SCENTROID
Future of Sensory Technology

UrbanScanner

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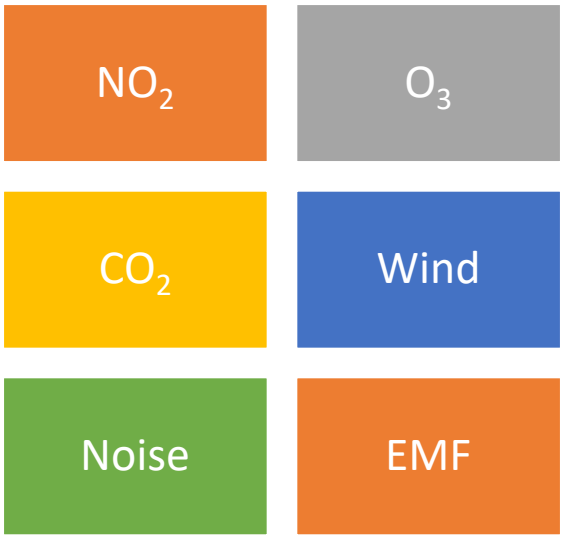
1. Urban Scanner Overview

1.1 Intelligent Air Quality Monitoring for Smart Cities

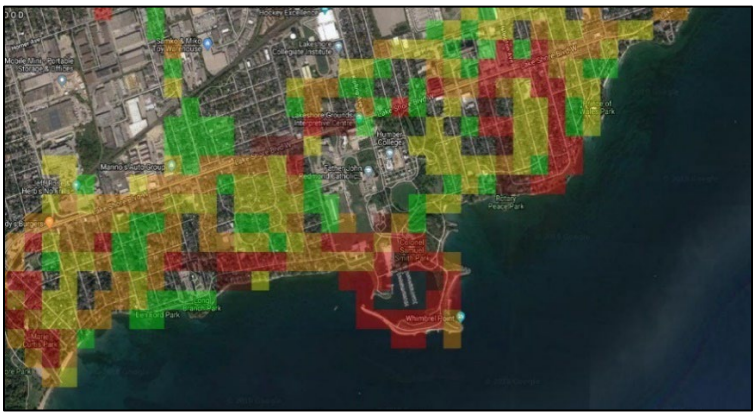
The Urban Scanner™ is a complete platform that predicts detailed air quality information within urban landscapes. It achieves this by collecting and combing a variety of information such as air pollution concentrations, a 3D map of the city being sampled, traffic conditions, micro-weather patterns, and more. Data is collected using a weather-proof, easily mountable device installed on the roof of a vehicle. As the vehicle advances through city streets, air pollutant concentrations are recorded along with secondary inputs such as GPS, FHD video/camera imagery, LIDAR 3D scanner imagery, noise data, as well as wind direction and speed. The data is then processed using sophisticated AI-based algorithms in order to extract key information and correlate them to an air quality value at any location within the sampling environment. The intelligent model created by the Urban Scanner is a valuable tool that can be sued to map urban air quality, predict pollutant concentrations, identify hot spots and emission sources, as well as determine the contribution of various air pollution sources.

1.2 Multi-dimensional Sensing

Urban Scanner uses multiple sensing technologies to provide a true measurement of the urban pollution. Advance gas sensing technologies are used to measure NO2, O3, and CO2 in a ppb (parts per billion) resolution. Additional pollutants such a H2S, SO2, and other VOCs can also measured using the same platform. Other pollutants such as electromagnetic field (EMF) radiation, noise, and even odour can also be monitored using the Urban Scanner.



