

# CASEBOOK

Embedded AI:  
Driving innovation  
across industries  
and everyday life





## Embedded AI: Driving innovation across industries and everyday life

Digital technology is increasingly embedded in physical systems to detect, monitor, control, and optimize operations. Traditionally, decision-making in these systems relies on models based on theory or practical rules. But what happens when these models are unavailable, too complex to create, or fail to deliver the needed performance? That's where AI steps in. AI models, trained with system data, can learn and adapt—provided there's enough processing power and data. They offer a smarter, more dynamic approach to decision-making in today's connected systems.

### EMBEDDED AI OVERCOMES CLOUD AI LIMITATIONS

The tools and tech to make this happen have been around for a while now. Typically, AI models are trained and run on powerful computers, with data collected from systems and centralised for processing. This process relies heavily on IoT, which connects physical systems to the cloud and enables centralised, large-scale processing. However, this cloud-based, centralised approach has some significant limitations, such as excessive use of resources, reliance on connectivity and data vulnerability.



#### EXCESSIVE DATA TRANSFER

The required data transfer to the cloud-based AI model in the cloud may well exceed the data-rate of the available connectivity solution. The communication and processing costs may be too high relative to the entire system. Not to mention the ecological impact of the data traffic and cloud infrastructure.



#### REAL-TIME PERFORMANCE CONSTRAINTS

If the system needs to react to the output of the AI model, then the latency and reliability of sending data to the cloud and getting back the result might not meet the real-time requirements of the application. A slow response could have a negative effect on user experience, performance, or even on the safety of the system.



#### SECURITY ISSUES

If the system handles personal or other confidential data, sending and processing it in the cloud makes it more vulnerable to unauthorised access. Even though there are ways to manage the risks of data exchange, users may want to keep control by not allowing sensitive data to leave their systems.



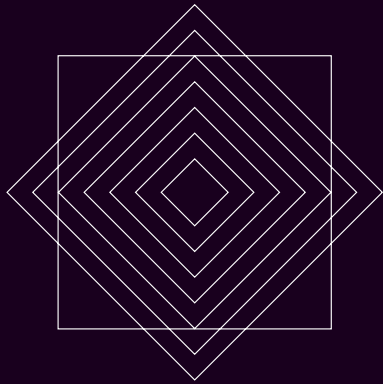
## A PARADIGM SHIFT TO EMBEDDED AI

Deploying the AI model at the physical system instead of the cloud, solves these limitations. Dealing with the limited processing capabilities of the device is a challenge when moving from the cloud to the device level. If the hardware platform has limited space, cost or power, the AI model and processing may be too much. This is where embedded AI comes in: using AI models on embedded devices in physical systems. In recent years, we have seen great advances in AI-optimised hardware and software for building smaller AI models and deploying them on embedded systems.

## EMBEDDED AI, WHAT'S IN IT FOR YOU?

Today, embedded AI is integrated in all sorts of new products in various domains. From health monitoring devices and context-sensing appliances for smarter living, to monitoring industrial equipment, crops or livestock, automatic stock updating in retail and traffic routing.

This casebook showcases actual products of Belgian companies and how embedded AI is used. Our aim is to shed light on the opportunities and challenges that come with the development of these products. Embedded AI isn't a one-size-fits-all solution, but the technology is changing fast. It's worth at least to think ahead about how it could improve products and businesses.



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## CASE 01

# Embedded AI drives iQunet's anomaly detection in manufacturing

iQunet has developed a set of IoT building blocks that can be quickly deployed for asset and condition monitoring at manufacturing companies. Thanks to embedded AI, sensor data can be processed in real-time on the edge server.

When a human expert helps to figure out which sensor data are most relevant, the AI models are smart enough to identify an anomaly on their own.



**iQunet** is a startup developing industrial IoT solutions for asset and condition monitoring. They work with manufacturing companies and integrators who provide the industry with production technology and digital manufacturing solutions.

At the heart of iQunet's offering is an industrial PC edge server that stores wireless sensor data and provides local processing capabilities. The built-in web interfaces visualise these data and enables data exchange with external software systems (SCADA, MES, ...) via industrial IoT protocols OPC UA and MQTT.

## SMART LOCAL MONITORING PREVENTS FAILURES

iQunet offers both the **wireless sensors** and the **server** that combine into an **end-to-end monitoring solution**. They do not only monitor the operational efficiency of industrial assets, but also check their health status to prevent unexpected failures.

iQunet's building blocks for industrial IoT are plug & play and don't require programming, which adds to the usability for industrial operators. The solution works in the edge, processing and maintaining all data locally, rather than in the cloud. The system has been specifically designed to deal with high-frequency sensor data for condition monitoring.

