Document Information

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3.2 Left Turn Assist (LTA)

3.2.1 General description

The Left Turn Assist (LTA) application focuses on providing indications to vehicle drivers intending to turn left in order to prevent collisions caused by overlooking oncoming vehicles or incorrectly estimating their speed. The LTA application identifies the intention of a left turn, in which case it calculates the risk of an accident and displays a warning to the driver if necessary. The system continues to work at traffic lights, regardless of which lights are green.
The LTA responds to every traffic participant who is sending a signal and works independent of traffic light regulations. LTA is not designed to be active on parking areas or traffic jams.

3.2.2 Use case description

3.2.2.1 Scenario description: PTW transmit CAM

This scenario is composed of two time sequences. Here, a PTW and a red car, both equipped with C-ITS system and driving on a priority road, are approaching an entrance of a building's parking lot at which the red car wants to turn left.

Time sequence 1   **Time sequence 2**

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Figure 1: Overview of LTA (PTW transmit CAM)

Time sequence 1

The PTW is running and sending CAM regularly. The red car driving on the same priority road but in the opposite direction wants to turn left to go into the building's parking lot (left turn signal on), but oversees the oncoming PTW because a truck is limiting its field of view. At the same time, the red car is receiving and processing the CAM sent by the PTW.

Time sequence 2

After all preconditions and triggering conditions on the car have been met, a warning is issued to the car driver. The driver recognising the warning then can stop before turning left, letting the PTW pass.

3.2.2.2   Scenario description: PTW receive CAM

This scenario is a mirrored setup from the PTW transmit CAM and therefore also composed of two time sequences. A PTW and a red car, both equipped with C-ITS system are driving on a priority road and both approaching an entrance of a building's parking lot at which the PTW wants to turn left.

Time sequence 1   **Time sequence 2**

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Figure 2: Overview of LTA (PTW receive CAM)

Time sequence 1

The PTW is receiving and processing the CAM coming from the red car regularly. The PTW is intending to turn left to go into the building's parking lot (left turn signal on), but oversees the oncoming car due to the truck obstructing its field of view.

Time sequence 2

After processing the received CAM, a warning is issued to the rider. They are asked to stop before turning left in order to let the car pass. For issuing this warning, the system must first recognise the intention of the ego vehicle (the PTW) to turn left and detect a vehicle oncoming from the opposite direction.

3.2.3 Technical description

3.2.3.1 PTW transmit CAM

CAM is transmitted periodically.

For detailed information about CAM, please refer to the following standard: ETSI EN 302 637-2 V1.4.1 (2019-04)[1].

3.2.3.2 PTW receive CAM

3.2.3.2.1 State flow

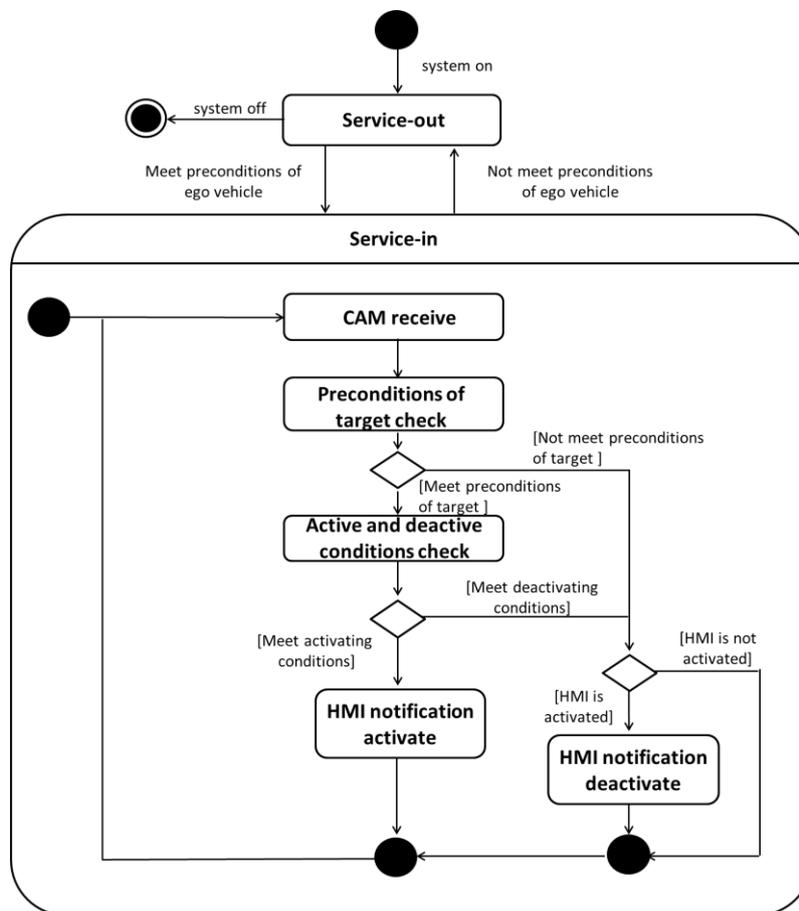The function state flow from Service-In to Service-Out of PTW receive CAM is indicated in the following figure.

Figure 3: State Flow of LTA (PTW receive CAM)

3.2.3.2.2 Preconditions

All of the following preconditions (PC_1 to PC_10) shall be satisfied every time before PTW receive CAM use case is activated:

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[1] ETSI EN 302 637-2, V1.4.1 (2019-04)
(https://www.etsi.org/deliver/etsi_en/302600_302699/30263702/01.04.01_60/en_30263702v010401p.pdf, accessed on 12.11.2020)

Table 1: Preconditions of ego vehicle (PTW receive CAM)

#	Item	Condition
PC_1	Ego vehicle	PTW
PC_2	Speed range	Up to 100km/h
PC_3	Location	-
PC_4	Road type	-
PC_5	Time	-
PC_6	Weather	-
PC_7	Other conditions	-
PC_8	Out of scope	-
PC_9	Left turn indication	Ego vehicle intends to turn left – by turning on the turn signal
PC_10	Acceleration	Not decreasing as for stopping or sufficiently slowing down before turning left

All of the preconditions of target (PC_11 and PC_12) shall be satisfied before active and deactivate condition check.

Table 2: Preconditions of target (PTW receive CAM)

#	Item	Condition
PC_11	Other vehicle	Other vehicle is on the same road as the ego vehicle, approaching to this, and driving in the opposite direction
PC_12	Distance between ego vehicle and other vehicle	< 100m

3.2.3.2.3 Activation and deactivation requirements

The activation and deactivation requirements of PTW receive CAM of LTA are stated below.

All activating conditions must be satisfied to trigger to warning.

Table 3: Activating conditions of LTA (PTW receive CAM)

#	Activating conditions
AC_1	A TTC between 2.5s and 6.5s is calculated.

Table 4: Deactivating conditions of LTA (PTW receive CAM)

#	Deactivating conditions
DC_1	There is no calculated Point-of-Collision any more for 1 second or more.

To deactivate the warning, all deactivating conditions must be satisfied.

Abbreviations

Please refer to the abbreviations in Preamble document.