1.3 Cloud-Based Software

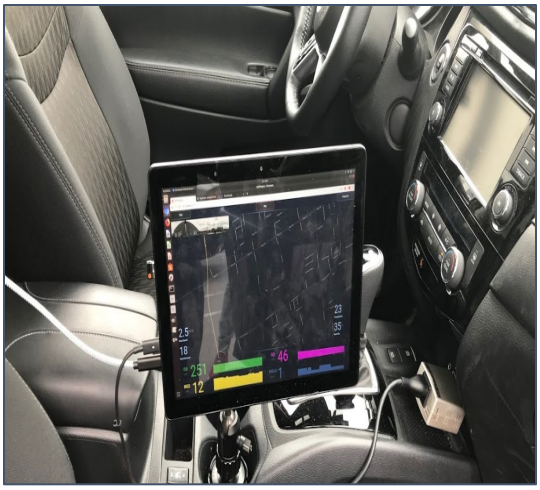


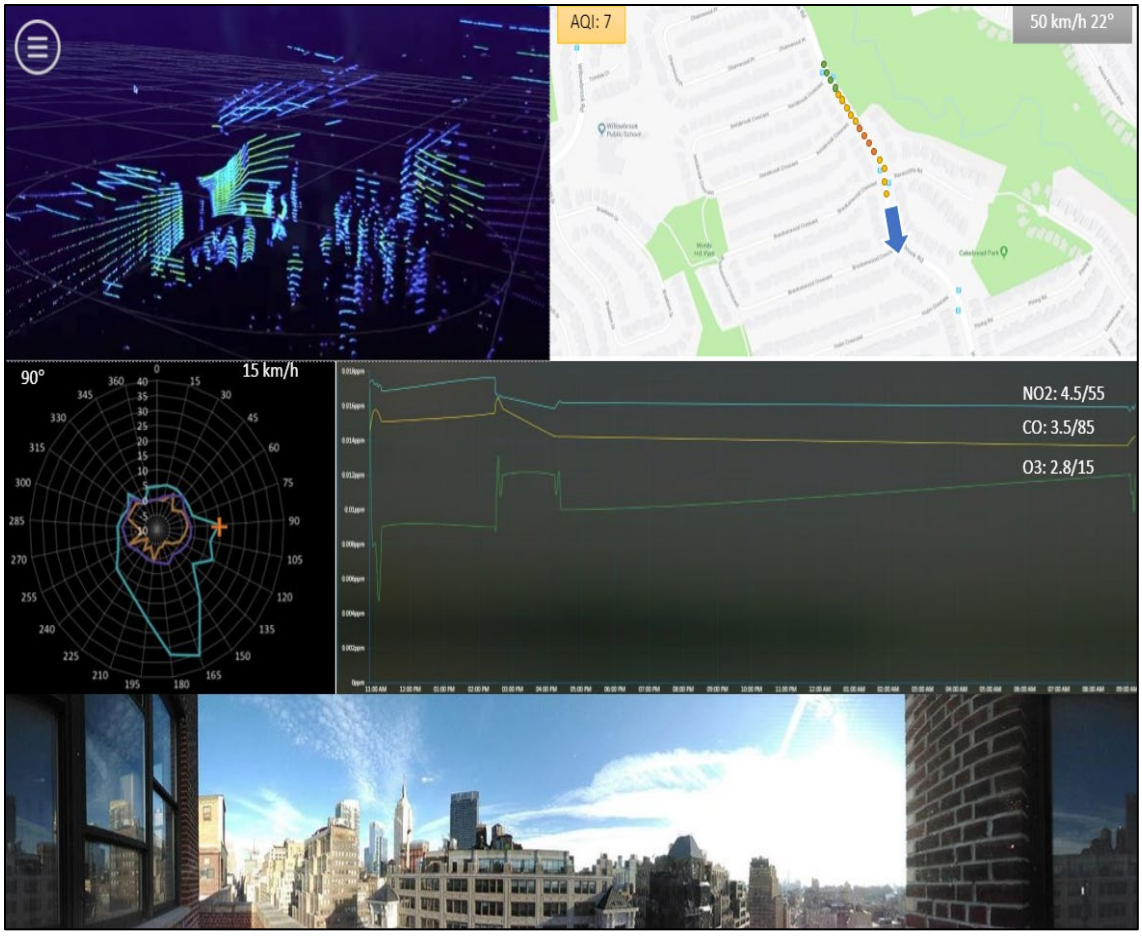
Urban Scanner comes with an intelligent cloud software which collects, analyzes, and visualizes the collected data. An advanced deep learning algorithm is used to generate geo-spatial predictions of urban pollution. This means that the system can provide pollution concentration values for locations that the Urban Scanner has not even sampled. The model can also be used to identify polluted zones and pinpoint the source of local pollution.

