How Sensor Advancements are Addressing Higher Levels of Automation

DVN LIDAR Conference | SESSION 3: MARKET AND ECOSYSTEM

John Cooper
November 15, 2021

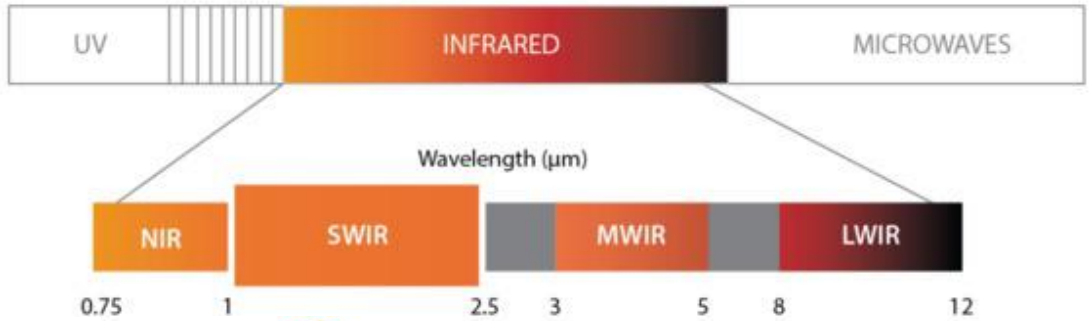
Agenda

How Sensor Advancements are Addressing Higher Levels of Automation

- Camera
- Radar
- Lidar
- ADAS/AD Applications Enabled by Improved Sensors and Perception SW
- VSI Labs Applied Research

Sensor Performance Attributes: Camera

Performance Attributes	Camera	
	Passive Camera	Active Camera
2D Object Detection		
3D Object Detection	3D Perception SW	
Object Classification	3D Perception SW for 3D Object Classification	
Object Edge Precision		
Environment Analysis (Semantic Segmentation)	CV/DL Algorithms	
Angular Resolution		
Depth/Range Resolution	Stereoscopy/ 3D Perception SW	
Velocity Resolution		
Traffic Sign Reading		
(RGB) Color Recognition (Traffic Lights Recognition)		
Lane Detection		
Lane Tracking		
Living Object Detection	CV/DL Algorithms, Thermal FIR	
Dark Object Detection		
Adverse Weather		NIR Gated Vision, SWIR
Low-Light Performance	Adjustable Aperture	



BWV Bright Way Vision

TRIEYE®

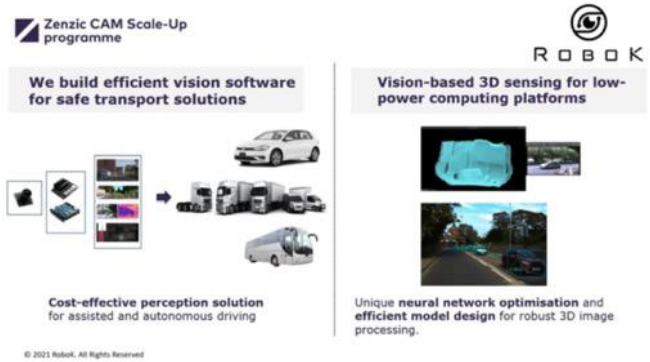
ADASKY Driven to save lives

FLIR®

FORESIGHT

OWL AUTONOMOUS IMAGING

NODAR



Note:
Green = High Ability
Yellow = Ability w/ Poor Performance
Red = Inability
Text = Method(s) to Improve

