



# A Wearable Revolution

*How cloud-connected wearable solutions  
are transforming healthcare, sports, and  
tough working conditions*

EVALAN

## Summary

Wearables are quickly becoming an essential part of our world. From smartwatches to smart glasses, more and more products are finding their way into consumers' lifestyles. Beyond casual uses, wearables are also becoming critical solutions across a range of industries, from healthcare to sports. By combining wearable tech with the Internet of Things (IoT), users can gather more accurate, and more valuable, real-time biometric data than ever before. Applying this winning combination can lead to increased efficiency, higher performance levels, and improved safety.

In this whitepaper, we will explore the immense application potential of wearables. Specifically, we will look at the growing role of wearable tech in three key areas:

- Healthcare;
- Sports;
- Occupations with tough working conditions.

By examining current and future applications, we will see how wearables are becoming crucial tools in helping us to solve pressing issues in these fields.

Following this exploration, we look at a key innovation that has the capacity to change the game: cloud-connected wearables, their application potential, and benefits. We conclude by observing how wearables are a key tool that will change our world – and how adopting them in your company can transform the way you operate.

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## Introduction

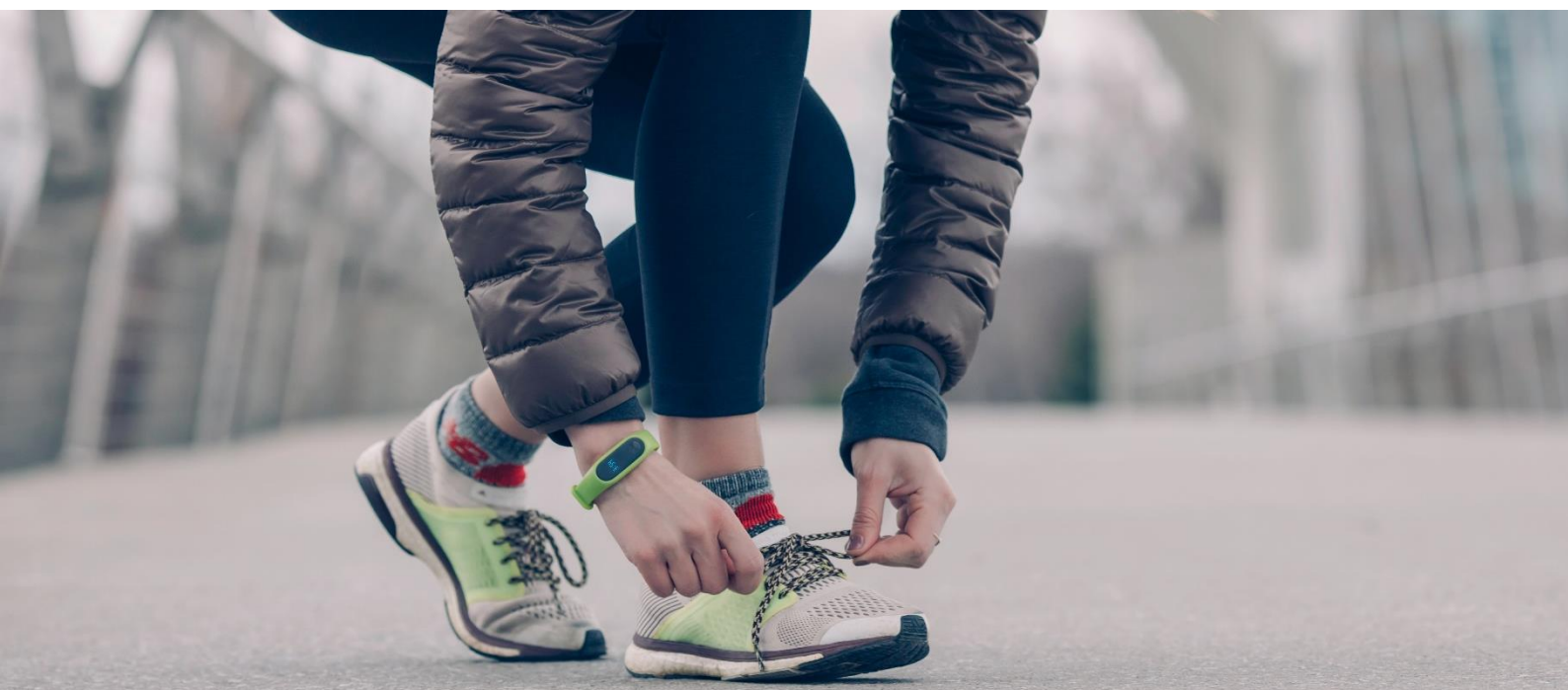
### An interconnected world

Today's world is built on interconnectivity. From smart homes monitoring our energy usage to wireless inventory trackers, the Internet of Things (IoT) has connected devices across every aspect of our daily existence. In fact, one study predicts that 35 billion IoT-connected devices will be in use across the world by 2021. With this level of interconnectivity comes more data than mankind has ever produced. As IoT solutions and advanced sensors allow for more accurate real-time data gathering, we are witnessing a revolution in how we work and live. Up in the front lines of this revolution, we see an exciting phenomenon: wearable technology.

### What are wearables?

By definition, 'wearables' are smart electronic devices that the user wears on the body. These devices detect and monitor data about the wearer and/or their surroundings. They can vary from biometric stats to environmental information, such as location or weather conditions. The wearable device transmits these data wirelessly to a platform, such as an app on the wearer's phone. The Fitbit is a good example: among other vital statistics, it tracks your heart rate during exercise, helping you to optimize your sports routine and monitor your progress.

As technology evolves, wearables are becoming more sophisticated, with the range and the precision of the data being gathered increasing every year.



### **Textiles that can communicate and support the wearer**

One exciting and rapidly evolving field in the wearables industry is that of smart textiles. Smart textiles, also known as e-textiles, are clothing materials made of fibres, filaments or yarn – knitted, woven, or non-woven – with subtly integrated electronics that enable them to interact with the wearer and with his or her surroundings. The electronics consist of sensors, actuators, and control units. These materials can be made to sense and react to