Based on vibration sensors data and amplified current clamps for motor current signature monitoring, it provides early warnings and trend analyses of potential equipment failures. This real-time local processing is made possible by embedded AI.

## RELIABLE ANOMALY DETECTION AND TRANSPARENT DATA OWNERSHIP

Large sensor datasets give valuable insights, even if you're not an analytics or programming expert. The algorithms are always running, so they can detect anomalies much faster than a human expert could.

iQunet has implemented edge AI instead of cloud AI for several reasons:

- Condition monitoring requires large amounts of data. Sending these to the cloud is too demanding in terms of technology and cost. At the same time, higher-level software systems are typically designed to handle low-rate data.
- A poor network performance of the cloud connection can also undermine the reliability of the monitoring system.
- Many manufacturing companies prefer to keep all production-related data on-premises to avoid data ownership and security issues.



iQunet's building blocks are easy to configure and extend, so customers can get a monitoring solution up and running quickly. They can get insights on the potential return on their investment, without spending ages on implementation and integration. For the AI functionality, the company offers a subscription service. In that case, iQunet builds the anomaly detection model on iQunet's server, which is then transferred to the customer's edge server. Alternatively, customers can also run their own AI models.

## TECHNOLOGY AND DEVELOPMENT BEHIND THE AI SOLUTION

The AI models that iQunet provides are unsupervised learning models, so called "autoencoders", that do not require prior data labelling, but only training on a historical data set. For each new measurement, these models output an anomaly score that in turn can be flagged when exceeding a threshold. The models in Keras and TensorFlow are trained on hired AWS GPU capacity and deployed on the edge using TensorFlow Lite.

Human expertise is of course still required when selecting the physical quantities to be measured and how to measure them, depending on the equipment and anomaly to be monitored. iQunet has been building up this domain knowledge over the years. All hardware and software has been developed in-house.

The company keeps extending the collection of supported sensor modules and performing remote software updates regularly for customers under the AI-as-a-service subscription. For large-scale integrations with numerous devices and sensors, iQunet also offers cloud-based data management (database-as-a-service). The subscription fees for these optional services are additional to the one time hardware cost for the server and sensors.

## IQUNET'S VIEW ON EMBEDDING AI

It took a while to get the whole AI training and deployment pipeline up and running and to achieve stable performance. On top of that, end-to-end monitoring requires every link in the chain to work properly. Even if the customer's connection with the edge server is not sufficient, the dashboard application should still be able to handle it and provide proper data visualisation. Choosing the right sensor signals and adequate models can also be tricky, especially when iQunet is only involved after the data has already been collected. There's always a link to be made between the detected anomalies and the physical causes.

iQunet wants to make the right technology choices. Adopting open-source standards, is key to save development effort and time. The same goes for the integration effort of the customer: it should be kept to a minimum as well. If the system takes too much time or specialised skills to set up, production companies won't use it.



## WHAT'S NEXT FOR IQUNET'S MONITORING TECHNOLOGY?

To cover an even wider range of connected sensors, iQunet is expanding its list of supported communication protocols, including Modbus TCP/RTU, EtherCAT and additional wireless protocols. The company wants to extend their AI services with multi-sensor models and further explore the possibilities of AI to get the most out of the customer data. iQunet already allows customers to grant third party access to the monitoring dashboard, to deal with urgent issues or to perform maintenance.







## CASE 02

# Catching you before you fall: how Nobi's lamp makes smart use of AI

Nobi is a smart lamp that helps caregivers and family members by preventing, detecting, and signalling falls in elderly residents or patients.

It combines vision technology with embedded AI, making it more performant than other fall detection systems. It also helps prevent falls while giving valuable insights into residents' health and well-being. Making its AI model work seamlessly in all practical scenarios was key to achieving the current product offering.



## LIVING LONGER AND MORE INDEPENDENTLY THROUGH 'AGETECH'

**The Nobi smart care lamp** combines a stylish design with powerful AI processing and wireless connectivity. On the preventative side, it turns on and off automatically when a person enters or leaves a room or gets in and out of bed. If it detects a fall, Nobi notifies caregivers or family members. Care facilities that have Nobi lamps installed, respond significantly faster to fall incidents.

Besides providing immediate assistance, the lamp also gives health professionals insights into a resident's general wellbeing, for example through sleep monitoring. Nobi integrates with nurse call systems and digital patient records, enhancing the digital healthcare workflow.

### WHAT'S UNDER THE LAMP HOOD?

The Nobi lamp is equipped with infrared sensors and an NVIDIA Jetson™ TX2 NX processing module. Images are processed locally by this module using the NVIDIA TensorRT inference engine and custom detection models to assess the position, posture, and pose of both people and beds in the room.