VSI Labs Applied Research

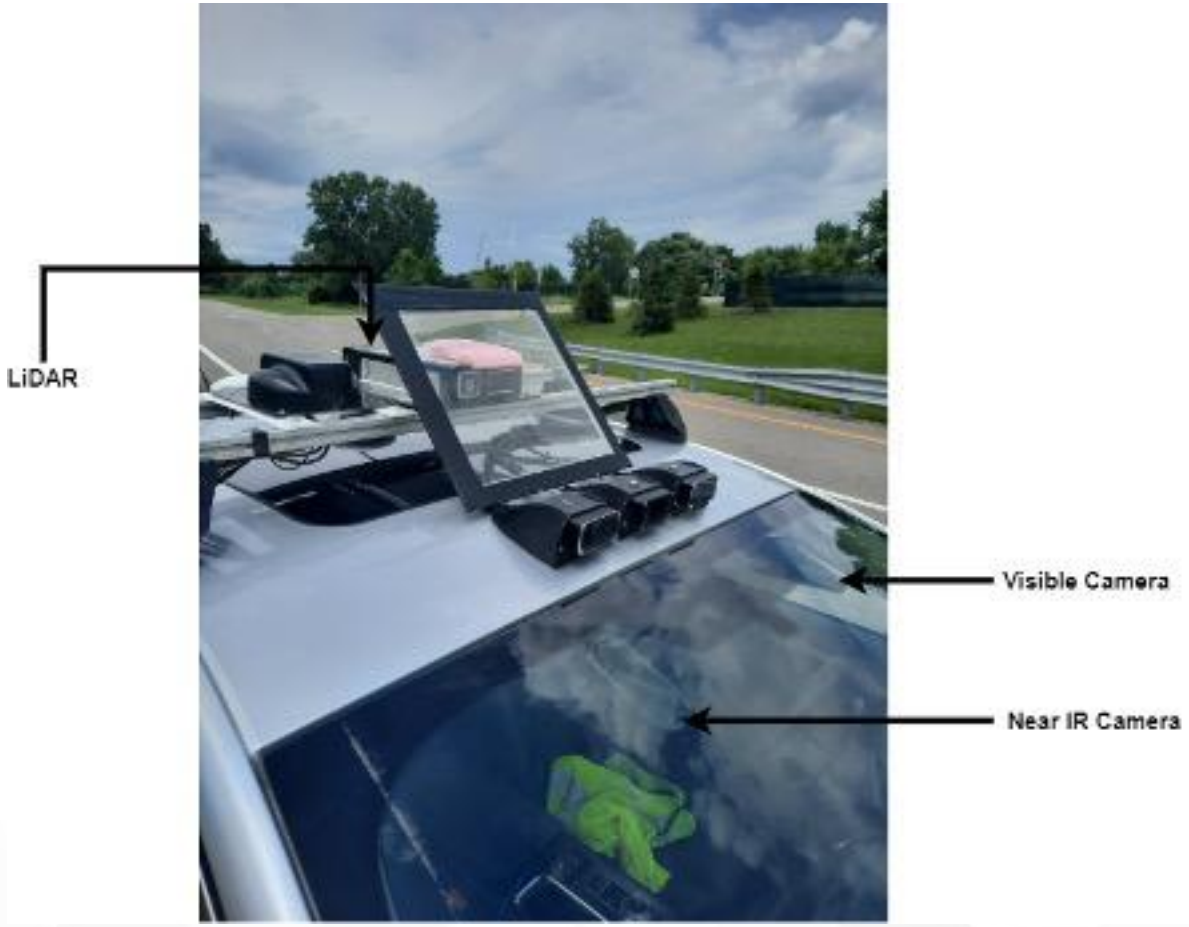
"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

American **C**enter for **M**obility
near Detroit

VSI Labs Applied Research

"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

- Sensor Placement



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near Detroit

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"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