thermal, mechanical, chemical, magnetic, electrical, or other sources of environmental stimuli. In addition to tracking data, as wearable devices do, smart textiles are being developed with the capacity to conduct energy, to communicate, and more. They are used in different fields, from sports and the medical field to the military and aerospace. Examples include fabrics that absorb sunlight and convert it into thermal energy, helping to regulate body warmth; clothing that changes colour in response to changing external temperatures; headwear with built-in speakers; sleeves with various functionalities and connection possibilities built in, such as alert functions; or garments that monitor and actively correct the wearer's posture.

### **Wearables on the rise**

Wearables and wearable gadgets are already a part of daily life for many people. Surveys back up this trend. Some researchers estimate that the number of connected wearable devices in operation across the world will hit one billion by 2022.

The growth potential for the industry is equally impressive: it is predicted that the IoT-enabled wearables market will grow by 2.29 billion USD between 2020-2024, with a compound annual growth rate (CAGR) of 14%. If one thing is clear, it's that wearable technology will soon be as much a part of day-to-day living as the clothes we put on every morning.

**The Internet of Things (IoT) has connected devices  
across every aspect of our daily existence**





## Looking forward with wearables

The consumer market, with wearable devices like smartwatches, is not the only growth area – or even the most important one. Wearables are quickly becoming vital solutions in professional contexts. As the uptake of IoT and advanced sensors paves the way for new wearable solutions, recognition of the benefits of wearable tech is growing. This applies especially to fields in which people depend on continuous and precise data monitoring. In this paper, we will look at wearables in three professional application areas:

1. Healthcare
2. Sports
3. Physically demanding professional settings, like firefighting, military training and certain industrial processes

In each of these areas, wearable tech is contributing to major steps with regard to safety, health and optimized conditions.

In the next section, we will take a closer look at these three key application areas for wearable solutions, and explore why it is important to adopt early.

## How wearables are changing the game: 3 application areas

### Why wearables?

Why are wearables going mainstream? Sure, fashionable gadgets will always enjoy popularity, but why are wearable solutions becoming more significant in our world? The answer is simple: the potential for ultra-precise real-time data gathering can make a major contribution to our health, safety, wellbeing, performance, and enjoyment. In some cases, as we will see in this section, their contribution can be critical and even lifesaving. As technology develops, the sensors used in biometric wearables are becoming more advanced, offering users ways of monitoring vital signs 24/7. In healthcare, sports, and physically demanding occupations, these are game-changing opportunities.

*“Wearables are moving from useful to critical”*

*Carolina Milanesi, Forbes*

### Where are wearables making a difference?

In order to appreciate the growing role of wearables worldwide, we will look at three leading application areas: healthcare, sports, and fields with tough working conditions.

