# ((SENSONEO))

Manage waste smarter



Sensoneo provides smart enterprisegrade waste management solutions for cities and businesses to efficiently manage the waste lifecycle, improve the environment and well-being of people.



With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tons in 2050

#### About the company

The Sensoneo solution for smart waste management was developed in 2014.

We drive innovation in the waste management market by development of comprehensive measurement and analytical tools complemented by state of art hardware designed and developed in-house.

Sensoneo hardware solution is compatible with the majority of IoT networks worldwide operating on GPRS, NB-IOT, CAT-M, SIGFOX or LORA.

Sensoneo Quality Management System is certified ISO9001:2015 and ISO14001:2015 as QUALITY is a priority in Sensoneo.







**On-going Projects** With waste collectors, municipalities, waste brokers, universities, highway operators...

Senior Engineers Developing in-house state of art hardware and software solutions 30

**Certified partners** Local partners supporting deployments in various regions worldwide.



**Countries** With SENSONEO active sensor units and software deployed

"Essence of success is to empower people to create disruptive innovation product and unlock their passion to work together as a team for customer success! "

Martin Basila CEO and Founder Micro Sensor

Single Sensor 3.0







WatchDog



**Collection Efficiency** Analysis





Founded office in Texas, USA

**EIC Accelerator grant** from the European Innovation Council

**Octopus Sensor** 





**Quatro Sensor** 



**Microsoft Award Public** Innovation World Cup administration & Smart Series Winner City category

Vodafone Idea of the year - finalist

Proptech Start-up Europe Winner

> Best smart city deployment in Czech republic

**Asset Management** Solution (RFID)



2019











**Double Sensor** 

Citizen App



2017

2016

Golden Ant 2016 Innovation Solution Category

> IT project of the Year at IT Gala 2016 poll

Via Bona 2016 award nominee in Green company category

Innovation of the Year awarded by Ministry of Economy Slovak Republic

Mission Award for tackling social challenges by innovation

Circular Innovation / Technology category

2014

First prototype developed

finalist

2015

**Single Sensor** 

Smart Waste Management System

Start-up Awards



## In-house R&D

Sensoneo has a team of senior HARDWARE and FIRMWARE engineers who have very broad experience with IoT device development, wireless technologies, sensors implementation and power management.

Sensoneo's SOFTWARE team is focused on development of cloud platform environment, advanced machine learning, data processing and structuring, user interface optimization, and app development.

Quality and on-time fulfilment of on-going projects is ensured by professional PROJECT MANAGER with assistance team of technicians.

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## **Quality - Priority no. 1**

Quality flow in Sensoneo starts with well organized and documented product development scope, targets and process, comprehensive supplier qualification and procurement, manufacturing quality control, and functional testing prior to customer shipment.

Quality related queries in the field are considered as a top priority, starting with immediate consultation of Sensoneo Support team and further complete quality review by Support team technicians and manufacturing quality department, incl. 8D analysis.











## **Product Reliability**

Excellent robustness and product reliability are essential to Sensoneo business model. Longevity of the solution with endurance to extreme weather conditions, impact or vandalism is necessary in the applications of waste management, industrial level measurement and public access installations.

Sensoneo applies the highest standards on hardware mechanical design to be able to claim its industry grade level compliance suited for harsh environments.

Electrical safety and compliance with regulations is also a compulsory part of the market entry and is embedded within our development and compliance testing process.

