



anSWer

Navigation On Pilot HandBook

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XXX , 2024

SMART TECHNOLOGY FOR SMARTER MOBILITY

Before You Start

The aim of the creation of this “**NOP HANDBOOK**” is to summarizing and grouping **EVERYTHING** about the NOP product. You can find or should be able to find everything that you need to know about Valeo NOP.

This handbook contains the product definition, development detail, technical concept, development status, achievement and all. Different metier for different purpose could all be beneficial from this document.

This handbook is also acting as a database for all the presentation for the PTF part of NOP function, you could copy/paste/link the slides to your slide to be always updated.

Do note that, this document contains internal and external information, be careful of the sign on the top right about the usage.

DO NOT SEND THIS DOCUMENT DIRECTLY and ENTIRELY to outside of VALEO



PRODUCT
INTRODUCTION



FUNCTION
SYNTHESIS

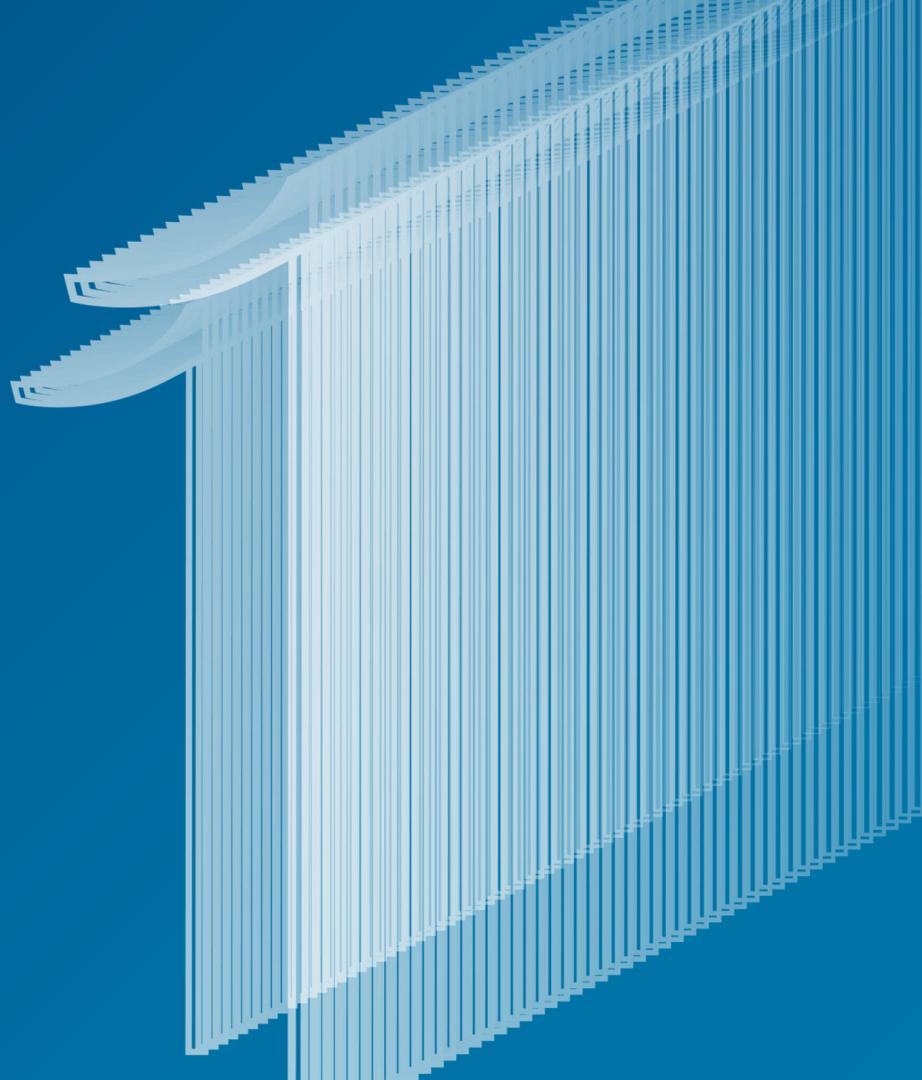


DEVELOPMENT
INFORMATION



PRODUCT INTRODUCTION

- General Introduction
- NOP Lite Introduction
- NOP Full Introduction
- NOP Premium Introduction
- Product Roadmap