- Target Placement

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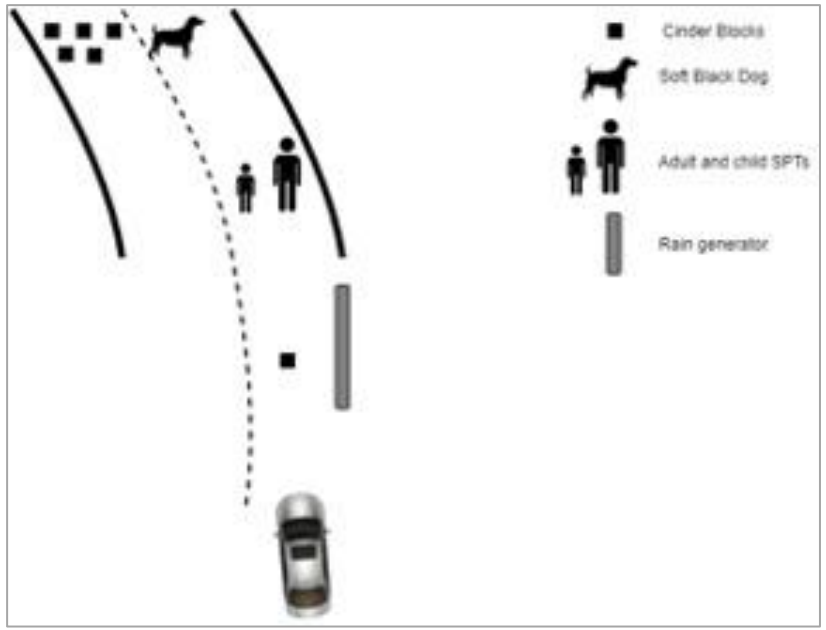
"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

- Target Placement



American **C**enter for **M**obility near Detroit

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"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

- Sensor Perception

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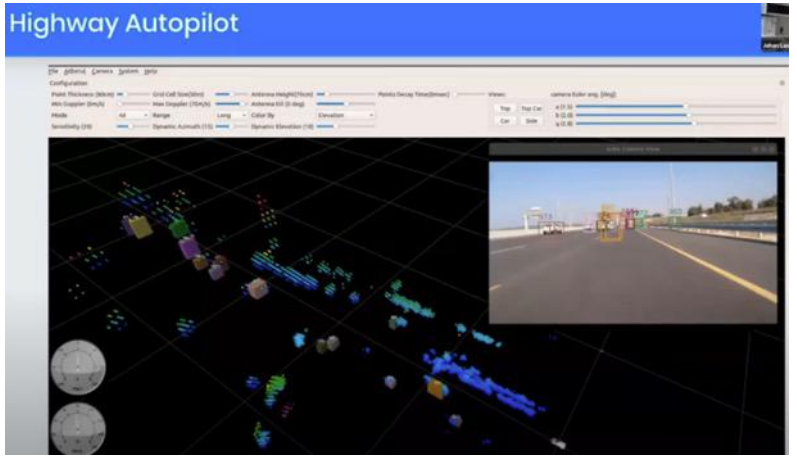
Sensor Performance Attributes: Radar

Performance Attributes	Radar	
	Radar	Imaging Radar
2D Object Detection		Imaging Radar SW, Radar DNN Processing
3D Object Detection		
Object Classification		
Object Edge Precision		
Environment Analysis (Semantic Segmentation)		
Angular Resolution		
Depth/Range Resolution		
Velocity Resolution		
Traffic Sign Reading		
(RGB) Color Recognition (Traffic Lights Recognition)		
Lane Detection		
Lane Tracking		
Living Object Detection		
Dark Object Detection		
Adverse Weather		
Low-Light Performance		



arbe

ECHODYNE

UHNDER

Ambarella

OCULii

METAWAVE

vayyar

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Sensor Performance Attributes: Lidar

Performance Attributes	Lidar	
	ToF LiDAR	FMCW LiDAR
2D Object Detection		
3D Object Detection		
Object Classification		
Object Edge Precision		
Environment Analysis (Semantic Segmentation)	Lidar Perception SW	
Angular Resolution		
Depth/Range Resolution		
Velocity Resolution		
Traffic Sign Reading		
(RGB) Color Recognition (Traffic Lights Recognition)		
Lane Detection	Lidar Perception SW	
Lane Tracking	Lidar Perception SW	
Living Object Detection	Lidar Perception SW	
Dark Object Detection	Lidar HW design	
Adverse Weather	Lidar Perception SW, Lidar HW design	
Low-Light Performance		

