WP1 – Integration Information

1 All sensors and devices integrated in the autonomous driving vehicles

In 2 ZOE vehicles, there are many sensors and equipment for autonomous driving, as well as some monitoring devices should be integrated for analyzing in case of an accident.

	Name	Number / Vehicle	Location	Function
Sensor & equipment	Front Stereo Camera	1	Front Windshield	Lane & Object detection
	AVM Camera	4	Front bumper, Rear door, Right side mirror, Left Side mirror	Lane & Object detection
	Radar	2	Right side bumper, Left side bumper	Front & Side Object recognition
	PC	2	Trunk	- Sensor data processing & Vehicle control - Radar data processing
	Embedded ECU	1	Trunk	- System monitoring - Mode switching - Sound & Vision Warning
Monitoring device	Front Mono Camera	1	Front Windshield	Front Road condition monitoring
	External Recording Device	1	Trunk	To record car information from CAN network.
	Digital Tacho-Graph	1	Trunk	To record Driving information
	Image Storage Device	3	Front Windshield, Rear Windshield	- To store the image from front road situation, rear road situation - To store the driver's driving image

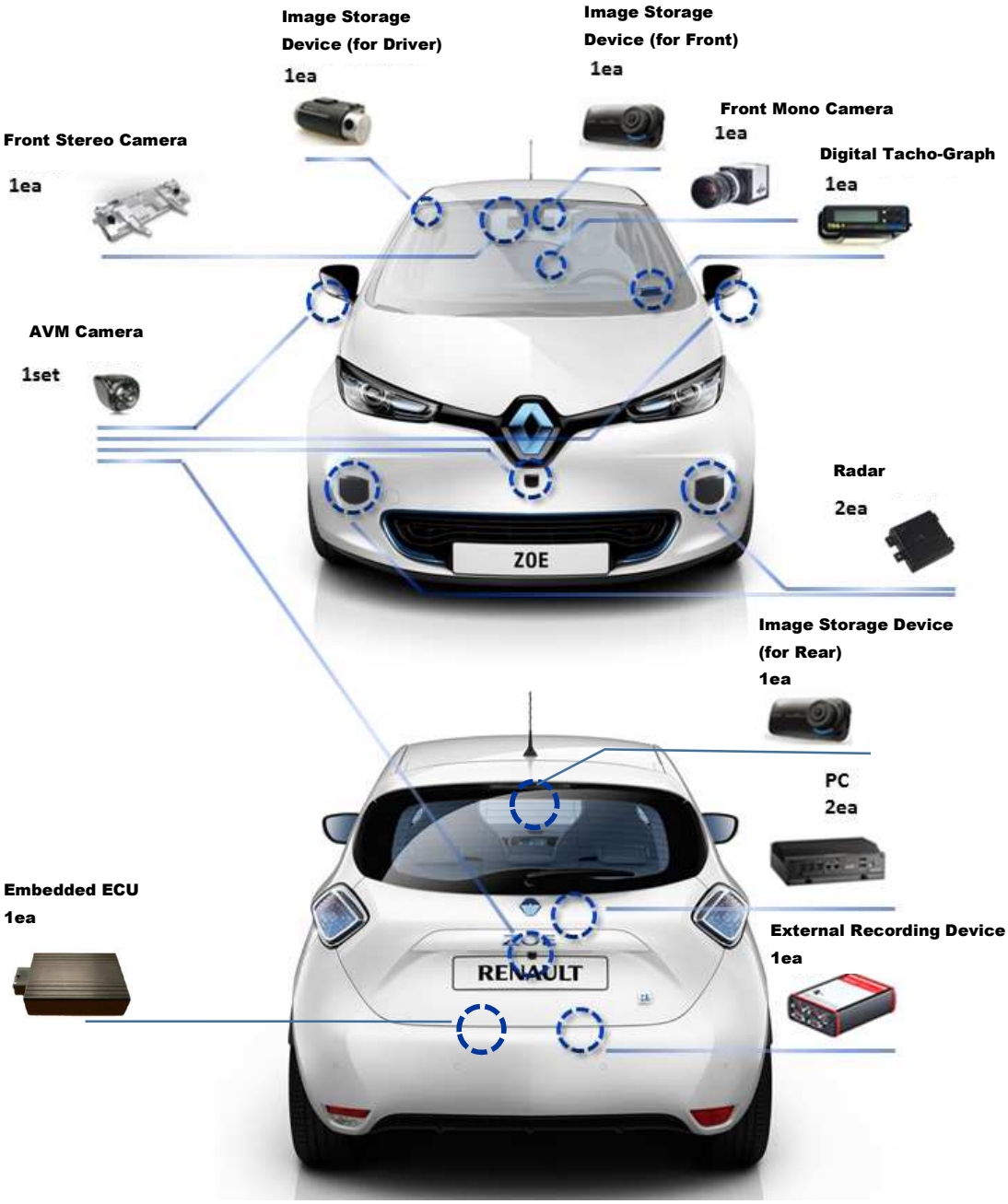
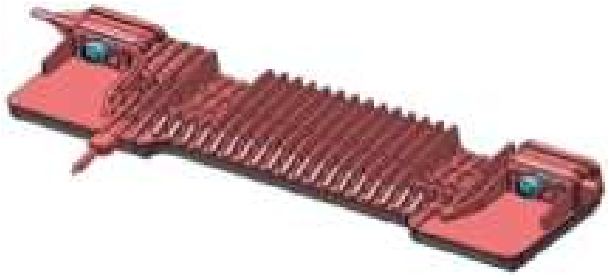