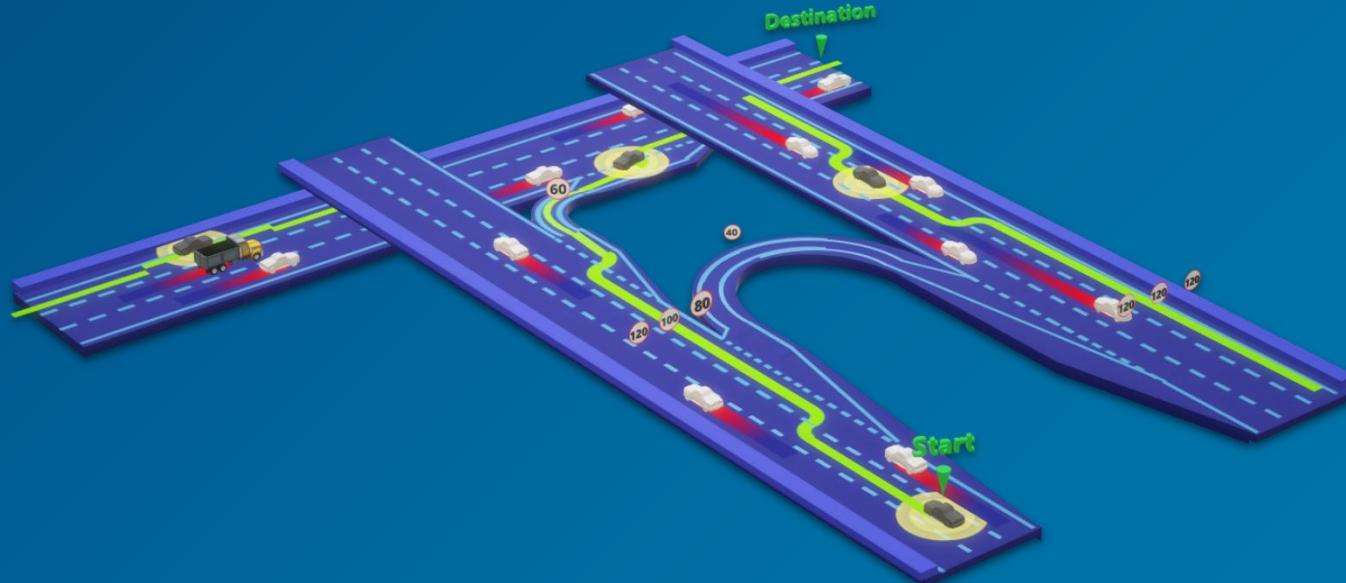


General Introduction

Function Overview

NOP(Navigation on Pilot) is a integrated **L2+** function which could provide Automated Driving Assist Under driver's supervision (**Hands On + Eyes On**) within the Structural Road (Highway or Urban Express) from **point A** and **point B** (start point and destination defined by user) at full speed range (0-130 kph).

NOP function including **longitudinal, lateral control** of the vehicle, and **lane change assist** (Full automatic, driver triggered and system suggested), which helps the driver to perform Automatic overtaking, Highway connections on top of the HWA functions today.

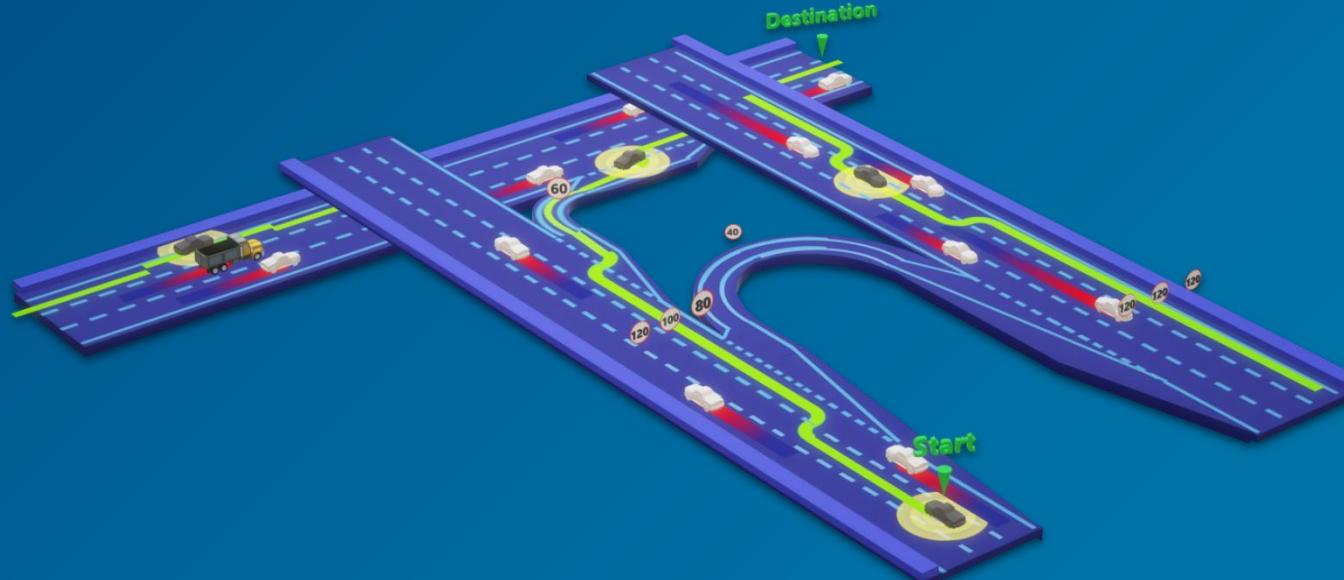


General Introduction

Function Overview

NOP(Navigation on Pilot) 高速领航功能是一个 L2+ 级别的高级辅助驾驶功能，该功能能够在限定的区域内(高速/高架等封闭道路中)在驾驶员的监控下(**不允许脱手脱眼**) 在车速 **0 - 130 km/h** 内为驾驶员提供点到点的驾驶辅助。

该功能为集成式辅助驾驶功能，能为驾驶员提供车辆的**纵向控制、横向控制**以及**变道辅助控制**等功能 (支持拨杆变道，系统推荐变道以及全自动变道) 能够完成**自动超越慢车，自动进出主路，高速切换**等功能



General Introduction

Product Portfolio



NOP as an End User Function is composed by a group of **mandatory features** and based on the solution provided and the system configuration more use cases and scenarios could be accomplished as well as its safety level.