#### I. Healthcare

##### **An industry in crisis**

With populations growing and aging, hospitals and healthcare providers are under pressure. The COVID-19 pandemic has added to the pressure and complexity of providing adequate healthcare. One result of the current challenges is a deficit of trained staff, with the World Health Organization predicting a shortage of almost 13 million healthcare workers by 2035. How can we support one of the most vital services in our world? And with rising healthcare costs, how can we ease the pressure on our economy? How can we create a new, futureproof healthcare system?

Wearables offer a lifeline to overburdened healthcare providers. More specifically, the use of biometric sensors and IoT solutions can alleviate the strain on healthcare providers and their staff, from hospitals to care homes. This is why IoT in healthcare is already an area of rapid growth, with the industry expected to be worth 534 billion USD by 2025.



### Remote patient monitoring

So how do wearables support healthcare providers? The key benefit of wearable biometric sensors comes from their capacity for remote monitoring. With today's innovative sensors, wearables can track any number of biometric parameters, including a patient's heart rate, blood pressure, and temperature. All the precise data can be collected and recorded automatically and remotely. For example, if a patient's blood pressure suddenly rises, an automated system can recognize it and notify a doctor immediately. While the patient's condition remains stable, the doctor can spend time with other patients. An added benefit is that this approach gives patients the option to be monitored at home, with more comfort, and potentially greater control over their own treatment.



## **The benefits of remote monitoring in healthcare**

Here are some of the clearest benefits of adopting remote monitoring in healthcare institutions:

- **Improved focus and performance at work**  
With continuous remote monitoring, healthcare professionals can focus on the job at hand, while routine checks like taking a patient's temperature and blood pressure can be done automatically. This will play a large role in alleviating the strain on healthcare providers in the years ahead.
- **Improved healthcare quality**  
With accurate and precise biometric sensors, the risk of human error is reduced drastically. Meanwhile, large amounts of accurate data provide doctors with more tools for prescribing personalized treatments, helping to raise treatment quality levels and patient outcomes.
- **Less hospitalization**  
The combination of at-home monitoring and improved healthcare treatment will reduce the frequency and duration of hospital stays. This means healthcare providers will be under less pressure, while also helping to control rising healthcare costs.
- **Better patient experience**  
With remote monitoring, patients can enjoy a better treatment experience, whether at home or in a healthcare institute. For example, older patients with wearable devices may be free to walk around a care home; if they fall, their wearable will detect the fall, and notify staff immediately, showing their location, too.

## **Transforming healthcare**

Wearables are another step toward equipping healthcare providers and patients alike with everything they need to survive and thrive in the new era of eHealth, while supporting them through the challenges they face today.

*To find out more about the transformative potential of IoT in healthcare institutions, download Evalan's whitepaper ['How to get your Hospital or Health Centre Wired for the Age of Smart Care'](#)*

## II. Sports

### Winning with data

In sports, increasing performance levels, even marginally, is essential for success. To get ahead, more and more athletes, teams and coaches utilize data, monitoring and analysing vast amounts of biometric information in order to improve performance. For example, by equipping soccer teams with wearables during training, their coaches can record and monitor the position of their players in real-time, alongside their speed, metabolic load distance, acceleration, and dynamic stress load, enabling them to work on their tactical game-plan and movement to a new level of detail, while maintaining optimum fitness. In athletics, solutions ranging from basic heart rate monitoring to sleep tracking facilitate more personalized – and therefore more effective – training programmes. In sports like ice-skating, wearables can reduce the risk of injury as well as over- or under-performance by tracking the number of jumps a skater makes, as well as the gravitational, rotational and other forces at play in this sport. For Olympic athletes and their coaches, wearables are becoming more and more commonplace.



### **Faster rehabilitation with SensiStep**

Wearables can help athletes dealing with injuries, too, from initial treatment to physiotherapy and rehabilitation. For instance, athletes and their physiotherapists can use accurate data to support a successful recovery programme. Evalan's SensiStep solution uses sensors, a wearable, a tablet, and a web portal to offer real-time feedback regarding the strain and load on a patient's leg. The physiotherapist can use these data to guide the patient to recovery with scientific precision, while the patient enjoys greater confidence in the instructions given. Solutions like these facilitate better treatment and quicker recovery, while saving on healthcare costs.

