Whitepaper

Indoor Positioning & Services

INFSOFT
smart connected locations

Editorial

Dear readers,

The field of indoor positioning and indoor navigation has been undergoing sustainable changes and experiencing exciting new developments since I founded infsoft in 2005. Over the years, we successfully demonstrated our ability to adapt fast to new trends and circumstances, anticipating and inventing new ways to connect locations. Today, positioning and navigation solutions for indoor contexts include technologies based on Wi-Fi, Bluetooth Low Energy (BLE), Ultra-Wideband (UWB), and RFID, just to name a few. We intend to build on this momentum, combining fundamental concepts in hybrid approaches to aim for more accurate, precise, and efficient solutions. There is always plenty of space for improvement and innovation, and I am very excited for what is yet to come!

With this white paper, we want to provide you with a guideline to help you find a way through the complex topic of indoor positioning and related services. You can use it to get an overview of the different positioning techniques, learn more about the wide range of possible applications, and get to know our products and solutions. If you want to dig deeper, you can always have a look at our website, or our indoor navigation wiki.

CEO Tobias Donaubauer

If you have any questions, please don't hesitate to contact us. Would you prefer to reach out to us via LinkedIn or X (formerly Twitter)? No problem, please stay connected and let us in on your thoughts!

All the best,
Tobias Donaubauer

1 | The Basics of Indoor Positioning

Indoor positioning systems (IPS) enable you to locate the position of objects and people within buildings. GPS, however, 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. That is why an IPS has to rely on other localization methods. There are two approaches to put such an "indoor GPS" into practice.

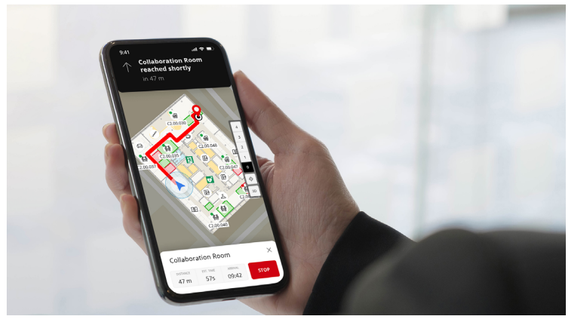
Indoor Positioning

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- and server-based approaches.

Client-Based

A client-based technology is used to keep track of individuals that might require a back channel for further information exchange (visualization of own position on a map, location-based alerts, task management etc.) and for navigation purposes. Hence, a smart device with a specific application is handling the indoor positioning based on external signalers such as Wi-Fi and Bluetooth Low Energy (BLE) in combination with the internal smartphone sensors (e. g. accelerometer, gyroscope, magnetic field sensor etc.).

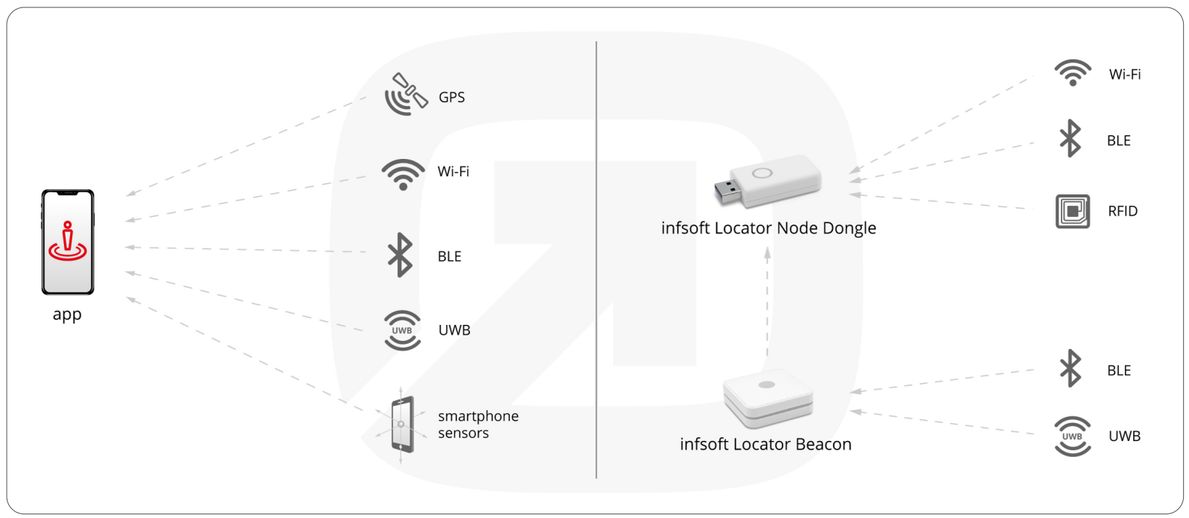
The position is determined on the smart device but can also be transferred continuously to a backend to provide supervisors with the user's current location. Therefore, the device requires a network connection.



Server-Based

A server-based technology is used to keep track of assets and persons and typically comes with a one-way communication towards the receiver. However, return communication to the asset tag is also possible, e.g. in the form of an activation of an LED or an output on an E-Ink display.

The receiver hardware is installed within the client's premises to capture the signals of the transmitters/senders and to transfer the data to a backend engine. infsoft can set up interfaces for indoor positioning from third-party providers such as Cisco, HP Aruba and Xirrus to visualize the position data within our Analytics and Tracking engine.



Client-Based and Server-Based Indoor Positioning

Technology Overview

To meet the requirements of a client regarding the requested accuracy, there are several potential sensor technologies available.

Client-Based Approach

Bluetooth Low Energy (BLE)

A client-based positioning (typically indoor navigation) is usually realized based on Bluetooth Low Energy (BLE) beacons. For this purpose, the small wireless radio transmitters are installed in the building at regular intervals. The position is determined on a mobile device (e.g. smartphone) and an app is required.

During installation and parameterization, attenuation properties of different materials must be taken into account (e.g. wood or glass with low attenuation properties as opposed to metal or water with high attenuation properties). For calibrating the position determination in a client-based approach, infsoft provides a calibration app that allows clients to work independently. infsoft also offers a beacon management tool to monitor battery levels.

The infsoft beacon calculator can help get a rough idea of the number of beacons required for a client-based indoor positioning project.

Wi-Fi

Wi-Fi is a possible alternative to BLE. In many cases, the existing Wi-Fi infrastructure can be used (e.g. cash register systems, public hotspots, access points of shops or exhibitors). However, due to higher inaccuracies, Wi-Fi is not the preferred option. For instance, the floor level cannot always be reliably determined. Furthermore, client-based positioning with Wi-Fi does not work under iOS.

EXAMPLES OF USE:

- Mobile App and Navigation for Company Premises
- Digital Patient Call and Indoor Navigation in Hospitals

Ultra-wideband (UWB)

Ultra-wideband (UWB) is a special form of wireless communication technology that is used for precise positioning at close range, especially indoors. In contrast to conventional technologies such as Bluetooth Low Energy (BLE) or Wi-Fi, which rely on measuring signal strength to determine position, Ultra-wideband is based on a time-of-flight method, also known as Time of Flight (ToF).

This process considers the time it takes for light to travel from an object to multiple receivers and back again. At least three receivers are required to accurately determine the position of an object, and it is necessary to have uninterrupted lines of sight between the transmitter and the receivers.

This particular form of location technology is suitable for determining the position on the user side, for example, for indoor navigation, as well as for determining the position on the server side in connection with asset tracking. Location-based localization on a mobile device, which is carried out at the device level, allows the location to be determined directly on the device itself. In contrast, with infrastructure-based, server-side localization, the position is determined on a server.

Due to its high accuracy and low latency, UWB is ideal for applications where precise, fast, and reliable positioning is required, for example in logistics, building management, or navigation in complex indoor environments such as shopping centers or airports.

Technology	Accuracy	Range	Cross-Platform
Wi-Fi	5-15 m	< 150 m	
BLE	1-3 m	< 30 m	
UWB	< 50 cm	Visual contact	

Comparison of Wi-Fi & BLE for client-based Positioning

Server-Based Approach

Various location technologies are available for server-based positioning (asset or people tracking).

Bluetooth Low Energy (BLE)

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 specific receiver hardware (infsoft Locator Nodes) in a server-based approach.

The underlying technology is using a signal strength (RSSI) measurement to determine the beacon's position. While tracking with the well-established Bluetooth Low Energy 4.0 standard offers accuracies of a few meters, the new Bluetooth 5.1 standard opens new perspectives for accuracies in the submeter range based on its "direction finding" function.

BLE Beacons are cost-effective and energy-efficient components that can run on button cells for up to five years and more. infsoft offers a Beacon management tool to monitor battery levels and set up business logics to replace batches in certain areas.

Bluetooth Beacons normally do not affect other radio networks and they also do not interfere with medical and industrial devices. However, BLE and Wi-Fi share the same frequency range (2.4 GHz). Interferences can be easily avoided by not using channels 2, 3, 4, 13 and 14 when configuring the Wi-Fi and using 1, 6, 7, 8, 9, 10, 11 and 12 instead. Bluetooth uses the remaining available channels to capacity in a uniform manner (frequency hopping). Advertising channels that are used for positioning are marked red in the graphic. The blue-colored channels are reserved for additional functions such as a temperature sensor.

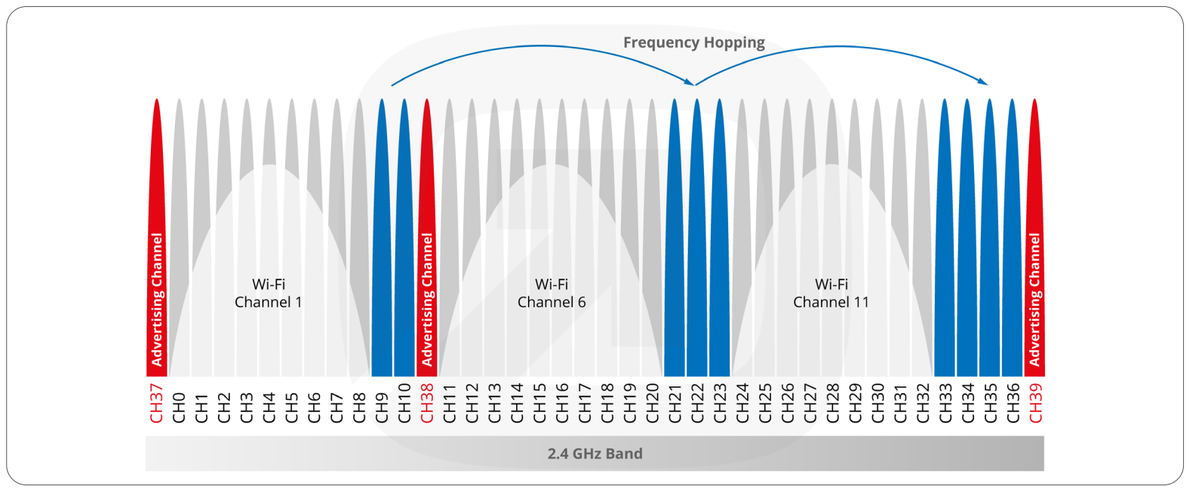
BLE Beacons are available from numerous suppliers and come in various shapes and sizes. infsoft solutions are compatible with Beacons of all manufacturers.

BLE Beacons 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:
- depending on size and shape of the asset, attachment of the Beacon can be difficult

EXAMPLES OF USE:
- Asset Tracking in a Manufacturing Facility
- Tracking of Endoscopes in Hospitals



Optimal use of radio channels when using BLE and Wi-Fi simultaneously

Beacons for Indoor Positioning

Wi-Fi

Inside buildings, Wi-Fi can be a good alternative to GPS. For a server-based solution, infsoft receiver hardware (infsoft Locator Nodes) can be used, detecting all Wi-Fi capable devices (e.g. smartphones, tablets, Wi-Fi tags) and enabling the monitoring of people flows and the tracking of objects. The user doesn't necessarily have to connect with the Wi-Fi, it is sufficient to have Wi-Fi enabled.

For positioning, 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. The accuracy of Wi-Fi used for indoor positioning varies from 5 to 15 meters – depending on the preconditions.

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
- high energy consumption with Wi-Fi tags

EXAMPLES OF USE:
- People Flow Analysis on Campus Areas
- Traffic Flow Analysis in Cities

Ultra-wideband (UWB)

Ultra-wideband is a short-range radio technology that is primarily used in industrial environments with high precision requirements.

With less than 30 cm, the accuracy is significantly higher than that of Beacons or Wi-Fi. Height differences can also be measured precisely. Another advantage can be the low latency time with up to 100 position updates per second.

In contrast to Bluetooth Low Energy and Wi-Fi, position determination is not based on the measurement of signal strength (Receive Signal Strength Indicator, RSSI), but on a time-of-flight (ToF) method. This involves measuring the time of flight between an object and several receivers (infsoft Locator Nodes).

The asset to be tracked is equipped with a small UWB tag that is battery-operated or can be powered by a forklift truck, for example. The tag sends data (ID, ToF, timestamp) to the infsoft Locator Node Dongle. These are permanently integrated into the infrastructure and can calculate how far away the asset is based on the measured time of flight.

If the position data is to be displayed directly on a mobile device (smartphone), the infsoft UWB tags can communicate with the smartphone directly via Bluetooth or via a USB interface.