NOP Lite/Full/Premium are created to provide to customer NOP function with different richness of feature and performance of the function

General Introduction

Product Configuration

		DIGITAL MAP*		
		SD Map (Navigation/ADAS Map)	HD Map	ME REM
SENSOR SET**	5R1V 5*Radar + 1*FC	NOP Lite	X	NOP R***
	5R4V 5*Radar + 1*FC + 2*SVC +1*RC	NOP Lite ***	NOP FULL	NOP FULL
	5R6V+ 5*Radar + 1*FC + 4 * SideCAM + 1*RC and above	X	NOP Premium	NOP Premium

* Different Level of digital map (lane level/road level) makes a big difference of the understanding a static environment and anticipation for the ADAS system, need to a important criteria of the function definition

** Different Sensor set makes difference of the dynamic traffic environment reconstruction, both on the detection capability and detection redundancy

*** Even with increased detection capability, the perception of oversight environment, complex intersection recognition and bad road condition can be covered with lane level map, thus can only provide NOP Lite

**** REM technology as a special product, provide lane level map information but always preferable to be used in low cost solution (5R1V) for that it's cloud based solution .But with the lost the object perception capability, NOP R is proposed as intermediate product in between.

***** X means no dedicated product that lies in the combination of sensor and map as the combination is either impossible or unreasonable

General Introduction

Product Configuration

		DIGITAL MAP*	
		SD Map (Navigation/ADAS Map)	HD Map
SENSOR SET**	5R1V 5*Radar + 1*FC	NOP Lite	X
	5R4V 5*Radar + 1*FC + 2*SVC +1*RC	NOP Lite ***	NOP FULL
	5R6V+ 5*Radar + 1*FC + 4 * SideCAM + 1*RC and above	X	NOP Premium

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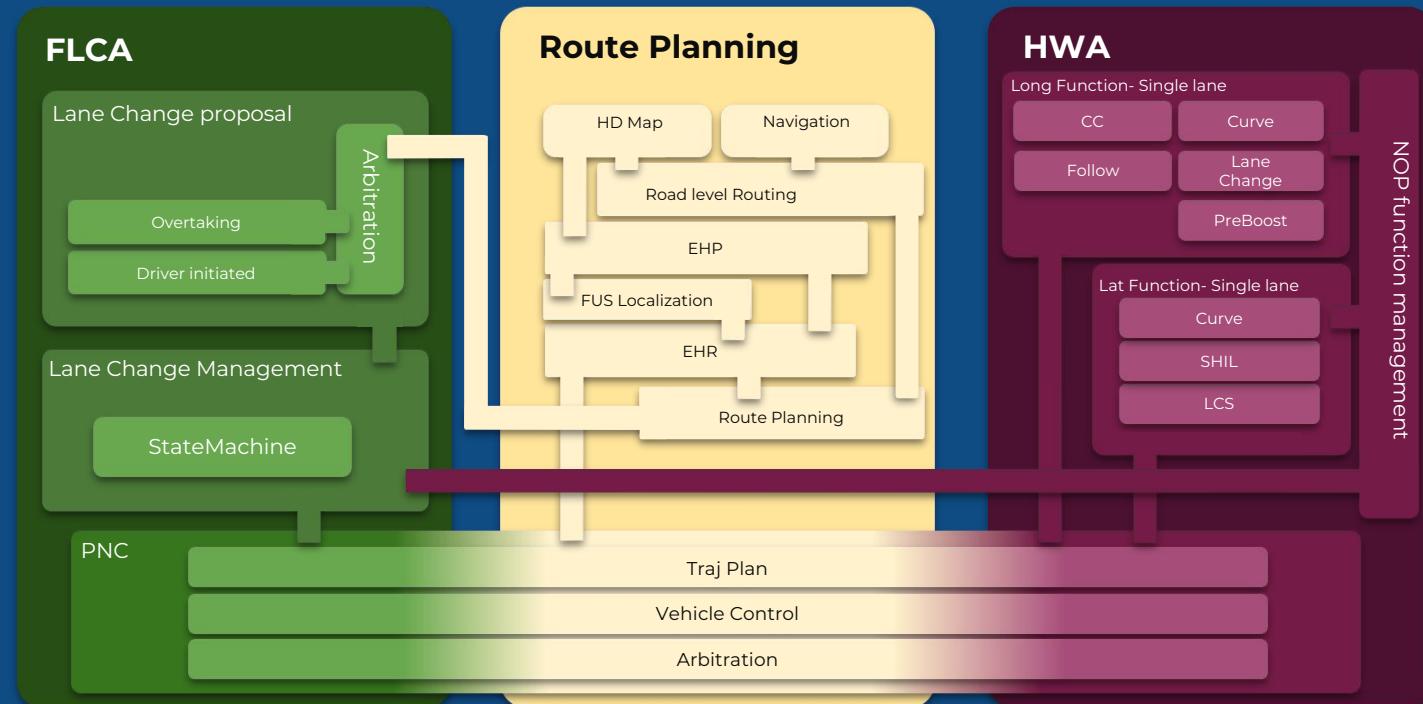
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General Introduction

Product Architecture

NOP Function



NOP Lite Introduction

Feature list

Navigation On Pilot Lite is a product providing the fundamentals of the NOP function with only the mandatory perception capability and the mandatory navigation information input.

