ASAM

ACTASYS

FRAMEWORK FOR STANDARDIZATION OF THE INTERFACE BETWEEN SENSORS, VEHICLE PLATFORMS, AND SENSOR CLEANING SYSTEMS

Pitch Session - Ideation Topics for 2023 and Beyond


ARK
SYSTEMS
A DIRTY SENSOR
THAT ‘DOES NOT KNOW’ IT IS DIRTY
IS
DANGEROUS
ARK
VISION
SYSTEMS
A DIRTY SENSOR
IS
NOT FUNCTIONAL

Snapshot

- Vision sensors are all around us – ADAS equipped cars, smart cities, and smart manufacturing.
- When sensors get dirty or wet, overheated, or misaligned – customers cannot trust sensor data anymore.
- According to AAA, ADAS-equipped vehicles suffer 33% more accidents in rainfall even driving as slow as 35 mph.
- Sensor cleaning must be energy-efficient to enable perception under day-to-day conditions, on electric vehicles.

Industry Challenge

Detect

Process sensor output data and identify and classify function Loss

Correct

Apply corrective measure

Sensor Function Loss

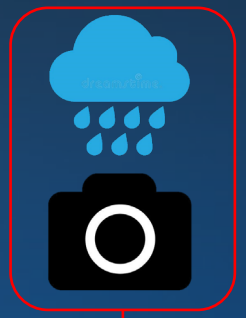
Report

Diagnostics & Real time alerts

Our Solution

Sensor
(Camera, LiDAR, Radar)

Weather



Temperature

Bump

Data Streams

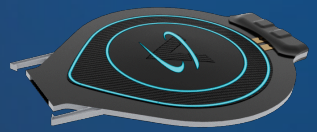
Perception loss detected

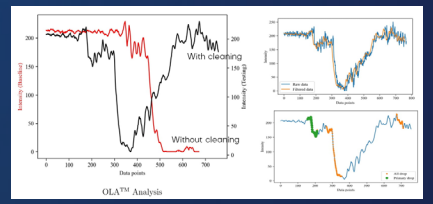
Overheating detected

Misalignment detected

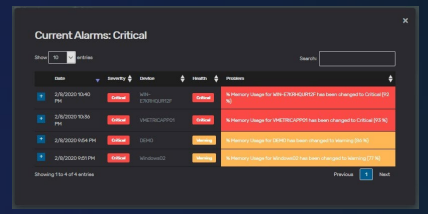
Perception Enablement by Cleaning

Thermal Stability by Cooling





Diagnostics
Real time alerts



Correct

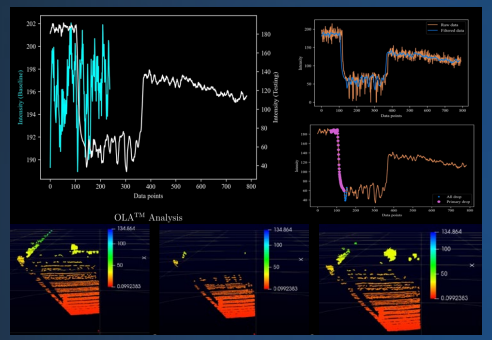
Detect

Report

Solutions

Detect + **Correct** + **Report**

Contamination Classification

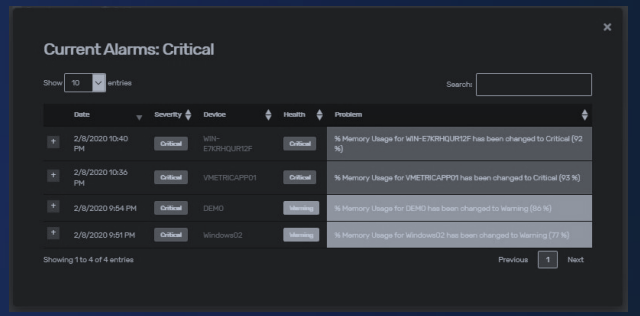


- Detection using ML video analytics algorithms for real-time processing.
- Sensor function loss ML Model to predict sensor perception level drop under various environmental conditions.
- Embedded controls in vehicle ECU.