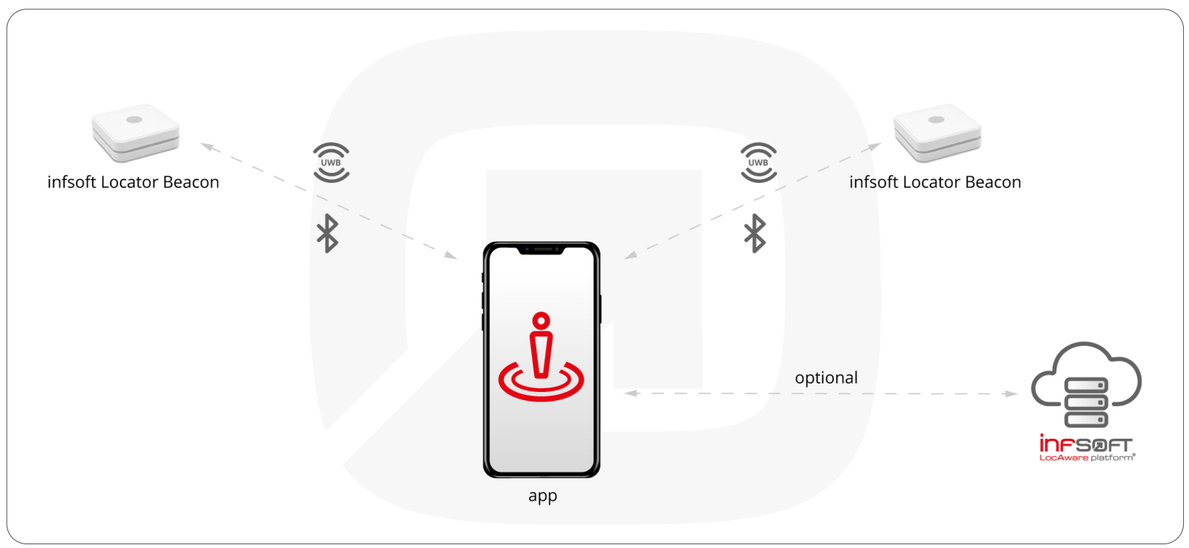
By using large frequency ranges with a bandwidth of at least 500 MHz, there is almost no interference. UWB can be a possible solution when it comes to locating a small number of assets in large industrial areas. However, compared to Bluetooth Low Energy, the price per tag hardware is significantly higher and the battery life is shorter.

UWB at a glance

Pros:
- high accuracy
- accurate measurement of height differences
- low latency times
- almost no interferences with given line-of-sight

Cons:
- cost-intensive
- shorter battery lifetime than BLE beacons

EXAMPLES OF USE:
- Tracking of Emergency Services During Training Exercises
- Improving Order Picking Productivity in Warehouses



client-based positioning using infsoft Locator 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 Dongle) 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).

No matter which industry you are thinking of – since it is a very versatile technology, RFID can be used almost everywhere. Common applications are systems for access control, time recording or inventory control in logistics. Since reliable identification of products or objects is required in many industries, RFID is particularly suitable as an asset tracking solution.

Since passive transponders do not have their own energy source, they are almost maintenance-free. As a result, initial acquisition costs will pay off in the long term in most cases. RFID tags do not require visual contact with the reader, and they are durable against impact and environmental factors.

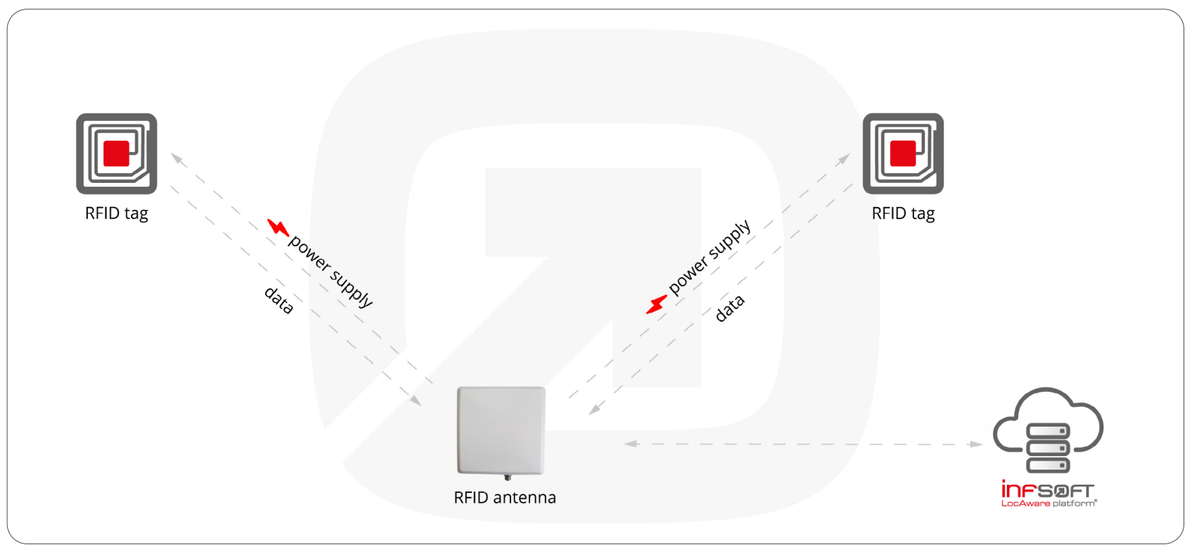
Combining RFID systems with other positioning technologies can solve the biggest problem of passive RFID technology: objects equipped with RFID tags can only be located at a specific point – namely exactly where RFID hardware (e.g. Locator Nodes) has been installed. However, if for example a forklift truck is equipped with an infsoft Locator Node, whose sensors not only respond to RFID, but also to Ultra-wideband (UWB), a link between the position data of the forklift truck and the identification times of RFID-tagged goods can be established.

RFID at a glance

Pros:
- low costs per asset
- immunity to interferences
- no battery needed

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

EXAMPLES OF USE:
- Tracking of Disposables in a Laboratory
- Tracking of Floor Conveyors and Goods in Logistics



Combination of RFID and UWB for identification and location of goods

2 | Solutions and Products

infsoft offers customized, comprehensive solutions and powerful products that allow for successful implementation of a Real-Time Locating System (RTLS).

infsoft Solutions

infsoft offers a whole range of indoor positioning services: indoor mapping, indoor navigation, tracking, location analytics, and geo-based services.

Digitization (Digital Twin)

Indoor digitalization can benefit buildings in a variety of ways. The digital recording of indoor spaces meets a range of customer requirements, e.g., simple navigation, efficient building management, and the linking of digitized processes and information with building structures, interior attributes, and building furnishings.

infsoft Maps Editor provides an easy way to capture large and complex areas with their different buildings in detail on all levels. Mapping a site is the first step in any indoor localization project, and it is critical to unlocking the digital value of indoor spaces. Digitizing all indoor processes is possible with access to digital maps and comprehensive building information.

Creating a location and importing existing map data (e.g., as an image file) only takes a few minutes. Organization of the plans based on buildings per level allows for clear management. The spatial structures are then simplified based on polygons, which are assigned properties such as color, 2D/3D representation, and height attributes.

The infsoft LocAware platform® offers various integrations with third-party CAFM systems and can exchange information via various data formats (e.g., XML, SVG, JPG, PNG, PDF, GML, GeoJSON, DWG, DXF, Shapefile, IMDF). The data provided via the interface is then processed by the CMS and displayed in the Maps Editor.

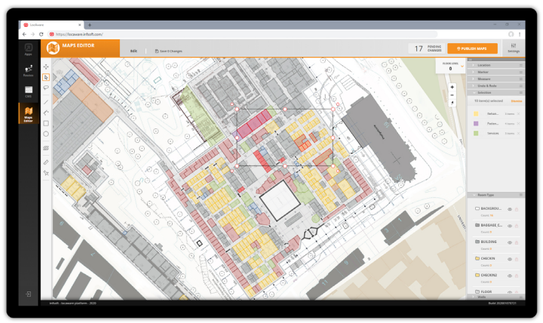
Positioning & Navigation

Indoor navigation means guiding people within buildings via a terminal device. Indoor navigation does not require automatic positioning, but in most cases is combined with it or equated with it in linguistic usage.

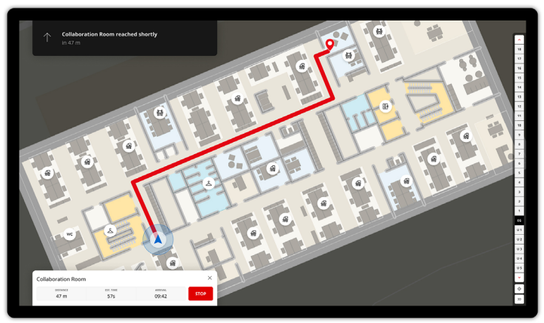
Solutions for routing in indoor and outdoor areas can be provided in the form of HTML applications for mobile/desktop or stationary kiosk systems. A native app is not necessary for this.

Permanently installed Bluetooth Low Energy (BLE) Beacons typically serve as indoor positioning technology because GPS cannot detect floors and the position resolution is extremely imprecise due to shadowing. A native app is required to determine the location. A major advantage in terms of data protection issues is that the smartphone determines its position directly, without recording it via a server.

A typical feature of route guidance is turn-by-turn instructions (information on route sections on the map), which are automatically updated when the position is actively determined. A feedback channel is also available, for example, for sending push messages. To refine the positioning, smartphone sensors are also always addressed – for example,



infsoft Maps Editor



infsoft Indoor Navigation

Mobile App for Indoor Navigation and Terminal with Indoor Navigation

GSM, 3G/4G (LTE), magnetic field, compass, air pressure, barometer, acceleration sensors, and gyroscope.

Indoor navigation and localization on the end device form a component in the system environment offered by infsoft, which is usually combined with other services to create greater added value for the user (see Workplace Experience solution).

infsoft's technology is also offered as a plugin for integration into existing systems (e.g., apps). An SDK (Software Development Kit) is available for Android and iOS mobile operating systems, as well as an HTML5 plugin. Depending on the desired accuracy, a Beacon should be installed every 7–10 meters in the building. Beacons are the most popular hardware for indoor positioning due to their high flexibility and accuracy. infsoft also offers special infrastructure hardware, infsoft Locator Beacons, which can also be used for indoor navigation. They enable simultaneous server-side applications such as locating people or objects.

Indoor navigation with Beacons

Wayfinding within buildings is usually implemented using Beacons. One of the reasons why this is so widespread is that the Bluetooth transmitters work across platforms and achieve accuracies of 1-3 meters. The best-known types are called iBeacon (from Apple) and Eddystone (from Google). Both work with the BLE (Bluetooth Low Energy) standard and therefore consume very little energy.

Depending on the desired accuracy, a beacon should be placed every 7-10 meters in the building. Beacons are the most popular hardware for indoor positioning due to their high flexibility and accuracy. infsoft also offers special infrastructure hardware, infsoft Locator Beacons, which can also be used for indoor navigation. They enable simultaneous server-side applications such as locating people or objects.

Indoor navigation mit Wi-Fi

Indoor navigation with Wi-Fi has an accuracy of 5-15 meters. The various signal strengths of several Wi-Fi access points are evaluated for this purpose. Positioning within the building, even over multiple floors, is made possible through specific shielding characteristics. The available Wi-Fi infrastructure can be used (e.g. customer hotspots, Wi-Fi-capable point of sale systems, routers) – the user only has to activate Wi-Fi on his/her smartphone, a connection is not required.

However, client-based positioning via Wi-Fi is not supported by Apple devices. Beacons are a good alternative if you want to include all smartphone users.

Indoor navigation with Ultra-wideband

Indoor navigation with Ultra-wideband has some significant advantages in industrial environments: high accuracy (10-30 cm), low latency times (position request up to 100 times/second), and accurate measurement of height differences.

For client-based positioning using Ultra-wideband, infsoft UWB Tags are required. They transmit their position directly to the smartphone – either via a USB dongle which is directly plugged into the smart-phone or via Bluetooth.

However, the technique is a special solution which requires appropriate components and thus is mostly suitable for special industry applications. One possible use case are floor conveyors whose drivers should receive precise turn-by-turn directions. Because of their high speed, latency must be kept to a minimum.

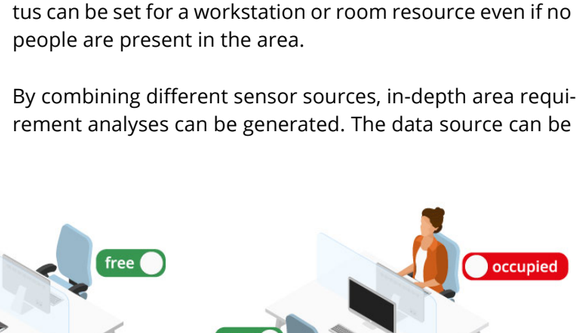
Application examples of indoor navigation:
- Indoor Navigation and Digital Signage in Hospitals
- Geo-Based Incidents and Data Enrichment for ITSM Software
- eCharging as a component of the Workplace Experience App

Occupancy Analytics

infsoft's analysis features can be based on an existing positioning system (client-side or server-side) or set up separately. Depending on the application scenario, the utilization analysis can refer to workstations, room resources, or areas, specify the evaluation of walking routes, or also mean the visualization of the degree of utilization of machines.

