# Indoor Positioning in Industry and Logistics

# Content

# Benefits of Indoor Positioning for Industry and Logistics

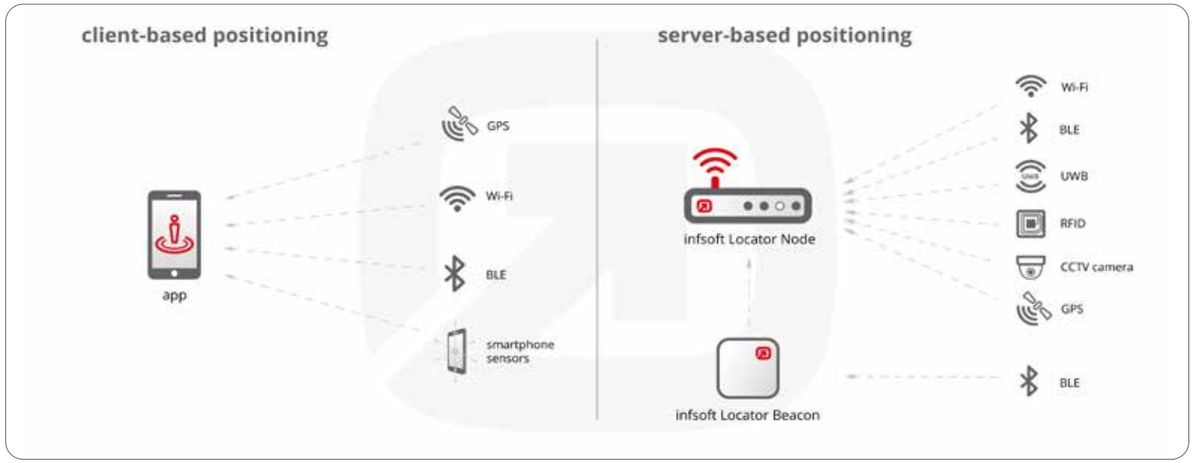
The use of RTLS (Real-Time Locating Systems) in industry and logistics is gaining in importance, especially with regard to the increasing automation of processes and digitization in the industry.

A major challenge in industrial environments is that even small delays in process flows result in high costs for the companies. Rigid systems and manual processes in handling data also represent a competitive disadvantage. In addition, many processes are inefficient and there is usually great potential for optimization.

By implementing an RTLS, relevant data can be collected and harnessed. A Real-Time Locating System supports companies in monitoring, analyzing and coordinating manufacturing and logistics processes. Walking and driving routes can be tracked, analyzed and optimized, goods and vehicles can be located more easily and protected against theft. Furthermore, the geo-based assignment of tasks to employees enables efficient task management. All in all, transparent and smoother processes and the optimization of workflows, inventory management and warehousing can be realized. This results in considerable efficiency enhancements as well as time and cost savings.

In addition, an RTLS can help improve the safety of employees. Compliance with safety zones when handling heavy machinery and the safe evacuation of employees in emergencies can be ensured. Monitoring of working conditions (temperature, air quality, etc.) and thus the minimization of health risks at the workplace are enabled by the use of complementary condition sensors.

# Positioning Technologies




client-based and server-based indoor positioning

## Basics: Indoor Positioning

Indoor positioning systems (IPS) enable you to locate the position of objects and people within buildings. GPS is not available in interior spaces, because there is no visual contact with the GPS satellites. Furthermore, with GPS, it is not possible to determine the floor level a device is located on. For this reason, other positioning technologies are used indoors.

Indoor positioning is based on a transmitter-receiver model where there are two possibilities to determine the current location of a person or asset indoors.

### Client-Based Approach

A client-based technology is used to keep track of individuals that might require a back channel for further information exchange and for navigation purposes.

Indoor navigation is usually based on Bluetooth Low Energy beacons. For this purpose, beacons are mounted at regular intervals in the building.

The position is determined on a mobile device (e.g. smartphone) and an app is required.

Optionally, the position can also be transmitted continuously to a backend in order to make the data available for communication and analysis purposes.


comparison of different technologies for server-based indoor positioning

### Server-Based Approach

A server-based technology is used to keep track of assets and persons. For this purpose, transmitters are attached to assets or are carried by people. The receiver hardware is installed within the client's premise to capture the signals of the transmitters/senders and to transfer the data to a backend engine. Especially the tracking of various assets is a frequent application of indoor positioning in industry and logistics.

To meet the requirements of a client with regard to the requested accuracy, there are several potential sensor technologies available for server-based indoor positioning.

### Wi-Fi

For positioning with Wi-Fi, the so-called fingerprinting method is used. The strength of the Wi-Fi signals (Received Signal Strength Indication, RSSI) and the MAC address (Media Access Control) are significant.

In a server-based solution, Wi-Fi enabled devices and Wi-Fi tags are detected by the infsoft Locator Nodes 1400 (hardware specially developed by infsoft) and asset tracking is possible. People flows can also be recorded using this technology.

Accuracy depends on multiple factors, such as reflections, for example in corridors, and shielding through walls, ceilings, and your own body. The accuracy of Wi-Fi used for indoor positioning varies from 5 to 15 meters – depending on the preconditions.

However, positioning via Wi-Fi is of comparatively little importance in industrial settings, as other positioning technologies are better suited for this environment.

### Wi-Fi at a glance

**Pros:**

- enabled Wi-Fi is sufficient
- under certain circumstances, the customer's existing infrastructure can be used (e.g. Cisco DNA Spaces)

**Cons:**

- relatively inaccurate (5-15 m)
- no latency guarantees
- use of randomized MAC address if smartphone is not connected to Wi-Fi network


beacons for indoor positioning

## Bluetooth Low Energy (BLE) Beacons

Beacons are small radio transmitters that broadcast signals using Bluetooth Low Energy (Bluetooth Smart) in a radius of up to 70 meters. These signals are detected by infsoft Locator Nodes in a server-based approach.
BLE beacons are cost-effective and energy-efficient components that can run on button cells up to five years and more. The transmitters are available from numerous suppliers and come in various shapes and sizes. From BLE tags that can be attached to goods, vehicles and tools to ISO cards and wristbands for employees, there is the right beacon for every application in industrial environments.

There are also especially robust and resistant beacons with a high IP protection class available. infsoft solutions are compatible with beacons from all manufacturers.
Beacons are suitable for diverse applications. In industry and logistics, they are frequently used in tracking solutions. Bluetooth beacons do not usually affect other wireless networks.

### Bluetooth 4

The current standard for BLE beacons is Bluetooth 4 (4.0 / 4.1 / 4.2), which uses RSSI (Received Signal Strength Indication) to determine position, meaning that the location is calculated based on the measured signal strength. RSSI based positioning is usually suitable for area accurate tracking.