Air + Water + Coating

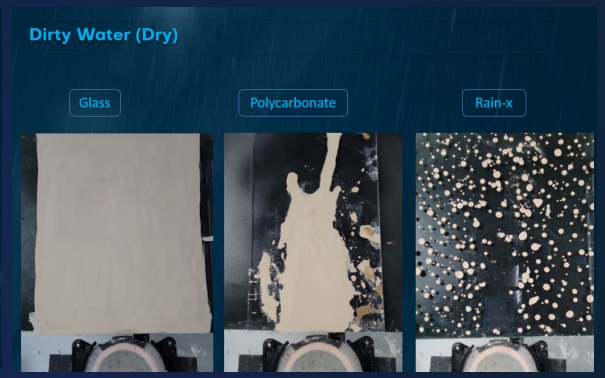
- Sensor-agnostic integrated cleaning solution.
- Solution including airflow and water spray to address broad range of environmental conditions.
- Extremely efficient on water and energy consumption.

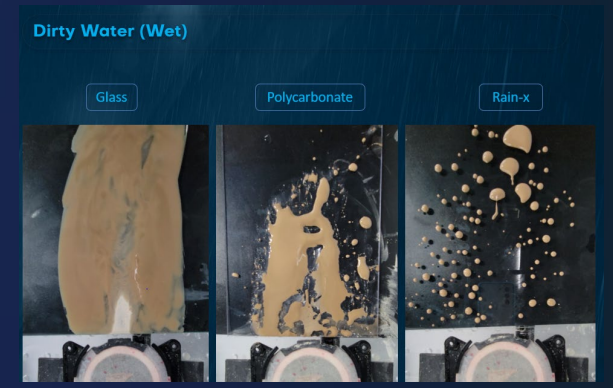
Servicing + Training

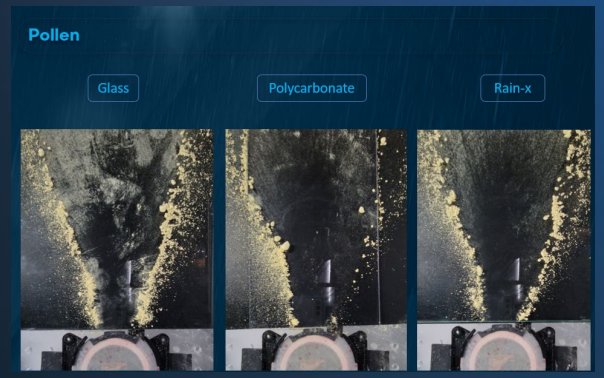


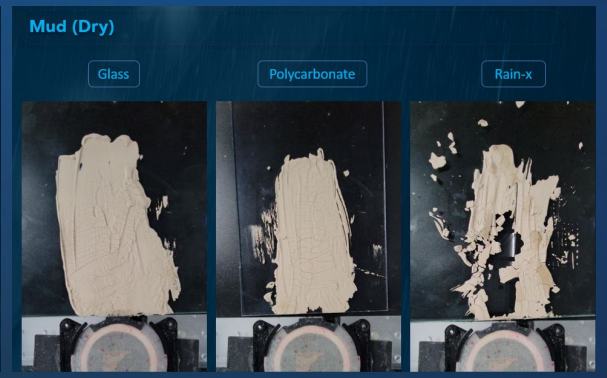
- Predictive maintenance and telematics.
- Over the air system updates and upgrades.
- Data provided through third party data provider.

