DEVICE INSIGHT

grand centrix

WHITEPAPER

NARROWBAND IOT FOR SMART PRODUCTS

Successful Implementation with Plug-and-Play Solutions

www.grandcentrix.net

EXECUTIVE SUMMARY

Low Power Wide Area (LPWA) Networks, in particular the mobile radio standard Narrowband IoT (NB-IoT for short), are becoming increasingly important, also in enabling the implementation of completely new IoT use cases.

This is, on the one hand, due to the low costs and high scalability of Narrowband IoT, and on the other, to the high building penetration offered by the transmission standard. The combination of these advantages makes Narrowband IoT the ideal technology for a wide range of applications, from Smart Metering to Smart City and intelligent control of building infrastructure to Smart Farming. Narrowband IoT opens up completely new possibilities for companies – for greater process efficiency, transparency, new services and business models, and in return, new revenue potential.

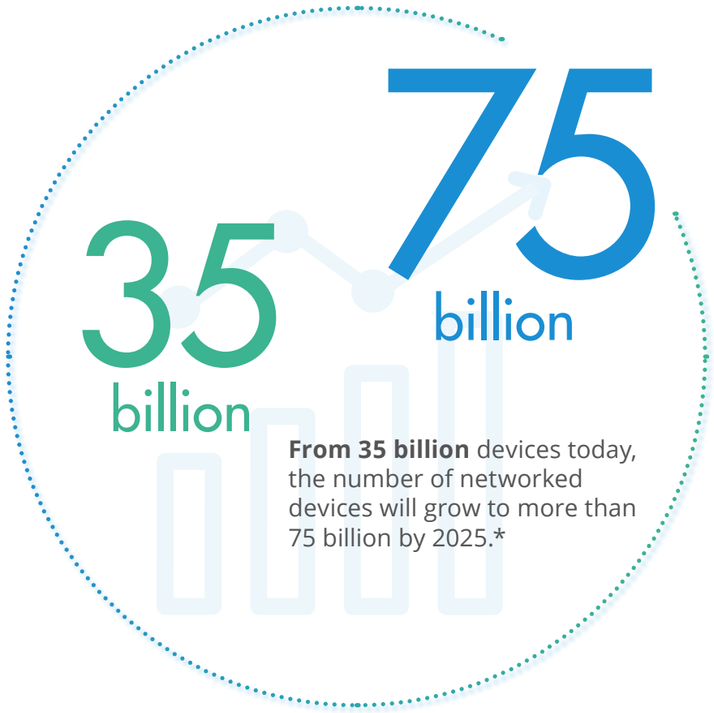
To enable companies to get started with Narrowband IoT quickly and cost-effectively, the two IoT specialists grandcentrix and Device Insight have created a holistic end-to-end approach. For this purpose, technologies and product components – from hardware and connectivity to the development of the IoT solution, user interfaces and apps – as well as project management are closely interlinked. This can massively accelerate the design and development of scalable NB-IoT solutions.

This is also shown by the example of Stiegelmeyer. The manufacturer of hospital and care beds has collaborated with grandcentrix and Device Insight to develop a digital out-of-bed system based on Narrowband IoT capable of relieving caregivers and significantly improving safety and comfort for both residents and patients.

NARROWBAND IOT OPENS BRAND NEW AREAS OF APPLICATION FOR THE INTERNET OF THINGS

The Internet of Things makes it possible to network a wide variety of things – vehicles, machines and devices of all kinds. According to forecasts, the number of networked devices will exceed the 35 billion mark for the first time in 2021 and grow to over 75 billion by 2025.*

This IoT boom has occurred as more and more companies, as well as private individuals, are recognizing the advantages of the Internet of Things, seeking to use them for themselves. However, a crucial prerequisite for exponential growth is also the further development of technologies and transmission options, making applications affordable and easy to use. In particular, so-called Low Power Wide Area (LPWA) networks and, above all, Narrowband IoT have again significantly increased the attractiveness of possible IoT use cases.



* Source: Statista

// What exactly is Narrowband IoT?

Narrowband IoT is a mobile communications standard that is already widespread in Asia and the USA and is now increasingly finding its way into Europe. NB-IoT is an extension of the LTE standard and uses existing mobile communications infrastructure, i.e., antenna locations, as well as previously unused frequency bands. This is what makes this offering so efficient for wireless carriers, resulting in low prices for users.

Unlike 5G or LTE, with its low bandwidths, Narrowband IoT is specifically designed for low data volumes, i.e., the transmission of telemetry data and control information. In addition, Narrowband IoT offers optimized, low energy consumption and, by operating at low frequencies, particularly good building penetration, which allows it to be used within building structures.