### Bluetooth 5

The latest Bluetooth version, Bluetooth 5, achieves significant improvements in terms of signal range, bandwidth and data transfer speed compared to applications using Bluetooth 4.
Bluetooth 5.1 furthermore has a direction-finding function and can use Angle of Arrival and/or Angle of Departure for positioning. With direct line-of-sight, this determination of the direction of a Bluetooth signal enables significantly more precise positioning than Bluetooth 4.

### BLE at a glance

**Pros:**

- cost-effective, unobtrusive hardware
- low energy consumption
- high accuracy compared to Wi-Fi
- under certain circumstances, the customer's existing infrastructure can be used (e.g. Cisco DNA Spaces)

**Cons:**

- with positioning resolution of BLE, automatic allocation to spaces in SAP is not always possible
- in some cases restrictions when using components with 2.4 GHz

## Ultra-Wideband (UWB)

Ultra-wideband is a short-range radio technology that is mainly applied in use cases with high precision needs. The technology is mostly used when assets in defined areas need to be tracked with a high position accuracy (e.g. automatic storage location bookings in SAP).

With UWB, a positioning accuracy of less than 30 cm can be achieved. Height differences can also be measured accurately. Another advantage can be the low latency times with up to 100 position updates per second, which means that even fast-moving objects can be located reliably.

The position is determined by a transit time method (Time of Flight, ToF). This method measures the running time of light between an object and several receivers.

The asset to be tracked is equipped with a small UWB tag which runs on battery power or can draw its power via a forklift, for example. The tag sends data (ID, ToF, time-stamp) to the infsoft Locator Nodes 1100. They have a fixed position in the infrastructure and can use the running time of light to calculate the distance to the asset. Due to the usage of extremely wide frequency bands with a bandwidth of at least 500 MHz, there are almost no interferences. However, the price per unit is significantly higher and the battery lifetime is shorter compared to BLE beacons.

### UWB at a glance

**Pros:**

- high accuracy (< 30 cm)
- accurate measurement of height differences
- low latency times
- almost no interferences, when there is a direct line-of-sight

**Cons:**

- cost-intensive
- shorter battery lifetime than BLE beacons

## RFID

RFID stands for “Radio-Frequency Identification” and describes systems that use radio waves to identify objects or persons. In a passive RFID system, there is a transponder (“RFID tag”) on whose microchip data (usually a serial number) are stored, which can be forwarded wirelessly to a reader. The reading unit (infsoft Locator Node 1100) generates an energy field that activates the RFID tag. In order to enable information exchange, the distance between Locator Node and transponder must be less than one meter (remote-coupling). RFID tags do not require visual contact with the reader, are durable against impact and environmental factors and are almost maintenance-free.

Common applications of RFID are access control systems, inventory management and localization of goods. Combining RFID systems with other positioning technologies can solve the biggest problem of passive RFID technology: objects equipped with RFID tags can only be located at a specific point (where the reading unit has been installed). However, if for example a forklift is equipped with an infsoft Locator Node 1100, whose sensors not only respond to RFID, but also to Ultra-wideband (UWB), a link between the position data of the forklift and the identification times of RFID-tagged goods can be established.

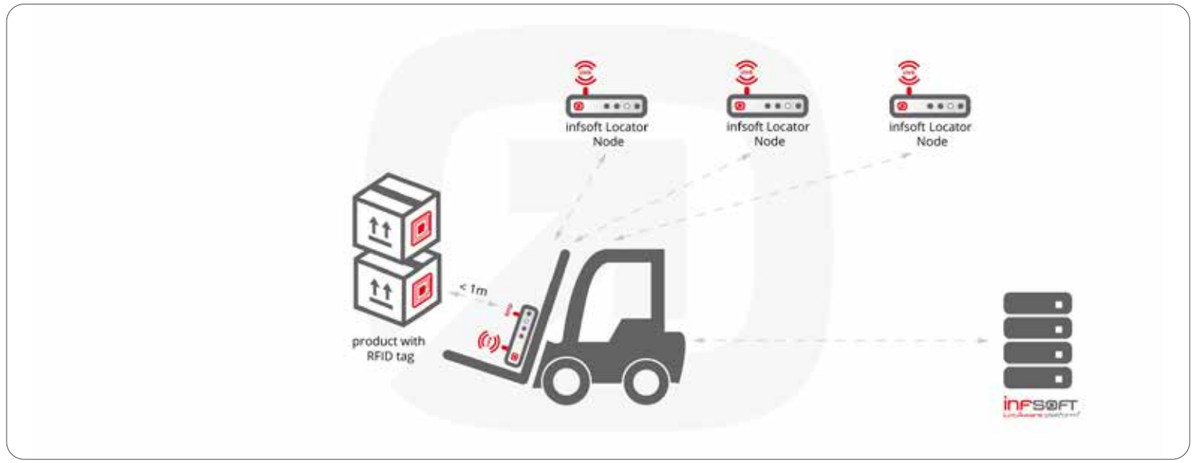
### RFID at a glance

**Pros:**

- low costs per asset
- no battery needed

**Cons:**

- short range (< 1 m)
- only providing a “point-in-time” location
- installation requires significant planning
- infrastructure can be expensive




combination of RFID and UWB for identification and localization of goods

## Summary View

### Client-Based Positioning

Client-based positioning is most commonly used for indoor navigation.
In most cases such a solution is realized with Bluetooth beacons. Advantages of this technology are the easy

