Standardization of Millimeter Wave Radar and Lidar on-board for Autonomous Driving Technology

Proposal for setting up a new Question under SG16

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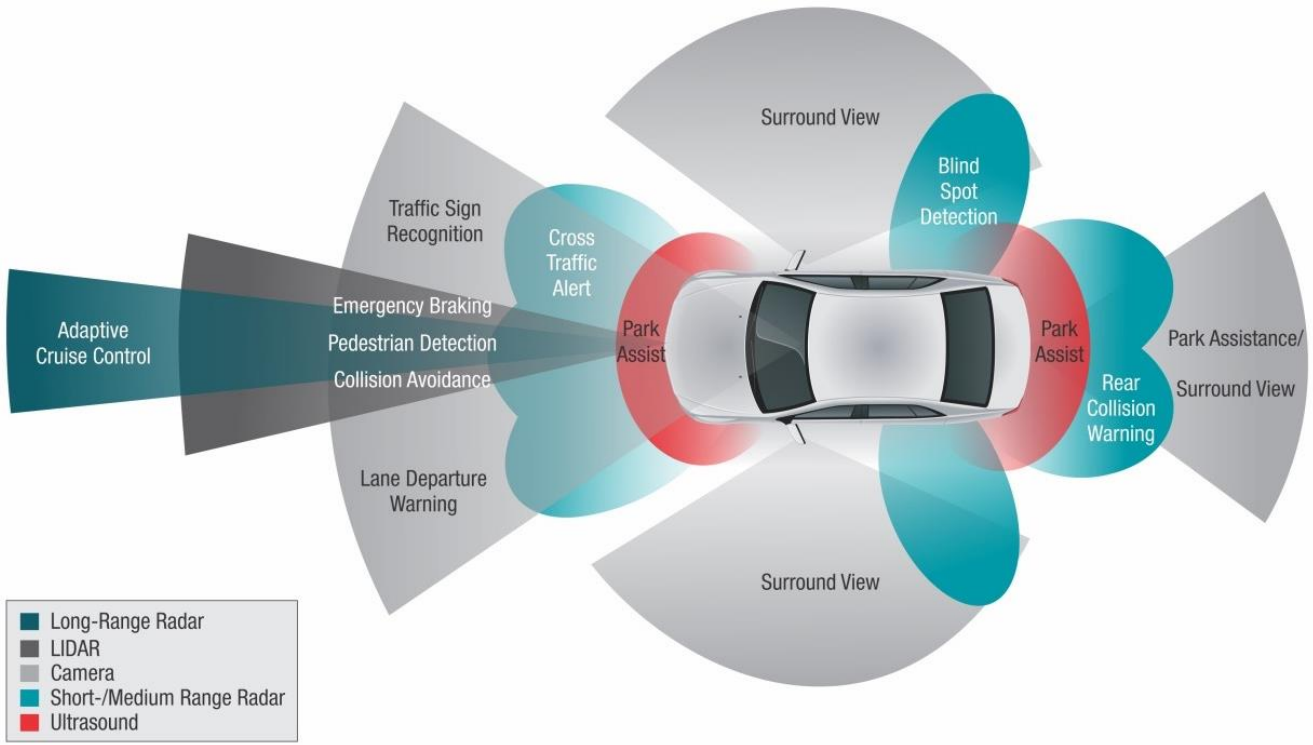
The Importance of MWR for Autonomous Driving



	Ultrasound	Short/Medium Range Radar	Long-Range Radar	Camera	LIDAR
ACC			●	●	○
AEB			●		○
BSD	●	●	●	●	
FCW			●	●	
LDW				●	
PA	●		●	●	
NVS					
PDS		●	●	●	
SVC		○	○		
LCA		●	●		
DOW		●	●		
RCTA		●	●		
RCW		●	●		

In order to achieve ADAS and Autonomous Driving, core unit on board needs to get road condition information around the vehicle by sensors. The sensor performance directly affects the realization of ADAS and Autonomous Driving.

