Aiding smoke forecasting & providing better information to help the public reduce their exposure.

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ASIC

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Wildland Fire Sensors Challenge

kunak air

INTRODUCTION: This challenge seeks a field-ready prototype system capable of measuring constituents of smoke, including particulates, carbon monoxide, ozone, and carbon dioxide, over the wide range of levels expected during wildland fires.

The desired Measurements were: PM2.5, CO, CO2, O3.

Kunak participated in the Challenge with 2 units of Kunak AIR, that were tested by EPA in March 2018. Results show excellent accuracy for PM2.5 (R2:0,95) - CO (R2:0,98) - O3 (R2:0,98)

Partnering Federal Organizations: EPA · NASA · USFS · NOAA · NPS · HHS · CDC

KUNAK PROPOSAL FOR CHALLENGE: Kunak AIR

Kunak®Air is an easy, small, light, plug & play and ready to use device to measure gases CO, O3, CO2 (1Q2019) at ppb concentration (also NO, NO2, SO2, H2S); particles PM1, PM2.5, PM10 µm; GPS location; pressure; temperature and relative humidity. And can include wind speed and direction, rain and other environmental parameters.

The unit is **battery and solar powered** so it can operate indefinitely. It processes and **wirelessly sends the sensor's data at the desired period (5 min to 24h)** to Kunak Cloud, with GPRS, Wifi, - locally with RS-232 - or any other technology under request.

KunakCloud is a **Web based software** that helps managing the network, updating firmware and adjusting reading and sending periods and alarms. It also offers a whole set of **Air Quality tools** such as Calendar Plot, Pollution Rose or Time Variation Plots,etc…

The device is calibrated in factory and can be **calibrated** on final destination – **both ZERO and SPAN or REGRESSION** - against reference gas or reference equipment, in remote mode from the same Kunak Cloud.

The integration of data into other platforms and software development is easy and secure with its **RESTful Open API**.

Kunak AIR shows **good correlations, above 90% vs. reference equipment**. This is only possible with such calibration tool and the advanced real time processing algorithms running in the unit.

Gas Measurement Specifications

GAS MEASUREMENT						
Gas	Max. Ratings (1)	Range (2)	LDL (3)	Precision (4)	Units	Life (months)
NO2	0–20 ppm	0 - 2 ppm	5 ppb	± 8 ppb	ppb or µg/m³	> 12 m
NO	0–20 ppm	0 - 4 ppm	5 ppb	± 5 ppb	ppb or µg/m³	> 24 m
CO	0–1000ppm	0-10 ppm	20 ppb	± 50 ppb	ppb or µg/m³	> 36 m
SO2	0–100 ppm	0 - 2 ppm	10 ppb	± 20 ppb	ppb or µg/m³	> 24 m
H2S	0–100 ppm	0 - 2 ppm	30 ppb	± 20 ppb	ppb or µg/m³	> 24 m
O3	0–20 ppm	0 - 500 ppb	5 ppb	± 7 ppb	ppb or µg/m³	> 12 m
Temperature and Humidity				-40 to +85°C / 0 – 100 %RH		
Pressure				500 to 1500 mb		

(1) Limit covered by guarantee (2) Dynamic range (3) Expected Low Detection Limit on field.
(4) Average accuracy of experimental data on field.

Particle Measurement Specifications

Technicall Specifications	
Dimensions / Weight	122 x 202 x H: 90 mm / <1,5Kg
Enclosure	PC IP67 & Metal Panel (optional)
Power Consumption	< 10 mA@ 3.7 Vdc,
Battery	8,1 Ah rechargeable (always incl.)
External Supply	5 –17 Vdc, Charger, solar panel, etc
Comms.	GPRS, Wifi, Modbus, RS232
Operating Temp.	-20ºC to +50ºC
Console interface	MicroUSB
Built-in Sensors	Internal Temperature, battery and signal
GNSS	GPS / Glonass(optional)
Measurement	3Hz continous sampling*