Image Storage
Device (for Driver)
1ea
Image Storage
Device (for Front)
1ea
Front Mono Camera
1ea
Front Stereo Camera
1ea
Digital Tacho-Graph
1ea
AVM Camera
1set
Radar
2ea
ZOE
Image Storage Device
(for Rear)
1ea
PC
2ea
Embedded ECU
1ea
External Recording Device
1ea
RENAULT

2 Sensor specification

2.1 Front Stereo Camera



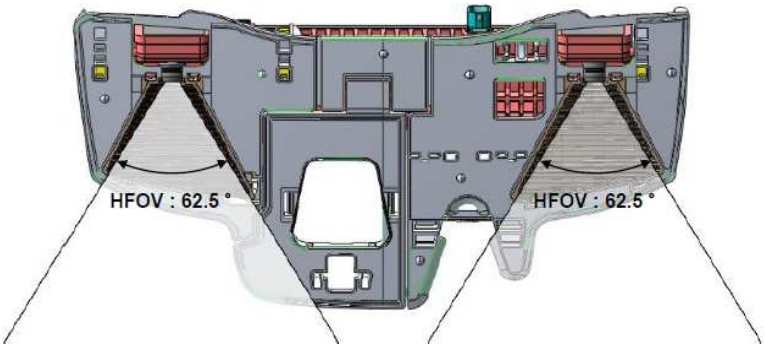
Supplier: LGE

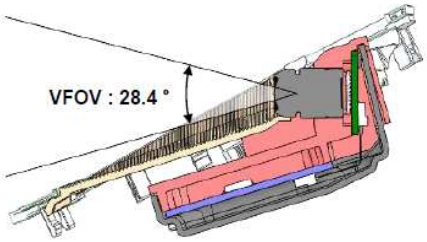
(1) Baseline : 220 mm

(2) Resolution : 1920 x 1080 pixels

(3) FOV (Filed Of View)

- VFOV: 28.4°
- HFOV: 62.5°



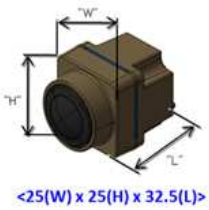


(4) Frame rate : 22 fps

(5) Package size : W273 x D86 x H34 mm

(6) Operating Temperature : -40 ~ 105℃

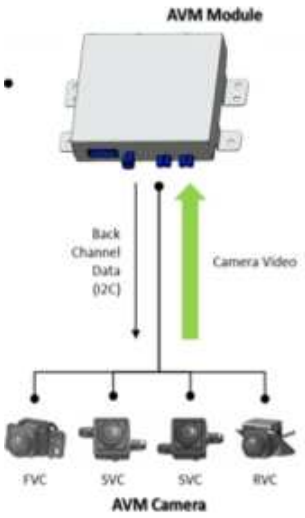
2.2 AVM Camera

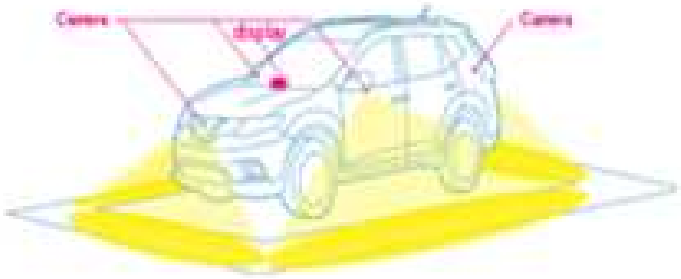


Supplier: LGE

Index	Spec.
Input voltage	DC 6.5V ± 0.5V
Consumption current	Max 200mA
Operation temperature	-40 ~ +85 ℃
Storage temperature	-40 ~ +95℃
Resolution	1280x720p 30fps
HDR	120 dB @WDR
Initial operating time	< 500ms
Minimum luminance	> 0.5lux
interface	LVDS POC
FOV	AVM (H : 190° V : 120°)
size	25x25x32.5 mm
weight	AVM : < 50g
waterproof	IP67

System diagram and FOV (Field Of View)