Utilization analytics generate relevant data for business decisions, especially for space management and facility services. The focus here is on optimizing the use of space and integrating services such as demand-oriented cleaning, e.g., of workstations, meeting rooms, and toilets.

Utilization analytics, in combination with location data (e.g., from infsoft Lead Time Tracking), also provide helpful insights for portfolio management of managed assets. The solution can make use of tag hardware (WLAN, BLE, RFID, and UWB) and uses additional motion sensors or power consumption measurement to measure the time and location at which assets were used. The data is displayed in a clear web interface in the form of diagrams and heat maps, making it easy to evaluate and process. Evaluations based on sensor data can also be made independently of or in addition to position determination.

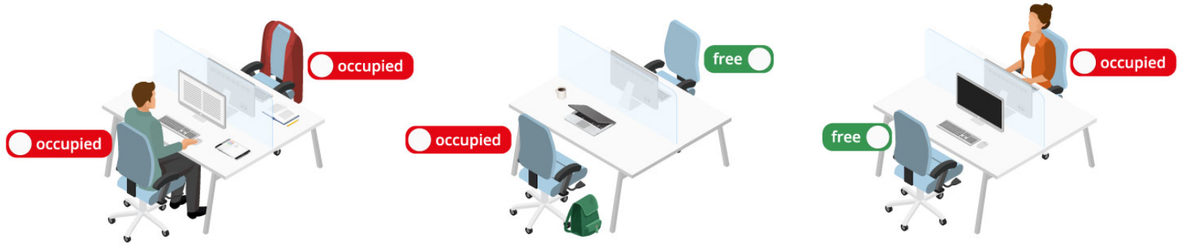


BLE tags are usually used to analyze movement flows. These can be attached to objects or carried by people in the form of wristbands or ISO cards. BLE tags can also be equipped with sensors, such as a motion sensor. This makes it possible, for example, to register whether a chair is in use or the corresponding workstation is free. In addition to recording via Beacons with motion sensors, data from third-party sensor systems such as VergeSense or XOVIS can also be connected to the infsoft LocAware platform® via interfaces. Some of these sensor systems support smart object recognition. Objects such as jackets, cups, bags, laptops etc. can be recognized and compared with a reference database.

Object recognition and indicators for passive occupancy (e.g. moving work equipment or a drink), an occupancy status can be set for a workstation or room resource even if no people are present in the area.

By combining different sensor sources, in-depth area requirement analyses can be generated. The data source can be anonymized login data from company devices in the Wi-Fi, which is provided, for example, via the existing Cisco access point infrastructure. Based on the data provided and the associated dwell times, movement patterns with associated working styles can be created, from which a space requirement can be derived.

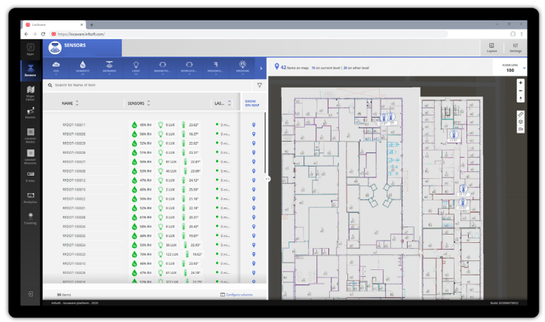
Application examples of occupancy analytics:
- Workplace and Room Occupancy Tracking



Sensor Evaluations

Sensor technologies can provide records of controlled parameters that can be used for purposes such as condition monitoring, occupational safety, air quality, or food safety. A network of wireless sensors ensures intelligent infrastructure management and enables valuable user experiences. Possible sensor data include temperature, humidity, CO_2, air pressure, illumination, vibration, and much more. Integrated into critical systems, the sensors can provide cost savings, improved energy efficiency, and reliable reporting.

Typically, a network of infsoft Locator Nodes and wireless sensor devices is used to collect the environmental or presence data of interest. Beacons can also be equipped with sensor technology ("sensor beacons"). Furthermore, effective energy management can be enabled by using infsoft Locator Beacons Smart Plugs to record and evaluate power consumption.

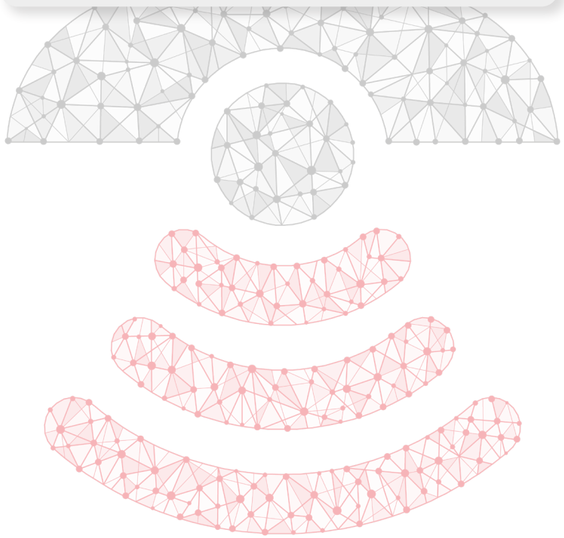


infsoft Sensors

Sensor Beacons (Door Sensor, PIR Sensor, Temperature/Humidty)

infsoft's software solutions provide real-time trending, notifications to relevant personnel, and automated reports. Alerts can be set up to automatically inform about situations that require attention. The web-based application infsoft Sensors provides real-time access to the collected sensor data. Customizable dashboards help to assess current situations and long-term trends.

Application examples of sensor evaluations:
- Cold Chain Monitoring in Food Logistics
- Water Damage Prevention with Water-Leak Sensors

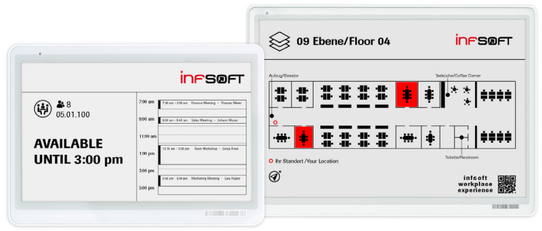


Smart E-Labeling

E-Ink displays are electronic screens that digitally present text and graphics with high readability and low power consumption. infsoft leverages this energy-efficient technology in combination with Bluetooth Low Energy (BLE) to not only facilitate dynamic digital labeling but also enable real-time tracking of E-Ink components within various environments, ensuring seamless updates and improved asset management.

The possible applications for infsoft E-Ink Display Beacons are extensive and highly versatile. Available in various sizes (ranging from 1.5 to 11.6 inches) and featuring a multicolor LED indicator, they can be deployed for digital labeling of rooms, workspaces, lockers, shelves, industrial containers, and many other assets. These displays are seamlessly integrated into the system and automatically updated with real-time information, ensuring accurate and up-to-date data visibility without manual intervention.

Interaction with a QR code or a physical button is also possible, providing a seamless way to engage with the system. Scanning the QR code can, for example, open a room booking system or direct users to relevant asset information,



Infrastructure Hardware E-Ink Displays

while pressing the button could transmit a status update, such as marking a room as occupied or signaling a maintenance request.

We distinguish between fixed E-Ink Displays (infrastructure hardware, e.g. digital door signs or floor plans) and mobile E-Ink Displays that are attached to assets to be tracked (tag hardware, e.g. digital labels for goods, devices, etc.). Positioning and dynamic labeling of the displays are provided in a server-based approach using a Bluetooth Low Energy gateway (infsoft Locator Node). The Locator Nodes may be supplemented by a network of infsoft Locator Beacons, especially if a system for asset tracking and/or indoor navigation is used simultaneously.

Tag Hardware E-Ink Displays

Application examples of smart e-labeling:

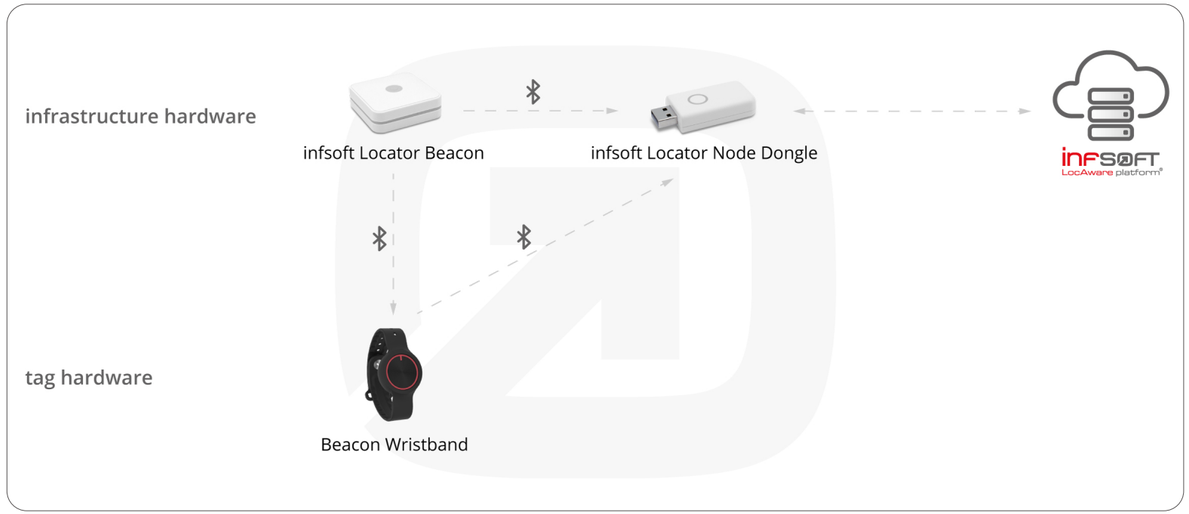
- Digital Information Displays for Office Buildings
- Tracking and Digital Labeling of Containers in Logistics

Asset- & Peopletracking

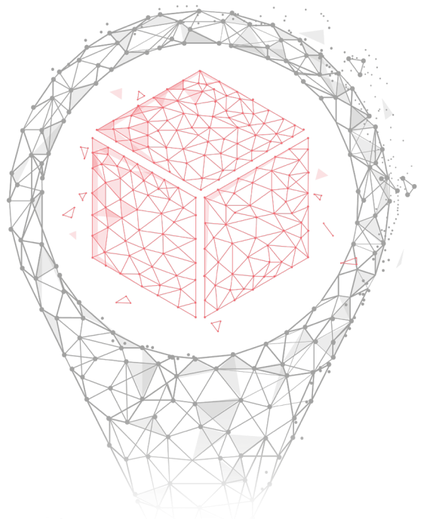
Indoor tracking, also called indoor localization, refers to the localization of people and objects within buildings. It is a technical challenge because GPS does not work reliably indoors. For this reason, in most applications, we rely on Bluetooth Low Energy positioning using infsoft Locator Nodes or infsoft Locator Beacons – scalable infrastructure hardware specially developed by us. It is also possible to use Wi-Fi (accuracy of less than 15 meters) or Ultra-wideband (high-precision localization with low latencies) for localization. RFID enables selective object identification and is not suitable for comprehensive tracking. All solutions presented also work seamlessly under the open sky in case a roof does not uniformly cover the plant grounds.

Indoor tracking is typically implemented as a server-based application. No app is required because a backchannel to the object to be located is not necessary in most cases.

In addition to the infrastructure hardware, the infsoft Locator Nodes and Locator Beacons, a tracking system uses suitable tag hardware that is attached to the objects to be tracked or carried by people. BLE Beacons in various forms (e.g. available as a button beacon, wristband, ISO card or with an E-Ink Display) are usually used here. In some cases, client-side positioning is used, for example if the personal location is to be part of an employee app. The position is determined directly on the user's smartphone, which requires an app. A feedback channel, for example for sending push notifications, is then available.

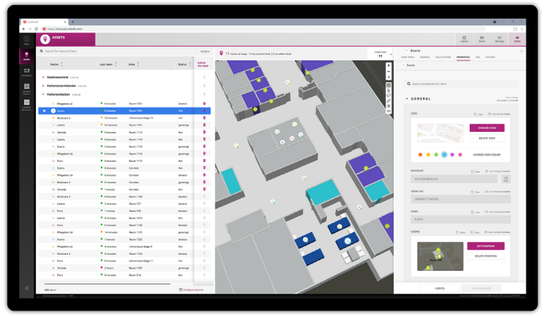


Real-Time Tracking with Beacon Wristbands



Asset Tracking

The tracking of objects is in great demand, especially in industry, healthcare, and enterprise locations. It is often necessary to determine the current location and/or movements of work equipment or goods. The systems from infsoft always come with a software package that enables various applications. The basis is a detailed digital map that can be viewed on all (including mobile) devices, displaying the objects' current position.