Feature List	DESCRIPTION
ACC S&G	Conventional Adaptive Cruise Control function
LCS	Conventional Lane Centering System
TLC	Triggered Lane Change
AOT	Automatic lane change to overtaking slow vehicle
NLC	Treating, choosing and control the vehicle to follow the navigation path
ASM	Automatically fuse and propose cruise control speed to the system
Automatic Ramp On	Automatically drive the vehicle to exist the main road to the desired ramp/exit
Automatic Ramp Off	Automatically drive the vehicle to merge into the main road from a ramp
Highway Interchange	Manage to drive in the ramp and select the correct road to go during split scenario
ODD Management	Determine the ODD of the function to control the function activation/deactivation
Minimum Risk Maneuver (SIL)	Stop the vehicle in the lane during emergency situation (handoff/eyeoff), road ending, etc
Best Planning Tracking	Selecting the lane with the best travel efficiency to.
Takeover Management	Issue warning or notification facing system limitation
Interspace insert	Actively looking for space and adjust ego speed to complete lane change

NOP Lite Introduction

Use cases and Scenarios

Single Lane



ACC S&G

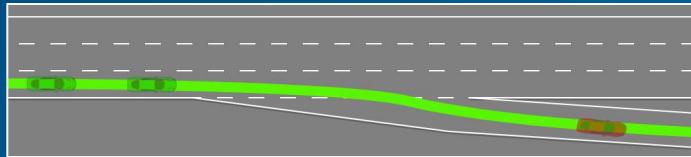


Lane Centering



Stop In lane

Ramp In / Out



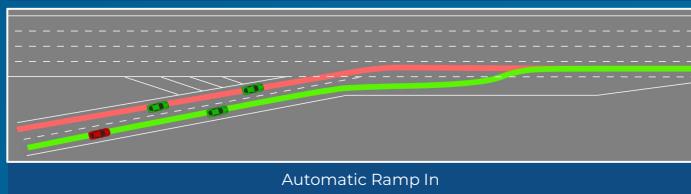
Ramp Out



Consecutive Multi Exit

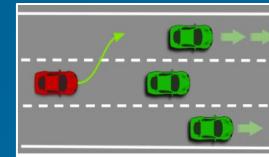


Intersected Ramp In/Out

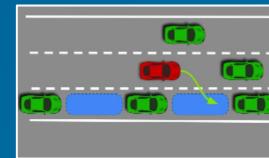


Automatic Ramp In

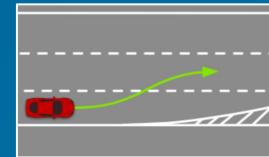
Lane Change



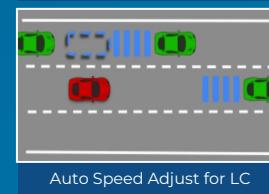
Overtake slow vehicle



Navigation Lane Change



Evasive Lane Change



Auto Speed Adjust for LC

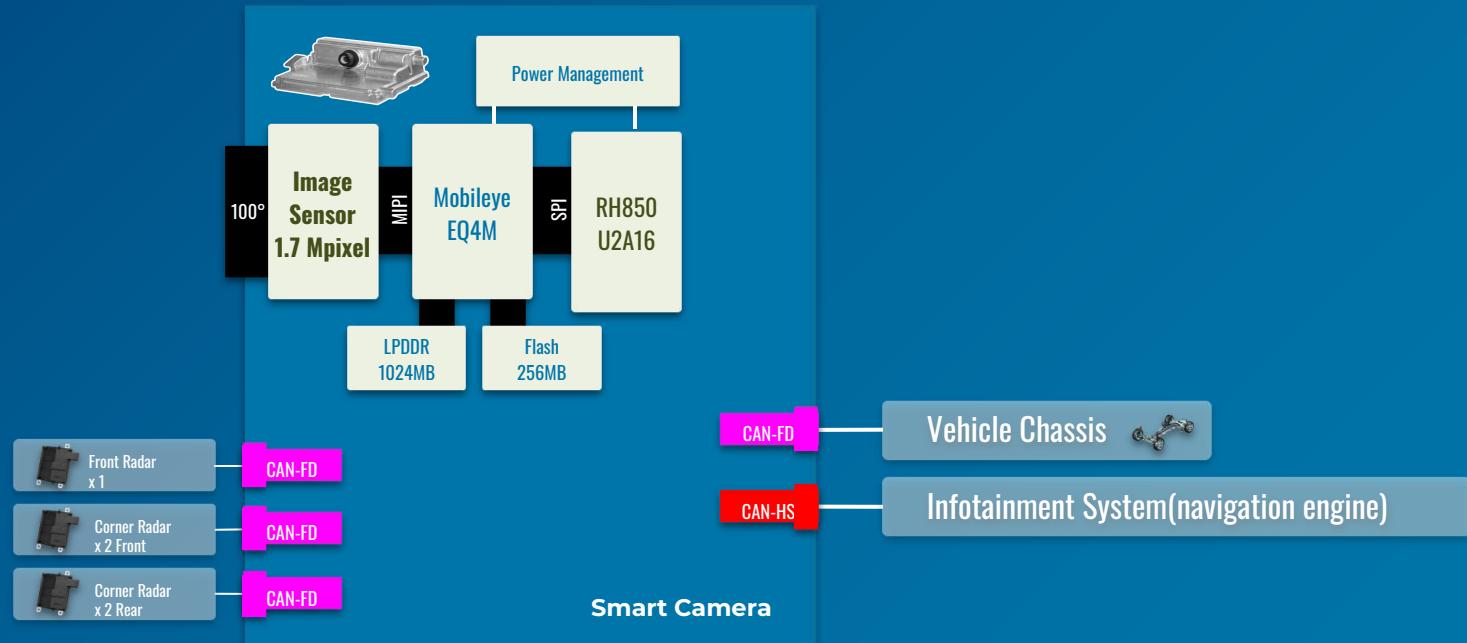
Intelligent Speed Control



Speed Management with Navigation Input

NOP Lite Introduction

System Solution

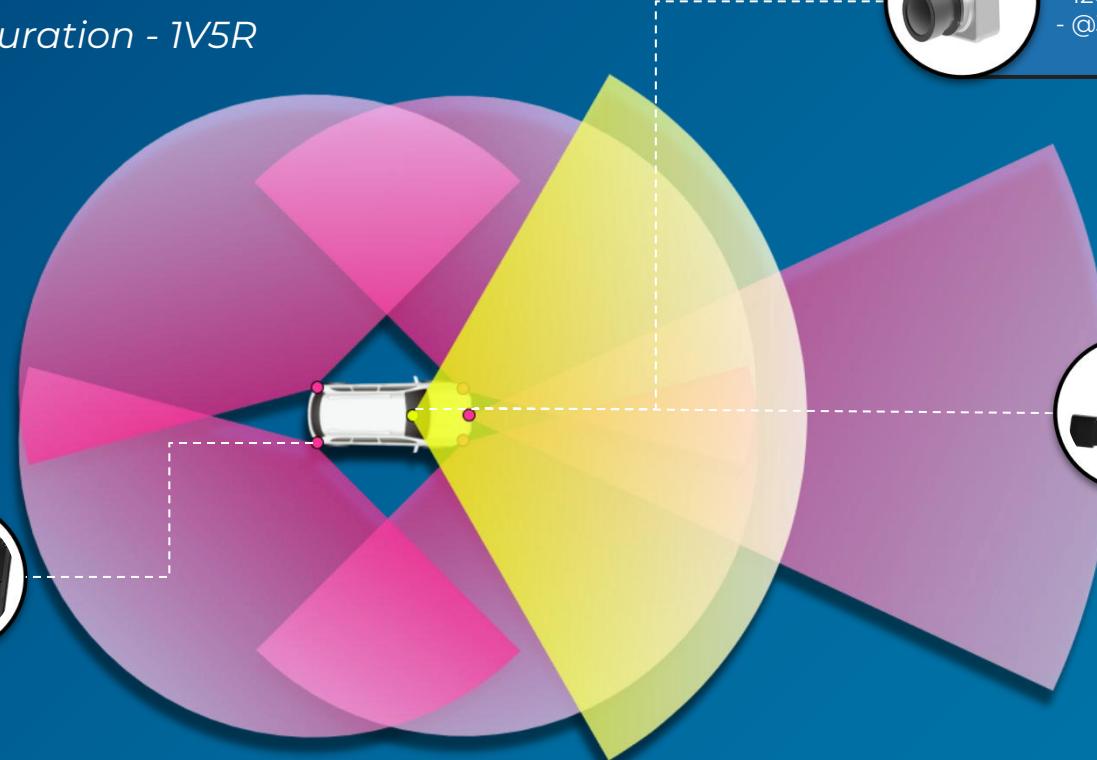


NOP Lite Introduction

Sensor Configuration - 1V5R