1.4 Data-Collection and Transmission

Urban Scanner collects data using a dedicated in-vehicle computer. The data is relayed in real-time to the operator. This includes live sensor readings, vehicle location, air quality map, as well as all alarms and notifications. The operator is able to instantly make decisions regarding the sampling route.

The data is also transmitted via a 4G cellular network to Scentroid's cloud software for further processing. Since the data is transmitted to multiple reliable sources, its storage is ensured with nearly 100% reliability, even when connection to the server is unstable or lost.





1.5 Urban Scanner Specifications

Product Name	**Urban Scanner**
Maximum # of Sensors	10
Type of sensors	PID, NDIR, EC, TLD, Laser Particulate counter, and MOS
Sampling rate	1 Hz
# of Sampling ports	1 to 2
Weight	36 Kg
Dimensions	Upon delivery: 110 × 62 × 48 cm When configured for sampling: 110 × 62 × 110 cm
Power requirements	12V 90W during full sampling /30W for low power sampling
Power Consumption	90W during full sampling /30W for low power sampling
Communication	3G/4G (default), LAN (default),
On-Board Data storage	500 GB SSD hard drive
Cloud Server	Included by Default
Local Server	Optional
On-Board Server	Included by Default
User Interface	11” touch screen PC
Ambient Temperature range	-50 to +50 °C (analyzer for gas analysis must be inside air conditioned car.
Decontamination	Automated purging
Calibration	Auto-zero function Manual span calibration, using calibration gas and on-board screen
Warranty	24 months full warranty on all parts including sensors
Sensor replacement frequency	Sensor dependent – first 2 years covered by warranty
Software	Sensor Information management System
Cabinet	NEMA 4X
Mounting hardware	Universal Roof rack mounting hardware (roof rails required)

1.6 Sensor List

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Scentroid Sensor List - Technical Information