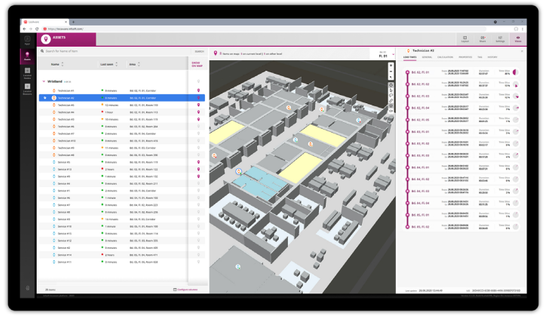
infsoft Assets

Application examples of asset tracking:

- Positioning and Condition Monitoring of Hospital Beds
- Inventory of Assets in an Office Building

People Tracking

Tracking people can be useful in various situations. On the one hand, safety aspects are crucial, for example to protect particularly vulnerable patients or when evacuating employees on large company premises. On the other hand, tracking can contribute to the optimization of work processes by helping to quickly locate employees in large areas or improve the efficiency of walking routes. This not only enables a targeted response in emergencies, but also more effective planning and organization of work processes.



infsoft Assets

Application examples of people tracking:

- Patient Wandering System for Dementia Patients
- People Tracking System for Industrial Facilities

Process Automation & Trigger Logics

Logics that refer to geodata or other triggers can lead to an optimization of operational workflows and processes. For this purpose, infsoft provides a comprehensive software solution that automates manual, repetitive, and complex processes. This results in increased process speed, minimized error sources, and reduced personnel workload.

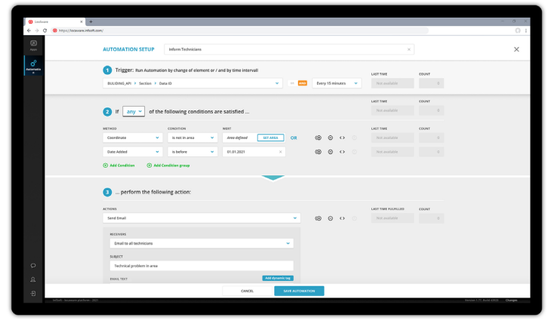
Using the infsoft Automation software tool allows the definition of various triggers along the process chain in order to simplify and accelerate workflows. For example, you can configure messages and tasks, trigger alerts, and protect assets or areas. Triggers can be defined with the greatest possible flexibility: They can reference location, time, a user, a device property, the status of hardware components, and more. It is also possible to freely interlink individual conditions.

In addition, third-party systems such as enterprise resource planning (ERP) solutions can be connected bidirectionally via API interfaces. This allows data imports as well as automated actions in the ERP, such as deregistration of orders.

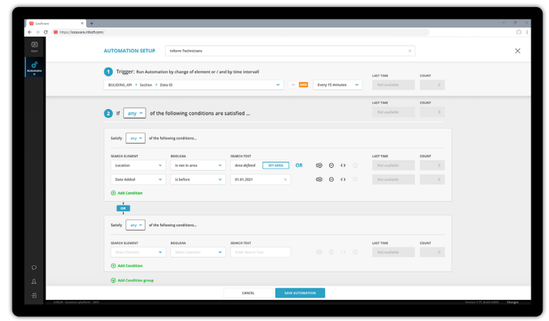
Important messages can be configured as push messages within the infsoft LocAware platform® (desktop/mobile). These messages are displayed in the Notification Center on the platform home screen.

Use Cases

A definition of trigger logics is beneficial whenever processes need to be made visible, workflows need to be accelerated, and resource availability needs to be improved. The infsoft automation solutions are used for industrial processes and in the environment of various other industries (automotive, healthcare, office environments, etc.).



infsoft Automation



infsoft Automation

Another example of leveraging infsoft Automation is the configuration of click interactions. In the healthcare sector, patients equipped with a Beacon wristband can use the button to send a mobile emergency call, which is transmitted to medical personnel along with the patient's current location. In offices, on the other hand, pressing a Beacon's button could be used to trigger the reordering of items such as everyday office consumables.

Application examples of Process Automation:

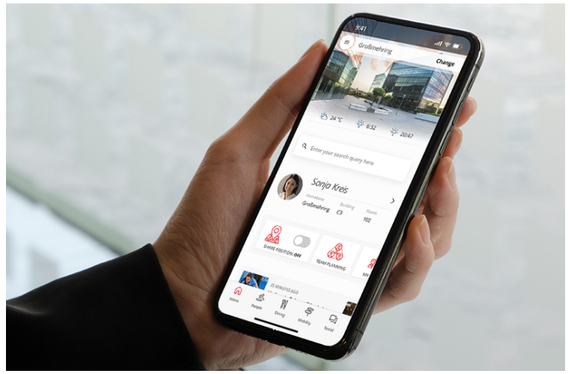
- Optimization of Milk Runs in Industrial Production
- Automated Workflow Management for Maintenance Orders in Healthcare

infsoft Products

In addition to customized solutions, infsoft also offers out-of-the-box solutions with powerful features.

infsoft Wayfinding

In large buildings or on wide campus areas, there are many destinations that visitors and employees want to reach. infsoft Wayfinding helps users to get to the desired location quickly and easily. The product can be used in buildings such as hospitals, airports and office complexes across indoor and outdoor areas. The solution includes a map of the location that offers an overview of the premises. Furthermore, points of interest (POI) can be found directly on the map as well as via a search bar and the shortest way can be displayed. On mobile devices, the app can also offer real-time turn-by-turn navigation and further assist the user.



infsoft Wayfinding App

Digital 2D/3D Building Map

The solution 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.

Points of Interest

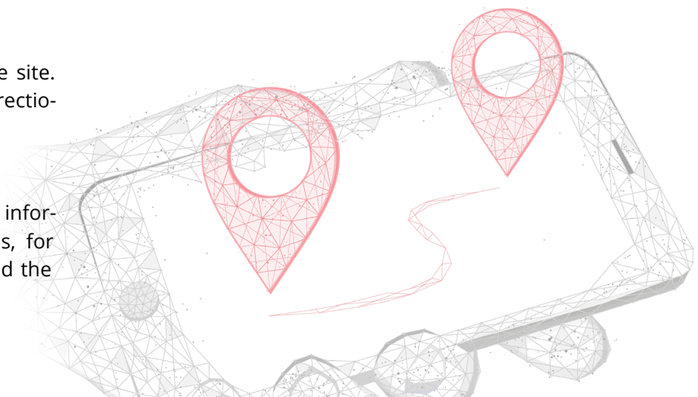
In addition to the position of the destinations, further information about them can be displayed. This includes, for example, a brief description, equipment features, and the relevant contact person.

infsoft Wayfinding App

Implementation

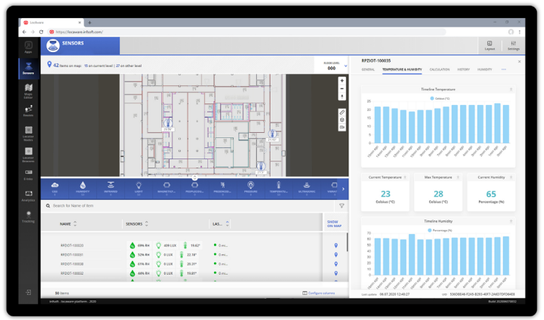
Depending on the specific requirements of each location, infsoft Wayfinding can be deployed as a native app, a progressive web app, or a stationary terminal solution. These options can also be combined to create a seamless and versatile navigation experience. Our comprehensive setup tools are always included in the solution, ensuring easy configuration and customization. With infsoft Maps Editor, infsoft CMS, infsoft Routes, and infsoft Calibration, the application can be tailored to meet individual customer needs. Additionally, our SDK (Software Development Kit) allows for seamless integration of the technology into existing applications, enabling businesses to enhance their digital ecosystems. For office environments, infsoft Wayfinding can also be embedded into a Workplace Experience App, providing employees and visitors with an intuitive and efficient navigation solution directly within their workplace platform.

More information
- infsoft Wayfinding



infsoft Room Environment

This intelligent room climate monitoring solution empowers businesses to improve the well-being and performance of their workforce. By collecting various sensor data that characterize the quality of the office environment (e.g. temperature, relative humidity, carbon dioxide levels, illuminance), optimal working conditions can be created and maintained. This can serve as an important measure to promote employee health and increase productivity and innovation. Automated notifications can be triggered when certain thresholds are exceeded, allowing an ideal indoor air quality to be restored as quickly as possible.



infsoft Sensors

infsoft Room Environment can also be utilized for effective energy management – by recording and evaluating power consumption. To do this, individual consumers must be connected to an intelligent Bluetooth Low Energy socket (infsoft Locator Beacon Smart Plug). The latter measures the power consumption and wirelessly transmits it to the web-based infsoft software tools. Here, the consumption data can be viewed, and energy-saving plans can be stored.

infsoft Room Environment can be used standalone or as an additional feature of the infsoft Workplace Experience App. The system relies on cost-effective, low-maintenance Bluetooth Low Energy hardware, is non-intrusive, and integrates seamlessly with existing control systems.

Environmental Data

Collecting sensor data helps companies create a healthy working environment for their staff. Relevant metrics are usually temperature, humidity, CO_2 levels, and possibly light intensity.

Analysis & Insights

Interpreting the gathered environmental sensor data helps with the monitoring and optimization of office spaces. That way, the health and productivity of personnel can be increased.

Room Climate Control

Sensor data can be integrated into a mobile app. With existing interfaces to the building control system, adjustments to the room climate, such as temperature regulation, can be made via the app.

Implementation

Beacons with integrated sensors for collecting environmental data («Sensor Beacons») and infsoft Locator Node Dongles are strategically installed throughout the premises to enable comprehensive monitoring. These Sensor Beacons continuously measure various parameters such as temperature, relative humidity, air quality, or motion, depending on the configured sensor functions. The collected environmental data is transmitted via Bluetooth to a nearby Locator Node Dongle, which acts as a gateway. From there, the data is forwarded to the infsoft LocAware platform®, where it is intelligently processed, analyzed, and made accessible via web services. This enables real-time monitoring, data-driven decision-making, and seamless integration with other systems for optimized facility management and process automation.

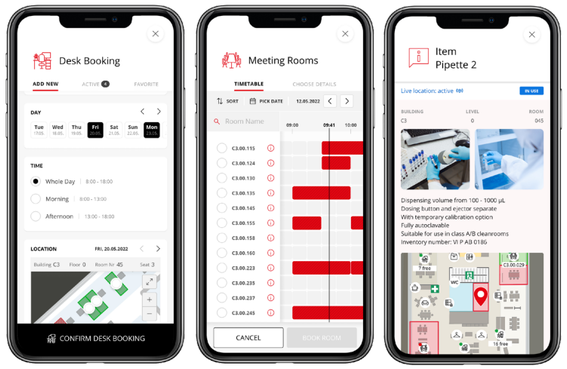
More information
- infsoft Room Environment

infsoft Workplace Experience

Diverse solutions and applications in smart offices lead to a more pleasant and productive working day for employees. From the company's point of view, there is potential to save costs and optimize processes. It also increases employee satisfaction and leads to higher productivity and lower staff turnover. It is also possible to integrate the technology into existing applications via SDK (Software Development Kit).

In addition to employees, the app can also be made available to visitors in a restricted version. As part of the integrated visitor registration process, visitors receive a login voucher that can be used to access limited content in the app. They can navigate to the stored meeting point, access the current menu of the public canteen and other POIs relevant to visitors.

There are a wide range of features that a digital employee app can enrich everyday life in the company.



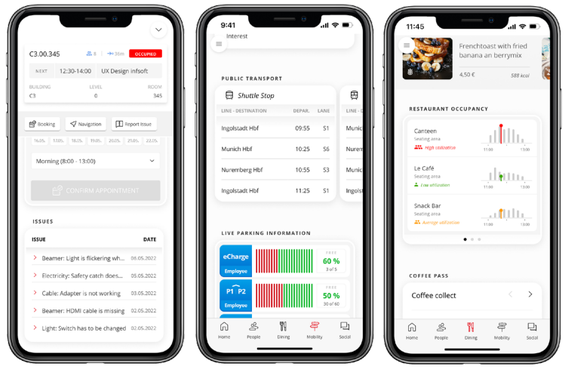
infsoft Workplace Experience App

Wayfinding

The navigation on site makes it easier for employees, visitors and guests to find their way around. The basic function provides users with an interactive map of the entire site, including all buildings and floors. This is supplemented by a search function including category assignments. Extensions are also possible in a variety of ways and are virtually unlimited.

Dining

A wide range of information about the restaurants on the company premises is displayed here. For example, the menus of various canteens or restaurants are announced a week in advance. Each user can customize the display, so allergens or specific diets (vegan, vegetarian, pescetarian) can be selected in advance and the menu selection is automatically adjusted accordingly. Information on the respective menus such as costs, nutrition scores or allergens can also be determined directly in the app. In addition, the latest editions as well as available meal vouchers, occupancy rates and opening hours are shared directly in the app.



infsoft Workplace Experience App

Meetings

Meeting rooms can be booked and meetings organized in the Meetings section. All information on equipment, capacity and utilization is available. Sorting according to geographical distance is one way of increasing efficiency. It is also possible to provide routing and links to catering services for guests.

Issue Reporting

Integrated issue reporting makes it possible to report errors or damage in meeting rooms or at the workplace directly in the app. For example, if there is a non-functioning screen in a meeting room, this can be easily reported via issue reporting. After pressing the issue button, an instance opens, which is already pre-filled with data such as the room number, in which the defect can be reported using the text function and optionally with images. Current status messages are also visible in order to avoid duplicate messages. The person reporting the defect is optionally informed by push message whether it has been rectified, for example by integrating service providers such as ServiceNow. Depending on the POI (meeting room; toilets), the damage reports are divided into different categories in order to be able to integrate different service providers depending on the damage category. In the backend, it is possible to assign the various service providers to the corresponding category, thus enabling uncomplicated and immediate rectification of the detected defects. It is also possible to use E-ink Displays to explicitly mark the meeting rooms in which a currently reported defect is located.