### **Wearables in sport**

Wearable tech is starting to have a noticeable influence on the sporting world, both among professional and recreational athletes. Whether it is used for tracking performance, monitoring temperatures to keep athletes safe, or supporting sportspeople during injury rehabilitation, wearables offer real benefits that more and more sports lovers are tapping into.

Solutions ranging from basic heart rate monitoring  
to sleep tracking facilitate more personalized  
training programmes.

### **III. Tough working environments**

#### **Prioritizing safety through wearables**

In fields with tough working conditions, safety is a top priority. Think of the military or firefighting. There are also many industrial settings where workers face challenging circumstances, for example, in dealing with hazardous substances, high temperatures or complex and powerful equipment.

Wearables offer ways of developing new safety practices without jeopardizing high performance levels: they enable these professionals to continue their vital work,

while reducing the risk of serious injury. One application is remote monitoring of vital statistics during training or in action. For example, by monitoring a firefighters' biometric data through a wearable – while also tracking environmental statistics, like air temperature and CO2 levels – a remote team member can predict when dangers will occur and step in.

### **Monitoring the load carried by soldiers**

Being a soldier is physically demanding. While the risk of overburdening soldiers has been known for a long time, objective measurement has been impossible for officers. By integrating sensors in army boots, officers can continuously monitor the weight of their soldiers' backpacks. With these objective data, they can prevent overburdening, helping to push soldiers to optimum performance levels without undue risk.

On top of this, modular solutions allow for multiple measurements, including body position, energy consumption, and heart rate. This gives officers even more insight into the physical state of each soldier. The result is that soldiers can continue to train and operate at the highest physical level possible, while maintaining safety standards.



## Higher performance and safety levels

Overall, wearables are a major opportunity in fields with tough working conditions. Monitoring biometric data allows the workforce to continue to push themselves while staying safer than before, whether in training or in the field. This is one reason why the industry is growing so quickly: the military wearables market, for instance, is projected to hit 6.4 billion USD by 2025, with a CAGR of 7.2%. As we move forward, wearables will gain a central place in these fields, raising performance and safety levels and saving lives.

## Adopting wearables

If you are thinking about adopting wearable tech similar to the solutions highlighted above, there are a number of different ways in which you can get started.

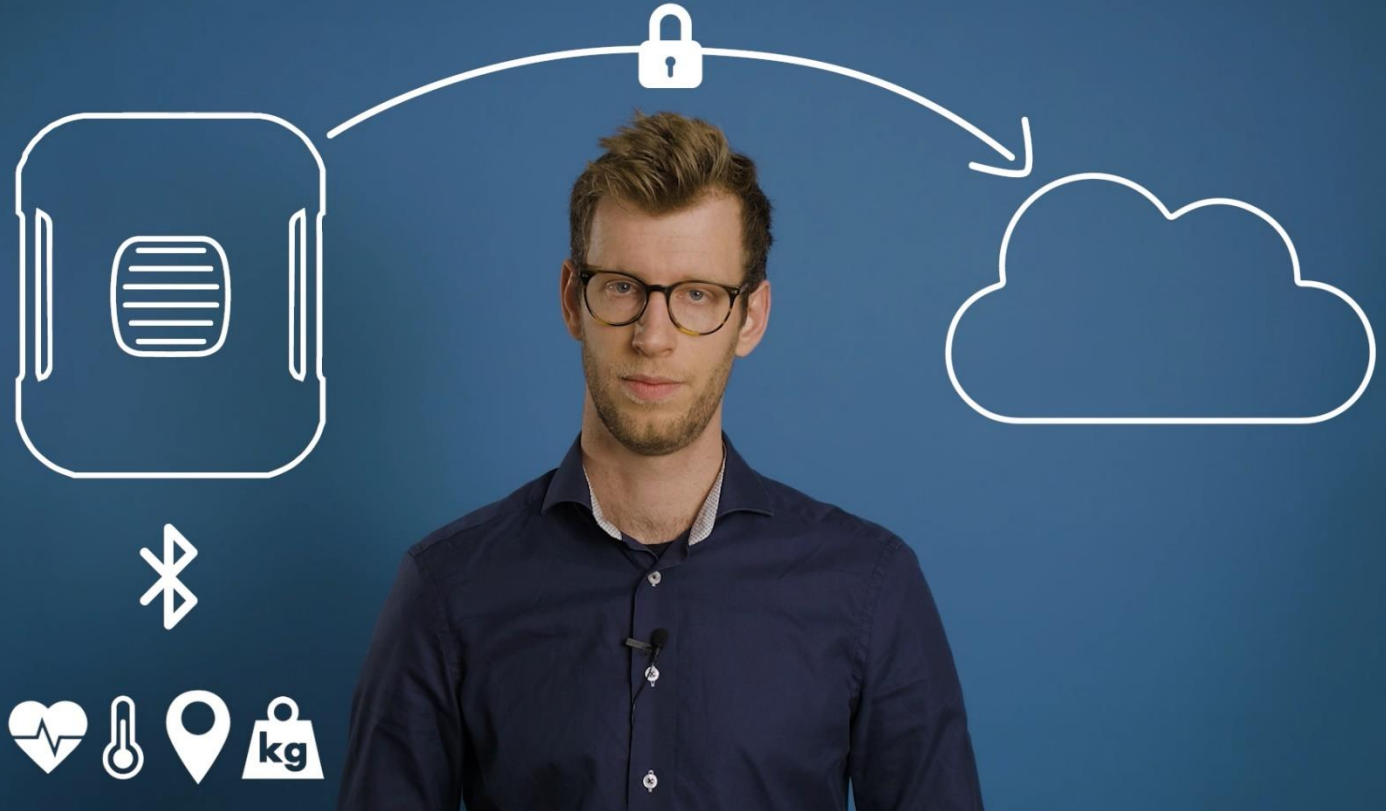
- Do you want to deal with a single issue? Then you can adopt a troubleshooting wearable that fixes your problem. For example, the ARMOR case study above saw officers struggling with overburdened soldiers, so they used a wearable solution to answer this specific need.
- Do you want to overhaul your entire operation? In that case, adopting a large-scale IoT-integrated wearable solution is also possible. Think, for example, of remote monitoring in a healthcare institute like a care home.