#	Sensor ID	Type	Formula	Chemical	Maximum Detection Limit	Lowest Detection Threshold	Resolution	Cross sensitivity		Industry	Expected Life (years)	Warmup Time (Sec)	Response Time (Sec)
								Required	Recommended				
1	CD1	NDIR	CO2	Carbon Dioxide - High Concentration	5%	100 ppm	20 ppm	-	-	Safety/Combustion/ process control	1	120	120
2	CD2	NDIR	CO2	Carbon Dioxide - Low Concentration	2000 ppm	1 ppm	0.6 ppm	-	-	Urban, Industrial, IAQ	1	120	120
3	CM1	EC	CO	Carbon Monoxide (Low Concentration)	100 ppm	0.03 ppm	0.01 ppm		H2, C2H4	Urban, Industrial, IAQ	2	40	40
4	CM3	EC	CO	Carbon Monoxide (Medium Concentration)	1000 ppm	1 ppm	1 ppm	-	-	Urban, Industrial, IAQ	5	40	20
5	CM2	EC	CO	Carbon Monoxide (high concentration)	10000 ppm	30 ppm	3 ppm	-	-	Safety/Combustion/ process control	2	45	40
6	CL2	EC	CL2	Chlorine (High Concentration)	2000	1 ppm	1 ppm	NO2	BR2	Safety/Combustion/ process control	2	45	40
7	CL1	EC	Cl2	Chlorine (Low Concentration)	10 ppm	0.05 ppm	0.01 ppm	NO2	NO2	Industrial, Safety	2	120	60
8	H1	EC	H2	Hydrogen	10000 ppm	100 ppm	10 ppm		CO	Industrial, Safety, IAQ	2	120	40
9	HCL1	EC	HCl	Hydrogen Chloride	20 ppm	0.5 ppm	0.2 ppm	H2S	HBr	Industrial, Safety	2	120	60
10	HCY1	EC	HCN	Hydrogen Cyanide	50 ppm	0.1 ppm	0.1 ppm	H2S, NO2, SO2	-	Industrial, Safety	2	120	30
11	PH1	EC	PH3	Phosphine (low Concentration)	5 ppm	50 ppb	30 ppb	NO2	SO2, H2S	Industrial, safety	2	60	20
12	PH2	EC	PH3	Phosphine (high Concentration)	2000 ppm	5 ppm	2 ppm	NO2	SO2, H2S	Industrial, safety	2	60	25
13	HS1	EC	H2S	Hydrogen Sulfide (low Concentration - ppb)	3 ppm	7 ppb	1 ppb	-	-	WWTP, Odour, IAQ, Urban, Industrial	1	180	35
14	HS2	EC	H2S	Hydrogen Sulfide (high Concentration - ppm)	2000 ppm	15 ppm	2 ppm	-	-	Safety, WWTP	2	180	25
15	HS3	EC	H2S	Hydrogen Sulfide (medium Concentration - ppm)	200 ppm	2 ppm	0.2 ppm	-	-	Safety, WWTP	2	180	60
16	E2	MOS	C2H6O, H2, C4H10	Organic solvents (Ethanol, Iso-Butane, H2)	500 ppm	25 ppm	1 ppm	-	Benzines <20%	Industrial, Odour, Compost	1	30	10
17	MT1	NDIR	CH4	Methane (LEL)	20,000 ppm	10 ppm	10 ppm	-	Propane	Safety/Combustion/Inprocess control, Industrial	>3 years	45	12
18	NC1	EC	NO	Nitric Oxide (Low Concentration)	1 ppm	0.01 ppm	0.001 ppm	-	-	Urban, IAQ, Industrial	2	120	60
19	NC2	EC	NO	Nitric Oxide (Medium Concentration)	25 ppm	0.2 ppm	0.1 ppm	-	-	Urban, IAQ, Industrial	2	120	60
20	NC3	EC	NO	Nitric Oxide (High Concentration)	5000 ppm	2 ppm	2 ppm	-	-	Industrial, safety, Process control	3	120	10
21	ND1	EC	NO2	Nitrogen Dioxide (Low Concentration)	1 ppm	0.01	0.001 ppm	-	-	Urban, IAQ, Industrial	>5 years	120	60
22	ND2	EC	NO2	Nitrogen Dioxide (Med Concentration)	20 ppm	0.1 ppm	0.1 ppm	-	-	Urban, IAQ, Industrial	>5 years	120	60
23	ND3	EC	NO2	Nitrogen Dioxide (high Concentration)	1000 ppm	2 ppm	1 ppm	-	-	Industrial, safety, Process control	2	120	60
24	NS1	NDIR	N2O	Nitrous Oxide	10,000 ppm	100 ppm	1 ppm	-	Negligible	Urban, Industrial, Process control	5	30	30
25	O2	EC	O2	Oxygen (high Concentration)	250,000 ppm	5000 ppm	200 ppm	-	-	Process control, Safety	1	60	15
26	PD3	PID	VOCs	Total VOCs 10.0 eV	100 ppm	5 ppb	5 ppb%	-	Aromatioc Carbons	WWTP, **Odour**, IAQ, Urban, Industrial	5*	5	3
27	PD1	PID	VOCs	Total VOCs (Low Concentration) - PID 10.7 eV	50 ppm (isobutylene)	1 ppb	1 ppb	-	All VOCs	WWTP, Odour, IAQ, Urban, Industrial	5*	5	3
28	PD2	PID	VOCs	Total VOCs (High Concentration) - PID 10.7 eV	300 ppm (isobutylene)	1 ppm	50 ppb	-	All VOCs	Safety, Industrial	5*	5	3
29	SD1	EC	SO2	Sulfur Dioxide (high Concentration)	2000 ppm	2 ppm	1 ppm	NO2	-	Safety, Industrial	2	120	25