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#### TEST REPORT No.: 184000119/IP

Test name:	Degrees of protection ( IP Gode)
Test subject – name:	Test of the equipment
Type/Model Enclosure marking:	Quatro sensor Master (QS Master), Single sensor (SS), Microsensor (MS)
Manufacturer:	SENSONEO j.s.a. Koliarova 27 841 06 Bratislava Slovak Republic
Customer – Applicant:	SENSONEO J.s. a Koltarova 27 841 06 Bratistava Slovak Republic
Order - application number:	184000119
Place of test:	TSÚ Piešťany, š.p.
Test – procedure method:	STN EN 60529:1993+A1:2002+A2:2014 EN 60529:1991+A1:2000+A2:2013
Date of test performance:	11-24.05.2018
Date of issue:	16.11.2018
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	TECHNICKY SKOSOBNÝ. OSTAV NEŠTAKY, Sp Skásobia TZ 20 JU Kruji ská posat Z 22 JU Kruji ská posat Z 22 JU





Visiedky skúžak uvedené v fornio protokole za híkalú len predmetu skúčky a nenahrádzajú mel dakumenty, ktoré sú požado kené orajinny sobal a toda, oroseka a mino posobal o prejo mi posobal o prejo mi posobal posobal na teresta posobal pos Posobal 1-10-101-0















#### **Customers**

- Waste management companies
- Waste brokers
- Cities and municipalities
- Public institutions /school, hospital, university/
- Industry parks and retails
- Commercial companies
- Facility management



## SOLUTIONS WE OFFER

## Asset Management

Smart Bin Tags Smart Waste Management System Smart Analytics Citizen App Watchdog

## Waste Monitoring

Smart Sensors Smart Waste Management System Smart Analytics Citizen App

## Route Planning

Smart Waste Management System Smart Analytics Driver Navigation App Watchdog







## **BENEFITS WE BRING**

### Asset Management

Transparency Traceability Digitization Automation Motivation for less production of waste Citizens' engagement



## Waste Monitoring

No unnecessary routes Lower emissions Less traffic Sustainability Improved environment Sufficient space for waste sorting



Maximize utilization Optimizated processes Efficient waste collection Automated collection routes Shortest and safest routing





# Asset Management

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## **Understand your infrastructure**

Sensoneo provides all tools necessary for asset mapping, digitalization of inventory and qualitative infrastructure

analysis.



### Asset management tools

Map all your existing containers via mobile app including photo and GPS position. Create digital bin inventory in cloud including an interactive map.

Update inventory, record maintenance or report problem on-site using mobile app or a RFID reader.

Plan maintenance runs with Route planning including step-by-step navigation for drivers.

Solution includes Smart Bin Tags (or stickers), Smart Waste Management System for ((S)) Operators and WatchDog (or a RFID reader).









### **Smart Bin Tags**

Smart Bin Tags provide uniques identification for every bin (or other asset).

Bin Tags enables you to identify (barcode, numerical code or RFID feature) and record all bin assets, simplify tracking, communication and invoicing, and restrains unauthorized use of bins.

Clear and accurate overview of all bin asset is one of the keys and very first steps leading to smart waste management.



### **Smart Waste Management**

All data are available in Smart Waste Management System, powerfull cloud-based platform on MS Azure, that asists Operator on daily waste management tasks.

#### **Digital interactive map**

Operator sees whole infrastructure on an interactive map, he can visit each stand/bin at any time via the Street View feature from Google.

You can filter bins by trash type, capacity, pricing and collection interval. The digital map provides big picture and a spacial awarness.

#### **Detailed bin inventory**

Thousands of bins with relevant information stored in one database you can work with. Use the data you have to your advantage.

You can see bin details such as stand, street, bin code, trash type, capacity, collection schedule, last emptying, maintanance reports and more.







## Improve the infrastructure

#### Mission no. 1: Save public space

Sensoneo analyses bin density to identify redundant stands that needlessly block public space.

Modern and well-placed stands keep streets clean and free of litter for citizens to enjoy.

#### Mission no. 2: Save resources

Sensoneo analyses pickup costs for each bin. Analysis identifies bins that drive up collection costs due to their remote location.

Increased capacity may significantly decrease pickup frequency and costs. Short-term discharges around the city may eliminate long drives, and the waste collection can be faster and less of a burden on traffic.

### **Service Verification**

WatchDog, Sensoneo's **ultimate service monitoring device for waste collection vehicles**, is mounted on the collecting vehicle and recognises all tagged bins emptied by the vehicle.