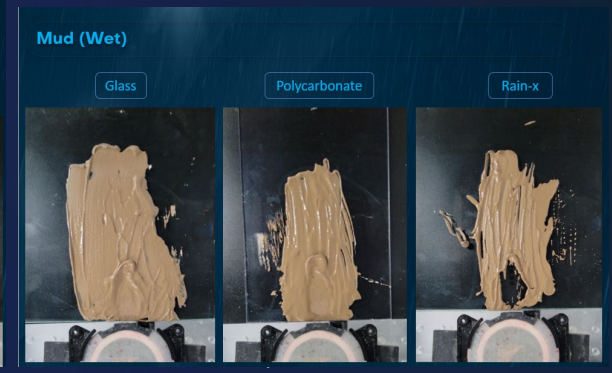
Real-world Contamination



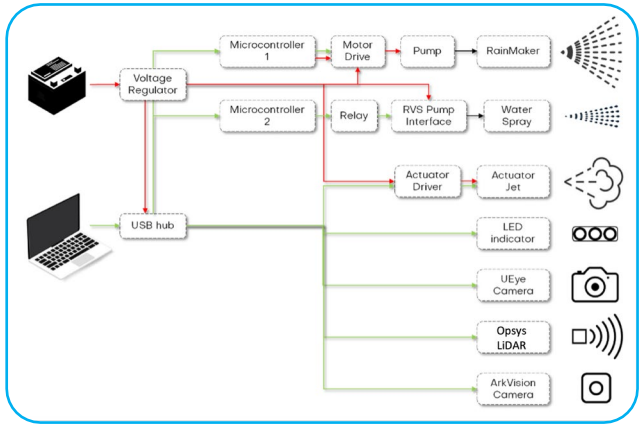


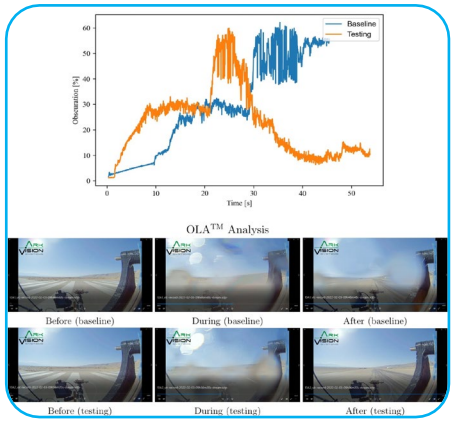


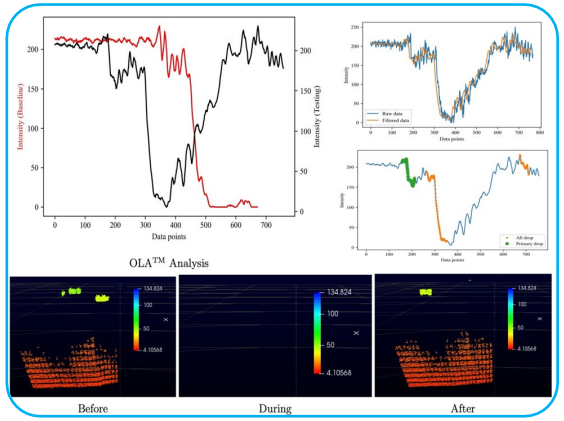


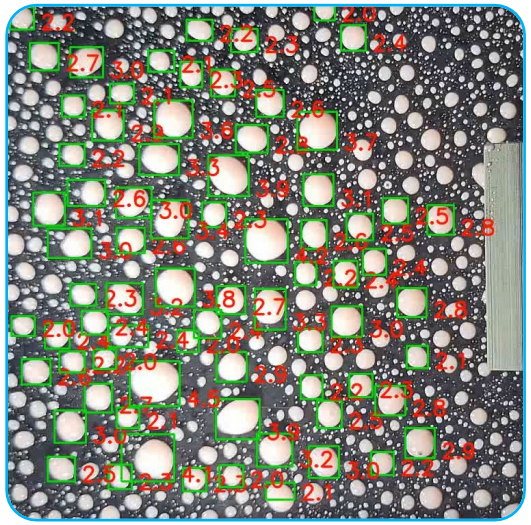


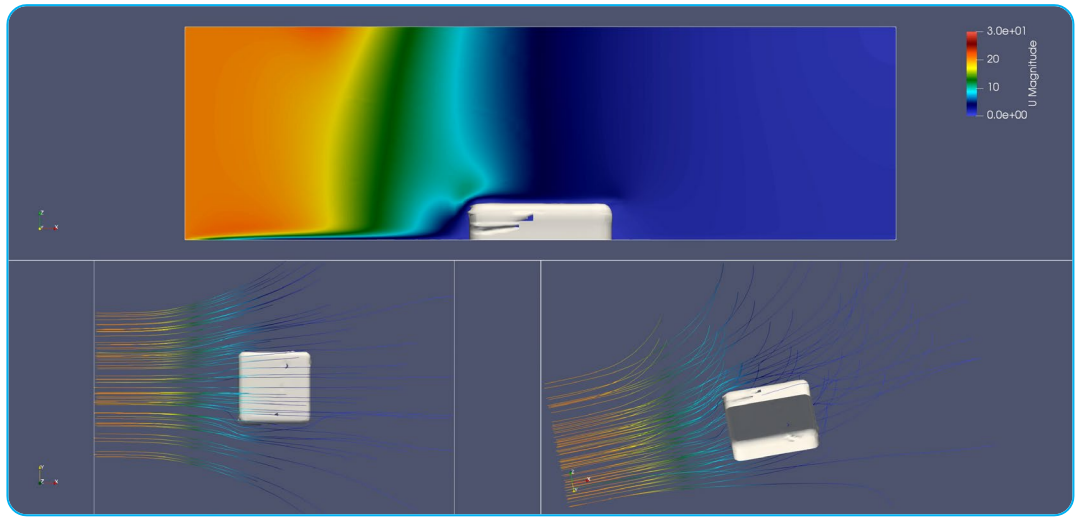
Quantifying Sensor Degradation

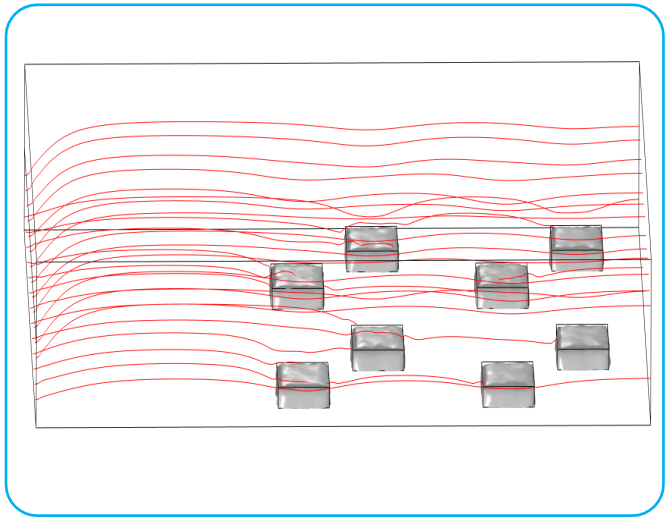












Energy Efficiency

