the car back to the center of the lane when more significant deviations are detected.

The main functions of the system are:

* Detection of the unintended departure from the lane’s center: The system shall keep track of the current lane, the car’s position inside the lane and the activation of the turn signals.
* Early warning to the driver: The system shall notify the driver when the car is drifting from the lane’s center and a turn light has not been engaged.
* Active correction when the deviation is significant: The system shall steer the car back to the center of the lane when the car is at risk of changing lanes and the turn light has not been engaged.

In order to achieve these functions, the following components are required:

* Lane tracking element: Shall identify the lane and the car’s position within the lane.
* Driving direction element: Shall identify if the car is travelling forwards or backwards.
* Turn indicator element: Shall identify when a turn indicator is turned on.
* Lane assistance behavior element: Shall detect unintended lane center departure and activate corrective actions in two levels. Shall calculate the amount of steering required to safely drive back to the center of the lane.
* Steering wheel subsystem with haptic feedback and steering override element: Shall engage the vibration when indicated to do so. Shall turn the wheels to direct the car without the driver’s help when indicated to do so.

The lane tracking element is further divided in:

* Camera element: Shall capture the scene in front of the car.
* Lane detection element: Using camera data, the system shall identify the lane size, boundaries and center. It shall also measure the current deviation of the car from the lane’s center.

The driving direction element has the following components:

* Driving direction sensor element: Shall identify the direction in which the wheels are turning.

The turn indicator element is already present in the car.

The lane assistance behavior element is further divided in:

* System viability element: Shall determine if operational and environmental conditions allow the system to work.
* Lane keeping assistance level calculation element: Shall determine if the car is within an acceptable distance to the lane’s center or if it is within warning or corrective action ranges.
* Required steering calculation element: Shall determine the minimum steering angle necessary to direct the car towards the center of the lane given the driving direction.

The steering wheel with haptic feedback and steering override element is a modification on the existing steering wheel component in the car. The new elements are:

* Haptic feedback element: Shall gently vibrate the steering wheel to alert the driver.
* Steering override element: Shall turn the steering wheel to direct the car without the driver’s assistance. It also shall do so with a moderate force, such that a driver may still direct the car in a different direction without unreasonable effort.

The camera subsystem shall be mounted behind the rearview mirror inside the vehicle’s habitat.

The driver is in one end of the system’s boundary. The steering column is at the other end of the system’s boundary. Items outside the boundary of the system are outside of the scope of the project. As such, there is no claim to control the driver or the systems that convert the steering wheel’s angle to car wheel’s motion.

In order for the system to provide lane keeping assistance (i.e. its intended objective), the camera must have an unobstructed view of the scene in front of the car. The road’s lanes must also be clearly marked and visible.

# Goals and Measures

## Goals

The goal of this project is to reduce the risk of a collision when the vehicle is travelling by making sure that the car is shifting lanes only when the driver intends to do so.

In order to do this, the driver will have to activate turn signals previous to engaging in a lane change. Any other course of action will result in the system warning the driver first and then attempting to steer the car back into the lane if the course is not corrected after the warning.

We aim to prove that use of the lane assistance system reduces collision risks.

## 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 Assessor | 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 Auditor | Conclusion of functional safety activities |

# Safety Culture

As a company, we pride ourselves in having Health and Safety as the top priority, as requested by our CEO. We build safety into our offices, our practices and our products and services.

Examples of safety in our offices can be found in the form of outward swinging doors, emergency signaling and lightning, see-through door panels, stair handrails, step highlighting and grip enhancements, electrical equipment guards, etc.

Examples of safety in our practices include going up and down the stairs with three points of contact, avoiding looking at mobile phone screens while walking, providing safety inductions to new personnel and visitors, encouragement by management to identify hazards and report near-misses and accidents, etc.

**[Instructions:**

**Describe the characteristics of your company's safety culture. How do these characteristics help maintain your safety culture. Hint: See the lesson about Safety Culture**

**]**

# Safety Lifecycle Tailoring

**[Instructions:**

**Describe which phases of the safety lifecycle are in scope and which are out of scope for this particular project. Hint: See the** [**Intro section**](#_sh22j99mm02k) **of this document**

**]**

# Roles

**[Instructions:**

**This section is here for your reference. You do not need to do anything here. It is provided to help with filling out the development interface agreement section.**

**]**

|  |  |
| --- | --- |
| 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

**[Instructions:**

**Assume in this project that you work for the tier-1 organization as described in the above roles table. You are taking on the role of both the functional safety manager and functional safety engineer.**

**Please answer the following questions:**

1. **What is the purpose of a development interface agreement?**
2. **What will be the responsibilities of your company versus the responsibilities of the OEM? Hint: In this project, the OEM is supplying a functioning lane assistance system. Your company needs to analyze and modify the various sub-systems from a functional safety viewpoint.**

**]**

# Confirmation Measures

**[Instructions:**

**Please answer the following questions:**

1. **What is the main purpose of confirmation measures?**
2. **What is a confirmation review?**
3. **What is a functional safety audit?**
4. **What is 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.