WatchDog reading Bin Tags provides

- Service verification for internal and external stakeholders
- Long (7m) and short-range (0.5m) RFID reading
- High data reliability due to the elimination of the human factor
- Early warning system for any unpaid bins
- Fraud prevention (unauthorized trash pickups)
- Easy collection retrace to settling customer disputes (missed pickups)
- Ongoing automatic bin inventory updates

... and much more.



# Waste Monitoring





## **Bin fill level monitoring**

We help you set the waste collection frequency right so that citizens can enjoy clean streets, less air and noise pollution.

Sensoneo provides data and tools necessary for efficient and data-driven waste management.

Waste monitoring harvests the data on fill-level and filling cycle of the bin.

Solution includes Smart Sensors, Smart Waste Management System for Operators and Citizen App for public.

#### **Smart Sensors**

Ultrasonic IoT Sensors can monitor any type of waste (mixed waste, paper, plastics, glass, clothing, bio-waste, liquids, electronics, metal....) in bins and containers of various types and sizes.

Sensoneo's solution is a result of in-house R&D.

- Sensors provide
- Fill level in bins
- Fire and tilt alarm
- GPS position

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Pick up recognition / verification of service /

Data transfer to cloud is via Internet of things networks / Sigfox, LoRaWAN, NB-IoT and CATM.















#### **Smart Waste Management**

All data are available in Smart Waste Management System, powerfull cloud-based platform on MS Azure, that asists Operator on daily waste management tasks.

Smart Sensors feed Platform with live data several times a day. Operator **sees actual fullness** on the interactive map and in the table highlighted by traffic lights.

Sensoneo calculates predictions based on historical data. Operator can see prediction for each bin for tomorrow, next week or next month.

Operator can access different statistics on fullness, for example how full was the bin when emptied.

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### Data is power

These data help managers

- to adjust pickup frequency as needed or even collect ondemand
- to identify fast filling bins (potential for large-capacity bins)
- to be smart and **plan pickups ahead** based on predictions
- to stay on top of ever-changing city ecosystem
- to have a service verification (pick-up recognition)

### Citizens are a part of the solution

Citizens have **access to data from Sensoneo Sensors** via the free 'Citizen App' by Sensoneo.

The mobile application informs people about **waste levels in all monitored bins and enables them to find the nearest available empty** bin for specific waste types, including directions to the bins. **Engage citizens in Smart Waste** 

By reporting real-time feedback, **citizens make their cities greener**, **cleaner and free of litter**.

Available for Android and iOS.







# Discover more efficient waste collection

Route Planning solution **automates the management of the waste collection routes**, based on precise predefined data regarding waste collection vehicles, depots, and landfills/ incineration sides. The aim is that **every single waste collection route is planned to maximize the utilization of your resources** (fleet, FTEs, time) and to minimize the costs needed to perform the job.

The introduction of the Route Planning solution results in fewer kilometres driven per kilogram of collected waste and the full utilization of vehicle capacity and time.

More efficient routes help **minimize the negative impacts of waste collection in the city with less noise pollution**, less air pollution and fewer traffic congestions.

## **Collection Efficiency Analysis**

#### How efficient is your waste collection?

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Sensoneo Collection Efficiency Analysis provides a **clear understanding of how well you currently operate** in terms of waste collection. Can you truly rely on your records? Are your current collection routes efficient? Do you maximize the use of vehicle capacities? Where could you save costs?

Answers to these and many other questions are already present in your existing records. Sensoneo experts provide a comprehensive analysis of your "AS-IS" status through a deep dive and evaluation of your existing records.

"AS-IS" status serves as basis for improvements. Let our Route Planning Engine replan existing routes and **see quantified savings and ROI.** 





## **Route Planning Engine**

We have **developed our very own Route Planning Engine.** No other engine available on the market have met our needs – input **100 vehicles and 10 000 bins**, and calculate a collection plan.