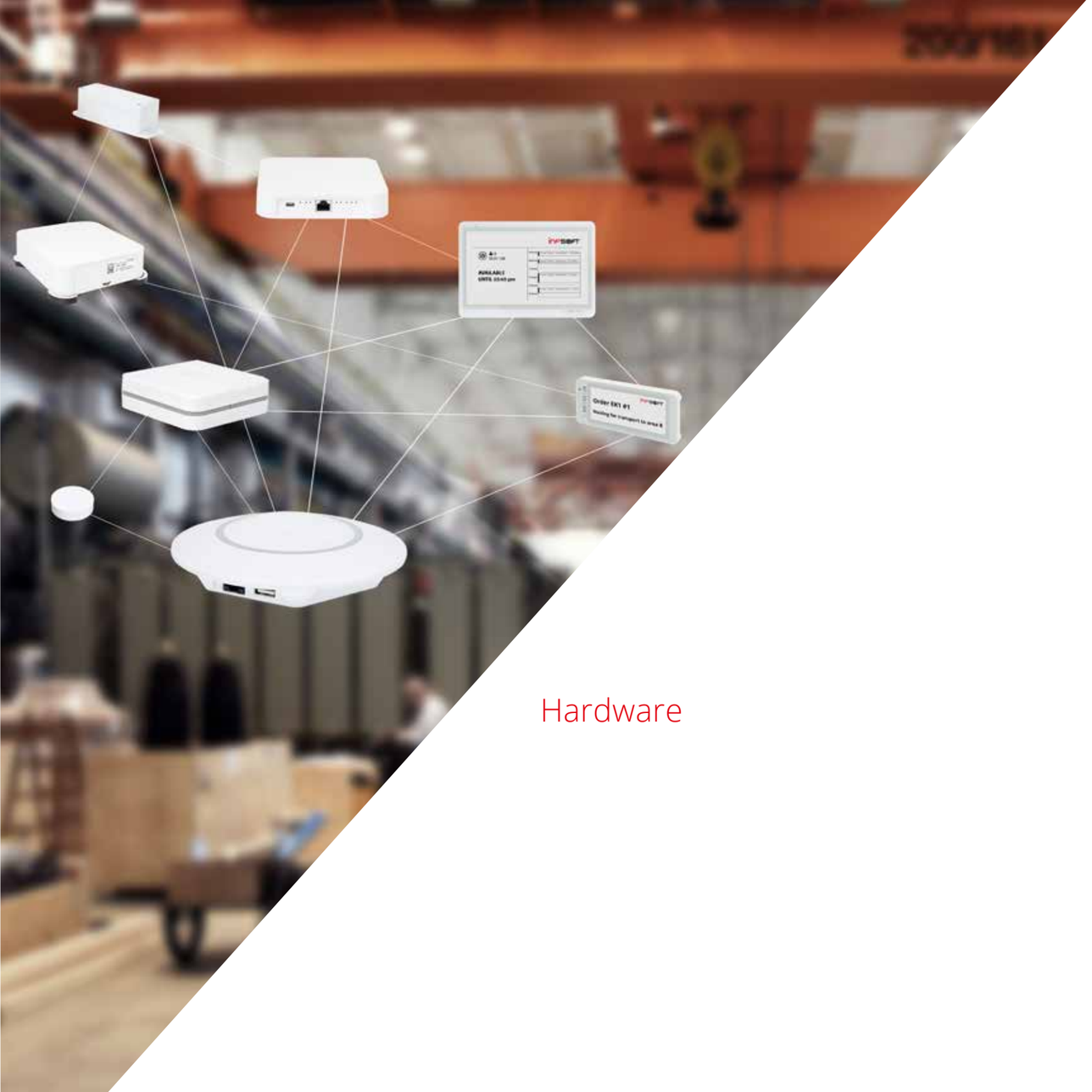
installation, the long battery life and the comparatively low maintenance effort for the beacons, which are installed at regular intervals in the building. In addition, Bluetooth enables client-based positioning on both Android and iOS devices, which is a major advantage in comparison to Wi-Fi.

In order to use the navigation, a smartphone app and an activated Bluetooth function are required. Employees and external personnel, for example employees of maintenance companies, can be easily navigated to relevant destinations on the premises and view their position on a digital building map. Sensor fusion – the use of smartphone sensors – can further improve precision in client-based applications.

### Server-Based Positioning

Server-based positioning in industry and logistics is mainly used for tracking assets – goods, pallets or vehicles. But also the localization of employees, for example for process optimization or for safety reasons, is an important application scenario.
Depending on the application and precision requirements, different positioning technologies can be used for server-based positioning. Bluetooth tags, which are characterized by a long battery life and low maintenance requirements, are particularly suitable for area-accurate or room-accurate positioning.

When high precision positioning is required, Bluetooth using Angle of Arrival or UWB are the most suitable technologies. These technologies enable a positioning accuracy of less than one meter if there is a direct line-of-sight between the transmitter and receiver hardware.
Since UWB provides very low latency, this technology is also often used when tracking fast-moving assets. Because the UWB tag sends out signals very frequently in such an application, the battery life is comparatively low. Therefore, a power supply via the asset (e.g. forklift) is useful in such an application scenario.
Another benefit of positioning with UWB is that height differences can be measured reliably and thus shelf-accurate localization can be achieved.



# Hardware

In order to address a client's need for a reliable positioning solution, we rely on our own hardware.

Positioning is based on a transmitter-receiver model. To implement a positioning project, you need hardware for receiving signals and hardware for transmitting signals.

mounting solution for Locator Node 1100/1200 © infsoft GmbH

For our hardware products we offer flexible mounting options, which are sold separately. The mounts are magnetic and have additional boreholes for fixed installation.

infsoft receiver hardware for industrial applications includes infsoft Locator Nodes and infsoft Locator Beacons.

## infsoft Locator Nodes 1100

With the Locator Nodes 1100, infsoft is providing a modular component for tracking and analysis purposes. Integrated into the central data hub – the infsoft LocAware platform® – the Locator Nodes allow for a comprehensive detection of different signal types, enabled through the modular system with different sensors.

infsoft Locator Node 1100 © infsoft GmbH

Beside the consumer standards Wi-Fi and Bluetooth Low Energy (BLE), the infsoft Locator Nodes are able to address high-precision needs with Ultra-wideband (UWB) and can also be equipped with an RFID reader. Data correlations with external camera systems and self-positioning via GPS in mobile scenarios are further capabilities. In addition to positioning, infsoft Locator Nodes are also able to communicate with Bluetooth devices via back channel, allowing bidirectional exchange of information.

### Seamless Integration

The Locator Nodes require a constant power supply and network connection and are transferring the scanned data to the infsoft LocAware platform®.
Integration with third-party systems such as Cisco (CMX, MSE, Meraki, DNA Spaces), HP Aruba or Xirrus is possible.

Videos

- RTLS made easy – infsoft Locator Node 1100
- features of the infsoft Locator Node 1100

## infsoft Locator Nodes AoA 1200

infsoft Locator Node AoA 1200 © infsoft GmbH

Angle of Arrival (AoA) is an emerging technology that indicates the direction of the signal sources and can be used for indoor positioning and asset tracking.
infsoft Locator Nodes AoA 1200 use Angle of Arrival for real-time measurement of the direction of a radio signal emitted by a mobile 2.4 GHz transmitter (e.g. beacon). Based on the angle and signal strength determined, it is possible to calculate the position of an object equipped with such transmitter with an accuracy of 1 to 3 meters.