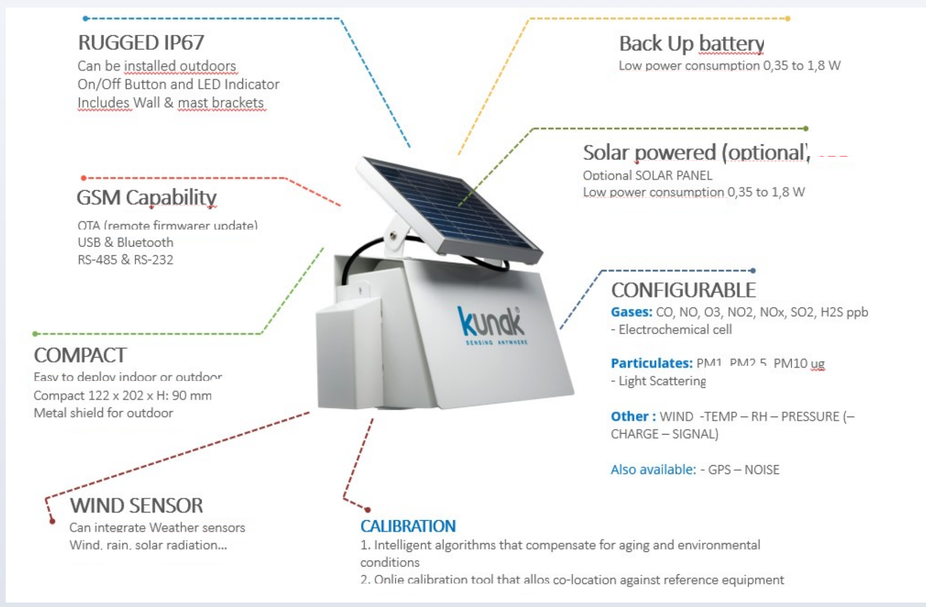
*Adjustable means and sending periods, 10s-4h. (1h set as default)