The Engine is part of Smart Waste Management System, powerfull cloud-based platform. The Engine can accomodate **multiple rules and many bin or vehicle attributes relevant for calculationg routes.** 



#### **Platform for Operators**

Your waste infrastructure (bins, fleet, discharges, depos...) is digitalized in Smart Waste Management System, Sensoneo`s powerful cloud-based platform on Microsoft Azure cloud.

Operator schedules all routes in the Smart Waste Management System. If using Smart Sensors, you benefit from **predictions on filling cycles**. That means you plan collection for tomorrow based on tomorrow's prediction rather than on today's data.

Operators can track ongoing routes vs. the plan live. The tool calculates statistics for each route – total costs, cost per cubic meter, cost per kilogram, duration of the route, driven distance, total volume collected, total weight collected. Drivers access the schedule via Driver Navigation App.

All data can flow back to Collection Efficiency Analysis to run a continuous efficiency analysis.

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## Ultimate Service Monitoring Device For Waste Collection Vehicles

WatchDog, Sensoneo's **ultimate service monitoring device for waste collection vehicles**, is result of in-house R&D.

Device combines

- Asset tracking via RFID Reading
- Vehicle and driving pattern tracking via GPS Tracking
- One device solving several problems thanks to the Enterprisegrade design



#### **RFID** features

- Service verification for internal and external stakeholders
- Long (7m) and short-range (0.5m) RFID reading
- High data reliability due to the elimination of the human factor
- Early warning system for any unpaid bins
- Fraud prevention (unauthorized trash pickups)
- Easy collection retrace to settling customer disputes (missed pickups)
- Ongoing automatic bin inventory updates

#### **GPS tracking**

- High location accuracy (GNSS, +- 10cm)
- Dead reckoning (lost GPS for a long time)
- Sensitive monitoring of driving patterns (acceleration)

#### Enterprise-grade design

- Installation under 90 minutes
- Network agnosticism (GPRS, NB IoT, CATM1, LTE)
- Integration via all common interfaces (CAN bus, RS485/RS422, STROBE 1&2 Pulse, TRIGGER Pulse, FLASH Beacon, BEEPER)
- Resilience to harsh weather conditions (humidity & temperature sensor, built-in self-diagnostic heating system)
- Backup power & data in case of the power failure



# Industry specific solutions

### **Factory Waste Management**

Factory Waste Management solution **minimize disruptions of the production by waste collection.** Where production happens, waste is produced. Eliminate overflowing bins or unnecessary disruption by waste collection.

Solution **automates management of waste collection** based on the floorplan, precise pre defined data about fleet, schedules, depots, and discharges.

• Just in Time Waste Collection

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- Precise collection of the requested bins only
- Automated route planning without the need of human interaction
- Feedback gathering during the collection route
- Data analyses from each bin and route



Solution includes Smart Button, Smart Waste Management System for Operators and Collection App for Drivers.



## Early Overflow Warning System

Sensoneo Octopus sensor is an enterprise-class device intended as an early overflow warning system. It measures water level in a manhole.

It's fully adjustable for different depths. Thanks to adjustable water level indicators (tentacles), Octopus can detect up to 3 different thresholds.

As the water level is rising, the tentacles recognize when they float.

Operator can see notification in **Smart Waste Management System**, powerful cloud-based platform. The platform can even send customized notifications via SMS or email.

Solution includes Octopus Sensor and Smart Waste Management System for Operators. Good decisions are data-driven decisions.

Sensoneo enables you to make truly good decisions.



# References

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#### Reference: Prague, Czech republic

#### Capital city of Czech republic

1.28 Mio inhabitants

Monitoring: Underground bins

Towns annual budget for waste management: 1.49 Bn. CZK (64 Mio USD)

#### Expectations from Smart waste solution:

Maximize benefits of newly installed underground bins

Set right frequency for collection

Eliminate overflowing bins and unnecessary pickups

#### Project:

Proof-of-concept implementation in 420 underground bins in fall 2018. Wider implementation is expected after 12-month evaluation period.