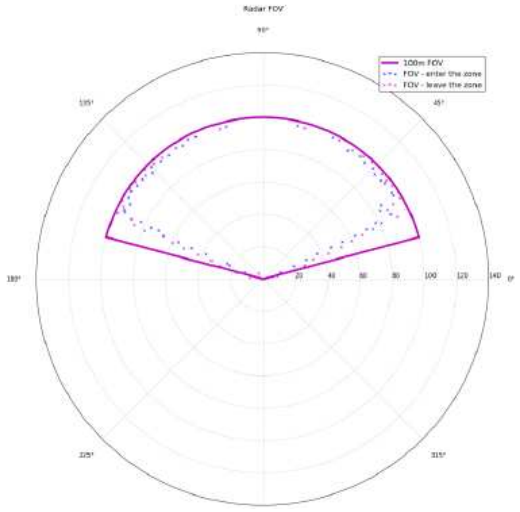
4 Cameras- Front, Back, Right, Left

2.3 Radar

Supplier: Valeo

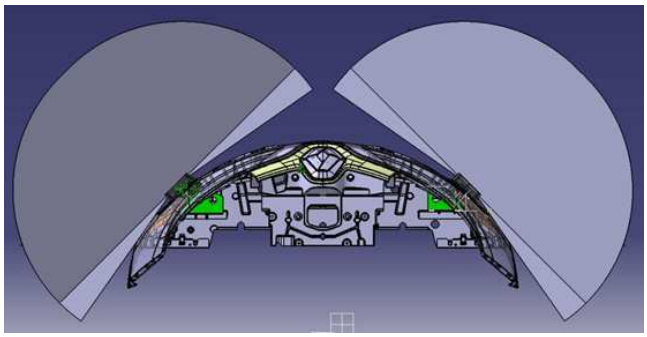
Parameter	Value
Antenna BW*	135°
Max Range	96m
Frequency	77 Ghz

(*) 10dB beam width of Antenna,

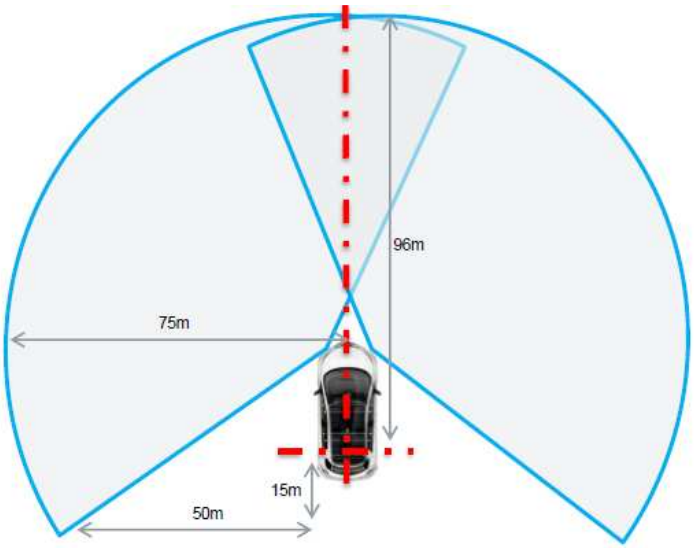


Mount of RADAR

- RADAR is located on the bumper surface to satisfy metal and plastic keep out requirement