Narrowband IoT therefore also paves the way for applications where IoT deployment previously failed due to economic viability or was not technically possible due to power supply and environmental requirements. This is especially true for application areas involving the networking of stationary items. In other words, applications that do not require high data rates can be mapped flexibly, cost-effectively, and even internationally, the ideal prerequisite for implementing applications with very high quantities.

ADVANTAGES OF NARROWBAND IOT AT A GLANCE

Low Cost

Narrowband IoT works with very small amounts of data, resulting in low energy consumption. Devices only require power when data is being sent or received and remain in a power-saving mode most of the time. As a result, battery sleep times of more than ten years can be achieved.

Low Complexity

With pre-installed SIM cards, Narrowband IoT enables plug-and-play applications, requiring significantly less complexity in commissioning than, for example, LTE, WLAN or Bluetooth applications, further reducing costs, making it quick and easy to get started with the technology.

High Scalability

A low cost per networked device coupled with reduced complexity provide perfect conditions for high scalability. Since the standard is now internationally widespread, devices can also be networked and operated across the globe via Narrowband IoT.

Strong Coverage

High building penetration makes Narrowband IoT the ideal transmission standard for use cases inside buildings, especially if existing internal network infrastructure cannot be accessed. The signal is also able to penetrate through thick walls and into basement rooms – a huge advantage for smart metering, for example, intelligent electricity, water, or gas meters. Due to the low frequency of NB-IoT, signals also have a long range, further increasing the number of possible use cases, for example in agriculture and forestry.

Security and Reliability

Unlike other LPWA networks such as LoRaWAN, Narrowband IoT is a licensed cellular standard featuring all security and privacy features of cellular networks, including data integrity, confidentiality, or secure authentication. Moreover, with NB-IoT, the provider is able to guarantee good transmission quality.

NARROWBAND IOT IN PRACTICE

The range of application areas for Narrowband IoT is huge, ranging from Smart Metering to Smart City and intelligent control of building infrastructure to Smart Farming. Many of these use cases can be realized more cost-effectively and securely thanks to the advantages of Narrowband IoT. This technology opens completely new possibilities for companies – **for greater process efficiency, transparency, new services and business models, and in return, new revenue potential.**

// Typical Narrowband IoT Use Cases

Smart Metering

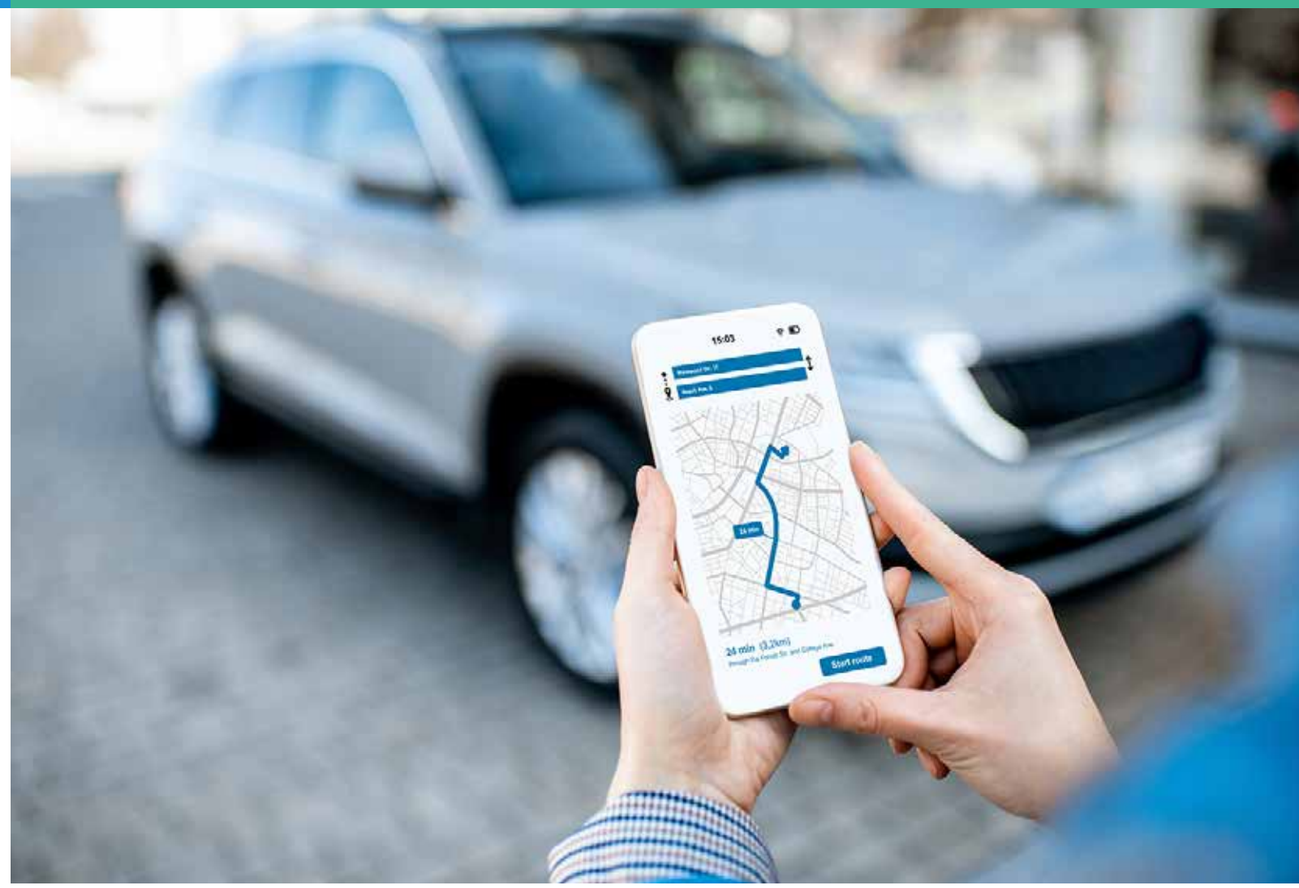
Networking of electricity, water or gas meters is an application area that is virtually predestined for the use of Narrowband IoT. To network a meter intelligently, i.e., to make it IoT-capable, you do not need large amounts of data. In addition, NB-IoT's strong coverage is perfectly designed to transmit signals from smart meters, which are typically located in basements.