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Scentroid Sensor List - Technical Information

#	Sensor ID	Type	Formula	Chemical	Maximum Detection Limit	Lowest Detection Threshold	Resolution	Cross sensitivity		Industry	Expected Life (years)	Warmup Time (Sec)	Response Time (Sec)
								Required	Recommended				
30	SD2	EC	SO2	Sulfur Dioxide (low Concentration)	1 ppm	0.01 ppm	0.001 ppm	NO2	–	Urban, IAQ, Industrial	2	120	20
31	SD3	EC	SO2	Sulfur Dioxide (medium Concentration)	100 ppm	0.4 ppm	0.2 ppm	NO2	–	Urban, IAQ, Industrial	2	120	20
32	FM1	EC	CH2O	Formaldehyde	5 ppm	10 ppb	10 ppb	–	Ethanol	IAQ, Safety, Industrial,	2	180	60
33	PM 2.5-10	Laser Scattered	PM	Particulate PM 2.5, 10 (simultanous)	1000 µg/m3	1 µg/m3	1 µg/m3	–	NA	Urban, IAQ, Industrial	>5 years	NA	NA
34	TS1	Laser Scattered	TSP	TSP - PM Required	20000 µg/m3	1 µg/m3	1 µg/m3	–	NA	Urban, IAQ, Industrial	>5 years	NA	NA
35	NMH	EC	NMHC	Non-methane Hydrocarbon	25 ppm	0.1 ppm	0.1 ppm	–	NA	Industrial, Process, Combustion	2	180	55
36	MS2	MOS	TRS	TRS and Amines	10 ppm	10 ppb	2 ppb	–	Trimethal Amine, Methyl Mercaptans, H2S, other	Odours, WWTP	1	30	10
37	MS3	MOS	NH3-C2H6O-C7H8	Air Contaminants (Ammonia, Ethanol, Toulene)	30 ppm	1 ppm	4 ppb	–	(ammonia, Ethanol, Toulene)	Odours, WWTP, Industrial	1	30	10
38	AM2	EC	NH3	Ammonia (High concentration)	100 ppm	3 ppm	1 ppm	CL2	H2S, NO2	Agricultural, Industrial	2	30	40
39	AM1	EC	NH3	Ammonia (Low Concentration)	10 ppm	0.005 ppm	0.001 ppm	CL2	H2S	Agricultural, Industrial	2	30	50
40	OZ1	EC	O3	Ozone (low Concentration)	0.5 ppm	1 ppb	1 ppb	CL2	H2S, NO2	Urban, Industrial	>5 years	60	30
41	OZ2	EC	O3	Ozone (High Concentration)	5 ppm	20 ppb	20 ppb	CL2	H2S, NO2	Urban, Industrial	>5 years	60	30
42	RD1	Geiger Counter	α-, β-, γ, X	Radiation Monitor (α-, β-, γ- and x- radiation)	1000 µSv / h	0.01 µSv / h	0.01 µSv / h	-	-	Mining, Industrial, Nuclear Energy, Security	>3 years	0	0
43	CIO21	EC	ClO2	Chlorine Dioxide	50 ppm	0.01 ppm	0.05 ppm	-	CL2	Odour, Industrial	2	180	60
44	CH4L *	TDLS	CH4	Methane - ppb	100 ppm	0.4 ppm	0.01 ppm	-	-	Greenhouse gases, industrial	10+	20	1
45	ET1	EC	C2H4	Ethylene - Low Concentartion	10	0.05 ppm	0.01 ppm	CO	-	Greenhouse gases, industrial	2	120	30
46	ET2	EC	C2H4	Ethylene - Medium Concetration	200	1 ppm	0.5 ppm	CO	--	Greenhouse gases, industrial	2	120	30
47	ET3	EC	C2H4	Ethylene - High Concentration	1500	5 ppm	2 ppm	CO	-	Greenhouse gases, industrial	2	120	30
48	MM	EC	CH3SH	Methyl Mercaptan	10 ppm	0.05 ppm	0.01 ppm	H2S		Odours, WWTP, Leak Detection, Industrial	2	120	35
49	EMF	EMF	EMF	Electro Magnetic Flield	200 mGauss	0.1 mGauss	0.1 mGauss	-	-	Urban, Industrial, power plants	3	<1	<1
50	CS	EC	CS2	Carbon Disulfide	100 ppm	1 ppm	0.1 ppm	-	-	Odour, WWTP, Industrial	2	120	30
51	TBM	EC	C4H10S	Tert Butylthiol	14 ppm	0 ppm	0.1 ppm	-	-	Odour, Leak detection, Industrial	2	120	30
52	THT	EC	C4H8S	Tetrahydrothiophene	14 ppm	0 ppm	0.1 ppm	-	-	Odour, Leak detection, Industrial	2	120	30