Each Nobi lamp monitors its own performance. False detections are automatically logged to retrain the AI model afterwards. The lamp also has a learning mode, in which new training data is captured by the sensors. In addition to the monitoring framework, Nobi also provides automatic software updates.

## TRIPPING HAZARDS ON THE GO-TO-MARKET TRAJECTORY

Developing everything from scratch as a startup is a challenge in itself, but the industrialisation stage was the hardest part of Nobi's journey to product success. In the development phase, they created a lab demonstrator to prove its feasibility and to secure funding. Once they made it through this stage, Nobi had to make further adjustments to perform in all practical scenarios.

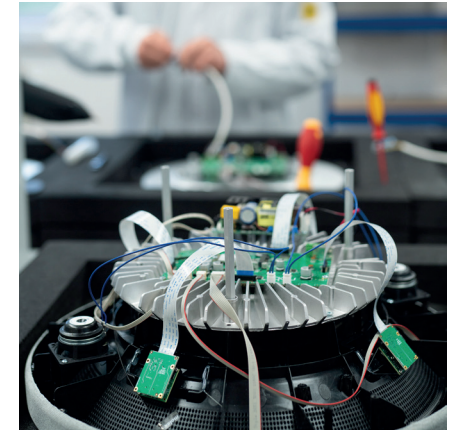


## DEVELOPING AND EMBEDDING AI

All AI-related developments have been managed internally. Nobi used open-source building blocks to save on development time and cost. They built their own AI training module to generate images of different room configurations and conditions. Each time a new model is available, it is tested on their central server before being deployed.

Existing fall detection technology often relies on surveillance cameras, motion sensors or radar systems. These are either very privacy-invasive or can't tell the difference between regular movement and a fall. Nobi overcomes these limitations using optical sensors and on-edge AI.

Because of these privacy concerns, Nobi chose embedded AI technology, instead of pushing data to a cloud-based AI model. Images are analysed locally and only a recorded fall is shared with the user's permission. The AI video works with anonymised stick figures to protect patients' privacy.



## ADAPTING TO REAL-LIFE CONDITIONS

Going from a lab demonstrator to field deployment and testing, revealed unexpected conditions and practical constraints. The diverse environments in which Nobi operates presented numerous challenges. Factors such as varying lamp installation heights, different types of bed frames, the presence of pets and caregivers had to be dealt with.

Nobi continuously evaluates and refines its AI model through a closed-feedback loop, taking input from caregivers and residents into account. This makes it more accurate and reduces false positives. From a practical point of view, the remote performance monitoring and software updates must be done while the smart lamp remains operational.





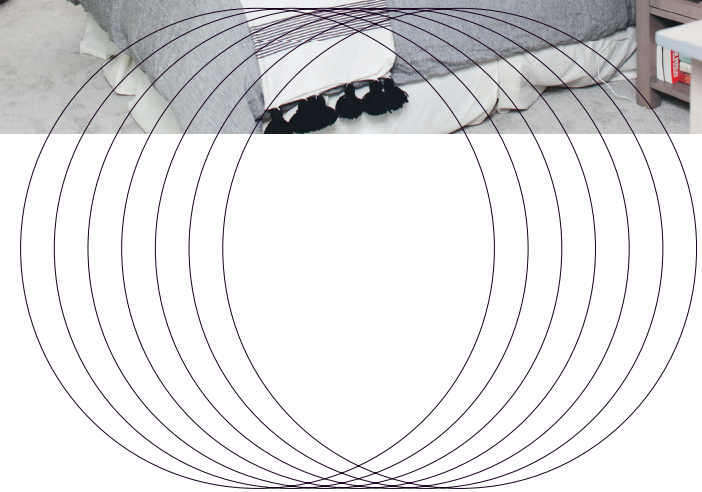
## WHAT'S NEXT FOR NOBI'S SMART LAMP?

After starting in 2018 and launching the first product in 2021, Nobi moved its production from Asia back to Europe by the end of 2022. All electronics and assembly are now based in Belgium, ensuring a close collaboration between product development and production departments.

Reliable fall detection, effective fall prevention and privacy protection by design remain Nobi's unique selling points. They are currently serving residential care homes and hospitals (B2B), but in the future they will also target home users.

Today, Nobi relies solely on its optical sensors, but they are working on leveraging the audio capabilities of their smart lights. They could, for example, train the system to recognize everyday noises, such as toilet flushes, tooth brushing, and showering, which might be leveraged as health indicators. If a resident were to become less active and these indicators were to decrease, they could provide an early warning of potential health issues. On the visual side, they want to become better at recognising specific poses that indicate instability or a resident becoming unwell, even before an actual fall.

Today, Nobi has lamps active in 21 countries and several sales offices and distributors around the world. They can rely on a team of 55 employees, including 15 developers.