The Importance of MWR for Autonomous Driving

Sensor types	Advantages	**Dis**advantages
Ultrasound	• Low cost; • Low resolution for close-up detection	• Obvious Doppler effect; • Near measuring distance; • Unable to identify the Angle; • Large beam divergence
Camera	• Lane line and traffic signs identification; • High horizontal resolution	• Affected by haze, rain and snow weather
Lidar	• Recognition of object contours; • High horizontal resolution; • High information volume	• High cost; • Difficulty identifying lane lines; • Affected by haze, rain and snow weather; • Optical devices susceptible to dust contamination; • Low accuracy in measuring velocity and position of distant objects;
MWR	• High precision while measuring the speed and position of distant objects; • Penetration of smog and rain and snow; • High reliability and dust resistance	• Difficulty identifying lane lines; • Low angular resolution; • Easily disturbed by road objects

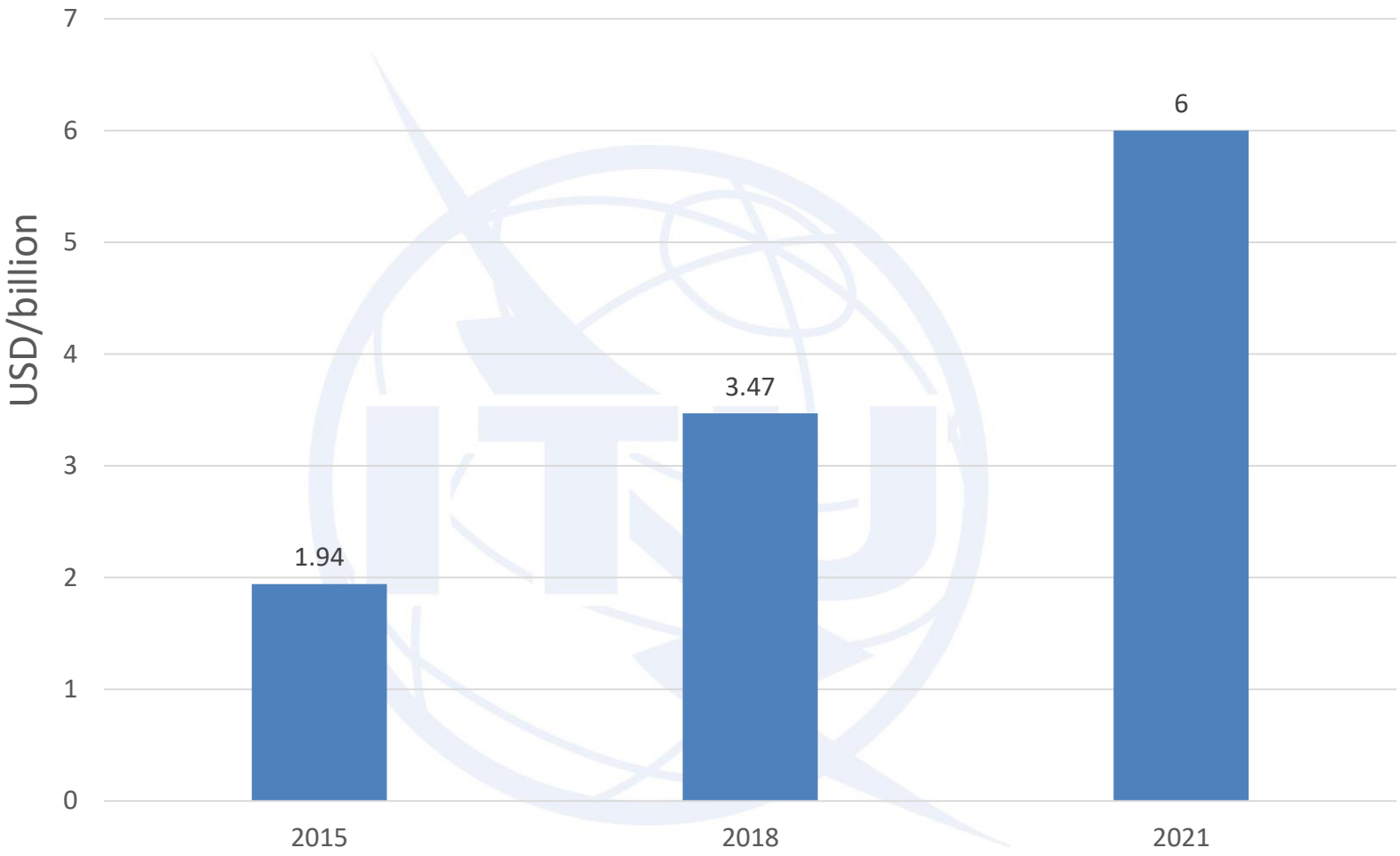
MWR has the advantages:

a) stable detection performance—it is not affected by the surface shape and color of the measured object, and has strong adaptability to atmospheric turbulence and gas vortex;

b) long detection range—the general detection range is 150m-200m, which can meet the requirements of environmental monitoring within a large range in high-speed driving;

c) good environmental adaptability—it has a strong penetrating ability, which can ensure the normal operation of vehicles under various weather conditions.

Global MWR Market Size



MWR is necessary for Autonomous Driving, the market is huge.

Current standard status

- The difficulty of standardization of MWR on-board is its dual standardization features which not only need meet standards of automotive industry, but also need meet standards of electronic products.

- Currently, the standardization of MWR on-board is mainly developed by ISO/ SAE/ ETSI, which mainly focuses on some of ADAS application , radar technology , communication and diagnostic, test, etc.

Standardization Suggestion (1)

- In terms of communication and diagnostic, standards are basically developed by ISO and SAE, which have been relatively perfect in ITS.
- However, standards of the communication between MWR and vehicle platform, the definition of fault code, display and so on, are not prefect.
- At present, different carmakers use different implementation schemes, because of insufficient content, detail and depth. It will be a huge trouble to the development of industry in the future, if there are no uniform standards for the communication and diagnostic in this aspect.

Communication and Diagnostic

Standards Types Involved	Organizations /Association	NO.
ITS	ISO	9141, 10681, 11518, 11898, 13209, 13400, 14230, 15765, 16845, 17458, 17987, 22900, 22901, 27145, 14817, 14819, 14827, 15628, 15784, 16460, 17423, 17425, 17426, 17515, 19079, 19080, 21210, 21212, 21213, 21214, 21216, 21217, 24101, 24103, 29282, 17427, 17429, 19091, 19321, 20026, 21177, 20452, 21215, 21218, 24531, 29283, …
	SAE	J1978, J1979, J2945, J3087, …
Graphical Symbols	ISO	7639, 14823, …
Diagnostic Trouble	ISO	14229, …
	SAE	J2012, …

Standardization Suggestion (2)

- In terms of certificate test, there are a lot functional requirements of MWR which include specific functional indicators.
- But there are no uniform standard for test environment, test cases, verification methods.
- So it is difficult for venders and carmakers to identify whether the product is qualified or not.

Certificate Test

Standards Types Involved	Organizations /Association	NO.
ADAS	ISO	19206, 15623, 22839, 20035, 11067, 11270, 15624, 16787, 17361, 17386, 17387, 19237, 19638, 20900, 21717, 22178, 22840, …
	SAE	J2400, J2399 , J3048, J2808, J2802, J3063, J3016, …
MWR	EISI	EN303396, EN302858, EN302288, EN301091-1, EN303264, …
	SAE	J3088, …

Standardization Suggestion (3)

- In terms of electromagnetic environmental standards, there are some standards that have requirements for electromagnetic compatibility and electromagnetic interference in the industrial environment.
- However, there are no relevant standards on how to achieve vehicle-to-vehicle communication, and verify whether the product is effective and reasonable.
- It can cause mutual interference among same or different radar products. These aspects are relatively blank and there are no corresponding standards to uniformly test the electromagnetic compatibility of radar products in noisy environments.

Electromagnetic Environmental

Organizations /Association	NO.
ISO	21609, 10305, 10605, 11451, 11452, 16750, …
EISI	EN301489, …

Standardization Suggestion (4)

- In field of ICV, platform on board needs to upload massive data which are generated by MWR and Lidar to the cloud for analysis and processing.
- In order to meet the requirements of communication bandwidth, platform docking standardization, we need lay down data compression format standard for MWR and Lidar when we upload data.

Proposal

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