With simple IoT-based wearable solutions, you can increase efficiency, safety, and performance cost-effectively. It's important to remember that these wearables can be tailored to your unique needs. Getting in touch with experienced experts and discussing your options is one way to guarantee successful integration.

## A new leap forward in wearable tech

While wearables are already advanced, another leap forward in wearable tech is already taking place: cloud-connected wearables. In the following section, we will explore the advantages this innovation can offer in healthcare, sports, and physically demanding occupations.





## Cloud-connected wearables

Uninterrupted, real-time, remote data monitoring

Cloud-connected wearables represent one of the many advancements being made in wearable solutions today. Like other wearables, cloud-connected wearables collect data about the wearer and/or his or her environment. The key difference: while non-cloud-connected solutions store data locally and upload occasionally, cloud-connected devices are made to continuously send biometric data directly to the cloud, 24/7. They allow for uninterrupted, real-time, remote and highly accurate monitoring of data – advantages we will look at more closely in this section. This technical innovation simplifies and upgrades the entire process of biometric monitoring, leading to new, cutting-edge, and easy-to-adopt monitoring solutions for the fields that need it most.

Cloud-connected devices are made to continuously send  
biometric data directly to the cloud, 24/7

Why are cloud-connected wearables so valuable?

Cloud-connected wearable solutions offer striking benefits over non-cloud-connected wearables. Let's look at the main ones.

### *True continuous monitoring*

While other wearables store data locally on your device and upload to the cloud periodically, cloud-connected wearables send data to the cloud continuously, 24/7.

### *Increased range*

By relying on Bluetooth connectivity, many wearables have ranges limited to their local setting – usually a few hundred metres at most (in many cases, these devices rely on the reach of the user's smartphone, which has to be kept near the device).

With cloud-connected wearables, the range becomes far wider, offering new application potential for long-range continuous monitoring. In fact, using LTE-M technology offers an unlimited range, as long as there is coverage by the (4G) mobile phone network.

### *Simpler, faster, safer*

As they're connected to the cloud all the time, cloud-connected wearables simplify the data transmission process, making it quicker and safer. Rather than using a short-range connection like Bluetooth to 'hop' to a gateway, cloud-connected wearables reach the cloud instantly. This drastically reduces the risk of data loss.

### **Why is LTE-M best for wearables?**

Based on 4G, LTE-M has been specifically developed for mobile IoT solutions. LTE-M is a form of cellular connectivity, which offers stable connections, even in high-density environments. This is because LTE-M doesn't restrict cellular reach: instead of having to operate within a single cell, you can move and communicate freely between cells. One benefit of this is that it's energy-efficient – an important value adder for biometric wearables that are in operation 24/7. There are other benefits too: LTE-M allows for low-cost solutions with a longer battery life, a secure reach over larger distances, and scalability. LTE-M, in short, is the ideal solution for next-gen IoT devices, like cloud-connected wearables.