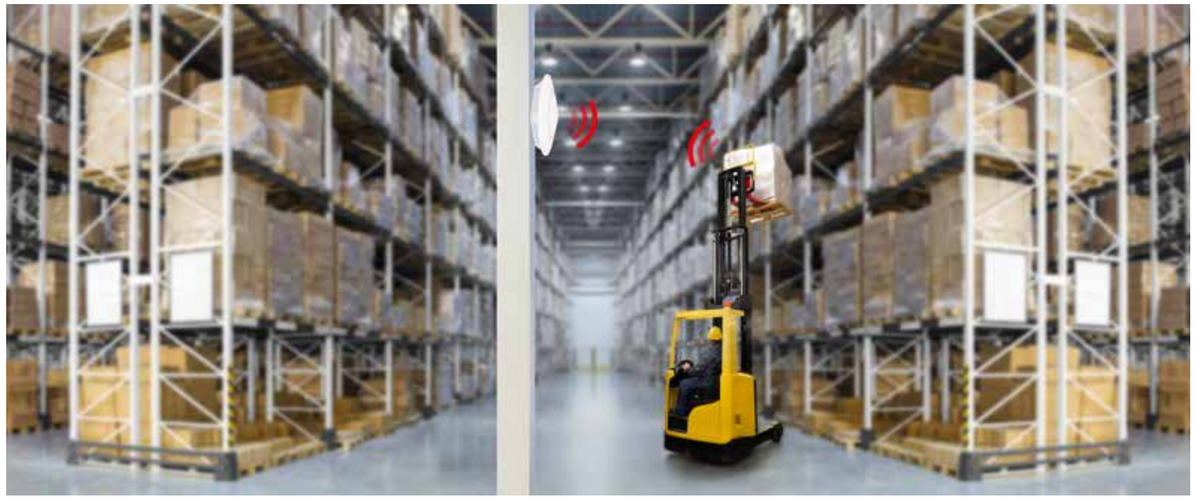
infsoft Locator Nodes AoA 1200

## infsoft Locator Nodes 1400

infsoft Locator Node 1400 © infsoft GmbH

infsoft Locator Nodes 1400 are hardware components that can receive Wi-Fi and Bluetooth Low Energy (BLE) signals from mobile transmitters. This enables the positioning of Wi-Fi tags and beacons attached to objects or carried by people, as well as the localization of Bluetooth or Wi-Fi-capable mobile devices. The gateway function allows communication between different types of devices and the cloud and enables bidirectional information exchange between infsoft Locator Nodes 1400 and Bluetooth transmitters such as infsoft E-Ink Display Beacons.

infsoft Locator Nodes 1400



## infsoft Locator Beacons

infsoft Locator Beacons are stationary installed, battery operated hardware components, which periodically scan for signals of mobile beacons, that are used to track persons or objects, and send information about the received signals to the nearest infsoft Locator Node. This technology is particularly suitable for applications in which an area-accurate positioning is required. A big advantage is that the number of Locator Nodes can be reduced, which significantly reduces installation effort and costs. The infsoft Locator Beacons are low-maintenance, as the battery life is up to ten years, depending on the scanning interval.

Locator Beacons can also emit signals that are received by mobile devices such as smartphones and are therefore also suitable for applications such as indoor navigation and location-based services.

infsoft Locator Beacon © infsoft GmbH

infsoft Locator Beacon

Transmitter hardware emits signals that are detected by the receiver hardware. Depending on the application, BLE 4 / 5 tags, infsoft UWB Tags or infsoft E-ink Display Beacons are used. In addition, the positioning can be enriched with sensor data.

## BLE 4 / 5 Tags

Bluetooth Low Energy Tags, also known as BLE beacons, are small battery-powered radio transmitters that emit signals at a specific time interval. Beacons are available in many sizes and shapes and are suitable for a variety of applications, e.g. indoor navigation and tracking solutions. The Bluetooth technology is continuously subject to further development. Beacons currently available on the market are equipped with different Bluetooth versions.
While Bluetooth 4 and 5.0 are best suited for room-accurate positioning, for example in hospitals or office buildings, Bluetooth 5.1 enables more precise positioning when there is a direct line-of-sight and is mainly used in positioning systems in open spaces, such as industrial buildings.

infsoft UWB Tag © infsoft GmbH

## infsoft UWB Tags

With infsoft UWB tags, objects can be located with an accuracy of 10-30 cm inside as well as outside of buildings. In order to do this, UWB tags are attached to the assets to be tracked. UWB tags can be battery powered or can be connected to an electrical power supply.
Especially in industrial environments UWB tags are often used because of their high positioning accuracy in three-dimensional space and low latency times. This enables reliable and precise real-time localization, even of objects that are moving quickly.

## infsoft E-Ink Display Beacons

infsoft E-Ink Display Beacons deliver look and utility of paper encompassing good readability, very wide viewing angles, design freedom, robustness, and low power consumption. Combining E-Ink displays and Bluetooth Low Energy (BLE) technology enables transferring content flexibly to the display as well as visualizing and tracing the device's location.


infsoft E-Ink Display Beacons © infsoft GmbH

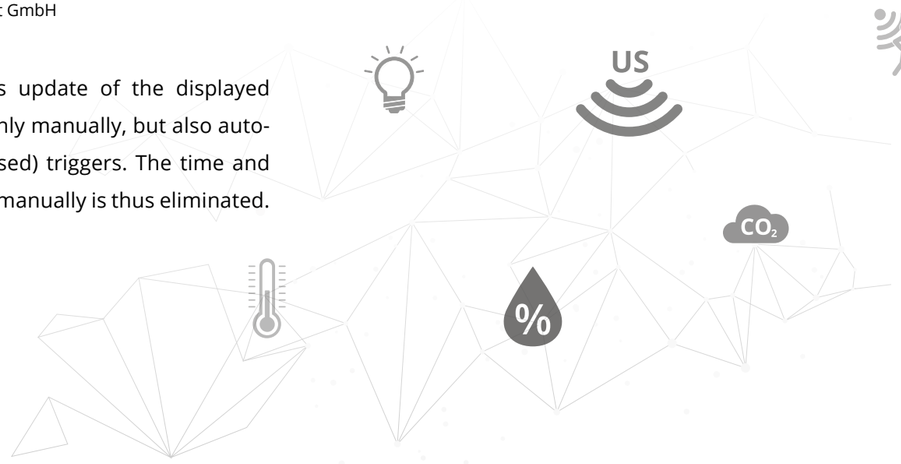
A fast, efficient and wireless update of the displayed content can be realized not only manually, but also automatically by defining (geo-based) triggers. The time and effort required to print labels manually is thus eliminated.