Consumers therefore benefit from the convenience of automated transmission. They receive a transparent and detailed overview of their current energy consumption and are able to recognize where the power guzzlers are in the household and how energy can be saved. **Smart Metering also enables companies to significantly improve their energy management, save costs and conserve resources at the same time.** In addition, building managers no longer need to read the electricity meters.

The benefits of Smart Metering go much further: Smart meters provide the basis for efficiently integrating electricity from renewable energy sources into the grid, balancing out power fluctuations and optimizing grid utilization overall. This transparency regarding current electricity generation and consumption enables completely new business models such as dynamic electricity tariffs. Energy suppliers can, for example, offer electricity at particularly low prices when a lot of energy from solar or hydro power is fed into the grid.

Smart City

By 2030, 60 percent of the world's population will live in cities (source: Statistisches Bundesamt, German Federal Statistical Office). There are already 35 so-called megacities around the globe, in other words cities with more than 10 million inhabitants. The increase of urban agglomerations with high population density in a tight living space poses great challenges to urban planners. Transport and infrastructure, drinking water supply or waste management must cope with an ever-growing population. The smart, networked



city offers enormous opportunities. **Numerous Smart City solutions can only be implemented cost-effectively and efficiently with Narrowband IoT.**

Example: finding a parking space: German drivers spend 560 million hours a year looking for parking spaces in city centers. It doesn't have to be that way. By equipping parking spaces with ground sensors that detect the magnetic field of a vehicle, it is possible to determine at any time whether and where a parking space is currently free. This information can then be used via app or on digital displays in public spaces to guide traffic. Due to the long range of Narrowband IoT, the sensors' signals can be transmitted over longer distances without any problems. The result: less stress and time spent by motorists, reduced traffic and environmental pollution, and better utilization of parking spaces.

Similarly, simple but enormously effective NB-IoT application examples include smart waste management or smart street lighting control. A waste bin that reports itself when it is full saves the municipal waste disposal a lot of time and money, as unnecessary tours and the emptying of half-full bins can be avoided. The unattractive sight and smell of overflowing rubbish bins also become a thing of the past.

Intelligent, IoT-enabled streetlights are not only centrally controllable, but also use a motion detector to detect whether people are nearby or not – and automatically adjust their brightness. Considering the large number of lanterns in public spaces, in this way, energy costs can be significantly reduced. If a lamp is damaged, it reports it automatically. This means that damage is repaired more quickly, and maintenance becomes much more efficient.

Smart Building

The term Smart Building refers to the intelligent networking and automation of buildings such as shopping malls, hospitals, or airports, but also office buildings. **The goal: more efficient building and energy management as well as more safety and comfort for the people on site.** Smart Building offers a wide range of possibilities for the use of IoT technologies. Narrowband IoT as a mobile radio standard is particularly suitable here due to its good building penetration. IoT use cases can easily be implemented without having to rely on the existing network infrastructure.