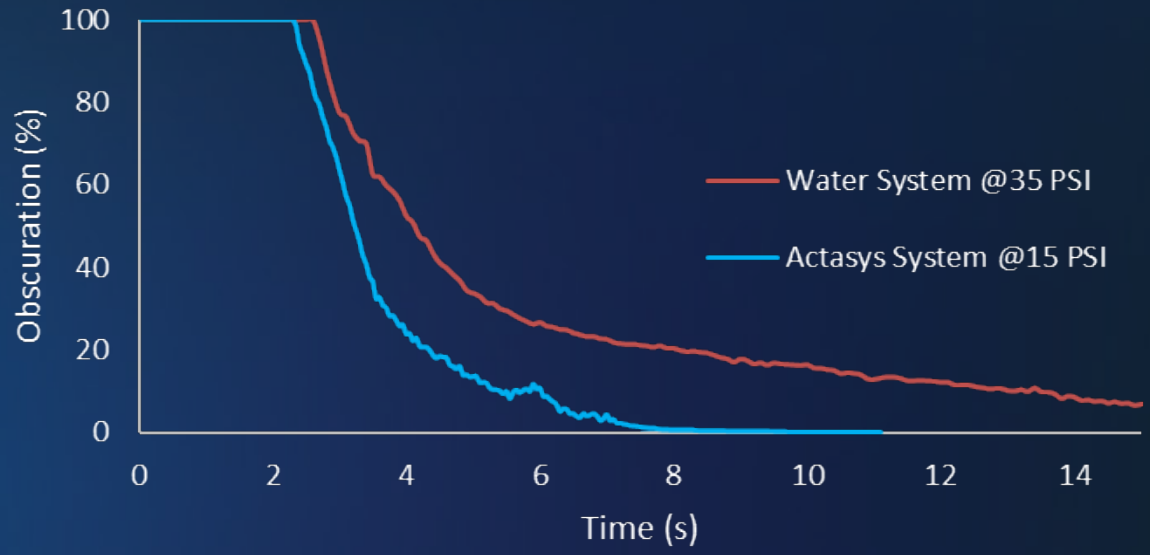
Water Alone

- Water Pressure: 35 PSI
- Flow Rate: 0.216 LPM

Water + Actuator

- Water Pressure: 15 PSI
- Flow Rate: 0.133 LPM

Actasys System vs Water System



Energy Calculator

Inputs:	Battery Capacity (kWh)	Efficiency (mi/kWh)	Vehicle Weight (kg)	# of Lidars	# of Cameras	Actuator Driver Voltage (V)	Actuator + Driver Weight (kg)	Water Pump Power Consumption (kWh)	Water System Weight (kg)
	78	3.21	2000	5	13	12	1.98	0.036	11.3

Actuator Testing Data:	Surface Contact Angle	Frequency (Hz)	Voltage (Vrms)	Currentn (A)	Power Consumption (kWh)
	25	180	100	0.87	45.47664
	70	160	100	0.964	50.390208
	90	140	100	0.938	49.031136
	110	120	100	0.854	44.640288
	150	100	100	0.72	37.63584

Weight Calculations	
100 kg = 7 kwh/62mi	0.6
x kg = 7 kwh/62mi	0.07968
Power Consumed (kWh)	16.79448774