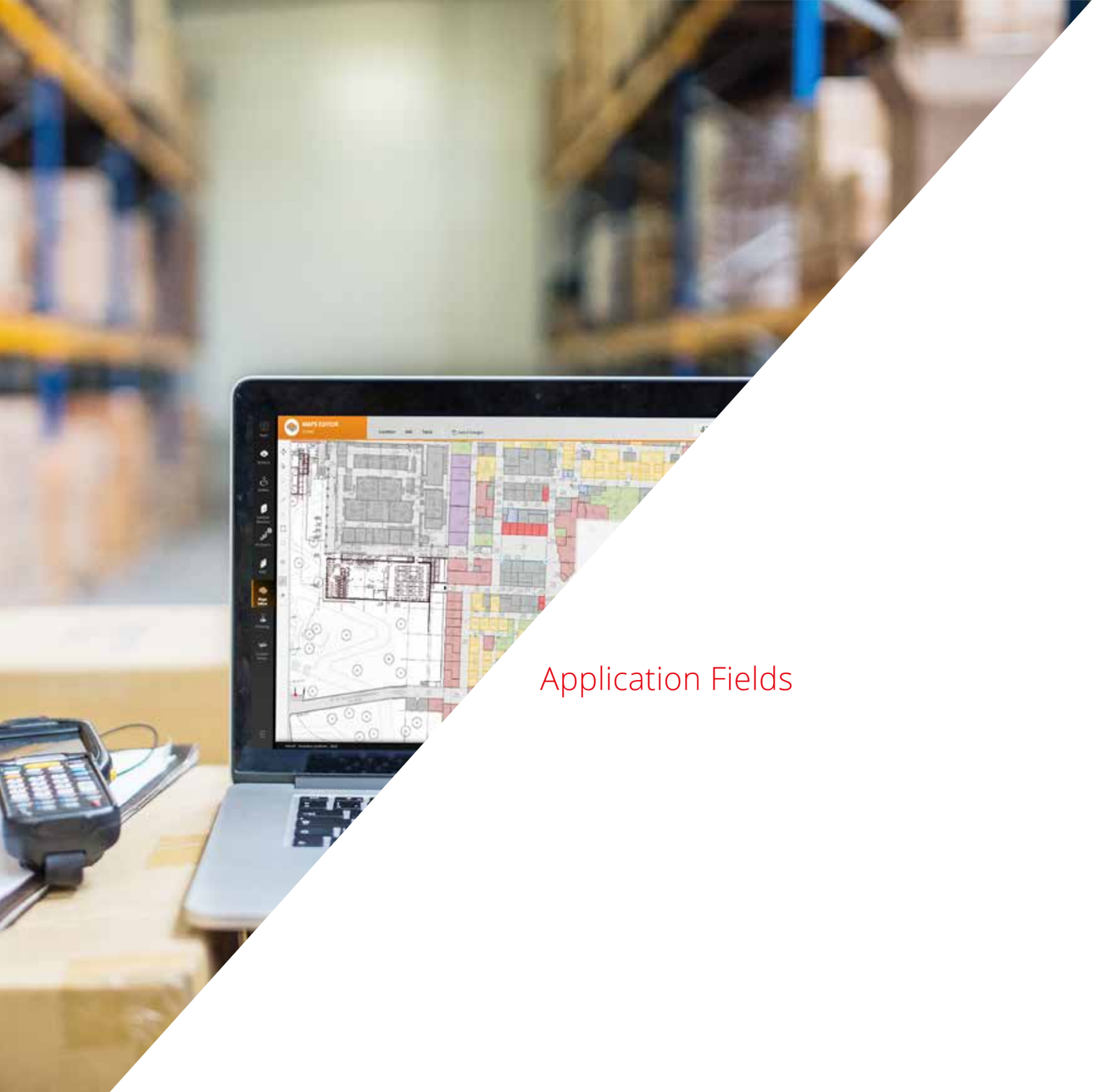
Beacons with E-Ink display are especially suitable for the electronic labelling of containers in production or shelves of all kinds.

infsoft E-Ink Display Beacons

## Condition Monitoring Systems

The existing Real-Time Locating Systems (RTLS) can be enriched with sensor data. Through the transmission and acquisition of this data (e.g. ultrasound, infrared, $CO_2$, temperature, humidity, light, air pressure, acceleration) an innovative, holistic sensor data fusion is achieved. Some of the sensors can be integrated into beacons, others represent a separate hardware component.
In industry and logistics, for example, it is particularly relevant to control the temperature in a storage room for temperature-sensitive goods, the air quality of the working environment or filling levels.





# Application Fields

infsoft offers the complete range of positioning services. In addition to indoor mapping and navigation solutions, these include tracking, location analytics and geo-based services inside and outside of buildings across the supply chain.

## Indoor Digitization

Mapping a location is the first step in any indoor positioning project – and crucial for accessing the digital value of indoor spaces. It provides access to digital maps and to every layer of building information, allowing all indoor processes to be digitized.

The integration of digital maps lays the foundation for the use of indoor navigation, indoor tracking, indoor analytics, and geo-based services.

Indoor Digitization

## Indoor Navigation

Indoor navigation, wayfinding within buildings, facilitates orientation and can be used by the company's own staff or by employees of external companies who are on the premises for maintenance tasks or for other purposes.

A turn-by-turn navigation (displaying directions on a digital map) in an app is one of the most popular forms of indoor navigation and reliably guides employees across indoor and outdoor areas to relevant points of interest on the premises.

Drivers of vehicles, such as tugger trains, can receive real-time direction instructions on their smartphones. The navigation solution for the driver always selects the most economical route, taking into account the current workload, thus minimizing delays in operations.

To implement such a system, a client-based solution based on Bluetooth Low Energy is used. In order to use the navigation, an app must be installed on the user's smartphone and Bluetooth must be activated on the phone. In order to refine the positioning function, smartphone sensors are always called upon.

## Indoor Tracking

Indoor Tracking describes the localization of people and objects within buildings. Depending on the application, the tracking solution is realized on the basis of different positioning technologies and is usually implemented as server-based application. In industry and logistics, a tracking solution can be used to track the movements of goods, pallets, vehicles, machines, employees and much more.

Tracking can be carried out seamlessly across indoor and outdoor areas and can be applied to the entire value chain in order to enable seamless asset tracking.

### Asset Tracking

Tracking of objects is particularly popular in industry and logistics with regard to time savings, process optimization and theft protection. The current location of goods, tools and vehicles can be viewed on a digital map at any time. The tracking solution can be complemented by sensor data such as temperature and humidity.

### Positioning of Goods

In a warehouse there are several thousand goods waiting for further processing. A lot of times, the required goods cannot be found straightaway, which results in process delays and increased costs. With a tracking solution, the position of goods can be determined reliably and displayed on a digital map. In this way, reduced search times and optimal stock keeping can be realized.

For positioning, individual goods, pallets of goods or pallet cages are equipped with transmitter hardware. The accuracy of the localization depends on the technology used. Especially positioning with Bluetooth Low Energy (BLE) beacons using Angle of Arrival and localization using UWB tags make very precise real-time positioning in three-dimensional space possible.