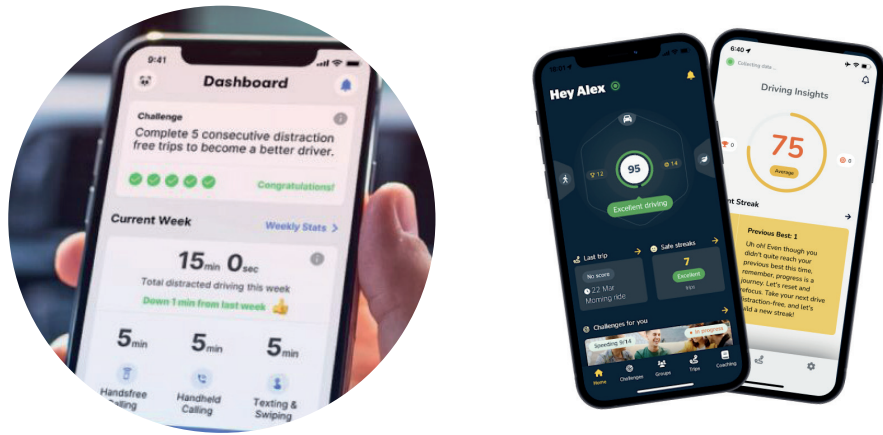


## CASE 03

### Sentiance's embedded AI reveals driving behavior through smartphone data

For Sentiance, using AI models to transform raw smartphone data into actionable motion insights was an obvious choice. However, the true benefits of privacy and real-time user feedback only became evident when they embedded these models directly on the smartphone, rather than in the cloud.

Embedding AI involved much more than just picking the right development tools—it required Sentiance to rethink the entire development process.



## MOBILE MOTION INSIGHTS, POWERED BY EMBEDDED AI

**Sentiance** is a provider of mobile software solutions that derive motion insights from mobile device data and of an API-centric digital coaching platform. Their customer base includes insurance companies and delivery companies.

At the core of their product lies a software development kit that collects motion data from a mobile device. These data are then converted into driving, mobility and lifestyle insights and provided to the application of the customer.

A possible application could be a mobile app for delivery companies to follow up on their drivers, or an insurance app that raises awareness amongst individual car drivers.

## BETTER PRIVACY AND REAL-TIME USER FEEDBACK

From the start, Sentiance had been using AI models and advanced signal processing to infer driving, mobility and lifestyle insights from mobile device data, but these models were running in the cloud.

It wasn't until 2020 when they converted their cloud-based AI implementation into an embedded solution that runs on a smartphone.

They did so for three reasons:

- Cloud processing comes at a cost, while unused processing power is available on the user's mobile device.
- All personal data, like location information, stays on the device, there is no direct risk of data leaks in the cloud.
- Without the latency of sending data to the cloud, more real-time functionalities are available for direct feedback to the driver.

The latter also sets their mobile solution apart from connected car solutions that don't have the info of the driver nor have the direct personal interface to the driver.



## ON-DEVICE TECHNOLOGY, SUPPORTED LOCALLY

The Sentiance platform provides companies with the user insights that allow them to individualise their products & services towards their users. This technology gives them access to user analytics without the need to revert to the products of the big technology companies. Analysing smartphone data can uncover a wealth of information on where and how people are visiting places, their driving behaviour, daily routines, ...

The value for the end users resides in the personalised digital coaching that can be provided based on behavioural insights. It helps users to adopt a better lifestyle, by becoming a safer (professional) driver.

Compared to competing connected car solutions, consisting of a hardware add-on to the car, a smartphone app doesn't have the additional hardware cost. Companies tracking only a limited number of cars, now have access to a cost-effective alternative such that they can start tracking all their drivers. At the same time, the app is tracking the end user and not the car. Being a sensor and user interface at the same time, the mobile solution allows for more personalised user interaction.

## CROSS-PLATFORM COMPATIBLE AI TECHNOLOGY

The software development kit (SDK) works for Android, iOS and the open-source UI software frameworks React Native and Flutter. It has been developed in-house by a team of mobile developers, data scientists and full stack engineers that has grown to about 25 technical profiles. The team has cloud and full-stack (i.e. both the user facing part and the back end) expertise on board for the development of web-based dashboards, integrating external data sources and setting up and maintaining the cloud infrastructure to support that.

When converting their initial cloud-based solution to an embedded solution, the AI models had to be re-architected. The models use location, accelerometer and gyroscope data from the mobile phone sensors to apply classification of the transport mode, detection of driving events and mapping of the venue type. The development team used TensorFlow Lite for the deployment of the models to a mobile device. In some cases, the initial size of the neural network model was either too big to deploy on a mobile platform or not all preferred data sources were available on a smartphone. Sentiance had to find the right mix of development tools and techniques that work together smoothly.