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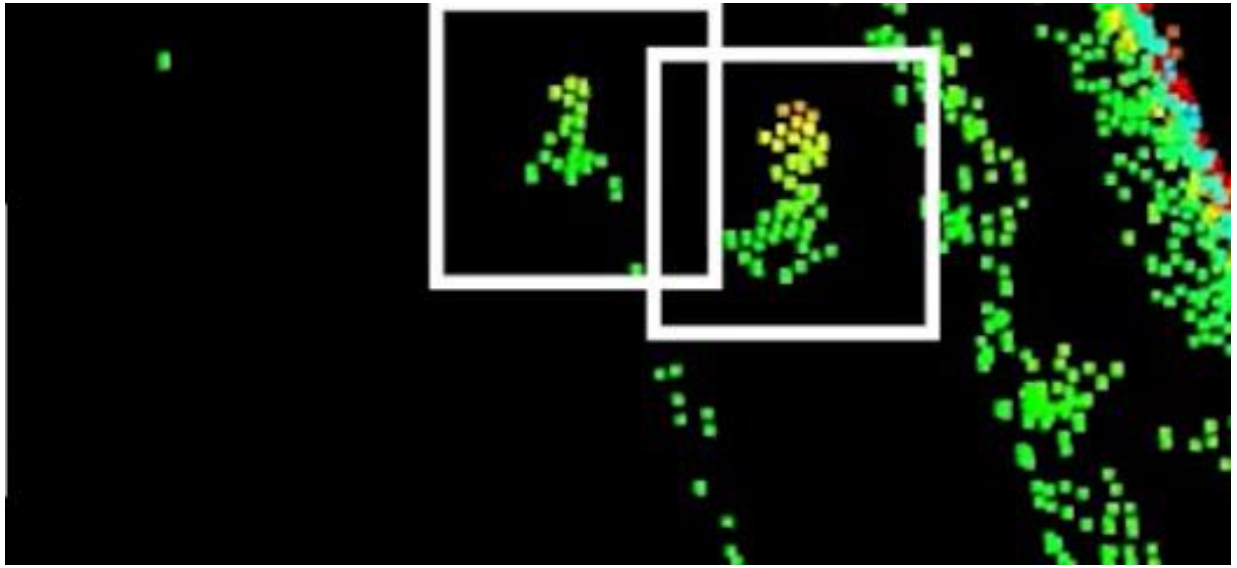
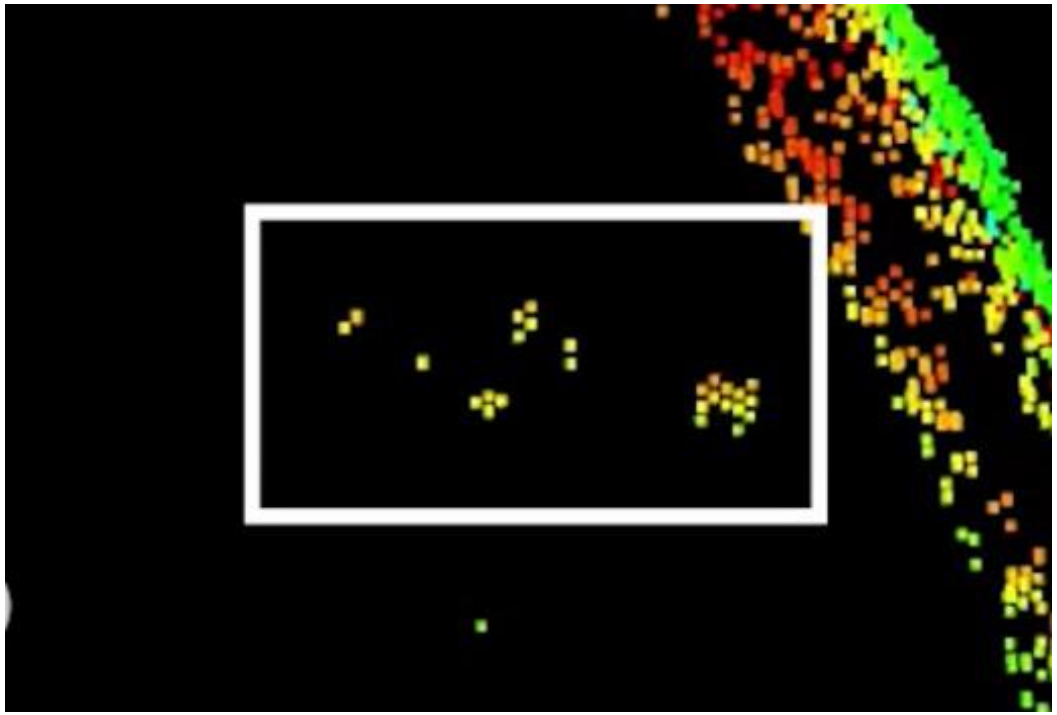
VSI Labs Applied Research