- 8 M Pixel
- 120° FOV
- @30fps



- 200 m range
- 150 / ± 0.5° Azimuth
- ±8° Elevation
- 77-77 Ghz
- FMCW(4Tx 4Rx)

x4



- 250 m range
- 60 / ± 0.5° Azimuth
- ±8° Elevation
- 77-77 Ghz
- FMCW(4Tx 4Rx)

360° Perception Sensor Config
- 1 x Front CAM (8 Mpx)
- 1 x FR
- 4 x CR

NOP Lite Introduction

BenchMark



Item	Description
Sensor Set	1R7V--1*Radar+2*FC+1*RC+4*SVC
Controller	TDA4 VH, 32TOPS
Map	SD Map

FUNCTION	SCENARIOS	DJI	VALEO	COMMENTS
Highway NOP	Automatic Overtaking Decision			DJI: Overtaking frequency very low ending up staying in the slow lane for long time. Sometimes change lane into slower lane Valeo: Reasonable number of lane change, after the lane change, the travel efficiency is mostly correct.
	Main Road Exit lane change			DJI: The lane change is sometime triggered to early, ego vehicle stays in the right lane for very long time Valeo: According to the lane change number left, the starting distance is dynamic. Also automatic deceleration is considered during the ramp off to improve the success rate
	Ramp Off Control			DJI: During the overwidth lane, the vehicle will following the virtual lane created based on the left lane marker DJI: During the overwidth lane, the vehicle will following the virtual lane created based on the left lane marker
	Ramp In Strategy			Both Solution: No emergency stop function when ramp in is NOK, only HMI warning is issued.
	Lane Change Motion Control			Valeo: the lane change control is smooth, no overshoot of vehicle control nor zig zag control.
	Static Object Strategy			DJI: Could stop in front of the static object. Valeo: Feature not implemented yet, will be implement before End of 2024
	Speed Management			DJI: Vehicle speed change is only sudden without notification and control sometimes is creating radical control Valeo: The speed management is logical and predictable by the driver and will not create strong braking or accelerating