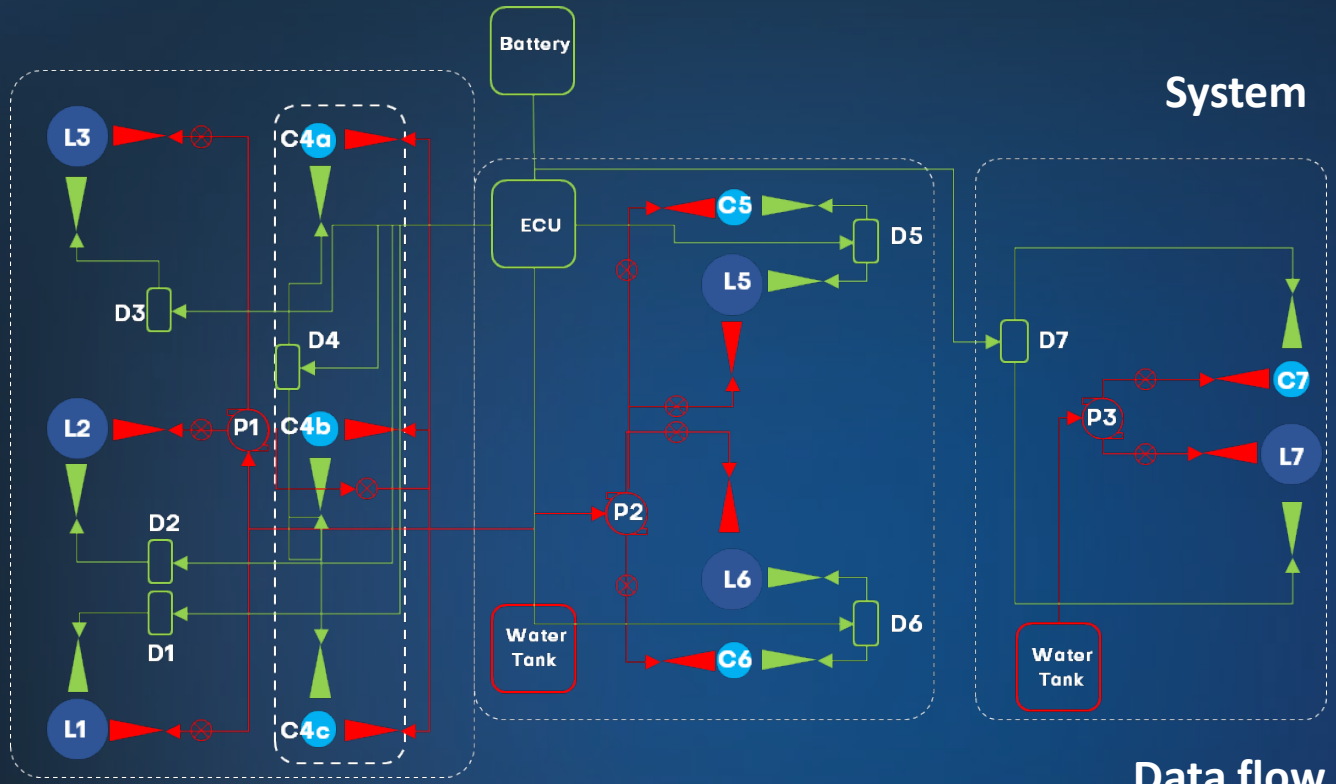
	Driving No Actuators	Driving w/Actasys @ 25 deg Contact angle	Driving w/Actasys @ 70 deg Contact angle	Driving w/Actasys @ 90 deg Contact angle	Driving w/Actasys @ 110 deg Contact angle	Driving w/Actasys @ 150 deg Contact angle
Time Driving in the Rain (hrs)	242	242	242	242	242	242
Driving Speed (mph)	54	54	54	54	54	54
Driving Distance (mi)	13068	13068	13068	13068	13068	13068
Power Consumed (kWh)	4071.028	4133.299	4138.213	4136.854	4132.463	4125.458
Efficiency (mi/kWh)	3.21	3.162	3.158	3.159	3.162	3.168
Percent Decrease in Efficiency (%)	-	1.51	1.62	1.59	1.49	1.32
Cost in US (USD)	692.07	702.66	703.50	703.27	702.52	701.33
Cost in Europe (USD)	1872.67	1901.32	1903.58	1902.95	1900.93	1897.71

Energy Consumption By Region

City	Number of Rainy Days (Per Year)	Precipitation Rate (in/day)	Power Consumption (kWh)*	
			Compressed Air	Actasys
Pasadena, CA, US	35	0.57	71.6	4.7
Beijing, China	68	0.28	139.1	9.13
Moscow, Russia	169	0.15	345.6	22.7
Berlin, Germany	159	0.14	325.2	21.4
Cairo, Egypt	15	0.07	30.8	2.01

