Elektrobit

UDACITY

Safety Plan Lane Assistance

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Document history

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25-10-2018	1.0	Archit Rastogi	Safety Plan for Lane Assistance Systems

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Introduction

Purpose of the Safety Plan

The safety plan provides an overall framework for the lane assistance system safety. Safety plan discusses about the following:

- Item Definition
- Goals and Measures
- Safety Culture
- Safety Lifecycle Tailoring
- Safety Management Roles and Responsibilities
- Development Interface Agreements
- Confirmation Measures
-

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 system is a simplified version of a Lane Assistance System. The Lane Assistance System has two functions:

1. Lane departure warning
2. Lane keeping assistance

When the driver drifts towards the edge of the lane, two things will happen:

- the **lane departure warning function** will vibrate the steering wheel
- the **lane keeping assistance function** will move the steering wheel so that the wheels turn towards the center of the lane

To state the **lane departure warning** engineering requirement more formally: "the lane departure warning function shall apply an oscillating steering torque to provide the driver a haptic feedback." In other words, the vehicle quickly moves the steering wheel back and forth to create a vibration.

The **lane keeping assistance functionality** will automatically **assist** the driver; the steering wheel turns towards the center of the lane.

The item functionalities are implemented by the following subsystem:

- **Camera subsystem**: This subsystem is composed by two components:
  - Camera sensor
  - Camera sensor ECU (Electronic Control Unit)

- **Electronic Power Steering subsystem**: This subsystem is composed by three components:
  - Driver Steering Torque Sensor.
  - Electronic Power Steering ECU.
  - Motor Proving Torque to Steering Wheel.

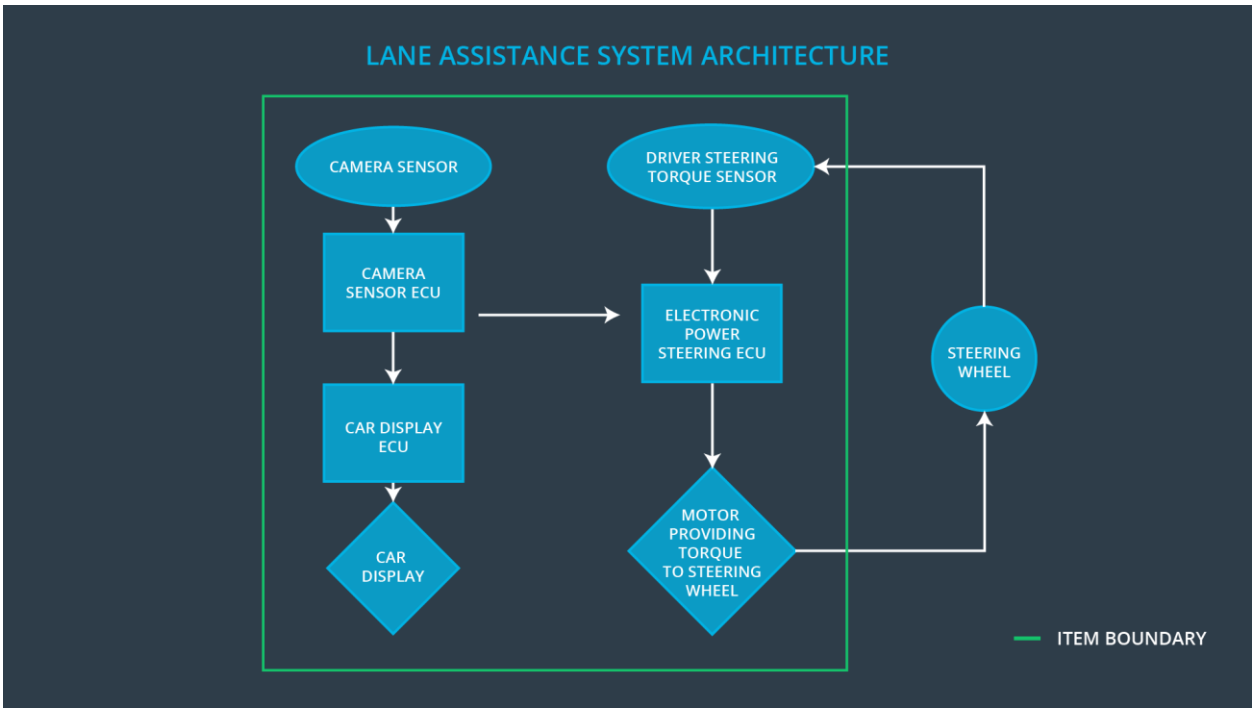
- **Car Display subsystem**: This subsystem is composed by two components:
  - Car Display ECU
  - Car Display

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.

What if the driver wants to leave the lane? 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.

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. 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.


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

Goals and Measures

Goals

1. **Identify hazards** in Lane assistance system that could cause physical injury or damage to a person's health
2. **Evaluate the risk** of the hazardous situation so that we know how much we need to lower the risk
3. Via **systems engineering**, prevent accidents from occurring by lowering risk to reasonable levels.

Measures

Measures and Activities	Responsibility	Timeline
Follow safety processes	All members	Constantly
Create and sustain a safety culture	All Members	Constantly
Coordinate and document the planned safety activities	All Members	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	Safety Assesor	Conclusion of functional safety activities

assessment		

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

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
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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 between companies involved in developing a product. All involved parties need to agree on the contents of the DIA before the project begins.

The OEM is supplying a functioning lane assistance system and is responsible for over vehicle functional safety. Tier-1 supplier needs to analyze and modify the various sub-systems from a functional safety viewpoint. All functional safety information will be shared through appointed Functional safety managers

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.

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.

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.

Functional safety assessment

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