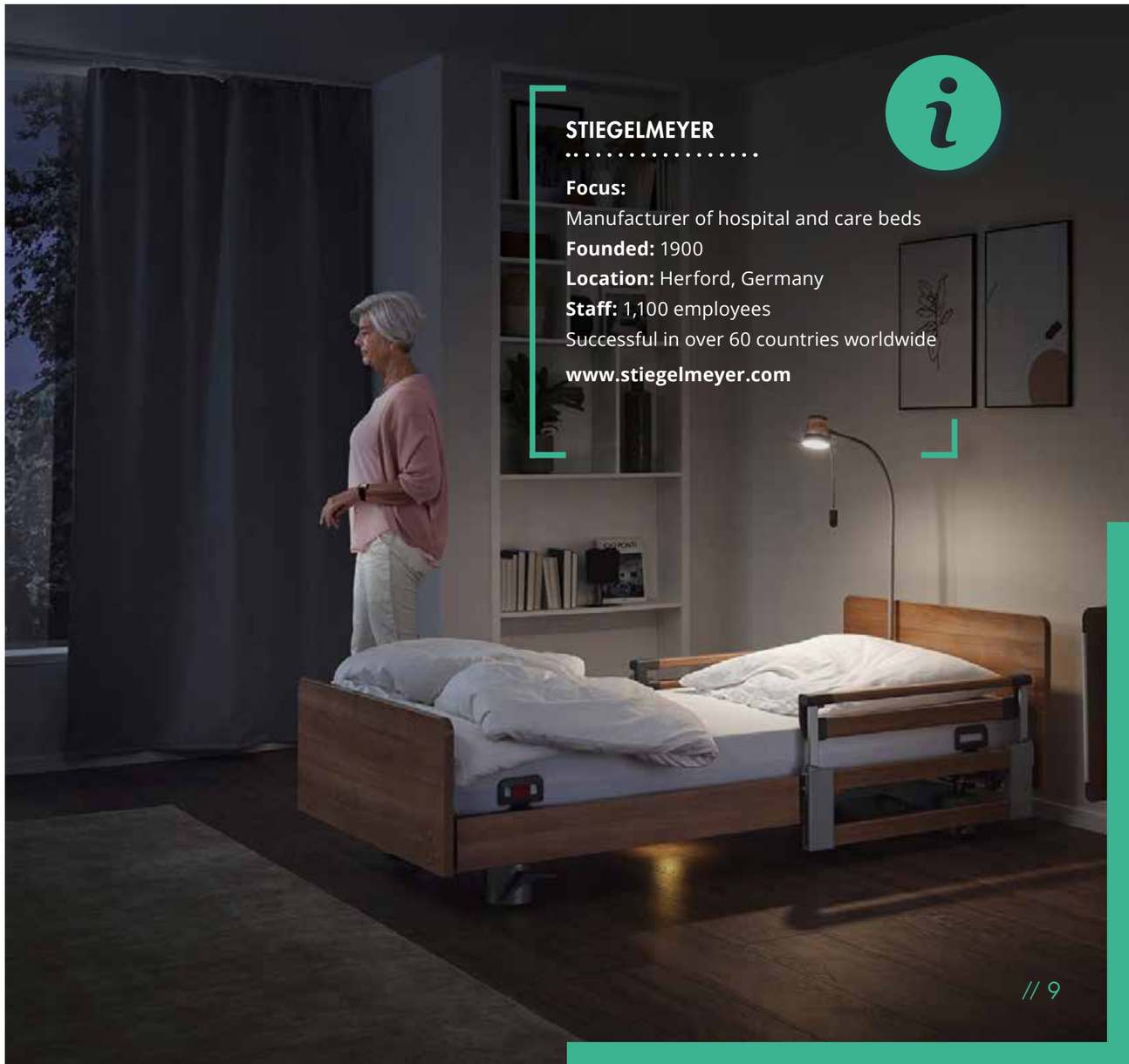
With the help of Smart Building, **doors, lifts, blinds, heating, or lighting, for example, can be controlled centrally** – depending on how many people are on site at any given time. An IoT platform can be used to display a digital twin of the building, providing a transparent overview of all facilities and systems. Defects can therefore be quickly detected and rectified, and usage can be managed efficiently and in an energy-saving manner.

The benefits of smart buildings have been particularly evident during the Corona pandemic. In places where many people gather, intelligent systems are needed to keep track of the number of people and the CO2 content in the air. By using smart air sensors as well as IoT-enabled doors that detect how many people are entering and leaving through light barriers or motion sensors, it is possible to precisely identify when maximum room occupancy has been reached. Automated alarms and thresholds also signal when a room needs to be ventilated. In conjunction with apps, visitors – for example in museums or libraries – can be shown online in advance whether admission is currently possible.

Thanks to Narrowband IoT, it does not matter in which part of the building sensors are installed. The building infrastructure can also be easily and cost-effectively retrofitted with appropriate sensor technology. At the same time, the technology provides the necessary data security and protection against cyberattacks.

STIEGELMEYER: NARROWBAND IOT FOR INTELLIGENT PRODUCT NETWORKING

The Herford-based company Stiegelmeyer, one of the world's leading manufacturers of hospital and care beds, has also recognized the great potential that lies in the networking of its products. In collaboration with grandcentrix and Device Insight, Stiegelmeyer has **developed a digital out-of-bed system based on Narrowband IoT** capable of relieving caregivers and significantly improving safety and comfort for both residents and patients.