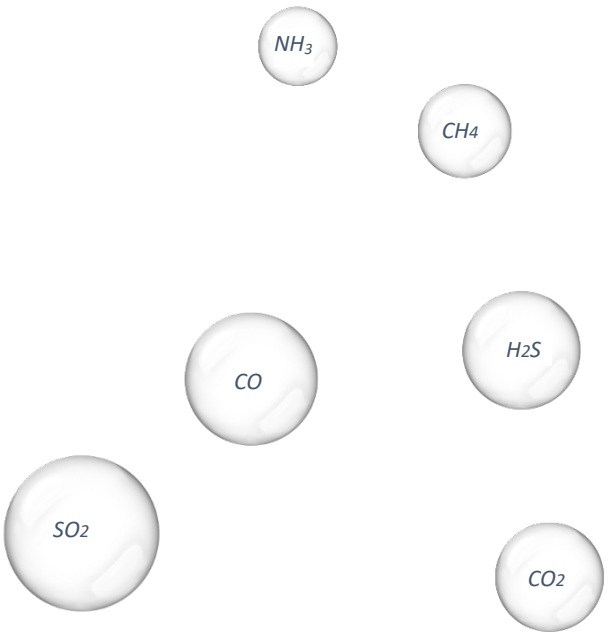
* CH4L : TLDS (Tunable Laser Diode Spectroscopy) - Some Restriction applies when integrating this sensor, Contact us for more detail