## LESSONS LEARNED ON EMBEDDING AI IN THE PRODUCT

The Sentiance team needed a diverse skillset to develop AI models running on a mobile device. Reaching the same data accuracy levels as their cloud-based counterparts, proved to be a challenge. In terms of privacy, bringing external location-related data, like speed limit information, to the SDK without exposing the user's exact location was another concern.

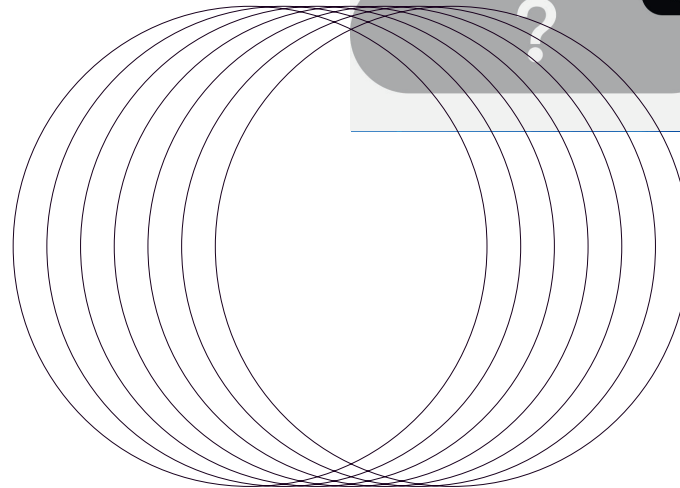
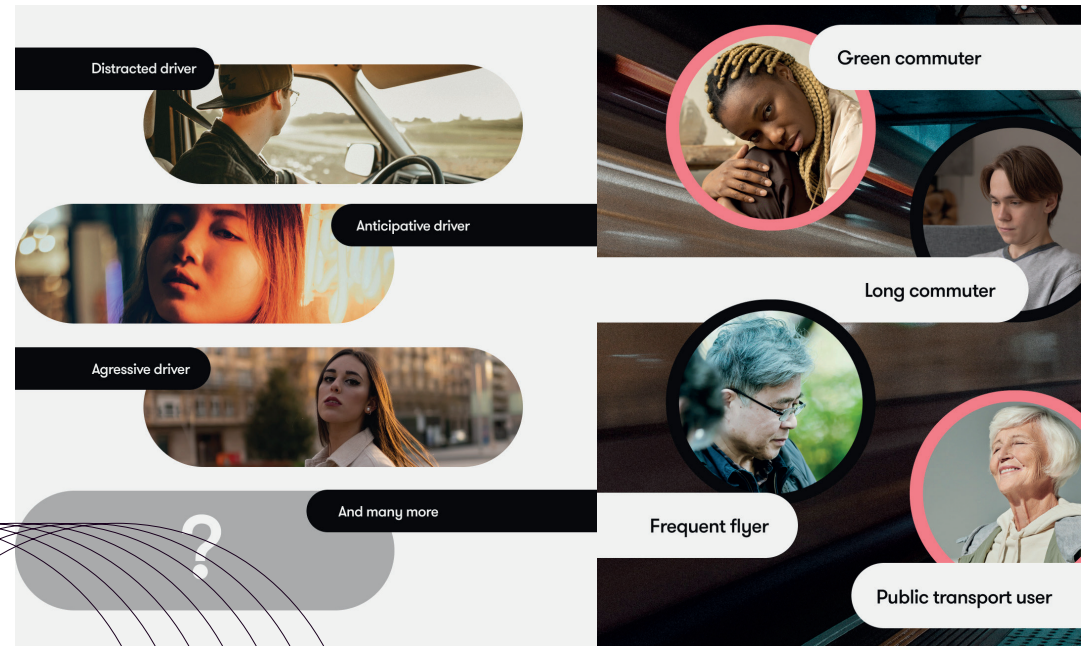
The main challenge, according to Sentiance, is to get the embedded AI integrated in the product. Although a lot of tools have become available, the entire process and effort of data collection and labelling, model training, deployment and maintenance is easily underestimated. Setting up the right feedback loop from products in the field to understand what decisions are made in the embedded system and what is happening at customers across the globe, is key for troubleshooting and debugging.





## WHAT'S NEXT FOR SENTIANCE'S ON-DEVICE MOTION INSIGHTS?

Sentiance is systematically extending their SDK with new features, typically initiated from customer projects. They have embraced the embedded AI approach and would only consider cloud-based features if no embedded alternative is feasible. The use of external data sources in the SDK remains essential for new features. Currently, Sentiance is also targeting new market segments: home, family, employee safety and sustainable mobility.