"Destination ACM" – Demonstrating Sensors Making the Unseen Visible

- Sensor Perception





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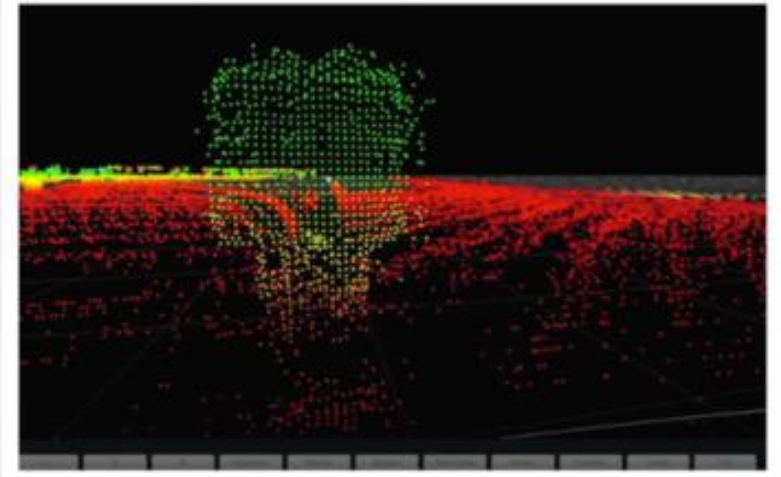
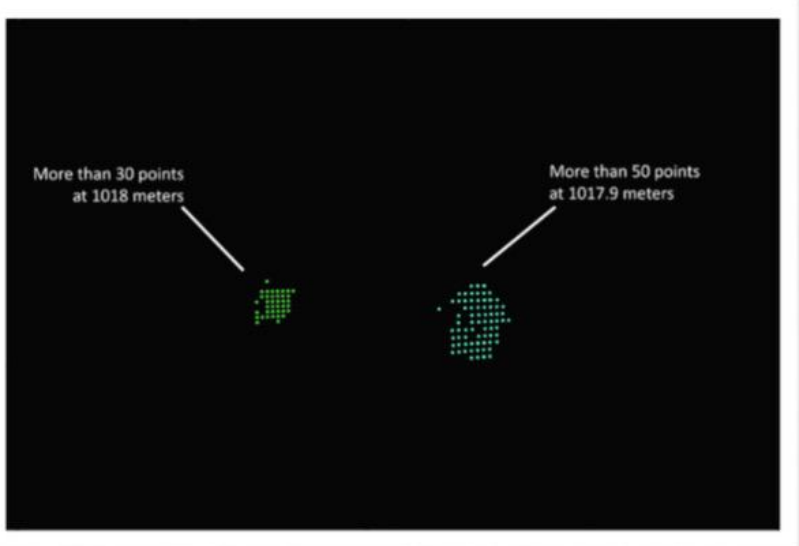
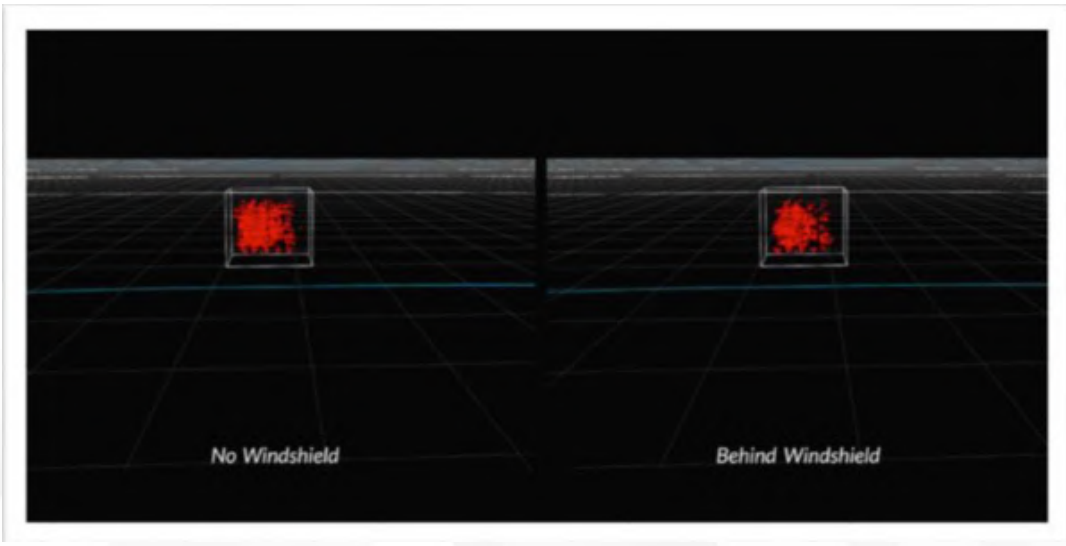
VSI Labs Validation Report on AEye iDAR Lidar Sensor Performance