NOP FULL Introduction

Feature list

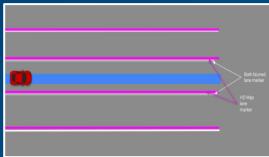
Navigation **O**n **P**ilot **F**ull is a product providing the full package of the NOP function with the input of 360° redundant perception system and HD map input

Feature List	DESCRIPTION
ACC S&G	Conventional Adaptive Cruise Control function
LCS +	Enhanced with HD map during lane marker lost scenarios
TLC	Triggered Lane Change
AOT +	Enhanced with HD map input knowing where the vehicle is in the road to improve AOT logic
NLC +	Enhanced with HD Map(oversight information) to improve the NLC logic
ASM +	Enhanced the speed management by lane level information
Automatic Ramp On +	Automatically drive the vehicle to exist the main road to the desired ramp/exit
Automatic Ramp Off +	Automatically drive the vehicle to merge into the main road from a ramp
Highway InterChange +	Manage to drive in the ramp and select the correct road to go during split scenario
ODD Management	Determine the ODD of the function to control the function activation/deactivation
Minimum Risk Maneuver (SIL)	Stop the vehicle in the lane during emergency situation (handoff/eyeoff), road ending, etc
Best Planning Tracking +	Enhanced with the lane topology contextual input
Takeover Management	Issue warning or notification facing system limitation
Interspace insertion +	Enhanced by the Map of the road situation to provide more intelligent speed control
Evasive lane change	Control the vehicle to change lane to avoid static target and road merge

NOP FULL Introduction

NOP FULL Use cases and Scenarios (enhanced to NOP Lite)