Powerful Platform with bespoken AQ Tools

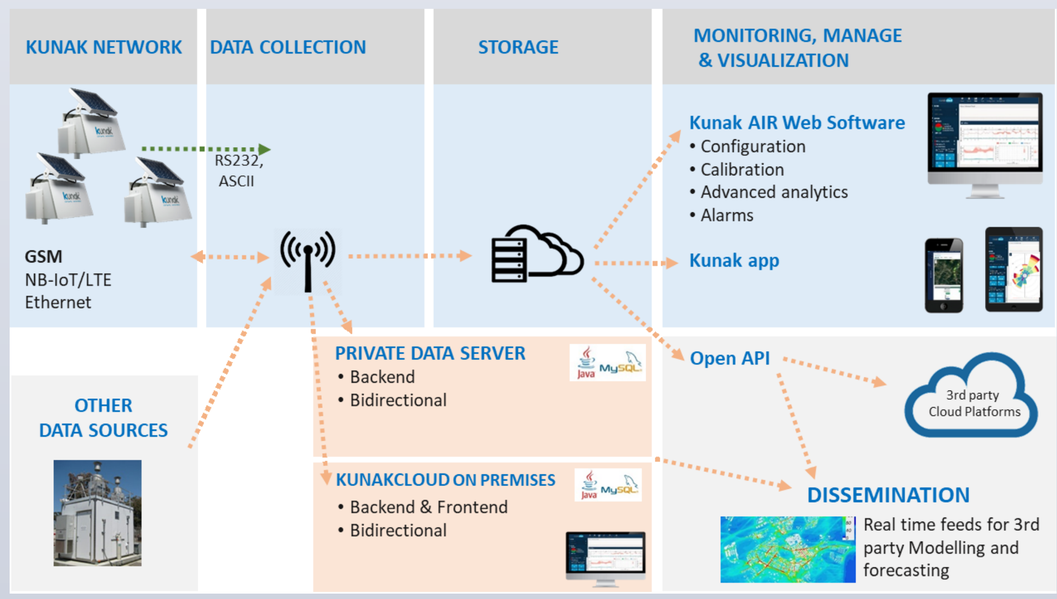


Control panel · Secure data · Advanced Analytics · Traceability · {REST-API}

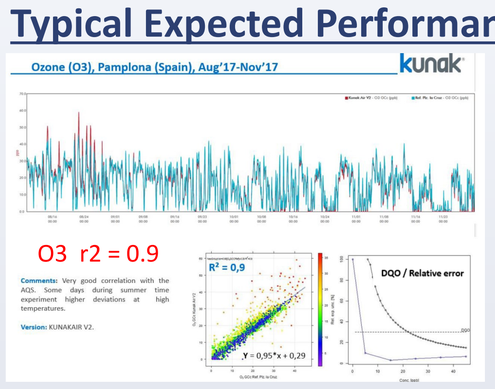
The Devices

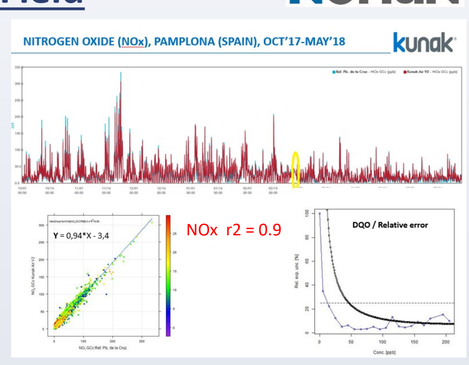


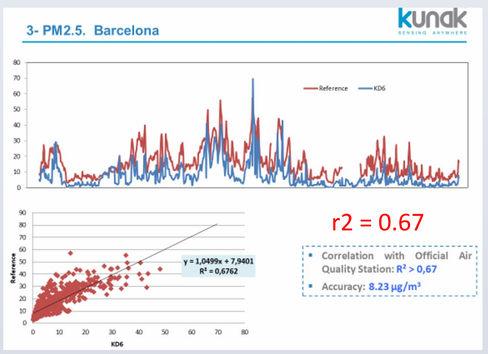
Best System Architecture Available

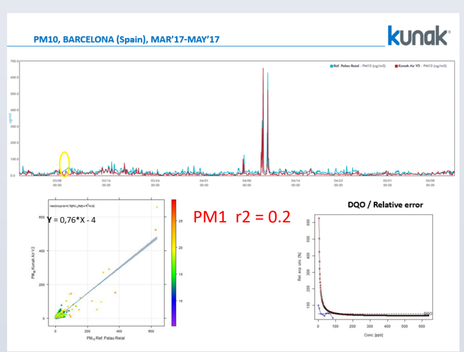


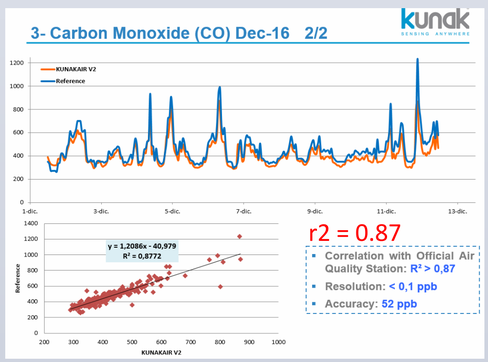
Typical Expected Performance On Field











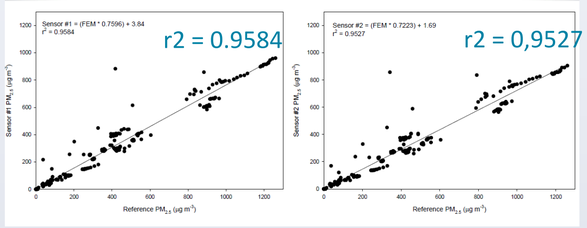
- Very high correlation to reference instruments for long periods >8 months
- Capable of detecting concentration changes very fast
- Calculations are made in the device. Temp., RH and pressure real time data is used.
- No external data is required for accurate performance..
- Remote configuration and maintenance: easy configuration, calibration, analysis and management using KunakCloud
- From KunakCloud it is possible to apply a remote individually calibration to the PM1, PM2.5 and PM10 based on a linear regression or scaling factor.

Wildland Fire Challenge Test Results

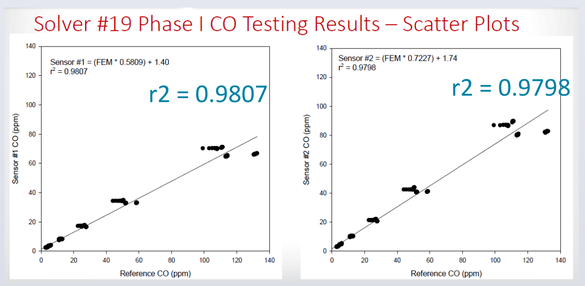
Extracts from EPA evaluation*. Ask for full report.

EPA Wildland Fire Sensor Challenge

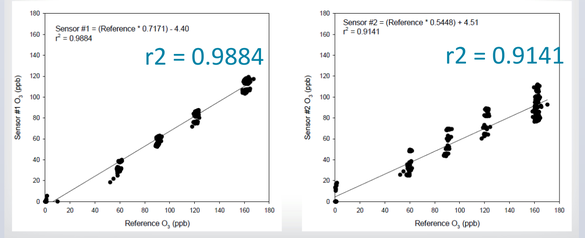
Solver #19 Phase I $PM_{2.5}$ Testing Results – Scatter Plots



Solver #19 Phase I CO Testing Results – Scatter Plots



Solver #19 Phase I O_3 Testing Results – Scatter Plots



Summary Testing Results – Accuracy* (Mean ± Std. Dev.)

Phase I Testing

	CO	CO_2	O_3	$PM_{2.5}$
Sensor #1	72.1 ± 6.6	---	66.3 ± 6.1	69.8 ± 31.6
Sensor #2	90.6 ± 4.9	---	58.7 ± 9.4	65.6 ± 25.1

As Received



As Tested



* EPA does not endorse any products