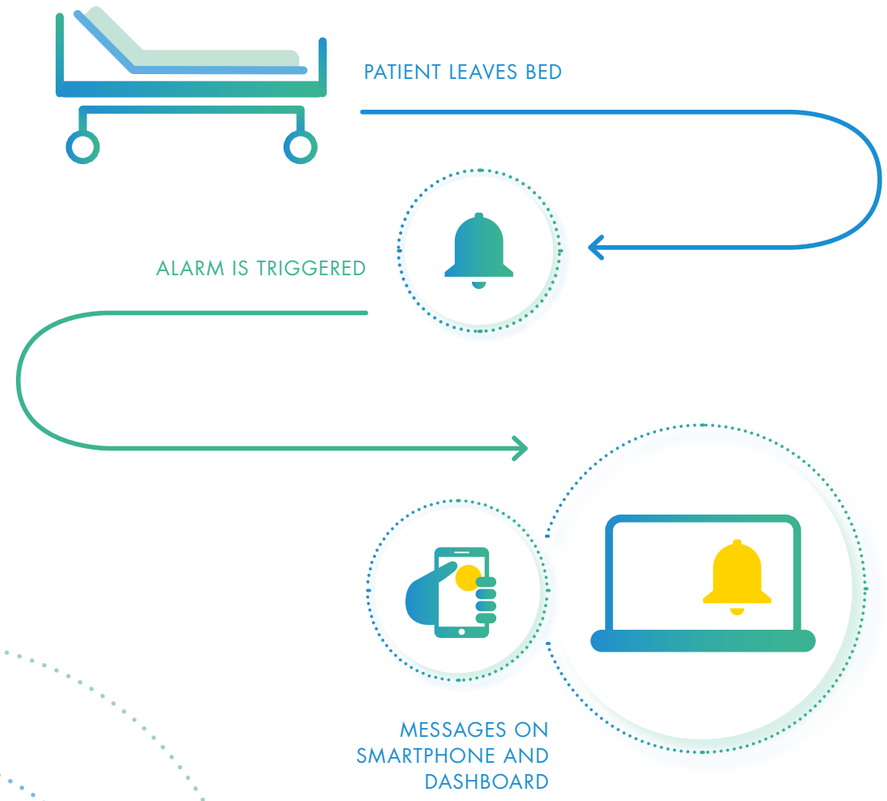
STIEGELMEYER

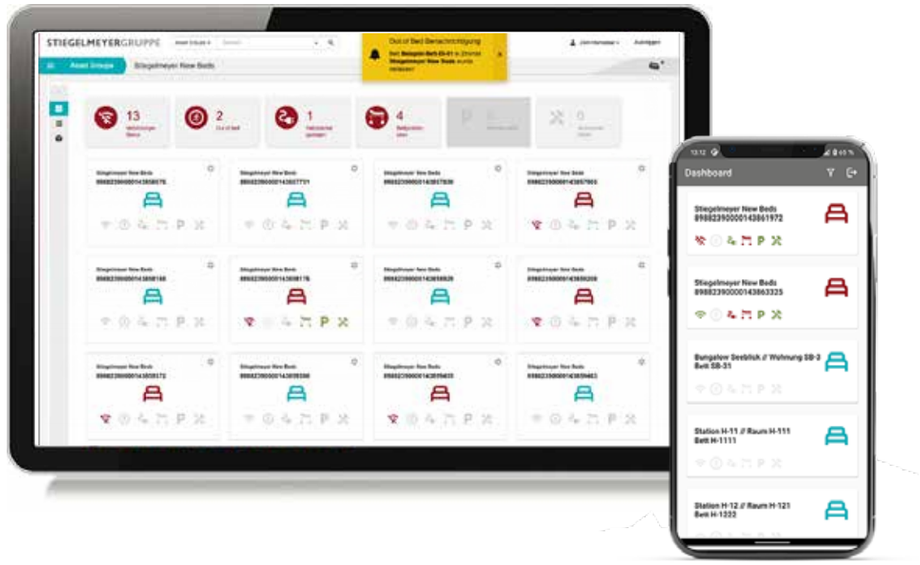
Focus:
Manufacturer of hospital and care beds
Founded: 1900
Location: Herford, Germany
Staff: 1,100 employees
Successful in over 60 countries worldwide
www.stiegelmeyer.com

// Initial Situation

Today, hospitals and nursing homes are facing major challenges. The progressive aging of society and a shortage of nursing staff require a rethinking of nursing care as well as new, innovative approaches. Stiegelmeyer has therefore set itself the goal of relieving nursing staff in their day-to-day work with the help of easy-to-use digital solutions. At the same time, it is also intended to support patients or residents of nursing and old people's homes in order to offer them maximum independence and comfort.