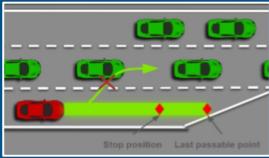
Single Lane



Enhanced lane centering

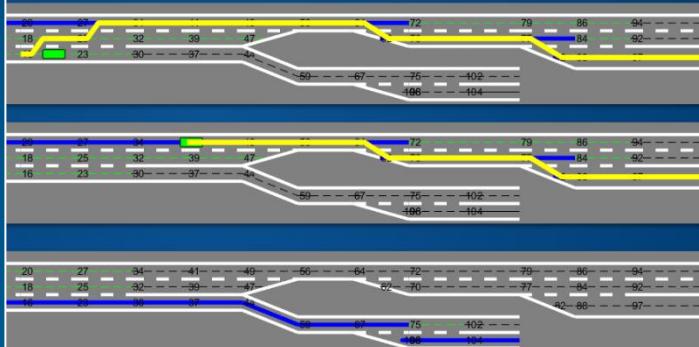


Anticipated cut-in



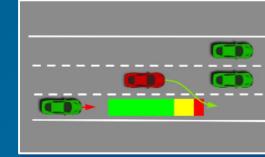
Emergency Stop In Lane

Ramp In / Out



Pre Planning navigation lane change

Lane Change



Lane Change gaming

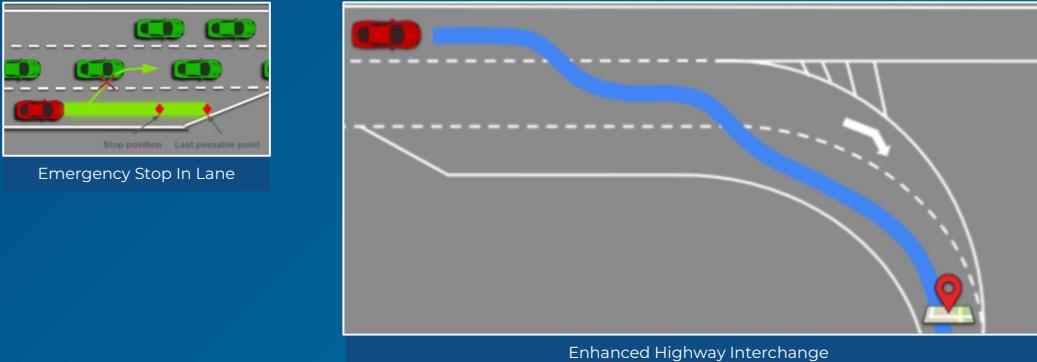


Lane Change inhibition

Intelligent Speed Control



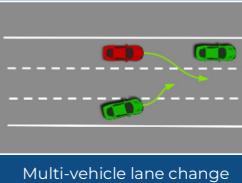
Speed Management with HD Map input



Enhanced Highway Interchange



Static object avoidance



Multi-vehicle lane change

NOP FULL Introduction

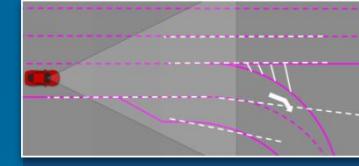
Enhanced Scenarios by HD Map



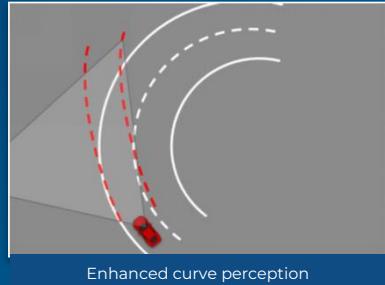
Enhanced speed limit control



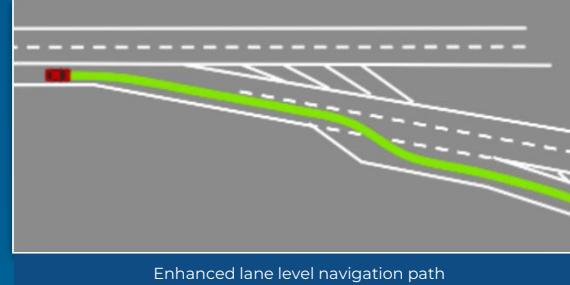
Enhanced lane change choice



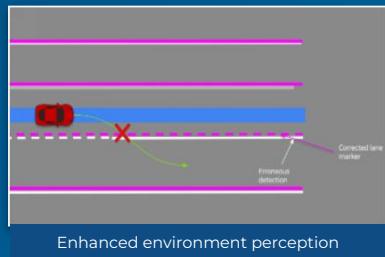
Enhanced intersection perception



Enhanced curve perception



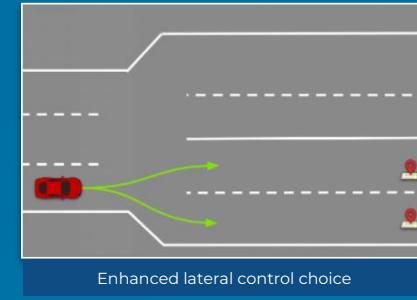
Enhanced lane level navigation path



Enhanced environment perception



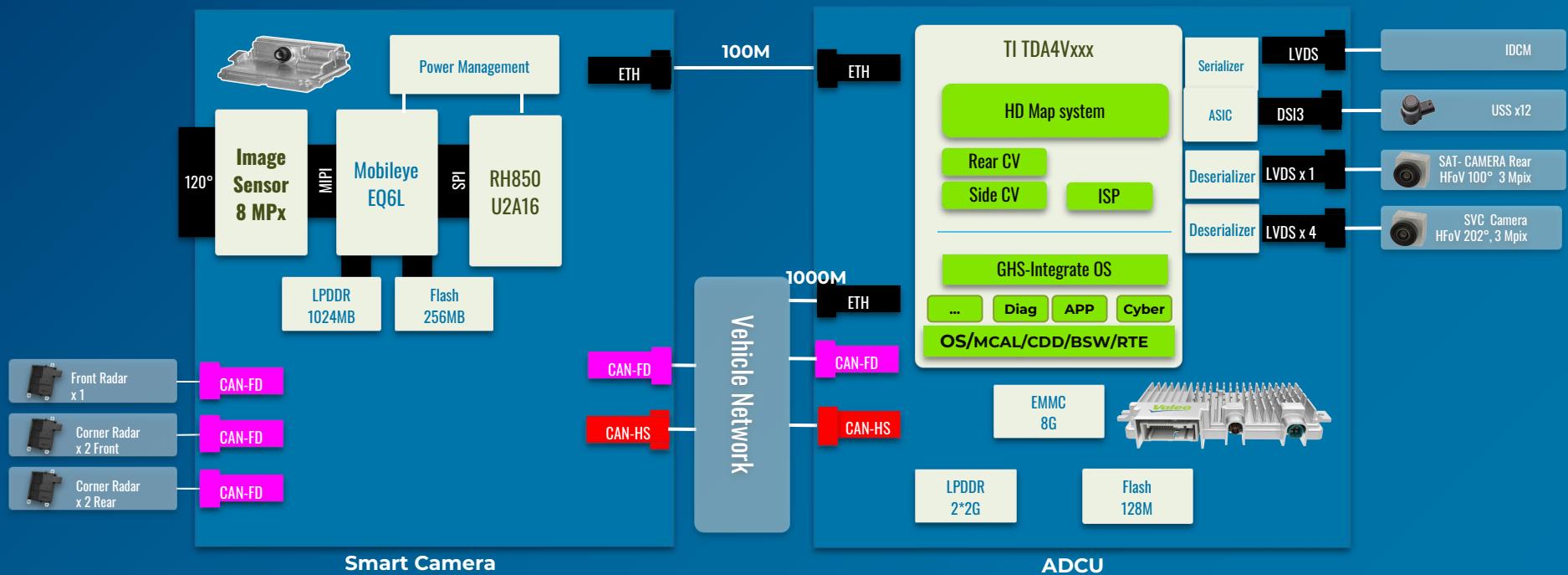
Enhanced lane change choice



Enhanced lateral control choice

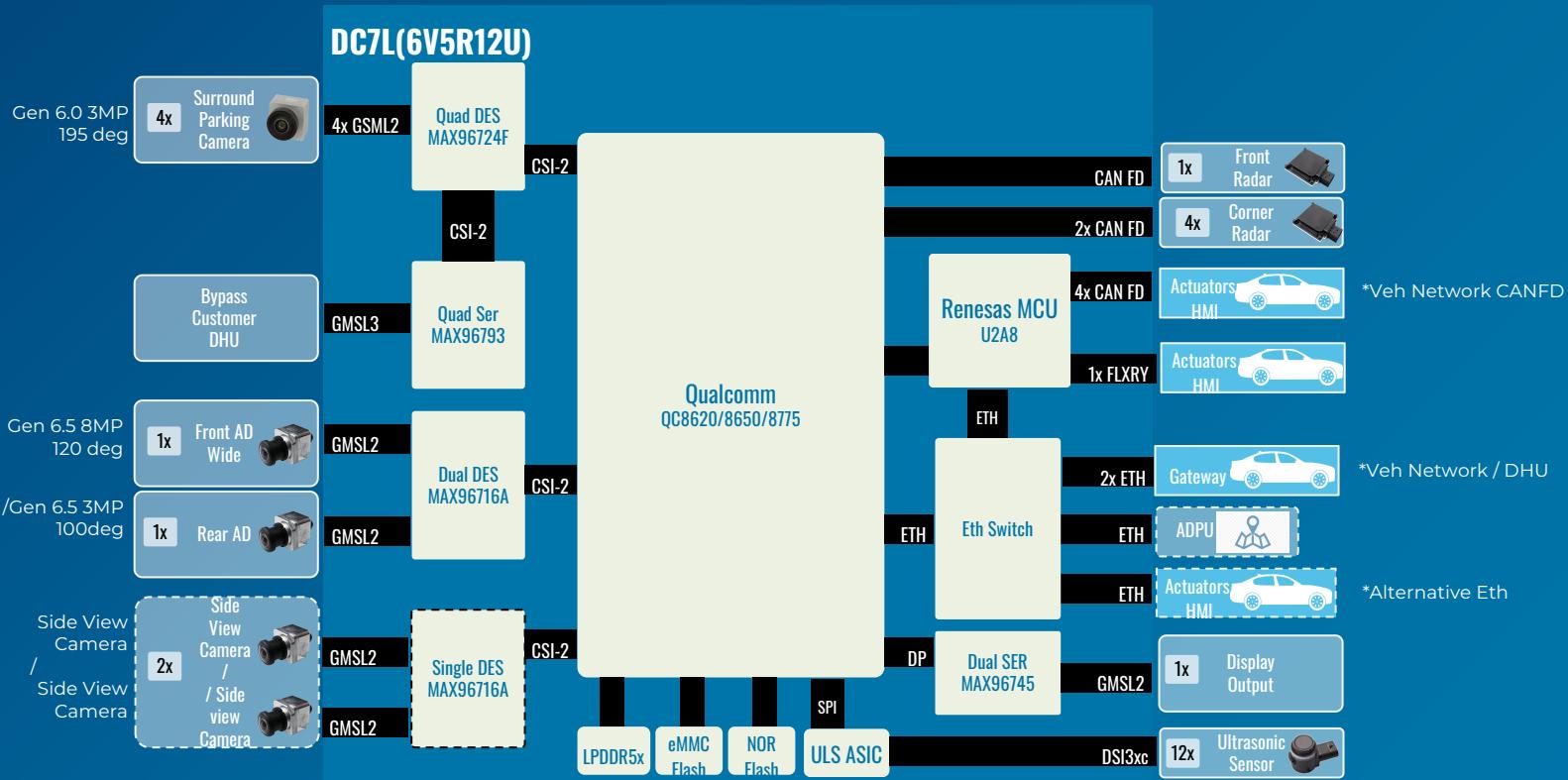
NOP FULL Introduction

NOP FULL System Solution - 2 Box



NOP FULL Introduction