## CASE 04

### Faster and smarter industrial insights with VersaSense's embedded AI

Initially focused on IoT sensor networks, VersaSense developed a monitoring tool that turns sensor data into actionable insights.

The system is powered by embedded AI and delivers faster and more accurate measurements for production, maintenance, or environmental emissions. VersaSense is working towards a long-term goal of making the platform fully self-serviceable.



## MAKING IOT EASY THROUGH SMART INDUSTRIAL SENSORS

The monitoring platform wants to bridge the gap between industry experts lacking AI expertise and AI experts lacking machinery knowledge. Using wireless battery-powered sensors, a wide range of industrial machines are 'smartified', measuring audiovisual parameters, emissions, temperature, vibration, etc.

The IoT platform by VersaSense combines low-power wireless sensors, edge gateways, monitoring and IoT device management software, and connectivity with external IT systems. Their sensors use wireless mesh connectivity to interconnect efficiently in complex industrial settings. The platform supports various types of sensors, also from third parties, and wireless protocols like LoRaWAN, SmartMesh, NB-IoT, or Wi-Fi. Processed data and analysis results are shared with higher level systems through the integration with a wide range of industrial, IT, and business platforms.

The company focuses on three key industrial applications with its platform:

- For production insights, edge devices near the production line analyse images or sound to monitor quality and detect anomalies in real-time.
- In emission monitoring, the platform measures gas, VOCs, dust, and noise to help reduce environmental impact.
- Vibration and temperature sensors, along with built-in analytics, predict when equipment needs maintenance, sending alerts before failures occur.

The company now targets enterprises active in heavy manufacturing, fast-moving consumer goods, petrochemicals, energy, utilities, and agriculture.

## FASTER AND MORE ACCURATE MONITORING AT THE SENSOR AND EDGE

**VersaSense** focuses on applications where AI delivers clear added value. Although complementary to monitoring by human experts, the prediction models are faster and more accurate and more effective in preventing machine downtime and its associated costs.

The low-power sensor modules aren't designed to transmit raw vibration data because they don't have the bandwidth or power for it. That's where AI-based feature extraction comes into play. The sensor data are fed to AI-based anomaly detection models running on the edge device. These models can be retrained automatically once a maintenance activity has been performed.





## HOME-MADE TECHNOLOGY

VersaSense has developed the entire system in-house and currently has a team of about 6 IoT developers working on system extensions and customer projects. Initially, their focus was on the low-power wireless sensor network and configurable hardware, which later expanded towards analytics and data management to cover the entire technology stack.

Their edge devices for production insights are typically based on the NVIDIA Jetson platform. TensorFlow, Keras and Pytorch are used both for supervised and unsupervised AI model training. TensorFlowLite handles predictive maintenance cases that need AI model inference on the sensor module.



## MORE COMPUTING POWER, LESS OF A HASSLE

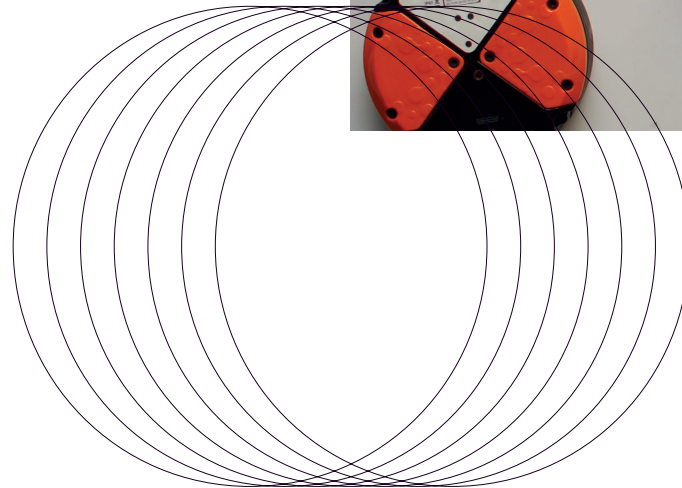
When VersaSense was developing suitable AI models, they had to deal with the hardware constraints of the sensor modules. Things have improved in this area recently. Some applications are still too demanding to be deployed on the smallest sensor controllers. In that case, edge devices provide extra computing power. In any case, the quality of the sensor data is important, not only to train accurate models, but also to obtain accurate predictions once the model is up and running.

As their products were being rolled out all over the globe, the company saw more and more proof of how important it was to make their system easy to use. Customers should be able to set up, train and adjust their system with as little help as possible, especially larger companies that want to use the same technology across several sites. At the same time, people on the production floor are also very busy with day-to-day tasks and often don't want to spend time tuning the system.