For technological implementation, Stiegelmeyer relied on the combined expertise of Device Insight and grandcentrix. Based on Narrowband IoT, this resulted in a smart out-of-bed system.





Fast alerting, adapted to needs

The out-of-bed system offers safety, especially to residents at risk of falling, but without restricting their mobility. The sensor system integrated into the bed detects when the resident sits up in bed at night and activates the bed's automatic light system. If a resident leaves the bed, a corresponding notification is triggered after an individually defined time interval. This interval can be adjusted depending on the time of day, health condition and mobility of a patient. For example, an alert can theoretically also be activated for nighttime only.

This ensures that nursing staff are alerted immediately to residents and patients at risk of falling and can rush to help – without having to constantly check all the rooms. Alerts are sent both via push message to a smartphone and also displayed on the IoT solution dashboard. In addition, the signal can also be routed to the existing in-house call systems, triggering visual or audible alarms in the corridor or in the nursing rooms.

All information at a glance via app and dashboard

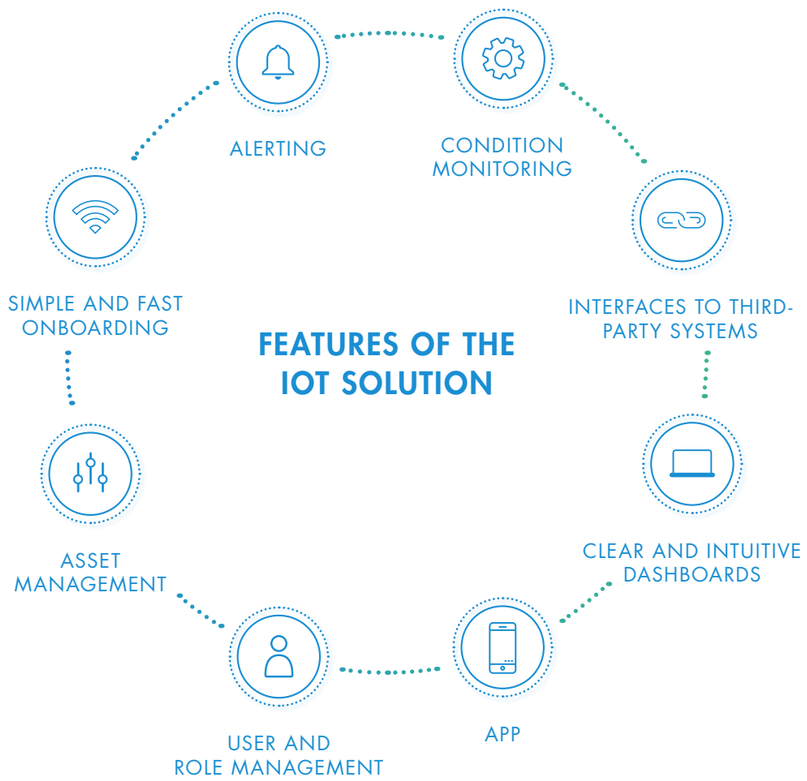
The nurse responding to the alarm and caring for the patient in question can also signal this via app or desktop dashboard. This ensures that multiple nurses are not checking on the same patient at the same time, resulting in an overall more efficient workflow.

In addition to alerting, the IoT solution offers transparent condition monitoring. With a glance at the dashboard, all status data of all beds can be viewed, for example, which bed has a technical defect, whether the brake is locked, or the main connection is interrupted. The patient's weight can also be automatically recorded via the solution. This eliminates the time-consuming process of daily weighing and manual recording as part of the hospital routine. In addition, strong weight loss in a patient is better recognized and rapid countermeasures are possible.

Easy integration thanks to Narrowband IoT

The so-called Bluebox is responsible for fast signal transmission from the bed to the IoT platform. This can already be permanently installed in the lying surface of the bed or simply retrofitted. Via Narrowband IoT, the Bluebox sends notifications without having to access the existing network infrastructure in the hospital or nursing home, a situation that is not usually easily possible. Onboarding additional beds also takes only a few seconds.

Hospitals and nursing homes are therefore able to get started with the IoT solution without major financial and organizational effort. Handling of functions via app and dashboard is intuitive and requires no digital know-how from the caregivers. In this way, the IoT solution becomes an essential tool to organize the daily care routine better and more efficiently.



NARROWBAND IOT PER PLUG AND PLAY – JOINT APPROACH BY DEVICE INSIGHT AND GRANDCENTRIX

The example of Stiegelmeyer and numerous other application areas have already shown the enormous opportunities offered by Narrowband IoT for a wide range of industries. The technology has opened completely new areas of application for the Internet of Things and can make use cases a reality that were previously impossible to implement.