NOP FULL System Solution - DC



NOP Product Introduction

NOP FULL Sensor Configuration - 5R4V

- 3 M Pixel
- 100° FOV
- @30fps



- 8 M Pixel
- 120° FOV
- @30fps

- 200 m range
- 150 / ± 0.5° Azimuth
- ±8° Elevation
- 77-77 Ghz
- FMCW(4Tx 4Rx)



x4

- 250 m range
- 60 / ± 0.5° Azimuth
- ±8° Elevation
- 77-77 Ghz
- FMCW(4Tx 4Rx)



- 3 M Pixel
- 195° FOV
- @30 fps



x2

- 360° Perception Sensor Config
- 1 x Front CAM (8 Mpx)
 - 1 x FR
 - 4 x CR
 - 1 x RVC (3 Mpx)
 - 2 x SVS (3 Mpx)

NOP Product Introduction

Product Scales

Feature List	DESCRIPTION	NOP Lite	NOP Full	NOP Premium
ACC S&G	Adaptive Cruise Control	OK	OK	
LCS	Lane Centering system	OK	OK +	
TLC	Triggered Lane Change	OK	OK	
AOT	Automatic Overtaking	OK	OK +	
NLC	Navigation Lane Change	OK	OK +	
ASM	Automatic speed management	OK	OK +	
ARON	Automatic Ramp on	OK	OK +	
AROF	Automatic Ramp off	OK	OK +	
HIC	Highway InterChange	OK	OK +	
ODD Management	ODD Management	OK	OK +	
SIL	Stop In Lane	OK	OK	
BPT	Best Path Tracking	OK	OK +	
TOM	TakeOver Management	OK	OK +	
Interspace insertion	Interspace insertion	OK	OK +	
ELC	Evasive Lane Change	/	OK	
Extended longi control		/	OK	

PRODUCT INTRODUCTION

HMI Presentation



Color Code



Error



Override



Active



Standby