# Reference: Dubai, UAE

#### Waste management company for Dubai, UAE

The company is servicing 4 000+ km2 area. They have many recycling centres distributed across the city.

Monitoring: 12 commodities (bins) in 17 Recycling centers

#### Expectations from Smart waste solution:

- Set right frequency for collection
- Keep surroundings clean from trash
- Eliminate overflowing bins and unnecessary pickups

#### Project:

In February 2018, 169 sensors were installed in the Recycling Centres. Sensors monitor 12 out of 17 commodities in each Recycling centre.



#### Reference: Granvia (Vinci Highways)

#### Highway operator for R1 highway, Slovakia

The company is servicing motoroway between the towns of Nitra and Tekovské Nemce (51,4 km long), and maintenance of the northern bypass highway.

#### Monitoring of 52 manholes/ oil separators under highway (10m deep)

Expectations from Smart waste solution:

- Early warning of rising levels
- Avoid physical inspection on all the separators locations during rainfall/ heavy raning periods

#### Project:

In May of 2019, Sensoneo installed 52 Octopus sensors to the oil separators. Octopus Sensor is an enterprise-class device intended as an overflow warning system. It measures the water level in a manhole. It's fully adjustable for different depths. Thanks to adjustable water level indicators (tentacles), Octopus can detect up to 3 different thresholds.

# Market & Positioning



Smart Waste Management 3,97 Bn USD by the end of 2025 CAGR 21%

Smart Waste Technology 1.5 million units WW in 2023 CAGR 30.8%

Smart Waste Collection Systems 4,5 Bn USD by the end of 2027 CAGR 1770

Sensoneo recognized among top 10 market leaders Home / IT & Telecom / Smart Waste Collection Market

#### Smart Waste Collection Market

TMRGL72564 2020-03-31 188 Pages

Preview Description ToC

Smart waste collection systems are being leveraged with data analytics that help a business or an organization tract their waste generation. As such, the revenue of public utility is projected to witness aggressive growth in the market for smart waste collection, where the market is estimated to reach a revenue of ~US\$ 4.5 Bn by the end of 2027.

Thus, having complete visibility of waste containers supports reduction of costs associated with overfilling a dumpster.

63k Euro

Average Deal Size

#### 568 **Opportunities in Pipeline**

12-24 months

Sales cycle to full scale deployment

## Pipeline 2020

35 Mio Euro

**Expected Revenue** 



**Prorated Revenue** 





Winner Microsoft Awards 2018 Smart City and Public administration



INNOVATION WORLD CUP SERIES

Winner Innovation World Cup Series 2019 Smart Territories



96%

Winner PropTech Startup Europe Awards 2019

# Bloomberg

Business

## Sensoneo Is the First Commercial Narrowband IoT Deployment in the United States, Powered by Twilio and T-Mobile

July 8, 2019, 3:00 PM GMT+2

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States, Powered by Twilio and T-Mobile Smart Waste Management company leverages Twilio and T-

in the United

Mobile Narrowband (NB-IoT) connectivity to optimize waste collection, demonstrating the future

of smart cities

Business

## Meet The Best Tech Companies From Central & Eastern Europe

Sensoneo Is the First Commercial Narrowband IoT Deployment

July 9, 2019, 3:00 PM GMT+2

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in Post	RetargetApp, the Ukrainian scaleup providing web app that
🔀 Email	creates effective digital ads in one click won CEE Scaleup Challenge, the biggest online
	competition in Central and Eastern Europe for innovative,



uropean

Sensoneo received a prestigious grant of € 1.368 million from the European Innovation Council

#iiot

#waste management

Services

26.08.2020

#circular economy

The Slovak technology company Sensoneo, which develops and provides revolutionary solutions for efficient and transparent waste management, has succeeded in the pan-European EIC Accelerator call focused on innovative technological projects supporting the objectives of the European Green Agreement.



## Sensoneo creates sustainable cities



## ((SENSONEO))

## Data-driven waste management