Sensor Performance Attributes and ADAS/AD Apps

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Performance Attributes	Sensors						ADAS / AD Applications									
	Passive Camera	Active Camera	Radar	Imaging Radar	ToF LiDAR	FMCW LiDAR	AEB Inter-Urban	AEB City	AEB-P	ACC	LKA	TJA	Lane Change	TJP <60kph	HWP (Full speed)	Urban/ City Pilot
2D Object Detection				Imaging Radar SW, Radar DNN Processing			X	X	X	X	X	X	X	X	X	X
3D Object Detection	3D Perception SW								X				X	X	X	X
Object Classification	3D Perception SW for 3D Object Classification						X	X	X	X	X	X	X	X	X	X
Object Edge Precision									(X)				(X)	(X)	(X)	X
Environment Analysis (Semantic Segmentation)	CV/DL Algorithms				Lidar Perception SW								(X)	(X)	(X)	X
Angular Resolution											(X)	(X)	(X)	(X)	(X)	X
Depth/Range Resolution	Stereoscopy/ 3D Perception SW						X	X	X	X		X	X	X	X	X
Velocity Resolution							X	(X)	(X)	X		X	X	X	X	X
Traffic Sign Reading										(X)		(X)	(X)	(X)	(X)	X
(RGB) Color Recognition (Traffic Lights Recognition)																X
Lane Detection					Lidar Perception SW						X	X	X	X	X	X
Lane Tracking					Lidar Perception SW						X	X	X	X	X	X
Living Object Detection	CV/DL Algorithms, Thermal FIR				Lidar Perception SW				X					X	X	X
Dark Object Detection					Lidar HW design										(X)	X
Adverse Weather		NIR Gated Vision, SWIR			Lidar Perception SW, Lidar HW design										(X)	X
Low-Light Performance	Adjustable Aperture						(X)	(X)	(X)						(X)	X

Note: Green = High Ability, Yellow = Ability w/ Poor Performance, Red = Inability, Text = Method(s) to Improve

X = Required, (X) = Optional

Q&A

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