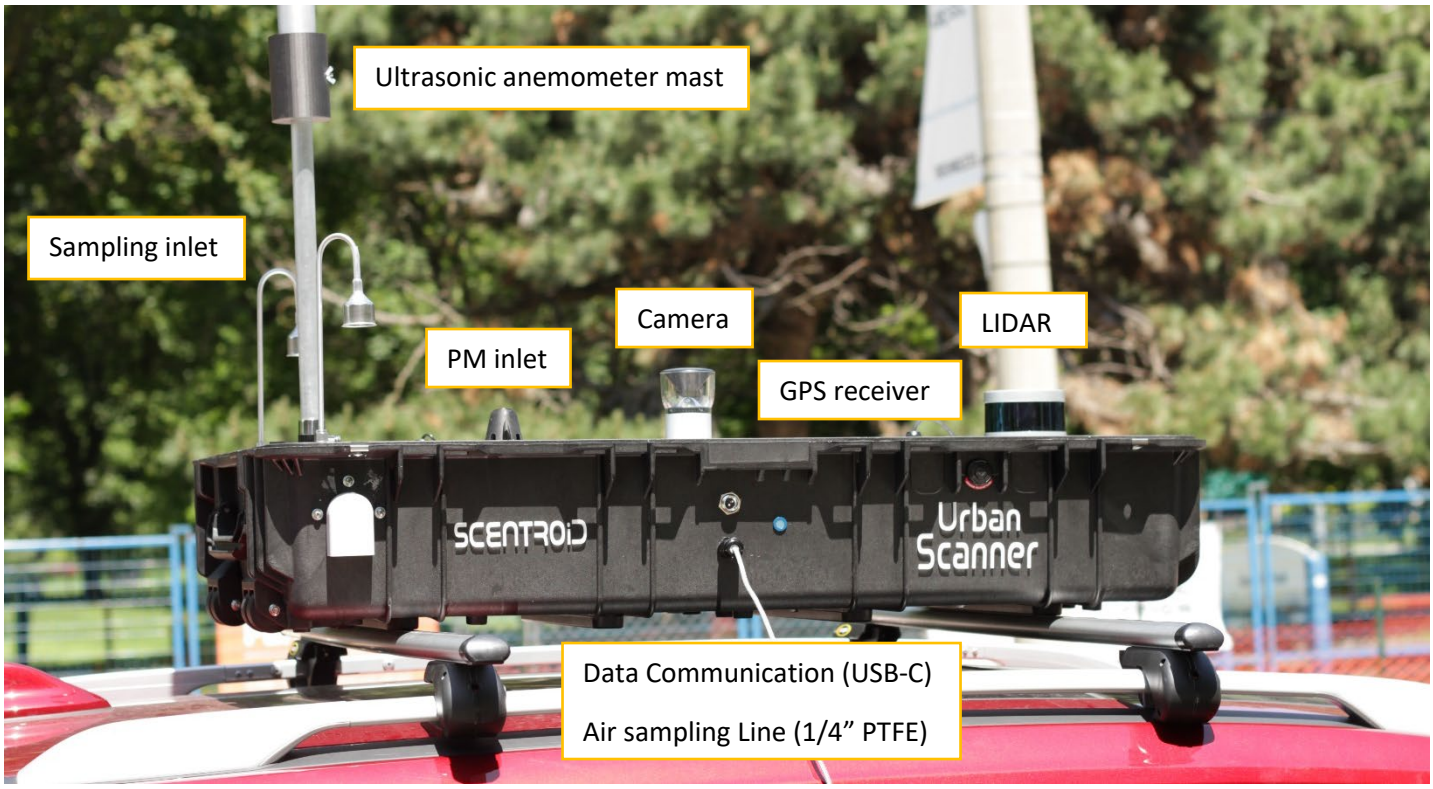
2. Urban Scanner Hardware

2.1 System Overview

Urban Scanner uses a variety of sensing technologies including:

1. Gas analyzers
2. Laser scattered particulate monitor
3. Ultrasonic anemometer
4. LIDAR (optional)
5. 360° camera
6. High resolution compass
7. GPS Receiver
8. T/RH probe
9. Noise Sensor
10. EMF detector





2.2 360° Camera

A weatherproof high resolution 360° camera is used to collect images and videos of the vehicle surroundings. Images are processed to determine traffic count and vehicle classification.

- 360° image created from stitching two 180 ° images
- 6480 x 1080 up to 24 fps

2.2 Anemometer

Ultra-sonic 2 axle anemometer is used to measure localized wind speed and wind direction. GPS based speed and digital compass-based vehicle direction are used to get absolute wind speed and direction even when vehicle is travelling.

- Range 0-60 m/s (216 km/hr)
- Frequency 4 Hz
- Data: U,V vectors in m/s
- Accuracy: 2% or 0.01 m/s (when stationary)
- GPS speed accuracy is reported to be 0.01 m/s and therefore should not be significant source of error for wind measurement.

2.4 Gas Analyzer

The Gas analyzer used in the urban scanner sits in a weatherproof casing inside the vehicle. A sample line is routed to the roof mounted analyzer to draw the sample through the sampling inlets on top of the vehicle. Data is transmitted from the analyzer directly to the in-vehicle ground station (laptop/tablet). This arrangement provides a climate-controlled environment for gas analyzers by using the vehicles heating and air conditioning system.