## WHAT'S NEXT FOR THE VERSASENSE IOT PLATFORM?

Today, VersaSense products are used by enterprise customers in over 35 countries worldwide. The company is growing fast and wants to deliver more value to existing customers. Sometimes the insights derived from basic monitoring already pay off, but there is still a lot of untapped potential in applications where conventional rule-based decision making is inadequate.





## CASE 05

### A digital nose for gas: how embedded AI boosted VOCsSens microsensors

With their low power microsensors VOCsSens, is paving the way towards IoT applications for gas monitoring. Thanks to embedded AI, the performance of these sensors can be significantly improved without sacrificing battery power for continuous cloud data transmission. While the hardware is being optimised for large scale production, VOCsSens is elaborating their AI algorithms.



**VOCsSens** develops self-calibrating, ultra-low-power and selective multi-gas microsensors. These sensors are used in solutions for monitoring pollutant gases in agri-food and recycling companies (especially ammonia in livestock farming), detecting gas leaks in the chemical and oil & gas industry, and improving air quality through climate control in smart buildings, among others.

## MICROSENSORS AND SOFTWARE FOR ACTIONABLE INSIGHTS

VOCsSens' flagship product line, EnviCam®, is a semiconductor chip with multi-gas sensing capabilities. Gases are measured through a chemiresistive transducer array. This array consists of polymer and nanomaterials, where every "pixel" or electrode of this array allows to measure a different type of gas or gas family. This type of sensor represents a large scale and cost-efficient production in comparison with traditional gas sensor technologies such as metal oxide (MOx), electrochemical, infrared-based (NDIR) and photoionization-based (PID)- sensors.

EnviSoft is the software that turns raw gas data into actionable insights on the surrounding target gas concentration. It automatically calibrates the gas measurements and compensates for temperature, humidity, false readings because of gas cross-sensitivity, and aging-induced drifts. The software can be deployed at all levels of the gas sensing chain: at the sensor device, at gateway or at server level.

## WHY IS GAS SENSING SO HARD, AND HOW TO KEEP IT LOW-COST?

Parasitic influences such as temperature, humidity and drift, complicate the correct processing of sensor data. VOCsSens' AI-based algorithms self-calibrate the sensors and compensate for these influencing factors towards reduced- or maintenance-less applications.

For security and economic reasons, VOCsSens' target audience prefers local, near-sensor data processing over cloud-based alternatives. The applications require battery-powered solutions with a long operational lifetime, making low-power local processing preferable to energy consuming cloud transmission. Besides low-power, local data processing also keeps the sensor low-cost. That's why VOCsSens is focusing on embedded AI to further improve their microsensor performance.

The low-power multi-gas microsensors are more cost-effective than competing technologies because they offer a 'lower cost per gas' measurement. They have an extended operational lifetime and require minimal configuration, which keeps the operational costs down. And they're easy to install on a circuit board, so integration costs are equally low.

That's why these sensors are perfect for IoT deployments, where AI-based algorithms help achieve more complex tasks and more accurate measurements. As a result, fire detectors could not only detect the presence of fire, but also indicate the type of fire.