Mobility

An app can offer employees greater convenience right from the start of their journey. By connecting parking lot information, company shuttle schedules and public transport, the user receives a quick overview of the travel options.

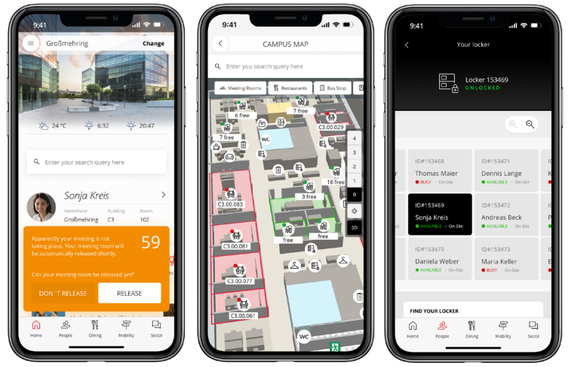
Social

This function can be used to plan internal company events and strengthen the connection between employees. It can be equipped with various functionalities such as chat, personal profile, skill finder and acquaintance list. Of course, personal data is made available in compliance with the GDPR.

Desk Booking

There are two ways to book a single workstation or zone in the Workplace Experience app. First, the desired workplace can be booked via a Booking Wizard and second, via a map booking (quick reservation). In the latter case, the desired building or the corresponding floor is selected and an overview of the currently available individual and group workstations is displayed. Various features can be seen directly from the map, such as quiet or special workstations.

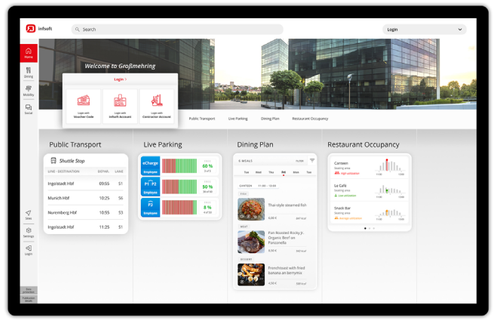
If the booking is made via the Booking Wizard, a large number of individual presettings can be made. For example, workstations with specific equipment (type of monitor; height-adjustable desks) can be displayed. Furthermore, various zones can be defined as favorites, which are automatically checked for availability in the Booking Manager first. If a workstation is booked, it is displayed directly in the active bookings on the start page.



infsoft Workplace Experience App

Desk Booking also has an assistance function. This means that workstations can also be booked in the name of another person. The date, zone, time and type of workstation can be freely selected.

Which zones an employee can book for themselves can be optionally controlled. Whether employees can book into different zones on an interdisciplinary and mixed basis or whether there should be defined departmental zones is controlled in the backend. As a backup, fallback zones are set up in which alternatives are defined for department-specific booking zones. Department zones or levels can be evaluated across the board. Appropriate sensors can be used to determine whether booked workstations are actually occupied.



infsoft Workplace Experience App

Onsite/Offsite Planning & Team Planning

The WPE offers the option of TEAM planning or onsite/offsite planning. An automatically generated indication of the attendance status on site is displayed directly after the workplace booking has been made. Attendances and absences can be maintained in the tool even without a workplace booking. The information can be made visible to colleagues using a release principle. If you proactively share your current workplace or location, the location is displayed in the team's profile overview. If colleagues' workplaces are not visible from the outset, they can be asked to share their current location via a push message.

More information

- infsoft Workplace Experience

infsoft Occupancy

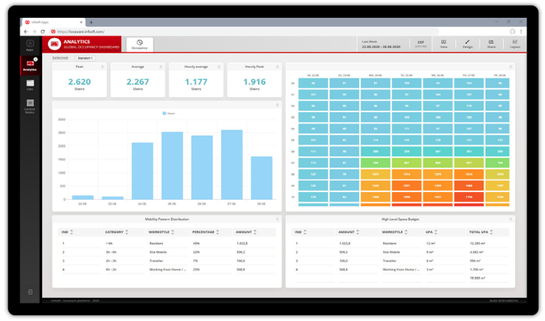
In buildings, reliable space utilization tracking can significantly help to manage busy environments such as offices more efficiently. Office space is one of the biggest cost factors for companies, so it is crucial for them to make the best use of available space. By using our intelligent, ready-to-use solution infsoft Occupancy, you can quickly build a flexible, agile and space-efficient office portfolio.

Our solution does not require building occupants to carry a device. Instead, it relies on cost-effective Bluetooth Low Energy hardware that is easy to install and maintain.

Furthermore, additional data sources such as Wi-Fi data are integrated to provide a solid information base. In contrast to sensor systems or sensors, this makes it possible to determine how long a person has been in a certain area. Mobility or workstyle patterns can be determined on the basis of these evaluations and space management can be adapted using the relevant factors. In addition, the overcrowding factor per workstation/meeting room can be determined, especially for flexible workspaces. By networking different data sources, various stakeholders can benefit from the utilization analysis in combination with other infsoft products. For example, power consumption can be made more efficient with infsoft Smart Plugs. Smart cleaning systems also benefit from utilization analyses, as they can be cleaned on an as-needed basis instead of cyclically. As the cleaning of buildings often represents a high cost factor, demand-oriented cleaning also guarantees considerable cost savings here.

Occupancy Tracking for Workstations

Bluetooth Beacons with motion sensors, attached to office chairs, can determine the use of workstations. In addition



infsoft Analytics

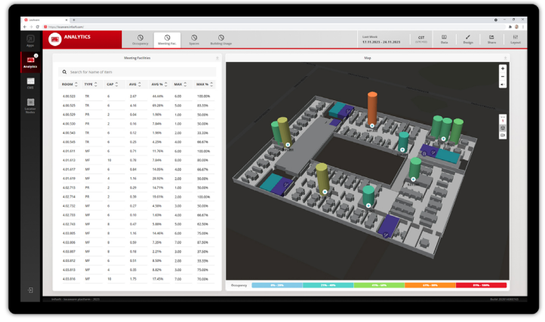
to BLE beacons, it is also possible to use smart object recognition to identify occupied workstations. Camera-based sensor systems can display an occupancy status even if no person is physically present at the workstation, for example through coffee cups, bags or jackets.

Indicators of passive workplace occupancy can also be changes in the arrangement of objects between the measuring intervals of the sensors. Examples are shifts in the work equipment or the coffee cup on the table. In this case too, the occupancy status of the workstation is determined without the physical presence of people in the detection area.

Occupancy Information for Conference Rooms

The installation of infrared sensors in meeting rooms makes it possible to obtain reliable occupancy information (occupied/unoccupied) and to detect changes in real time.

Camera-based sensor systems are used to determine actual occupancy figures. This allows the number of employees present to be determined. It is therefore possible to check whether the number of employees present is appropriate



infsoft Analytics

for the conference room in order to ensure better utilization of buildings and rooms.

Data Insights and Analysis

infsoft Occupancy provides companies with valuable data to determine whether workspaces are meeting requirements and to make adjustments to optimize the use of office space.

In addition, insights into occupancy data provide an important basis for further business decisions. Occupancy analyses provide reliable data for optimization. This enables building operators to act in a better, more optimized and more effective way.

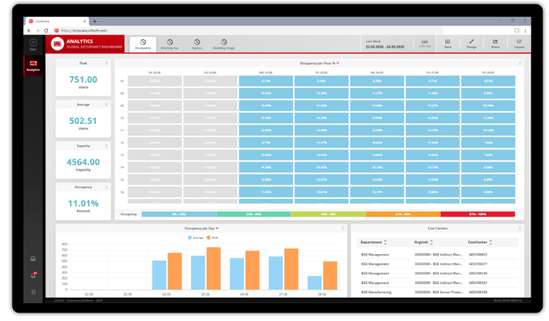
Implementation

Bluetooth Low Energy (BLE) Beacons with integrated motion sensors are attached to the office chairs. A small number of infsoft Locator Nodes are installed in the areas to be monitored. In conference rooms, presence detectors (passive infrared sensors, PIR) can record occupancy.

Combination of Technology and Application

As part of the various options for capacity utilization analysis, for example at workstations or in meeting rooms, employees can benefit from an app that displays different capacity utilization indicators at a glance. Linking occupancy analyses with the Workplace Experience App provides all the information tailored to the various stakeholders.

This makes everyday working life more productive and easier for employees, as workstation bookings and the utilization of different building levels can be seen directly from the app and the search for a free desk is significantly reduced, especially for companies with flexible office concepts.

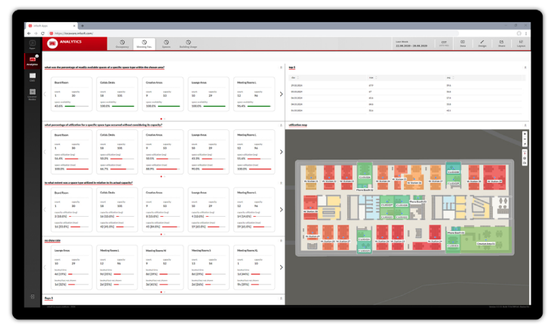


infsoft Analytics

The employees' lunch break can also be organized more effectively, as the capacity utilization of the various locations on the company premises can be viewed in advance and their predicted waiting time for the lunch menu displayed. Values from the past and predictions for canteen occupancy in the future are also displayed in the app.

Other sectors and application areas also benefit from the combination of analysis and application. For example, passengers at the airport can find out in advance about the current number of security checkpoints and their waiting times.

In combination with infsoft Wayfinding, where passengers can also be navigated to the nearest security checkpoint, this offers a holistically effective and optimized user experience.



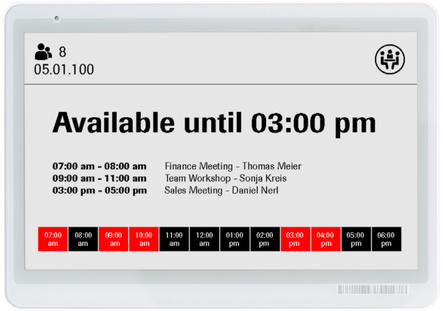
infsoft Analytics

More information

- infsoft Occupancy

infsoft Room Signage

infsoft offers innovative electronic room signage systems based on battery-powered E-Ink Display Beacons. These modern and also very practical room signs simplify work processes and create transparency, as employees and visitors can view up-to-date information about ongoing and upcoming meetings at any time. The displays enable the automation of processes and a reduction in overall operating costs. With the help of the display beacons, not only office, seminar and conference rooms, but also treatment and patient rooms can be updated and easily managed at any time. E-Inks can also be used to digitally label lockers, which many companies provide to their employees and customers for storing valuables and personal items.



infsoft E-Ink Display 7,5 Inch

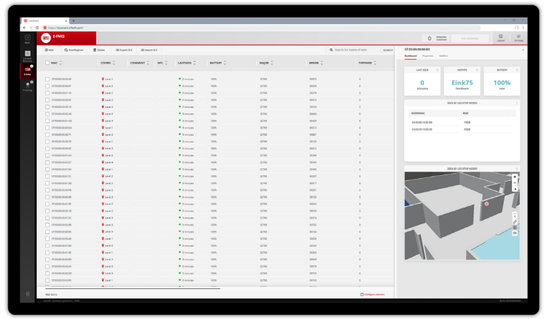
The displays are centrally managed via an infsoft Locator Node Dongle and the displayed content is automatically updated via infsoft Automation. Room lists and schedules can be easily imported and displayed via interfaces to third-party systems (e.g. Google Calendar, Office 365). While sample templates are available for this product, individual layouts according to your own corporate design can be used as well.

The tricolor display is equipped with an LED indicator and uses fully daylight-compatible ePaper technology. The batteries last for about 5 years, even with several content updates a day. The battery status can be monitored using the software tool infsoft E-Inks. Due to the simple assembly, complete office buildings can be easily retrofitted with the room signs.

Implementation

Bluetooth Low Energy Beacons with E-Ink display are placed next to the room doors. infsoft Locator Node Dongles installed in the building receive the signals of the display beacons and transmit them to the infsoft LocAware platform®.

Via Bluetooth, the content is transferred from an infsoft Locator Node Dongle to the E-Ink Display to be labeled. The content on the display can be automatically updated using infsoft Automation.



infsoft E-Inks

More information
- infsoft Room Signage

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. In healthcare, the application can help physicians and nurses reduce the amount of time and resources devoted to management purposes. Process tracking and automation can also be applied to various other sectors such as automotive, office, and retail.

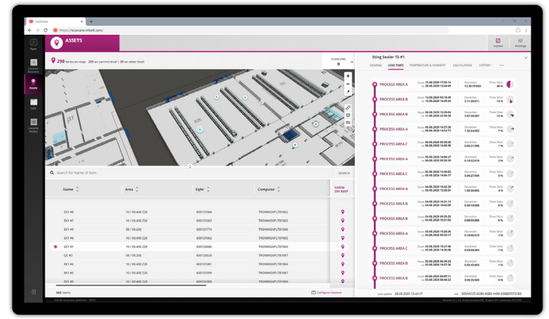
infsoft Lead Time Tracking relies on cost-effective Locator Beacon hardware that is easy to install and easy to maintain. An interface to the in-house ERP software facilitates processes and automatically assigns asset details.