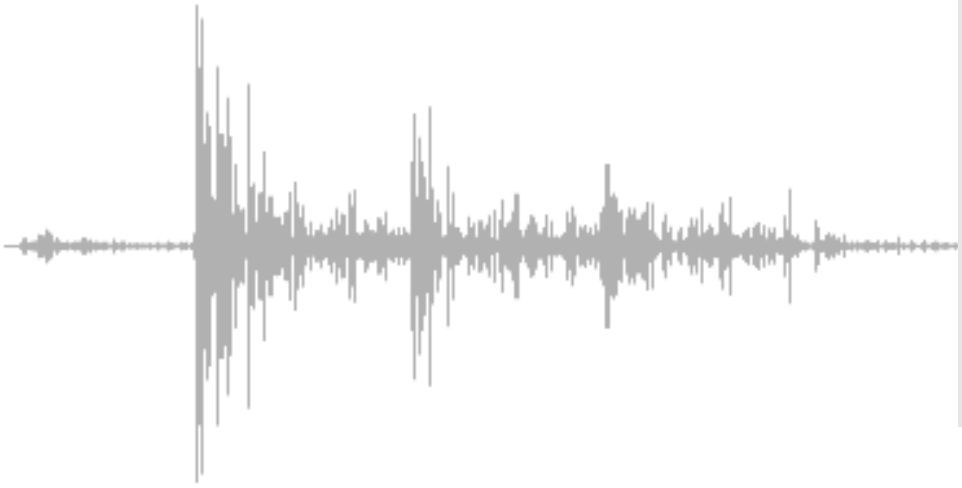
2.5 Flexible Sensing and Modular Design

Urban Scanner can be equipped with up to 10 sensors from Scentroid's sensor list.

There are 5 categories of sensors:

- Photo-Ionization Detector,
- Non-Dispersive Infrared,
- Electro-Chemical,
- Laser Scattered Counter (for PM1-10), and
- Metal Oxide Sensor

2.6 Noise Monitoring



In addition to gas and particulate monitoring, the Urban Scanner can be equipped with an outdoor Class 2 noise sensor. No additional equipment is required to measure and record ambient noise. An automatic integrated calibration procedure provides convenient and accurate noise measurements ranging from 30 to 100 dB (A).

2.7 EMF Detector

The 2 axis EMF sensor provides readings of urban electromagnetic fields created by power plants, transmission lines, and large industries. The sensing range is 0.1 - 199.9 Milli Gauss or 0.01 - 19.99-micron tesla at frequencies of 30-300 Hz.

2.8 PM Sensor

Urban Scanner uses a two laser Particulate counters to provide accurate PM 1, 2.5, and PM 10 readings. By using 2 counters, Urban Scanner is able to increase measurement accuracy and reliability. A heated line will reduce the effect of humidity and water droplets in particulate measurements.

3.1 Power During Mobile Monitoring

3. Power Requirements

Urban Scanner can be powered using a vehicle's 12V alternator and battery. During mobile monitoring, the vehicle engine will provide the 8 amps (90 watts) required by the system to operate.

3.2 Power During Short Term Stationary Monitoring

It may be required to monitor an area over a span of 1 to 10 hours. During this time, the vehicle engine may need to be shut down but sampling may be required to continue – in this case, the Urban Scanner will be required to draw power from another source. Scentroid recommends the use of a 12V deep cycle 200AH battery. This battery type will enable the system to operate for roughly 30 hours. The battery can be connected in parallel to the vehicle's alternator in order to charge while the vehicle is in motion or alternatively, be charged separately.

3.3 Long Term Stationary Monitoring

A 200-Watt solar cell will provide the required power to charge the deep cycle battery during long term monitoring. The solar cell can be deployed next to the vehicle without the need for a mast or other structure. Urban Scanner can be purchased with the optional solar control module which automatically alternates between a vehicle's 12V power, deep cycle battery and solar cells. The module will also control the battery's charging cycle by using the solar cells.

200-Watt Solar cells can be deployed for long term monitoring

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