With these benefits, we can create new applications that would not have been possible before. Here are some examples.

### **Healthcare**

As we saw earlier, wearable monitors are becoming vital to healthcare providers. Cloud-connected wearables offer new benefits, wider application potential, and more flexible usage. For example, if a patient has a condition that requires continuous monitoring, like a heart defect, he or she would traditionally stay in the hospital for a few days. With the increased range of cloud-connected wearables, staff can remotely monitor this patient 24/7, whether he or she is at home or on the go. This can improve the quality of healthcare offered, reduce hospitalization frequency and duration, reduce staff workload, and improve the patient experience.

### **Sports**

In sports, the key benefit of cloud-connected wearables is clear: long-range transmissions. Without needing to rely on Bluetooth, sports that take place over bigger distances can now also take advantage of continuous biometric tracking. Think, for example, of long-distance runners or swimmers, cyclists and mountain bikers, or climbers.

### **Tough working environments**

The increased radius of action offered by cloud-connected wearables can help those working in tough environments, too. It adds new opportunities to solutions based on Bluetooth. For example, the load monitoring solution for soldiers mentioned earlier, is Bluetooth-based. This is ideal for military teams entering geographies lacking 4G coverage: as long as the officer monitoring the soldiers' load is near the soldier, the solution will work perfectly without 4G. The added advantage of cloud-connected wearables is that in areas that do offer stable 4G coverage, the officer can monitor continuously over far greater distances, without the risk of losing the connection or missing out on important data.

## Cloud-connected wearables in action: BACE Go

### **BACE: Building A Connection Everywhere**

Evalan's BACE Go communication module is an example of a cloud-connected wearable solution. It can collect all kinds of biometric data, giving a clear picture of the physical condition of the wearer. Think, for example, of heartrate, weight, oxygen saturation, blood pressure, body temperature, hydration, or fall detection.

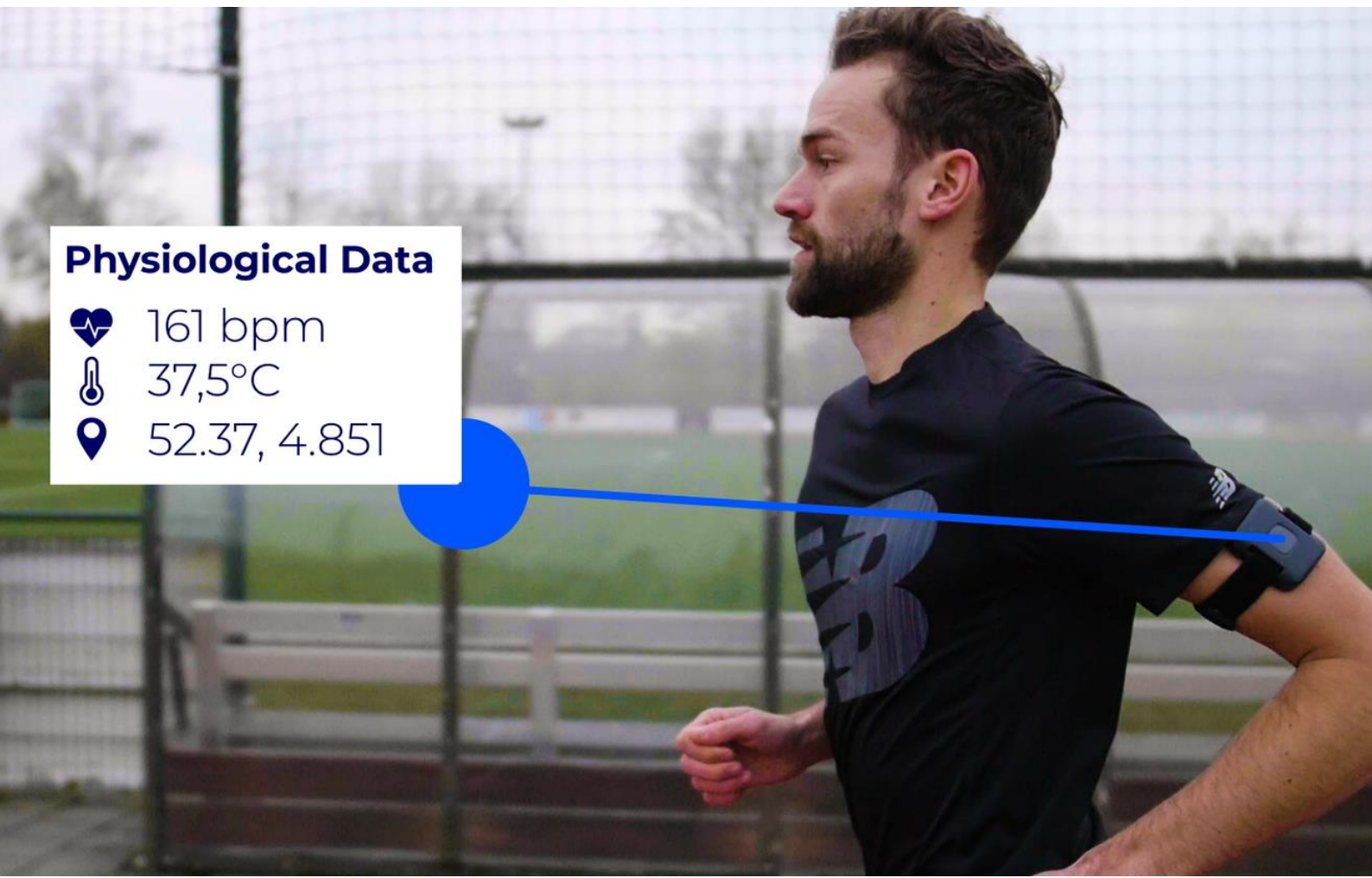
By simplifying the communication process, allowing for continuous cloud communication, and offering long-range transmission, the BACE Go wearable is fully optimized for biometric monitoring.