### Tracking with Digital Display and LED Identification

In addition, the goods or containers to be tracked can be equipped with a display. infsoft E-Ink Display Beacons can be used, for example, to display information on the contents of the container or work instructions. The display can be updated via a connection to the ERP system or using infsoft's own software. The labeling can also be automatically updated, for example, when a container leaves a certain area and is ready for the next work step.

To further facilitate the search for specific goods for pickers, beacons with integrated LED lamps can be attached to containers with individual parts. The lamp lights up automatically when it's approached.

### Tracking with Temperature Monitoring

Maintaining an uninterrupted cold chain is particularly important when storing food or pharmaceuticals. When beacons with integrated temperature sensors are attached to these goods, in addition to locating the goods, the surrounding temperature can be determined and controlled. If there is a deviation from the target temperature, an alert can be sent automatically to the responsible personnel and prompt intervention is possible.

### Integration of GPS Positioning

The additional use of GPS tracking can ensure the seamless tracking of goods throughout the supply chain. For example, a truck can be equipped with an infsoft Locator Node 1100, which receives the signals from Bluetooth

tags attached to goods and can simultaneously locate itself using an integrated GPS unit.

### Tracking of Vehicles on Industrial Sites

In addition to goods, vehicles such as forklifts, pallet trucks and tugger trains can also be tracked on industrial sites. With a tracking solution, the current position is always visible on a digital map. To implement such a solution, the vehicles are equipped with transmitter hardware and receiver hardware is installed at regular intervals on the premises.

A tracking solution based on UWB has the advantage of extremely low latency times. This allows real-time tracking as well as providing the drivers with real-time route instructions.

## Localization of Employees

Tracking employees can be useful for several reasons. In addition to optimizing processes and implementing efficient workflow management (for example, through geo-based assignment of tasks), security aspects play an important role.

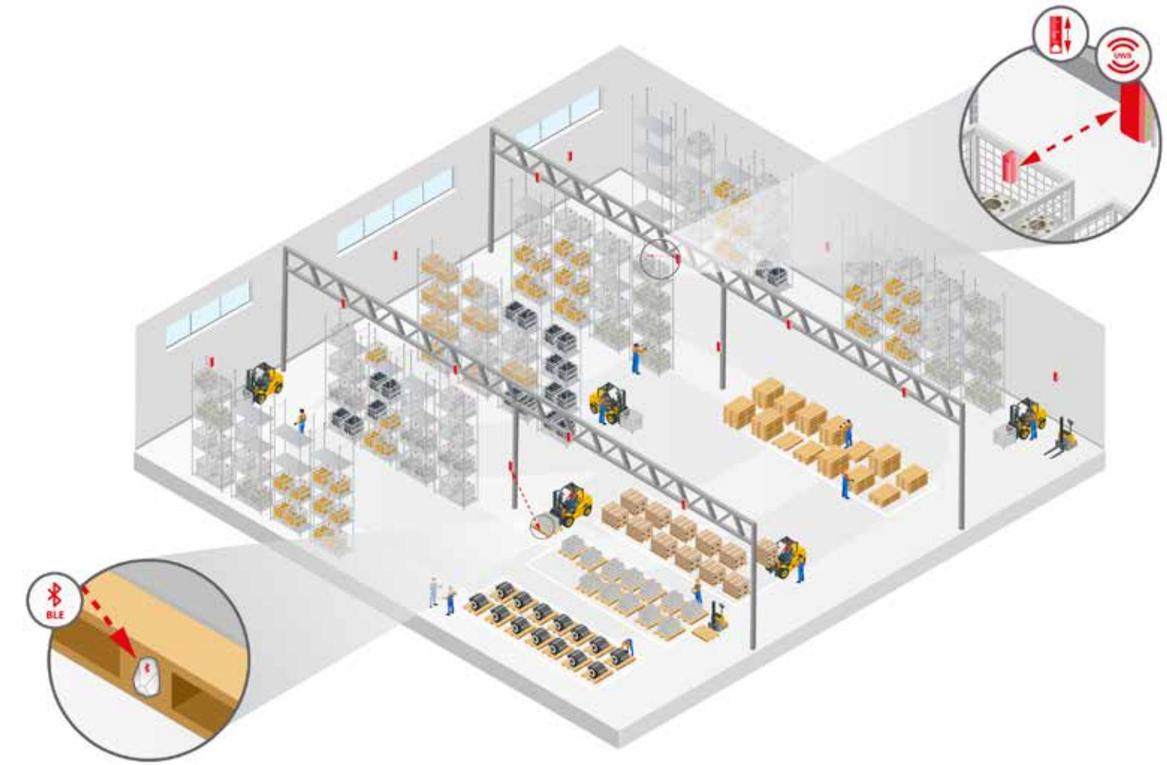
### Evacuation in Emergencies

In an emergency, such as when there is a fire, it is important to get everyone out of the building. With a tracking solution, the position of employees can be determined in order to evacuate them promptly and reliably and make sure that nobody is left in a danger zone. For this purpose, employees and visitors carry BLE beacons in the form of ISO cards with them. To ensure privacy, the solution is only activated in an emergency and the locations of people are only tracked in this case.

### Monitoring of Environmental Conditions

By monitoring temperature, air quality and lighting conditions, it is possible to ensure constant, optimum working conditions in an industrial complex. This has a positive effect on the health and occupational safety of all employees.

### Use Case: Indoor Tracking in Logistics




Pallet Tracking in Logistics

## Success Story
## Sterman Technische Systeme GmbH

### Indoor Tracking and Analysis of Components in Manufacturing

Sterman Technische Systeme GmbH is a specialist for innovative workpiece clamping and relies on solutions developed by infsoft to monitor and optimize its manufacturing processes.

The tracking solution from infsoft enables tracking components and monitoring of production processes. The assets to be tracked are localized with BLE beacons using the Angle of Arrival technology, whereby positioning accuracy of 1-3 metres is achieved. The position of all components and orders including status information are recorded in real time. In the analysis software, historical and current position data are visualized and analyzed in clearly structured dashboards.

Sterman production facility (Photo: STERMAN Technische Systeme GmbH)

Sterman production facility (Photo: STERMAN Technische Systeme GmbH)

The solutions from infsoft support Sterman in increasing the transparency of workflows and in uncovering optimization potential in manufacturing processes. Production status and production times can be viewed at any time and processes can be documented. In this way, throughput times and machine utilization can be optimized, production bottlenecks avoided and adherence to delivery dates can be improved for customers.