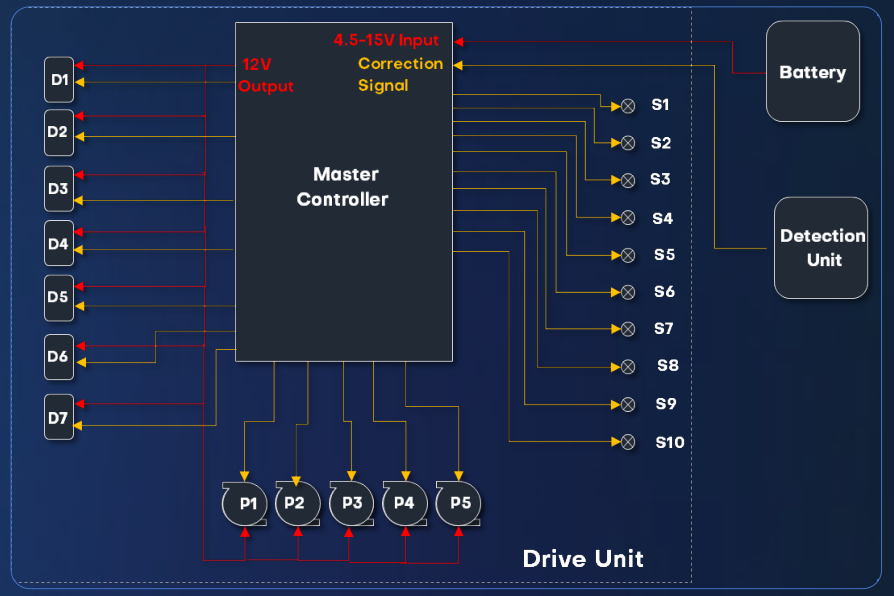
Assumptions:
** Based on energy consumption calculator – L4 Autonomous vehicle with 5 Lidars and 13 Cameras. Assumed that both systems are running continuously*
*** Assumed each day vehicle is driving in the rain for 1 hour*
**** Weather References: Pasadena – Link , Beijing – Link , Moscow – Link , Berlin – Link , Cairo – Link*