FOV (Field Of View) after integration



2.4 Digital Tacho-Graph

Supplier: Daesin Electronics Technology

(1) Model : TDS-1

(2) Size: 80mm x 26mm x 100mm

(3) Weight: 180g

(4) Supply voltage: DC 9~36V

(5) Operating voltage: DC 12 / 24V

(6) Operating temperature: -20 ~ 70ºC

(7) **Operating current: 35mA**

(8) **Man function**

A. **Speed, Brake data record**

B. **GPS data record**

C. **Mileage / Driving time / abnormal data record**

D. **G-sensor embedded**

2.5 External recording device

Supplier: Vector

(1) Model : VN1640A

(2) Electrical specifications

A. Power consumption: Approx. 2.5W

B. Operating temperature: -40 ~ +70ºC

C. Operating system: Window 7 (SP1), Windows 8.1, Windows 10

(3) Testing and analyze on CAN network

(4) Weight: 180g

(5) Power consumption: Approx. 2.5W

2.6 Image storage device

2.6.1 Image storage device for Driver

Supplier: i-navi

(1) Model : CLAIR pop

(2) Main specification

항 목	규 격	비 고
모델명	CLAIR pop	
크기/무게	108.5 X 45.2 X 26mm / 75g	
용량	MicroSD 메모리카드	8/16/32GB
녹화방식	상시 녹화	1분 단위로 녹화
	충격 녹화	충격 전/후 각 10초 녹화 (총 20초)
	수동녹화	
	주차녹화 (주차모드)	상시 전원 공급을 위한 별도의 장치 혹은 설치가 필요
	사진촬영	
	음성녹음 (최초 ON 모드로 설정)	설정 버튼 (3초 이내) / 음성 녹음 ON/OFF를 설정할 수 있음
일반녹화화질	총 3단계 모드로 설정 가능	파티션 구성에 따라 녹화 시간 다름
카메라	2.0M Pixels, 1/3.2" CMOS	약 200만 화소 이상급
화각	약 140° (대각기준)	
비디오	HD (1280X720/H.264/확장자 AVI)	
프레임수	1채널 : 전방 동작시 (최대 30프레임)	
오디오	PCM (Pulse code modulation)	
가속도 센서	3축 가속도 센서(3D, ±4G)	10단계 감도 설정

GPS	외장 GPS 지원	아이나비 CLAIR pop 호환용 외장 GPS 별도 구매
입력 전원	DC 12/24V 지원	동시 입력 시 DC 12V 우선
소비전류	3.1W(Max)	
전원보조장치	슈퍼 캐패시터	
시큐리티 LED	파노라마형 화이트 LED	
알림 LED	3색 LED	후면부 LED 2개
경고음	스피커 내장	음성(부저음) 안내
외부출력	NTSC	
동작온도/보관온도	-10~60℃	
인터페이스	AV-OUT(2.5Ø) / 외장 GPS	

2.6.2 Image storage device for Front and Rear view

Supplier: i-navi

(1) Model : V700

(2) Main specification

항 목	규 격	비 고
모델명	아이나비 V700 (후방카메라 포함)	
크기/무게	106 X 63 X 27.1 / 93g	후방카메라 : 25Ø x 27 x 61mm / 25g
디스플레이 패널	3.5 인치 TFT LCD (480 X 320)	
용량	MicroSD 메모리 카드	16 / 32GB
녹화방식	상시녹화	1분 단위로 녹화
	이벤트 녹화	이벤트 전/후 각 10초 녹화 (총 20초)
	수동녹화	
	주차녹화 (주차 모드)	충격감지/모션감지/타임랩스
카메라 센서	130만 화소 CMOS	후방카메라 : 100만 화소 CMOS
화각	약 140° (대각기준)	후방카메라 : 약 139° (대각기준)
비디오	HD (1280 X 720/H.264/확장자 MP4)	2채널 동작 시 후방 : HD (1280 X 720)
프레임수	최대 30프레임	전/후방 동작 시
오디오	PCM (Pulse code modulation)	
가속도 센서	3축 가속도 센서	5단계 감도 설정
후방카메라	V-IN port	Stereo jack 2.5Ø, 4극
GPS	외장형 GPS port	Stereo jack 2.5Ø/ 4극
입력 전원	DC 12/24V 지원	후방카메라 : 5V DC
소비전류	3.3W (mean)	2채널 동작시
알림 LED	전면 : Security LED 후면 : Status LED (2ea)	
경고음	스피커 내장	음성(부저음) 안내
동작온도/보관온도	-10 ~ 60℃	

2.7 Front Mono Camera

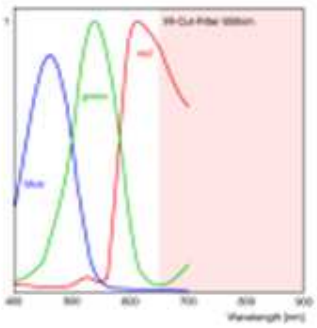
Supplier: IDS

(1) Model : Ueye (UI-2230SE)

(2) Main specification

Sensor

Sensor Technology	CCD
Manufacturer	Sony
Resolution (h x v)	1024 x 768
Color depth (sensor)	12 bit
Color depth (camera)	12 bit
Pixel Class	0.8 MP
Sensor Size	1/3"
Shutter	Global shutter
max. fps in Freerun Mode	40.0
Binning Modes	Mono
Subsampling Modes	-
Sensor Model	ICX204AK
Pixel size	4.65 µm
Optical Size	3.571 mm x 4.762 mm



Design

Interface	USB 2
Lens Mount	C-Mount
I/O In	1 x Opto
I/O Out	1 x Opto
I/O RS-232	-
I/O GPIO	-
I/O I2C	-
Protection Class	IP30
Dimensions H/W/L	34.0 mm x 32.0 mm x 41.0 mm
Mass	79 g
Power supply	USB Cable

2.8 PC

Supplier: ADLINK

(1) Model : MXE-5401

(2) Main specification

A. Intel®Core i7-4700EQ
B. 2.4 GHz processor
C. RAM: 16GB

2.9 Embedded ECU

Supplier: Freescale + ACE Lab

(1) Model : MPC5675k

(2) Main specification

D. **Clock: 0-180 Mhz**
E. **RAM: 512kB**
F. **Flash memory: 2MB**