### Features of the Solution

- real-time tracking of components and position overview on digital building map
- shelf-accurate positioning by the use of infsoft Locator Beacons
- display of current status of orders
- automatic status change via geofencing
- visualization and analysis of position data
- assignment of order details via an interface to ERP software

## Indoor Analytics

The analysis software from infsoft can be added to existing positioning systems (client-based or server-based) or set up independently. For example, walking and driving routes or the utilization of work equipment can be analyzed. The location- and time-related analyses reveal a wide range of optimization potential.

The data is displayed in a comprehensive web interface in the form of diagrams and heat maps so that it can be easily evaluated and processed. The analytics dashboards can be customized to fit the needs of each customer.

### Optimization of walking and driving routes

If employees are tracked during order picking, their routes can be retraced and analyzed. A particularly accurate positioning can be achieved with UWB. Based on the analysis, improvements in process flow can be realized and order picking can be optimized. This results in considerable time and cost savings.

Tracking vehicles (e.g. tugger trains) and analysis of the routes enables the detection of possible problems and a more economical route planning. This in turn leads to more efficient processes and increased productivity.

## Use Cases for Industry and Logistics

### Indoor Navigation

- Indoor Navigation and Tracking of Tugger Trains
- Indoor Navigation and Monitoring in the Substation

### Indoor Tracking

- Tracking of Goods in Logistics
- Pallet Tracking in Logistics
- Effective Inventory Management in Warehouse Logistics
- Tracking and Labeling of Containers in Production
- Positioning of Tractors
- Temperature Monitoring of Food in a Warehouse
- Workplace Safety and Health Management in an Industrial Complex
- Workpiece Carrier Tracking
- Tracking and Digital Labeling of Containers in Logistics

### Indoor Analytics

- Improving Order Picking Productivity in Warehouses

### Geo-based Processes & Services

- Localization of Casting Ladles in a Steel Mill
- Cargo Tracking at a Container Port

Use Case: Analytics in Logistics


Improving Order Picking Productivity in Warehouses

## Geo-Based Processes & Services

A distinction is made between reactive and proactive location-based services. For reactive location-based services, a user searches for locations in the vicinity directly on his/her device. Proactive services “recognize” when a user enters a specific area and automatically trigger a predefined action. When using proactive location-based services, for example, the detection of smartphones, BLE beacons, UWB tags, etc. at a certain location can trigger such an action.

### Geofencing in Interior Spaces

The triggering of an action when taking a specific path is called geofencing (combination of geography and fencing).

### Process Automation

Geofencing allows intelligent process automation. Using infsoft Automation, various geo-based triggers can be defined. It is possible to, for example, configure emails and tasks, create alerts, and protect areas by triggering automatic door locking / unlocking. In manufacturing, the automatic status change of orders is also possible.

### Securing Hazardous Areas Through Geofencing

Many heavily loaded vehicles move around on industrial sites. It can also be very dangerous for employees to be near certain machines. By securing high-risk areas using geofencing, accidents can be prevented. If an employee enters a danger zone, an alarm is automatically triggered or the machines are stopped to ensure the safety of the employee. In order to detect when an employee enters a certain area, they carry BLE beacons with them. These can be integrated into the helmet or carried in the form of a wristband or ISO card.

### Geo-Based Task Management

With indoor positioning and automated task management, it is possible to assign tasks to employees based on their location. If a problem occurs in a factory, this message is automatically sent to the security employee who is located at the shortest distance to the detected problem. This solution enables efficient task management and guarantees that problems are solved in a timely manner. The employee‘s location is determined with the help of his/her smartphone and its Bluetooth function. The smartphone and, possibly, a connected smartwatch can also serve as a display medium for tasks and direction instructions.

Use Case: Geo-Based Processes & Services


Positioning of Overhead Cranes

# Products

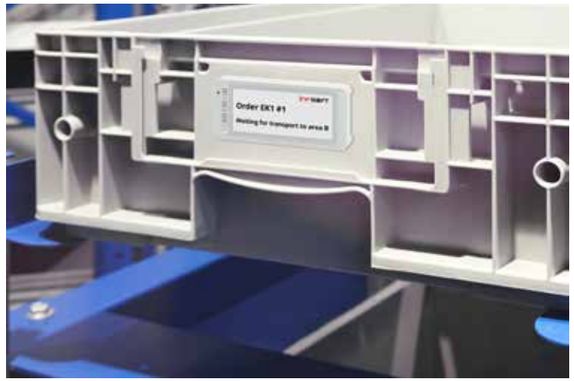
In addition to tailor-made, customized solutions, infsoft also offers ready-to-use solutions with powerful and innovative features. Intelligent applications for the industrial sector include solutions for lead time measurement, inventory of assets and navigation on large company premises.

## infsoft Lead Time Tracking

With its lead time tracking system, infsoft has developed a powerful solution that monitors processes and documents each individual process step. The solution enables high process transparency, utilization optimization and adherence to delivery dates.

Depending on the industry, the concept of “lead times” can take on different forms. In logistics and manufacturing, the monitoring and optimization of lead times is pivotal to organizing all the processes along the supply chain. Knowing the precise lead time will allow you to commit to a specific delivery date. It is also key to prevent production line shortages.

infsoft Tracking Dashboard



infsoft Lead Time Tracking relies on cost-effective BLE hardware that is easy to install and easy to maintain. An interface to the in-house ERP software facilitates processes and automatically assigns asset details.

### Asset Tracking

Mobile goods are tracked at relevant checkpoints. The current position and status can be viewed on a digital map. A dashboard displays dwell times at different process areas.

### Digital Labelling

infsoft E-Ink Display Beacons that are attached to the assets can be rewritten automatically with the current status and individual information such as instructions on the next work step.

infsoft Tracking Dashboard

### Geofencing

Process steps or asset statuses can be automatically updated via infsoft Automation, e.g. if an asset enters or leaves a defined area or stays in a certain area for a specific amount of time.

### Technical Implementation

Bluetooth Low Energy beacons or beacons with a display medium (E-Ink Display Beacons) are attached to the assets to be tracked.

infsoft Locator Beacons and a small number of infsoft Locator Nodes 1400 are installed in the production area. The asset tags' Bluetooth signals are received by the Locator Beacons and sent to the infsoft LocAware platform® via a Locator Node.

More information and cost examples
- infsoft Lead Time Tracking

## infsoft Inventory

With infsoft Inventory, we provide our customers with a solution that facilitates efficient inventory management of all assets.
In the basic version without tracking functionality, infsoft Inventory does not require any hardware investment. For product identification, assets are tagged with QR codes or barcodes.


infsoft E-Ink Display Beacons © infsoft GmbH

There are several options available if companies wish to use infsoft Inventory more extensively. The application can be integrated into ERP software, for example, and can thus be connected to existing databases. Another option is to link the application to geodata. Either Bluetooth beacons or E-Ink display beacons can be used for this purpose. E-Ink display beacons offer the added benefit of allowing information to be displayed directly on the asset (e.g. product details, reservation status, maintenance schedule).