### **Technical specifications**

- 5-year battery life
- Built-in accelerometer and gyroscope
- 4G (LTE-M) connection with 2G fallback
- KPN ChipSim, GPS, and Bluetooth

### **Physiological Data**

♥ 161 bpm  
🌡 37,5°C  
📍 52.37, 4.851



## Wrapping up: The future of wearables

### The wearable revolution

As we have seen throughout this whitepaper, wearables are becoming an indispensable part of our lives, from high street to hospital. Whatever field you are working in, wearables could play a role in improving efficiency, performance, and safety. They have the potential to transform your entire working environment simply and cost-effectively. Whether you adopt a standard biometric device to troubleshoot a single issue or have a complex IoT package developed to transform your workplace, wearable solutions give you a way to overhaul your operations and improve in almost any way you want to – the only limits are your vision and ambition.

In the health sector, pressure on the health care system calls for smart solutions that facilitate higher efficiency and better treatment. In sports, data analysis can power new and inspiring human achievements. In physically demanding occupations, tech can contribute to workers' safety, improved performance and the saving of lives. As cloud-connected wearables gain ground, they can contribute to a better world for many people. By adopting early, you can survive, grow, and get ready to move with a changing world: particularly if you operate in healthcare, sports or a tough working environment, embracing the wearable revolution will help you become truly futureproof.

### Getting started

If you are interested in pursuing a wearable application, there are a number of ways you can get started. From entry-level solutions to all-encompassing biometric systems, you can find the ideal way to integrate wearables into your field of work. At Evalan, we work with a range of organizations across diverse markets, from healthcare institutions to the army. We can support you in your adoption of wearables, finding the best solution for your challenge.



## About Evalan

Evalan is a fast-growing and innovative development and application partner in the field of the Internet of Things. We work in close collaboration with our customers to achieve the best results possible. Evalan focuses primarily on remote monitoring, biometric measurements, and telemetric solutions for the healthcare, industry, and government sectors. We develop mobile devices, sensors, data management systems, data processing algorithms, and user interfaces for different platforms. We serve around 100 clients, ranging from large multinationals like Heineken and Unilever to government departments like the Ministry of Defence to hospitals and small technology companies. Evalan has been ranked by the Chamber of Commerce among the 100 most innovative Dutch small to medium-sized enterprises several times. The company was founded in 2005. From our offices in Amsterdam, we track assets in over 50 countries. Find out more at <https://evalan.com>. Or follow us on [Twitter](#) or [LinkedIn](#).

If you are interested in exploring the possibilities of wearables, we invite you to contact us today. We look forward to discovering the real potential of wearables with you.

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