Asset Tracking

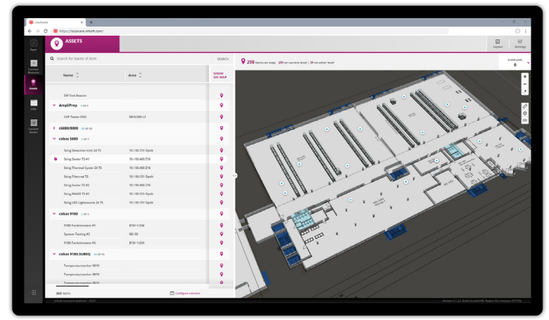
Mobile goods are tracked at relevant checkpoints. The current position and status can be viewed on a digital map. A dashboard displays dwell times at different process areas.

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 Assets



infsoft Assets

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.

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 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
- infsoft Lead Time Tracking

infsoft People Tracking

Real-time location and motion tracking increase safety and productivity. Bluetooth Low Energy wearables and low-maintenance hardware enable reliable location tracking for employees, patients and visitors. The system offers location and route tracking, people counting, crowd and dwell time tracking, access control and protection of sensitive areas. infsoft People Tracking works reliably in any building layout, offers easy implementation and high scalability, and location data can be accessed via intuitive interfaces.

Real-Time Localization

The system provides real-time visibility into the location and movement of people, powering a multitude of location-aware applications. Management can drive operational efficiencies, gain insights into space utilization, and enhance safety.

Location-Based Actions

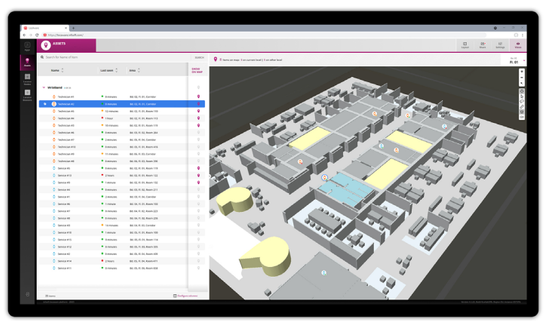
The system allows you to set up virtual zones, and trigger automated responses when a tracked tag enters, exits, or dwells within a defined area. For businesses, location-based order assignments can majorly contribute to efficient workflows.

Safety and Security

The tags are equipped with a “panic button”, which can be used to request help immediately, sending an alert with the current position. In case of emergencies, knowing the location of affected individuals significantly reduces the necessary rescue time.

Implementation

Every individual to be tracked wears a small rugged BLE wristband, which is used to identify their location in real time. infsoft Locator Beacons and infsoft Locator Node Dongles are installed at regular intervals throughout the facility. The wristband receives Bluetooth signals from infsoft Locator Beacons installed in the monitored zones. The data is then forwarded to a Bluetooth gateway (infsoft Locator Node Dongle) and the infsoft LocAware platform®.



infsoft Assets

More information
- infsoft People Tracking

infsoft MedEquip Tracking

infsoft MedEquip Tracking helps medical facilities manage their moving assets, from hospital beds to endoscopes. The solution enables real-time location and status updates of devices, which are displayed in a clear dashboard. It provides transparency on availability and supports process automation through flexible conditions and actions. Positioning is mainly carried out via BLE Beacons, but can also be supplemented with a connection to the bed software for modern beds, which provides additional information such as height adjustment.

Device Localization

The solution enables reliable room- and area-accurate positioning of mobile medical equipment and hospital beds in healthcare facilities. The localization can be carried out seamlessly across all floors of the building.

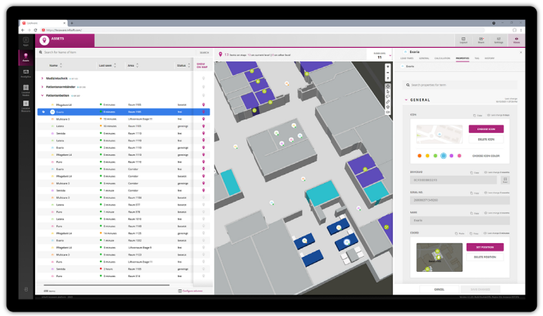
Process Management

By using infsoft Automation, individual triggers and resulting actions can be defined along the process chain. This enables the automation and optimization of processes.

Implementation

Bluetooth Low Energy (BLE) Beacons attached to the assets send out signals that are received by infsoft Locator Beacons mounted in the building. These signals are forwarded to an infsoft Locator Node Dongle and sent to the infsoft LocAware platform®. This is where the position is determined and the data is intelligently processed.

In infsoft Assets, the locations and motion profiles of assets are visualized. Furthermore, the use of infsoft Automation enables the definition of individual triggers.



infsoft Assets

More information
- infsoft MedEquip Tracking

infsoft Inventory

infsoft Inventory helps companies to efficiently inventory and manage assets. The application can be linked to existing ERP systems via interfaces and infsoft Paper Tags, BLE Beacons or E-Ink Display Beacons can be used for localization. The latter also enable the dynamic display of information such as inventory numbers or QR codes directly on the asset. Other functions include automatic notifications before inspection dates and color highlighting of borrowed items in the user interface.

Inventory

In contrast to key date inventories, infsoft Paper Tags enable continuous recording and counting of assets.

Positioning

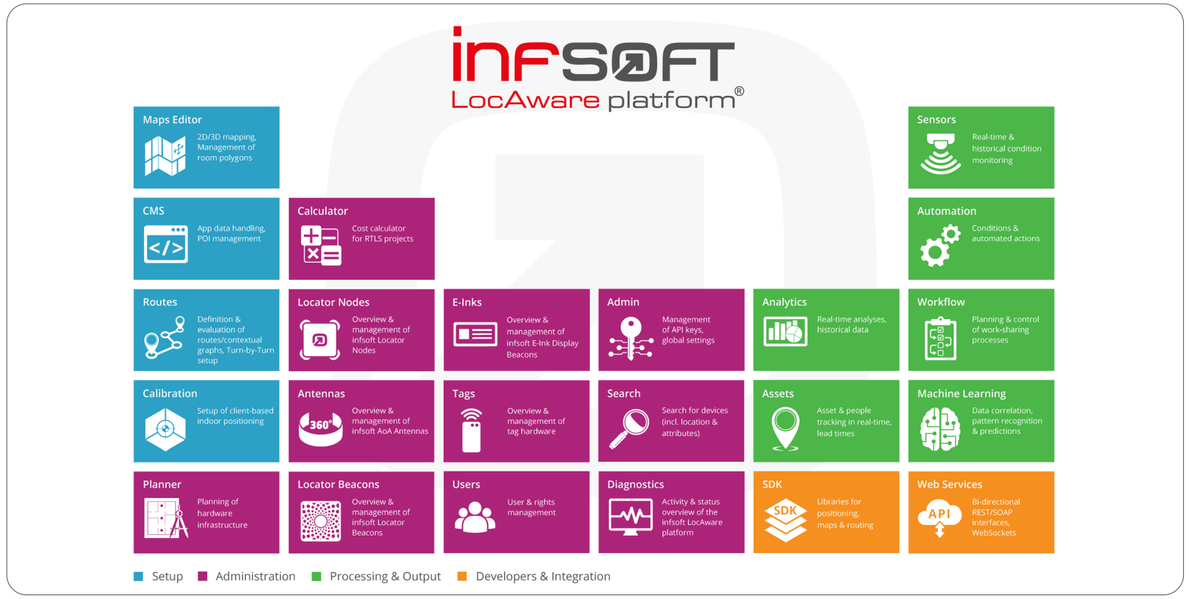
This solution enables mobile and stationary office inventory to be reliably located in specific rooms and areas. The position can be determined seamlessly across all floors of the building.

Analyses

In addition to location and status information, a clear dashboard provides the user with insights into the use and utilization of the assets. There are also functions for grouping and filtering the objects.

More information
- infsoft Inventory

3 | Platform – LocAware platform®



infsoft LocAware platform®

infsoft offers powerful software products that are bundled and linked in the infsoft LocAware platform®.

infsoft LocAware platform®

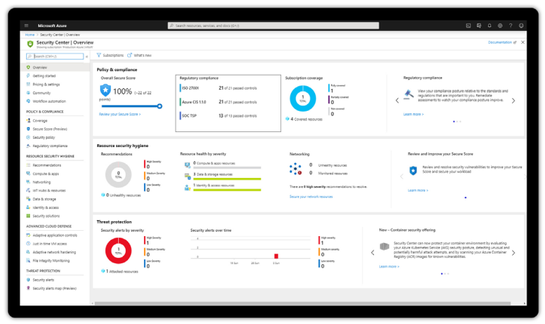
The infsoft LocAware platform® is infsoft's central data hub that provides functions as a SaaS solution. The platform consists of numerous tools whose data is exchanged within the platform via web services. infsoft LocAware also offers a large number of standardized interfaces for exchanging data with third-party systems. Corresponding customer systems can also be connected to the platform via specific ‹connectors' (individual interfaces).

The infsoft LocAware platform® is cloud-based (MS Azure) and offers benefits such as automated load balancing, upscaling, geo-redundancy and continuous deployment. Reliability is guaranteed for at least 99.9 % of the uptime is guaranteed.

IT Security

The solution is hosted by default in MS Azure with all security features and functions such as load balancing, geo-redundant data hosting and automated upscaling provided by Microsoft. The default MS Azure regions are West Europe (The Netherlands) and West Central US (Wyoming). Other data centers of the worldwide MS Azure network are also possible.

The infsoft LocAware platform® with its services running in MS Azure implements various security functions such as multi-factor authentication, role-based access management, logging for all activities within the MS Azure portal as well as all activities in the infsoft LocAware platform®. HTTPS is used for encrypted transmission. Database encryption provides enhanced security for your data.



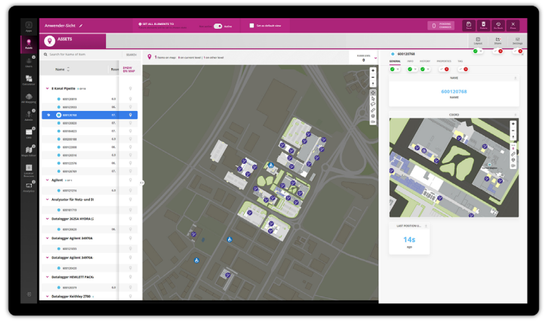
MS Azure Security | infsoft

Accessibility & Authorization

All tools are bundled in the infsoft LocAware platform® and accessible via a standard browser with single sign-on. In principle, all applications can be accessed via a standard browser on the desktop. With the LocAware app (mobile version), the tools within the platform can also be used on mobile devices.

Users and user groups can be transferred from existing directories (OAuth/SAML). Corresponding functions are implemented natively in the infsoft LocAware platform®.

The infsoft LocAware platform® has its own user administration with roles and rights concept, which is mapped in "infsoft Users" and "infsoft Admin". User views with corresponding interactions can be created within the assigned tools, which contain corresponding restrictions (read-only, access only to selected functions).

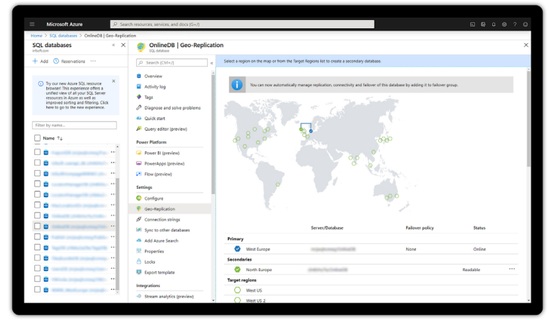


infsoft Assets - User View

The infsoft backend consists of numerous tools whose data is exchanged within the platform via web services. The web service-based structure makes it possible to connect external data sources at any time. All interactions and data processed by the tools and within the LocAware platform® can be easily queried via interfaces (bidirectional connection). Third-party solutions are also connected to the infsoft LocAware platform® via API and processed within it.

Scalability & Performance

The infsoft LocAware platform® with all its services is geographically, vertically and horizontally scalable and offers automatic load balancing and upscaling as well as geo-redundancy due to its hosting in MS Azure.



MS Azure | infsoft

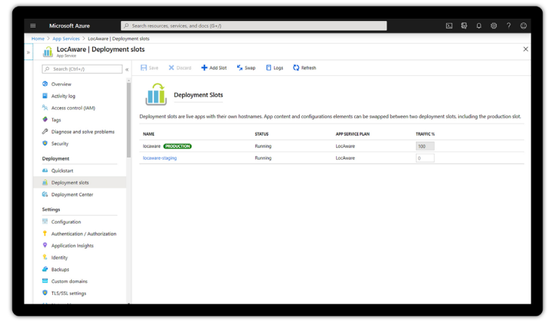
Due to the hosting of the infsoft LocAware platform® in MS Azure, Recovery Time Objective (RTO) of maximum one working day and Recovery Point Objective (RPO) of maximum one day are available within the MS Azure Recovery Manager. A disaster recovery plan with the corresponding procedures is available as standard.