Other possible functions of infsoft Inventory include automatic notifications before an upcoming inspection date or colored highlighting of borrowed items in the user interface.

### Localization

The tracking solution enables reliable positioning of mobile and stationary inventory with room or area accuracy. The position can be determined seamlessly across floors and indoor and outdoor areas.

### Analyses

In addition to location and status information, a comprehensive dashboard provides the user with insights into asset utilization. Furthermore, there are functions for grouping and filtering the assets.

### Theft Protection

Via infsoft Automation, an automated warning can be generated, e.g. when an asset enters or leaves a predefined area or stays in a certain area for a certain period of time.

### Technical Implementation

In the basic functionality without a tracking function, QR codes or barcodes are attached to the inventory items. The data of the respective code is captured by a reading device and can then be accessed via the infsoft Inventory user interface.

For location tracking, Bluetooth Low Energy (BLE) beacons are attached to the assets. The signals emitted by the beacons are received by infsoft Locator Beacons and then forwarded to an infsoft Locator Node 1400. From there, the information is sent to the infsoft LocAware platform® where it is intelligently processed.

## infsoft Wayfinding

On a large industrial site, the fastest way to reach a destination is not always apparent. A smartphone app can help employees to better find their way around the premises. With infsoft Wayfinding, users can be guided reliably to their destination across indoor and outdoor areas.

With the software tools infsoft Maps Editor, infsoft CMS, infsoft Routes and infsoft Calibration, the application can be flexibly configured according to the customer's needs. Using our SDK (Software Development Kit) it is also possible to integrate the technology into existing applications.

### Digital 2D/3D Building Map

The app provides 2D and 3D maps of the individual floors of all buildings on the site. The user can see their own location as well as relevant destinations on the premises.

### Turn-by-Turn Navigation

The user can be navigated to any destination on the site. Using turn-by-turn navigation, the user follows the directional instructions displayed in the wayfinding app.

### Information about Points of Interest

In addition to the position of the destinations, further information about them can be found. This may include a brief description, contact details and opening hours.

### Technical Implementation

Bluetooth Low Energy (BLE) beacons (or infsoft Locator Beacons) are installed at regular intervals throughout in the site. The beacons emit signals which are received by the users' smartphones. Based on the received signals, the position of the device is determined directly in the smartphone app.

Inside the app, the user can select a navigation destination and follow the directional instructions to their destination.

**More information and cost examples**

- infsoft Wayfinding

# Software: LocAware platform®


infsoft LocAware platform®

infsoft offers customized, holistic solutions and powerful software tools for the successful implementation of Real-Time Locating Systems.

As a central data hub, the infsoft LocAware platform® represents the center piece of the infsoft tools. All tools required for the setup and data management are bundled here and are accessible with single sign-on. The platform is available as cloud solution.

The web-based tools enable managing a location on all floor levels, analyze traces through the building, manage devices, beacons and Locator Nodes as well as to define geo-based alerts.

## Setup & Administration

The setup tools include all the required features to set up an indoor positioning system – mapping, calibration, data management, and route definition.

The infsoft administration tools provide useful functions for managing the deployed indoor positioning system (e.g. registration and administration of beacons and infsoft Locator Nodes).

## Data Processing & Output

infsoft's processing and output tools enable the intelligent use and evaluation of the collected data and help companies to optimize processes and improve decision-making.

### infsoft Analytics

infsoft Analytics visualizes detected devices within the floor plans and enables real-time monitoring of motion profiles. You can measure frequencies in specific areas, create time- and location-related analyses and combine the system with infsoft Automation to enrich your data. The live scripting engine can filter information or visualize data links in real time and in retrospect. The tool also provides heat map visualization and route tracing.

infsoft Analytics

### infsoft Tracking

Real-time visualization of the position of specific devices is enabled by the infsoft Tracking engine. You can add attributes to a device (e.g. mail address, name etc.), organize devices in groups and send push notifications to selected users. The engine can also be used for asset tracking and can be linked with other tools such as infsoft Automation.

### infsoft Sensors

infsoft Sensors visualizes condition sensing devices on the map and enables real-time monitoring of status information (e.g. light, temperature, pressure, humidity, $CO_2$, and presence based on infrared or ultrasound).

infsoft Tracking

### infsoft Automation

infsoft Automation allows for the definition of various geo-based triggers along the process chain in real time. The automated actions to be triggered can include alerts, notifications (push, email, ...), door locking / unlocking.

### infsoft Workflow

infsoft Workflow enables the active planning, control and logging of work-sharing processes within RTLS projects. Using the tool, all tasks that have to be carried out with the execution of organizational procedures can be registered and structured. Additionally, it is always possible to store geo-information.

### infsoft Machine Learning

infsoft Machine Learning is a visual tool that allows creating user-defined machine learning models, train them within a very short time and use them in a wide variety of applications. The powerful environment processes position and/or sensor data and uses self-optimizing algorithms that can learn from experience. By recognizing patterns and regularities in existing data, values and results can be predicted.

infsoft Automation

Software Videos

- infsoft Analytics
- infsoft Tracking
- infsoft Automation

## SDKs, Web Services & Developer

infsoft's technology is also available as plugins for integration into third-party apps. The plugins contain indoor positioning, indoor navigation & routing, 2D/3D building maps and GEOItems. The determined position is issued as virtual GPS coordinates and can be used as such in the app for your own purposes. The SDK (Software Development Kit) is currently available for the Android and iOS mobile operating systems and as an HTML5 plugin. In addition to a native implementation, the use of frameworks such as PhoneGap or Xamarin is also possible.
infsoft's products can also easily be adapted to different system environments. The infsoft web services allow fast and efficient data integration via REST/SOAP interface.

### infsoft Developer Hub

The infsoft Developer Hub gives developers access to the full range of functions of the infsoft LocAware platform®. The hub provides API explorer capabilities, code samples and comprehensive guides and documentation to help start working with the platform as quickly as possible.

## About infsoft

infsoft GmbH, located in Großmehring near Ingolstadt (Germany), has been offering solutions for indoor navigation, indoor analytics, indoor tracking, and location-based services since 2005. In addition to comprehensive solutions for major clients, infsoft also provides developers with access to its core technologies via scalable Software Development Kits (SDK), enabling integration with third-party applications. infsoft's client base includes Frankfurt Airport, Swiss Federal Railways (SBB), UNIDO, Siemens and Roche.

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