System Interfaces – Power, water, data

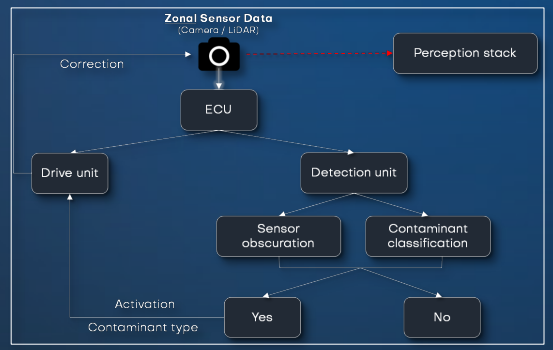


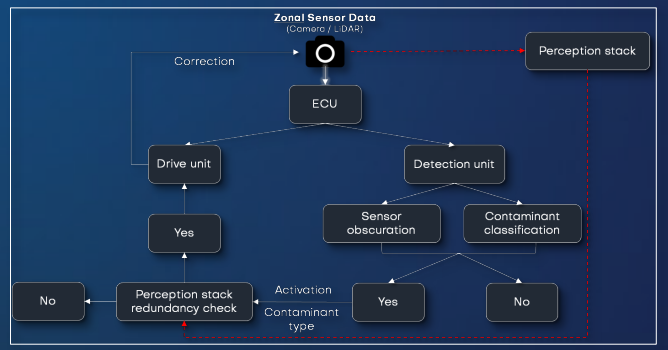
System

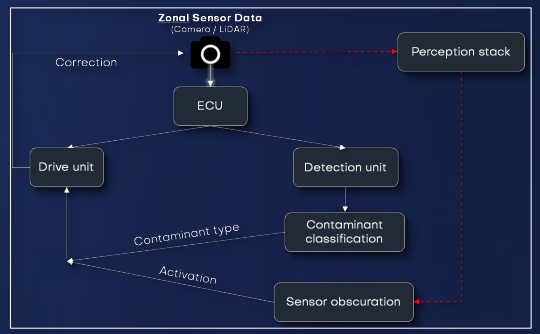
Power Supply



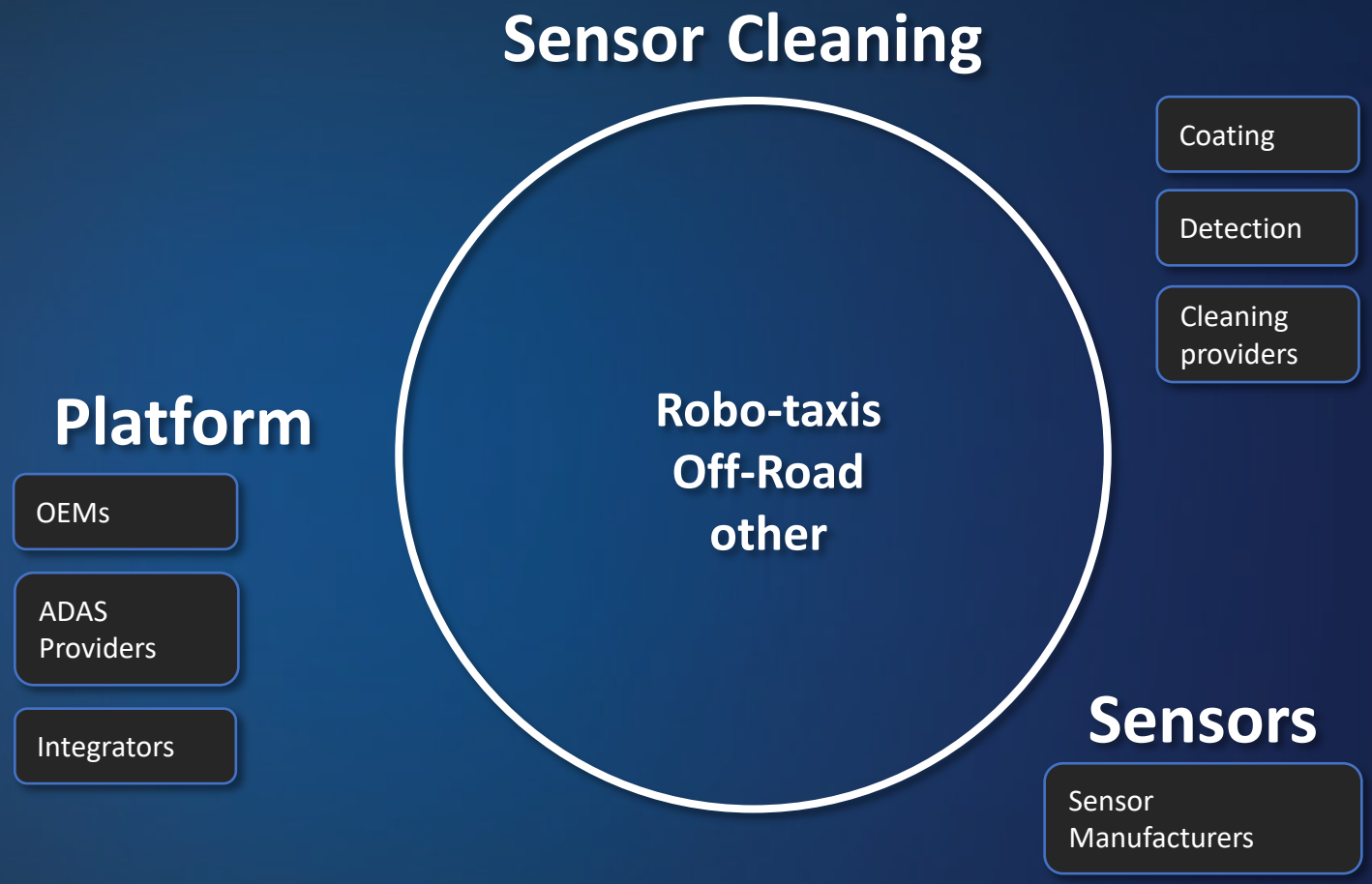
Data flow options







Let’s Discuss on How to Interface



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Thank you!

david.Menicovich@actasysinc.com