The LocAware platform® offers a guaranteed uptime of 99.9%.

Maintainability

infsoft uses MS Azure Continuous Deployment to ensure that maintenance service and updates do not affect the functionality, availability and performance of the solution.

Maintenance windows that would affect the availability of services and interfaces are proactively communicated to the customer in advance.



MS Azure | infsoft

Setup Tools

The setup tools include all the functions required to set up indoor positioning - mapping, calibration, data management and path definition.

infsoft Maps Editor

The infsoft Maps Editor simplifies the creation and management of locations by allowing users to define building outlines, rooms, and properties. It achieves this by projecting detailed floor plans as customizable layers onto the background map, ensuring precise spatial representation and easy modifications.

The data is referenced in the WGS84 coordinate system, offering precise location information that includes latitude, longitude, and elevation details. This ensures high accuracy, seamless integration with other geospatial systems, and broad compatibility across mapping applications.

The polygons of the drawing area are assigned by so-called patterns, which make it possible to flexibly adapt the coloring and the display of the height information in 3D views. This makes it easier to visually distinguish between different areas and levels within a building or area.

In addition, the infsoft Maps Editor offers extensive integrations with third-party CAFM systems. This enables seamless data transfer and use between different systems, making the management of facility management data much easier. The editor facilitates integration into GIS and planning applications through the exchange of data formats such as GeoJSON.

infsoft CMS

The infsoft CMS, which provides information in a structured list format, is seamlessly integrated with the map editor. It allows users to efficiently manage the properties of numerous POIs, enrich individual menu items with additional details, and organize data both with and without geo-referencing.

The infsoft CMS uses the detailed cartography of the infsoft Maps Editor to efficiently manage points of interest (POIs), allowing you to precisely place and categorize POIs. It allows you to create and organize different menu structures, which are then seamlessly integrated into custom applications such as the Workplace Experience App. In addition, the CMS supports the editing and management of data with and without geographical reference, giving you comprehensive control and customization of your location and information data. Thanks to flexible data management, you can easily update and publish both geo-related content and general information.

The data from the CMS is synchronized with the other tools of the infsoft LocAware platform®. Changes to POIs or menu items can be immediately transferred to the live systems on various end devices. An update via the App Store or similar is not required for content changes. In addition to customizable views, the infsoft CMS also offers a customizable editing system.

With configurable user rights, actions can be restricted, and publications can be managed through defined release processes, ensuring controlled access and content approval. The infsoft CMS also supports the maintenance of multilingual content in LocAware and integrated customer applications using Unicode, allowing seamless handling of different languages and character sets.

infsoft Routes

With infsoft Routes, you can create and test route relationships. For example, routing across several floors can be checked for accessibility and the weighting of different routes. The map material comes from the Maps Editor.

This tool allows you to create and test context-related path relationships. For example, routing across several floors can be checked for accessibility and the weighting of different routes. The underlying map data comes from the infsoft Maps Editor and is supplemented by the points of interest managed in the infsoft CMS.

The definition of route graphs for navigation within the building levels is anchored in infsoft Routes, which enables precise routing. In addition to route weightings, bidirectional and unidirectional route graphs and connections between different floors, points of interest and prominent waypoints can also be integrated as turn-by-turn instructions to facilitate navigation. The created route contexts can be validated using infsoft Routes to check their accuracy and efficiency. Different start and destination constellations enable cross-floor path tests, while heat maps visualize main traffic routes to analyze user movements and optimize routing.

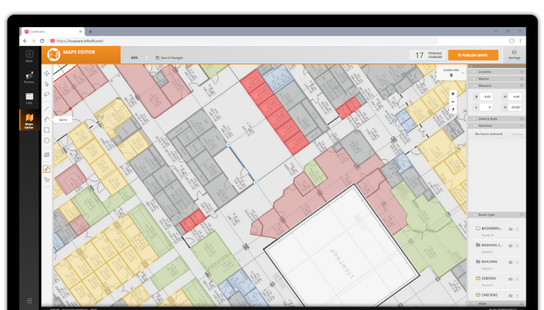
The visualization of heat maps helps identify hotspots, making it easier to detect bottlenecks and optimize routes for better efficiency. Additionally, scenario simulations allow for the flexible adaptation of navigation to changing conditions by modeling various traffic patterns and user behaviors. This enables proactive decision-making, ensuring smoother movement flows and improved overall navigation performance.

infsoft Calibration

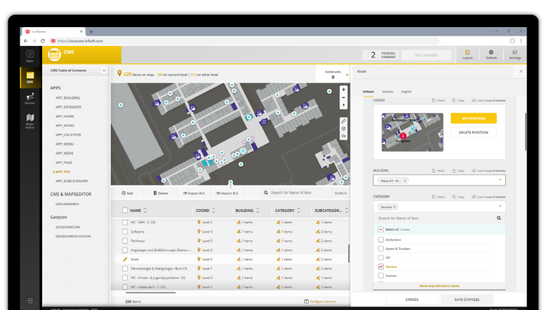
The infsoft Calibration Tool supports the setup of client-side indoor positioning using Wi-Fi, Beacons and sensor fusion. It enables the creation of calibration routes, the management of Beacon proximity UUIDs, the visualization of detected Beacons and the verification of heat maps to display the signal strength. In addition, access points or Beacons that should not be used for the project can be filtered out. The tool is linked to the infsoft Calibration Apps and seamlessly exchanges calibration information with them to ensure precise and efficient calibration.

infsoft Calibration facilitates the setup of client-side indoor positioning by leveraging Bluetooth Low Energy (BLE) Beacons and sensor data from mobile devices through sensor fusion. This process enhances positioning accuracy by intelligently combining signals from multiple sources, ensuring reliable real-time location tracking even in complex indoor environments. Additionally, it supports automated calibration routines to optimize performance with minimal manual effort.

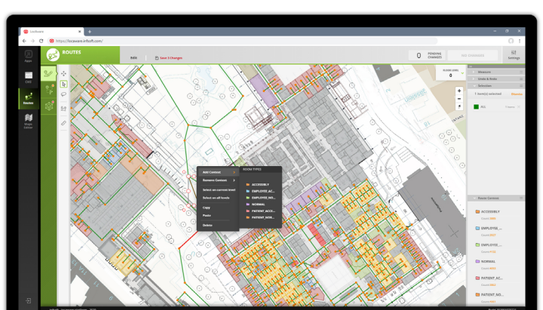
This tool also uses the maps from the infsoft Maps Editor and allows the creation of calibration routes in the illuminated areas. Detection is controlled by the stored proximity UUIDs of the Beacons used. The calibration routes are available in the associated iOS application, which is used to determine the signal strengths of the beacons using the fingerprinting method. The application transfers the measurement data to infsoft Calibration and also supports collaborative measurements, as routes that have already been recorded are synchronized between the systems. The final data check with heat maps, information on signal quality and publication in the live application is carried out in infsoft Calibration.



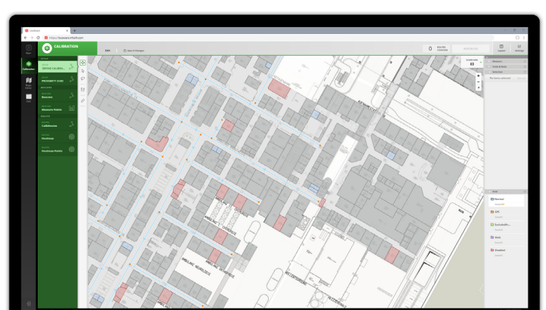
infsoft Maps Editor



infsoft CMS



infsoft Routes



infsoft Calibration

Administration Tools

The administration tools from infsoft offer useful functions for managing the indoor localization system used.

infsoft Planner

The infsoft Planner tool assists users in identifying optimal installation points for infsoft Locator Nodes and infsoft Locator Beacons, streamlining the planning and deployment process. By analyzing factors such as coverage, signal strength, and environmental conditions, the tool helps ensure maximum positioning accuracy and efficiency. Furthermore, it provides visualization features and automated recommendations, reducing manual effort and minimizing the risk of positioning errors. This results in a more cost-effective and time-saving installation process.

Once the user has defined the desired distance for the hardware installation, for example every 7 meters, auxiliary lines can be drawn in the building plan with just a few clicks. These lines serve as the basis for the automatic planning of the required hardware, taking into account the distance and room structures. The user receives an immediate overview of the number of hardware units required for each floor and the entire building. The generated planning data on the hardware infrastructure can be shared at any time and the user has the option of making adjustments to further optimize the planning.

Using the share button, this information can be passed on to installation teams for a specific period, such as a week or a month. This enables efficient coordination and planning of the hardware implementation and ensures that everyone involved always has up-to-date information, which supports the smooth execution of the installation.

infsoft Locator Nodes

The infsoft Locator Nodes tool enables users to register, monitor, and manage the Locator Node hardware within a location. It allows the creation of device groups, facilitates remote firmware updates, and provides options to configure scan levels for optimized performance. Additionally, users can check real-time scan data, analyze device activity, and troubleshoot potential issues, ensuring a reliable and well-maintained positioning infrastructure.

Global settings such as Wi-Fi connection data, upload intervals and notifications can be configured via the group management. The dashboard provides a simple and quick overview of the locator nodes and their status. A list view and a direct map view based on the data can be displayed. Historical scan data can also be called up and evaluated. Current scan information from the various sensors (e.g. Wi-Fi, BLE and UWB) can also be called up. Information on any downtimes of individual Locator Nodes is available in various views.

Automatic notifications can be configured via the platform to inform the user in the event of a failure over a certain period of time. Status reports are also available for all Locator Nodes, e.g. regarding the network connection (e.g. Wi-Fi, Ethernet or UMTS) or data consumption. Individual configurations of individual locator nodes (e.g. warning messages, updates, reboots, location changes, etc.) are possible via special add-ons. The interface is designed to be simple and user-friendly. When using Cisco access points, administration is carried out via the tool interface. To connect non-network-bound locator nodes, the infsoft LN Gateway app (iOS and Android) is used, which enables automatic connection and updating of the node settings.

infsoft Locator Beacons

The infsoft Locator Beacons tool can be used to manage the Locator Beacon hardware used in the location. It is possible to register and maintain Locator Beacons, check their position on the map and monitor the battery status - including error messages such as downtimes.

The Locator Beacons can be located within the building and assigned to defined area IDs. The application can also be used to view which Beacons are scanned by the Locator Beacon. The iOS application LB-Setup makes it quick and easy to register and locate the hardware in the building. The Locator Beacons are identified in a user-friendly way via a QR code, which contains the MAC address of the Locator Beacon, among other things. The tool provides a clear overview of all Locator Beacons located in the building. The user is provided with a user-friendly representation in the stored building plan as well as additional information on the respective Locator Beacon.

The web application offers all options to enable efficient maintenance and use of the Locator Beacons. The battery status is displayed and parameters such as the scan and sleep time of the Locator Beacon can be set online. Firmware updates over the air are also possible. If necessary, visual feedback from an individual Locator Beacon can be triggered via an LED.

The “Locator Beacon Setup” app is used to georeference the infsoft Locator Beacon hardware on site. A Locator Beacon can be scanned there using a QR code and its position can be defined on the map.

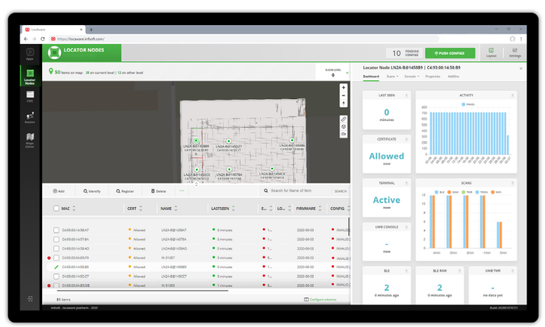
infsoft E-Inks

infsoft E-Inks facilitates comprehensive registration and management of all infsoft E-Ink Display Beacons installed on the premises, covering both fixed infrastructure hardware and mobile tag hardware. With this tool, users can access detailed information about each individual E-Ink Display, including real-time battery status and operational metrics. It also offers functionalities for performing updates and modifying display content, either manually or automatically, to ensure that information remains current and engaging. Moreover, the system’s intuitive interface streamlines monitoring and maintenance, optimizing the performance and reliability of the display network.

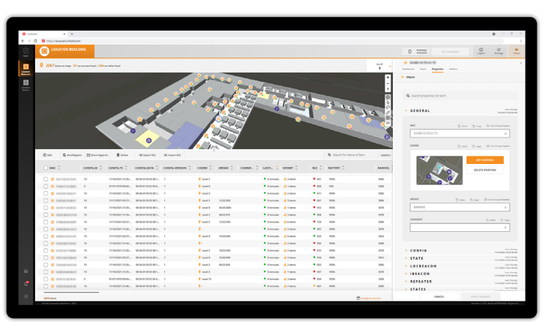
The application includes integrated management of templates for different display statuses, allowing for flexible and customizable presentation. By using triggers in infsoft Automation, labels on the E-Ink Displays can be updated automatically, whereby the conditions for each display can be configured individually. For example, changes can be triggered by entering a certain area (geofencing) or by status changes that are managed via SAP.