It is also important to avoid stumbling blocks in the realization of NB-IoT projects so that the advantages of Narrowband IoT are not negated by mistakes in planning and implementation. To achieve this, Device Insight and grandcentrix have created a holistic end-to-end approach. **The goal: to enable companies to get started with Narrowband IoT quickly and cost-effectively.**

To achieve this, the two IoT specialists rely on an **interlocked plug-and-play approach that massively accelerates the design and development of scalable NB-IoT solutions.** For this purpose, technologies and product components – from hardware and connectivity to the development of the IoT solution, user interfaces and apps – as well as project management are closely interlinked.

Device Insight has contributed its many years of experience in the development of complex IoT and IIoT solutions. grandcentrix, a wholly owned subsidiary of Vodafone since 2020, has provided its expertise in the design of custom-fit transmission technology and connectivity solutions as well as in app development.

DEVICE INSIGHT

Focus:
IoT and IIoT solutions
Located: Munich, Germany
Founded: 2003
Staff: 100
www.device-insight.com

GRANDCENTRIX

Focus:
Connectivity, hardware and app development
Located: Cologne, Germany
Founded: 2010
Staff: 200
www.grandcentrix.net

GRANDCENTRIX

HARDWARE AND CONNECTIVITY

- Versatile, easily customizable, certified standard hardware
- grandcentrix Connectivity Board
- Integrated, globally usable NB-IoT connectivity

DEVICE INSIGHT

IOT SOLUTION CENTERSIGHT SCALE

- Combination of ready-to-use IoT components, system integration and individual software development
- Flexibly expandable with new features and functionalities
- Ready-to-use UI Framework

GRANDCENTRIX

APP DEVELOPMENT

- UX design and conception
- Pre-developed interfaces to devices and the cloud
- Native and cross-platform app development

NARROWBAND IOT TECHNOLOGY FROM A SINGLE SOURCE

1 STATUS QUO AND BUSINESS CASE ANALYSIS → 2 SOLUTION DESIGN → 3 BLUEPRINTS AND PROOF OF CONCEPT → 4 AGILE SOFTWARE DEVELOPMENT → 5 ROLL-OUT, OPERATION AND SUPPORT

END-TO-END PROJECT MANAGEMENT

This integrated approach enables Device Insight and grandcentrix to offer all services within a NB-IoT project from a single source. For customers, this means **better inter-locked processes, less effort for project management and accordingly, a significantly faster time-to-market.** Combining the technologies and solutions of both partners provides companies with a fast entry point and at the same time a long-term and globally scalable Narrowband IoT solution that also brings the necessary openness and flexibility to address growing requirements.

With their respective solution approaches, Device Insight and grandcentrix provide the ideal conditions for this.

// grandcentrix IoT Offering – Proven, Robust, Globally Available

Hardware

- Cellular Boards and Blueprints
- Firmware SDK
- Factory connect

Infrastructure

- Provisioning
- Device Management
- LwM2M Server
- FOTA

Device Interaction

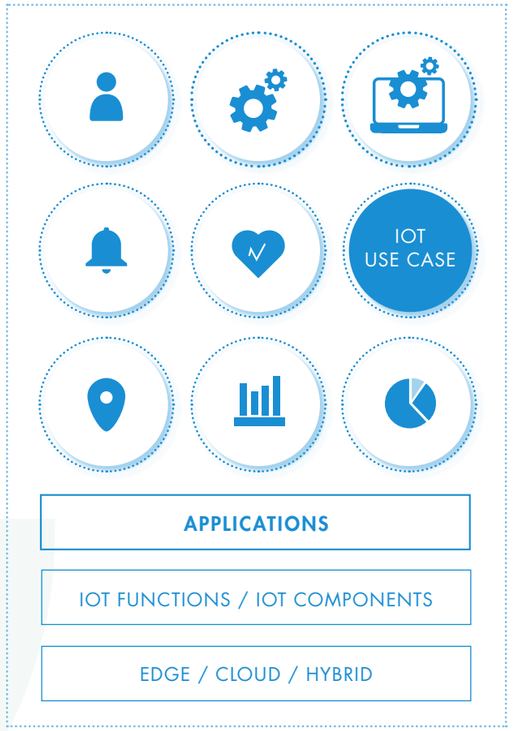
- Onboarding
- Platform Adapter

As a 100% subsidiary of Vodafone, it is our mission to make IoT affordable and accessible. To this end, we have packaged our experience from working for the flagship companies of the German-speaking SME sector into components and preliminary products. With these modules, we are now in a position to implement even sophisticated product networks very quickly in high quality and also to adapt them flexibly.

We focus on the development and production of individual IoT end-to-end systems for our clients, which turn their intelligent products into intelligent networked products. Systems thinking is always at the heart of our approach to solutions, so we integrate leading IoT chips and leading platform solutions from partners and bundle these custom-fit IoT solutions with Vodafone's global mobile services.