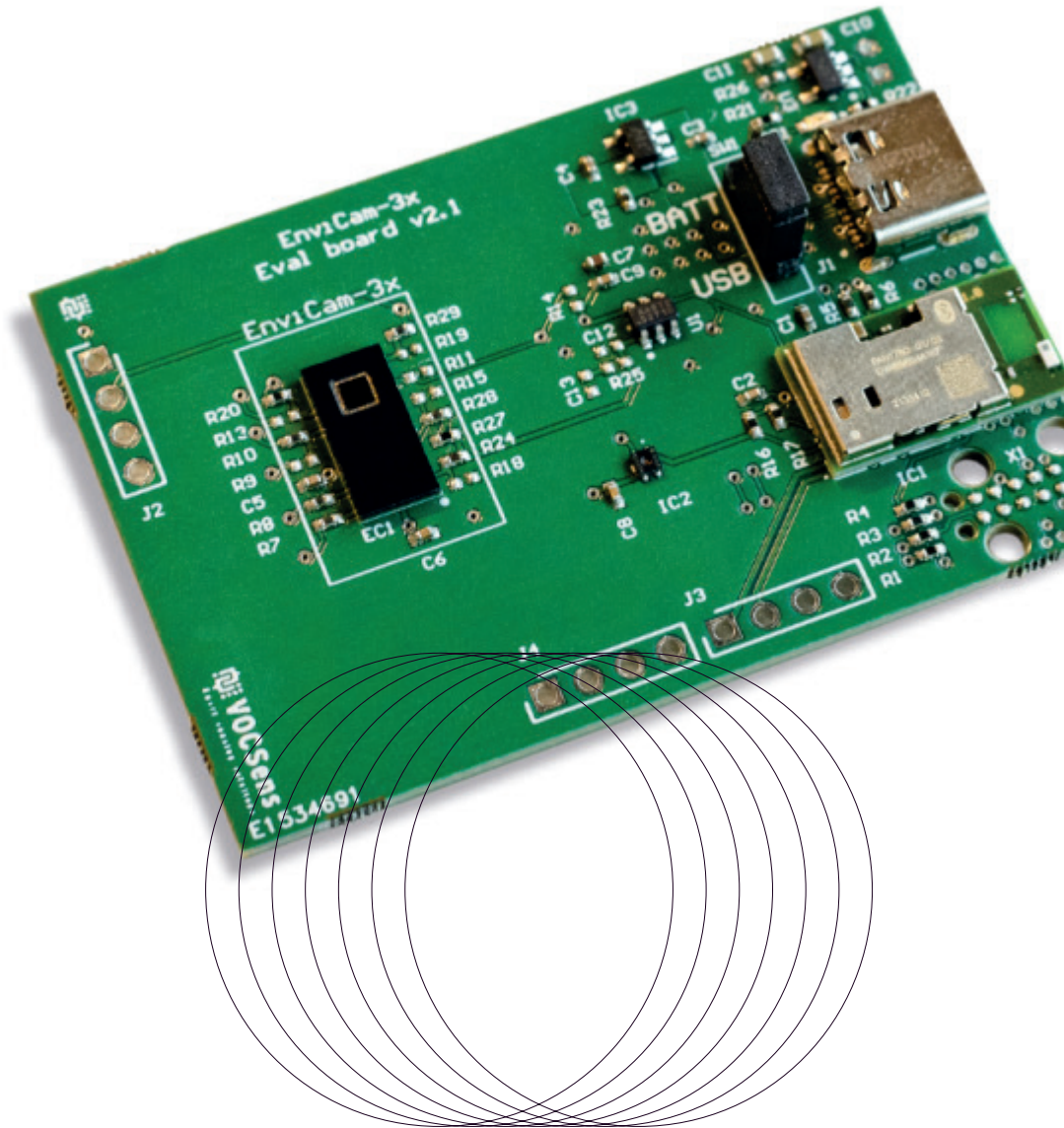


## TECHNOLOGY AND DEVELOPMENTS BEHIND VOCSSENS' AI SOLUTION

VOCSens dedicates their development focus on new sensing materials and ASIC (application specific integrated circuits). Their software team is developing the embedded (at the sensor) and server implementations of the gas measurement software (a software at the gateway is expected for a midterm future). For the AI-based algorithms, the company is working on constrained deep learning techniques with University of Namur (UNamur). These algorithms are still being improved, especially to deal with the cross-sensitivity and drift characteristics of the sensors. Getting the right performance out of the AI model is their main challenge in that respect.

## WHAT'S NEXT FOR VOCSSENS' AI-BASED GAS SENSING SOLUTIONS?

Currently, VOCSens is focusing on finalizing the industrialisation of the final hardware design, aiming to launch production in the course of 2025. At the same time, the prototypes currently active at their customers and in controlled environment in several laboratories are already providing valuable data to improve the AI algorithms. The company is also exploring other markets and applications, like early fire detection, battery thermal runaway monitoring and in a later stage, disease monitoring and help for medical diagnosis.







## Conclusion: The larger scope of the EmbedML project

The European EmbedML project aims to accelerate the integration of machine learning in products with embedded hardware.

This casebook has been realised within the framework of the EmbedML project, a COOCK CORNET initiative (reference: HBC.2021.0894), funded by Flanders Innovation & Entrepreneurship (VLAIO).

The EmbedML project is changing the game for SMEs looking to integrate machine learning into their products with embedded hardware. It's making advanced technology more accessible than ever! By focusing on practical tools, best practices, and real-world case studies, EmbedML speeds up the development process from feasibility to proof-of-concept and beyond. From predictive maintenance in manufacturing to patient monitoring in healthcare, the potential of embedded ML is huge. And now, thanks to EmbedML, it's within reach of more companies than ever.

The project is helping companies adopt embedded ML through a mix of workshops, seminars and tailored support. It'll help them avoid development risks and costs, and it'll also encourage them to work more closely with other supply chain businesses.

The real value of EmbedML is in how it can make vertical applications more efficient, automate low-level tasks and let people make decisions at a higher level. With the tools and support it provides, companies can create new value, improve product performance and stay ahead in the fast-changing tech landscape.

Eager to find out what embedded machine learning can do to leverage your product? Or could your project benefit from the webinars or workshops hosted within the EmbedML framework?

Feel free to contact us via [innovation@sirris.be](mailto:innovation@sirris.be)





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