With NARROWBAND PLUS, we combine cellular, globally available LPWAN mobile services with high-performance modem technology, highly functional firmware as a software development kit (SDK) and scalable protocol converters in the mobile network with flexibly deployable platform adapters. This is how we implement the connection of our clients' devices with the customer's own or Hyperscaler IoT platforms – robustly, securely and with little effort.

// Device Insight IoT Framework – Fast, Custom-fit, Scalable



We see our IoT solutions as enablers for new, innovative business models and as a long-term basis for our customers' digital roadmap. The prerequisite for this is an IoT framework that allows fast, cost-effective implementation of initial IoT use cases that can at the same time be flexibly and easily scaled to new conditions. This is due to the fact that the requirements for an IoT solution are dynamic, and functionalities must be tailored to the user and the needs of the market again and again.

With CENTERSIGHT scale we have combined the best of different worlds: combining ready-made IoT components, software development and system integration to create tailor-made and at the same time flexibly scalable IoT solutions. Our approach is based on the principle "think big, start small". Based on major hyperscaler IoT platforms and using ready-made IoT building blocks, we enable companies to achieve a fast time-to-market for their IoT solution as well as measurable proof of value within the shortest possible time. At the same time, our open infrastructure enables us to flexibly expand IoT solutions and tailor them precisely to the respective requirements with new, individual applications – also for the challenges the future may bring.

> With the help of Narrowband IoT, we have succeeded in developing our beds into smart products and thus improving everyday life for nursing staff and patients. Thanks to the plug-and-play approach of grandcentrix and Device Insight, we were able to develop another market-ready and scalable communication platform for our out-of-bed system within a very short time.
>
> *Gunter Röper, Chief Marketing Officer, Stiegelmeyer*

YOUR ADVANTAGES

Low costs and fast time-to-market

Through our ready-to-use product components – both in hardware and connectivity as well as through ready-made IoT building blocks – we are able to radically reduce the complexity of the Internet of Things. This allows us to implement Narrowband IoT solutions quickly and cost-effectively. First use cases can be implemented within a few weeks – with a directly noticeable ROI.

Unlimited scalability

Fast, simple, globally available and with a low cost per asset: these are the prerequisites that make our plug-and-play approach maximally scalable. Our framework enables you to roll out your NB-IoT solution on a large scale worldwide within a short period of time.

Flexibility and openness

In the joint implementation of Narrowband IoT solutions, we rely on the successful principle of "think big, start small". Due to the modular structure of our IoT framework, new functionalities and features can easily be added later. The IoT solution can grow to meet your individual requirements.

All from one source

We serve our clients end-to-end, both technologically and in project management, providing the necessary expertise no matter where your IoT project is. We rely on agile methodology and lean project implementation with centralized responsibility. This speeds up processes and reduces friction loss.

READY TO START YOUR NARROWBAND IOT PROJECT?

Together we will evaluate your individual use case and its implementation based on Narrowband IoT.

www.grandcentrix.net/en/products/narrowband-plus/

DEVICE INSIGHT

grand centrix

ABOUT DEVICE INSIGHT

Founded in 2003 in Munich, Device Insight GmbH is an IoT specialist, accompanying companies in their digitization in the fields of Internet of Things, Industry 4.0, and artificial intelligence. Based on a flexible IoT framework, Device Insight combines ready-to-use IoT building blocks and individual applications for customized IoT services. System integration based on common cloud providers and development are combined to create tailored solutions that are both fast and scalable. Device Insight supports global networking of machines, vehicles, plants, and devices and provides applications in the fields of data acquisition, condition monitoring, predictive maintenance, machine learning, industrial analytics, and AIoT (Artificial Intelligence of Things). Device Insight is active in more than 15 countries, working together with large enterprises and mid-size customers from various sectors, including machinery and plant engineering, HVAC, commercial vehicles, vending, transport, energy as well as the Connected Home environment. Services range from business case analysis and implementation to secure IT operations. Since 2019, Device Insight has been a subsidiary of automation specialist KUKA AG.

www.device-insight.com

ABOUT GRANDCENTRIX

grandcentrix is a leading system integrator for Internet of Things (IoT) and Smart Products. With over 200 specialized employees, grandcentrix offers a complete range of services from electronics and embedded software development, certifications, manufacturing of IoT products, app and backend development, connectivity, security, analytics to the operation of IoT platforms from a single source. With our comprehensive range of services in combination with the services of our established partners, grandcentrix has been responsible for the successful end-to-end implementation of networked, digital products for flagship companies from German-speaking SMEs for over 10 years. grandcentrix has been a 100% subsidiary of Vodafone Germany since 2020. Within the Vodafone Group, grandcentrix is on the one hand responsible for the implementation of individual IoT projects of Vodafone customers and on the other hand is one of four specialized product houses for the development and provision of IoT products and end-to-end solutions for the global Vodafone organization.

www.grandcentrix.net