In addition, the labels can be automatically adjusted based on information from room booking systems or employees’ personal calendars. This enables dynamic and context-sensitive adaptation of the information on the displays. The open-interface architecture of infsoft LocAware ensures easy integration into existing systems and enables a smooth connection to other software solutions. This makes the management and updating of the E-Ink displays efficient and flexible, which improves the user-friendliness and adaptability of the information displays.

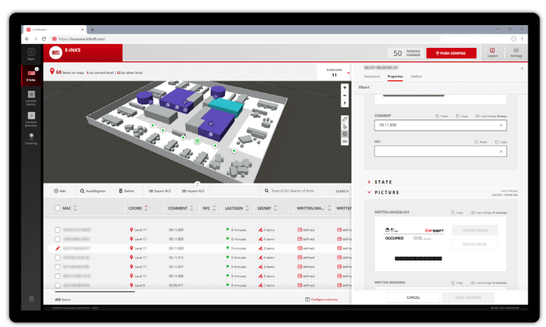
infsoft Planner



infsoft Locator Nodes



infsoft Locator Beacons



infsoft E-Inks

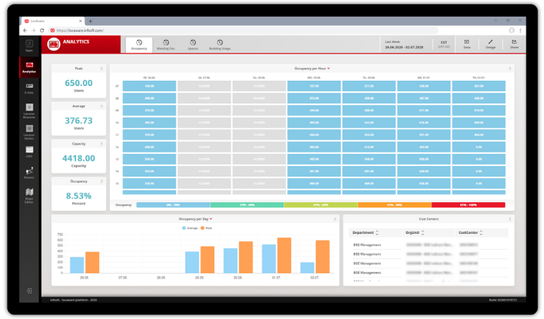
Data Processing & Output Tools

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 detailed floor plans, enabling real-time monitoring of motion profiles and user behavior. It allows to measure frequency patterns in specific areas, generate time- and location-based analyses, and integrate seamlessly with infsoft Automation to further enrich the data.

The live scripting engine offers powerful filtering capabilities and enables real-time or retrospective data visualization, providing dynamic insights. The tool also features heat map visualizations and route tracing, helping identify trends and optimize space usage by tracking movement flows and activity hotspots.

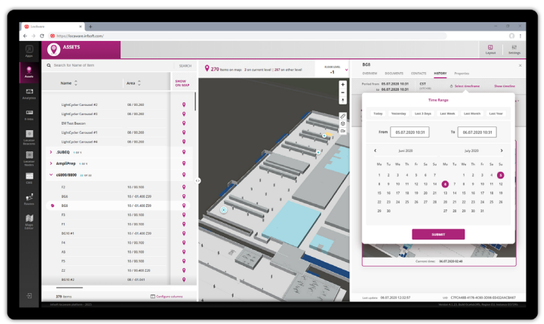


infsoft Analytics

infsoft Assets

With infsoft Assets, the position of a specific device can be visualized in real time. This tool makes it possible to assign additional properties such as E-Mail address or name to devices and to organize these devices into groups. In addition, selected users can receive push notifications to inform them of important events or status changes.

The tool is suitable for both device location and asset tracking and, through integration with infsoft Automation, allows automated notifications to be set up for entering or leaving specific areas, enabling seamless monitoring and management of devices and assets.



infsoft Assets

infsoft Sensors

infsoft Sensors visualizes condition-sensing devices on the map, offering real-time monitoring of light, temperature, pressure, humidity, CO_2, and presence via infrared or ultrasound. This allows for immediate insights into environmental conditions, enabling efficient management and prompt responses to any detected changes or anomalies. The tool improves decision-making by providing a clear overview of sensor data in the mapped area.

The tool can also record information on room occupancy based on an occupancy monitoring ring. Based on "smart room" concepts, the status of a room can be continuously monitored and processes can be automatically controlled on the basis of rule-based decision-making. A link with infsoft Automation makes it possible to carry out automated actions based on the measurement results. For example, sending notifications when a device reaches a certain status or exceeds defined values.

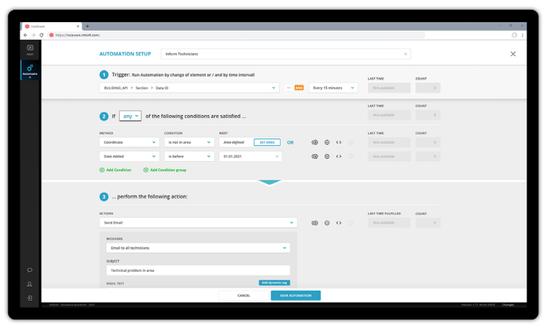
infsoft Sensors

infsoft Automation

infsoft Automation enables the definition of various geo-based triggers along the process chain in real time, allowing for precise control over operational workflows. Actions derived from these triggers can be automatically initiated based on specific conditions, ensuring quick responses to dynamic changes. The automated actions to be triggered can include, for example, warnings, notifications (push, e-mail, etc.), door locking/unlocking, and even the adjustment of environmental settings like lighting or temperature.

infsoft Automation can be used to configure click interactions for various applications, such as emergency alarms in healthcare settings, where a beacon wristband transmits a patient's location to medical staff in case of distress. It also supports material orders in office environments, where a beacon button triggers the (re-)ordering of supplies. This flexible system enhances operational efficiency by automating responses to specific actions, improving both safety and workflow management in real-time. It is also possible to link different criteria with each other and flexibly define inspection intervals. Automated actions include transferring data to customer-specific interfaces, such as ERP systems, updating content on E-Ink Displays, creating service tickets or sending push notifications to defined recipient groups.

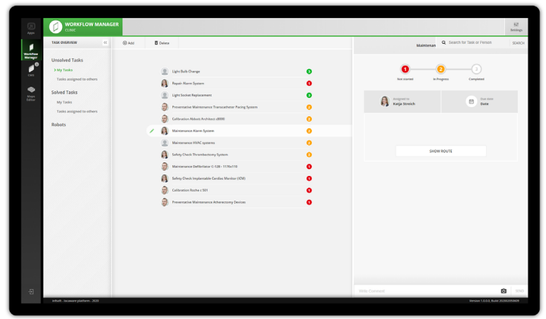
In addition, the data from infsoft Automation can be seamlessly integrated with other tools from the infsoft LocAware platform®. For example, device information from infsoft Assets can be combined with infsoft Automation to control throughput time measurements. This offers comprehensive possibilities to automate processes and manage data efficiently.



infsoft Automation

infsoft Workflow

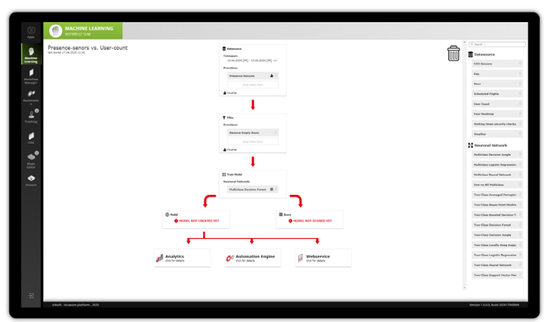
The infsoft Workflow tool enables the active planning, control and logging of work-sharing processes within RTLS (Real-Time Locating System) projects. The tool can be used to record and structure all tasks that need to be performed during the execution of organizational processes. Geoinformation can also be stored at any time.



infsoft Workflow Manager

infsoft Machine Learning

infsoft Machine Learning is a visual tool with which user-defined machine learning models can be created, trained in the shortest possible time and used in a wide variety of applications. The powerful environment processes position and/or sensor data and uses self-optimizing algorithms that are able to learn from experience. By recognizing patterns and regularities in existing data sets, values and results can be predicted.



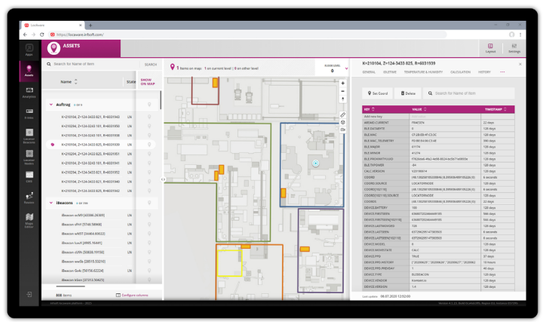
infsoft Machine Learning

SDK & Web Services

infsoft's technology is also available as a plugin for integration into third-party apps, allowing companies to integrate powerful localization and navigation features directly into their own mobile applications. The plugins offer a variety of features, including indoor positioning, indoor navigation, 2D and 3D building maps and GEOItems. With these features, users can navigate and find their way precisely within buildings, which is particularly useful in large or complex environments such as airports, shopping centers or hospitals.
infsoft products can be easily adapted to various system environments, providing seamless integration across platforms. The infsoft Web Services allow for fast and efficient data exchange through REST/SOAP interfaces, enabling smooth connectivity with existing systems.

infsoft's technology is also available as a plugin, allowing for effortless integration into third-party applications, further enhancing its flexibility and interoperability.

The SDK (Software Development Kit) is available for Android and iOS mobile operating systems and as a Progressive WebApp (PWA). All position data is WGS84 compliant, allowing easy connection to external solutions. The following libraries are part of the Software Development Kit:

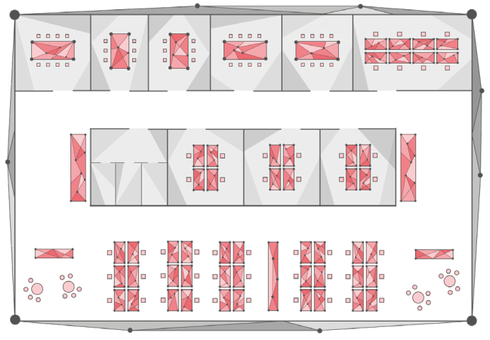


infsoft Assets

Maps Library

The map material from infsoft is infinitely zoomable and enables a detailed display of all buildings and floors of a location. This provides users with precise orientation both indoors and outdoors. The infsoft Maps Editor is used to easily configure and customize the map content, while the infsoft CMS enables the content to be managed and updated. As a result, the user remains flexible and can make changes at any time, be it in the presentation of rooms, paths or other relevant information.

A major advantage is the use of vector-based maps as opposed to conventional raster maps. Vector maps offer several decisive advantages: they significantly reduce loading times as only small amounts of data need to be transferred, which is particularly relevant for mobile devices.



They also support offline use, ensuring that maps remain accessible even without a constant internet connection. This combination of flexibility, performance, and low data load makes the system particularly well-suited for complex environments, such as airports or large office buildings, where fast and reliable navigation is essential for efficient orientation and smooth operations.

Locator Library

The infsoft Locator Library is a comprehensive solution for precise positioning both inside and outside buildings. It combines various technologies to enable seamless navigation. The most important methods include GPS, Wi-Fi and bluetooth Beacons. These technologies are further optimized by the integration of smartphone sensors. For example, the infsoft Locator Library uses the barometer to record altitude, the accelerometer for movement patterns and the compass to determine orientation. This multitude of sensors and technologies enables high-precision positioning even in complex environments.

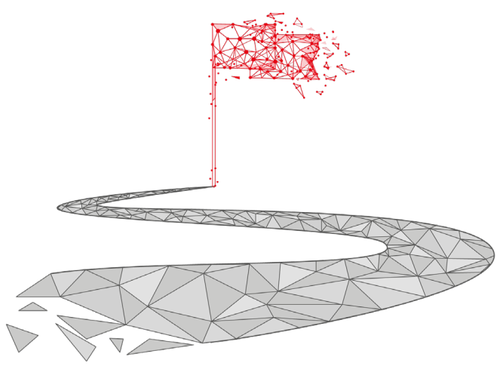
The system also provides a seamless transition between indoor and outdoor localization, ensuring continuous tracking as users move from outdoor areas with GPS to indoor spaces. This transition occurs without interruption, maintaining high accuracy levels with minimal loss of precision, ensuring a smooth and reliable user experience across both environments.

infsoft Calibration is used to configure the system for optimal performance, ensuring high accuracy and reliable location data. The infsoft Locator Library is compatible with both Android and iOS mobile operating systems, making it versatile and suitable for a wide range of end devices, enabling broad application across various platforms.

Routes Library

Routing based on start and destination parameters is realized by the infsoft Routes Library. This enables precise and contextual navigation that adapts to different user needs. For example, special routes can be offered for barrier-free routing based on the individual requirements of users, such as wheelchair users or people with restricted mobility. The Routes Library uses the data provided by infsoft Routes to always calculate the optimal routes.

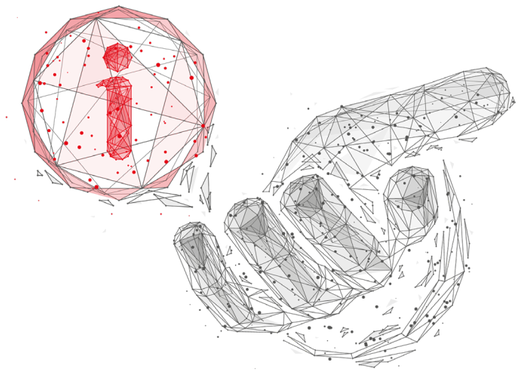
Turn-by-turn instructions guide the user with step-by-step directions, updated in real time based on the user's current position, as determined by the infsoft Locator Library. This dynamic system ensures continuous, accurate navigation, even in complex environments, allowing users to confidently find their way through intricate spaces without interruptions or inaccuracies.



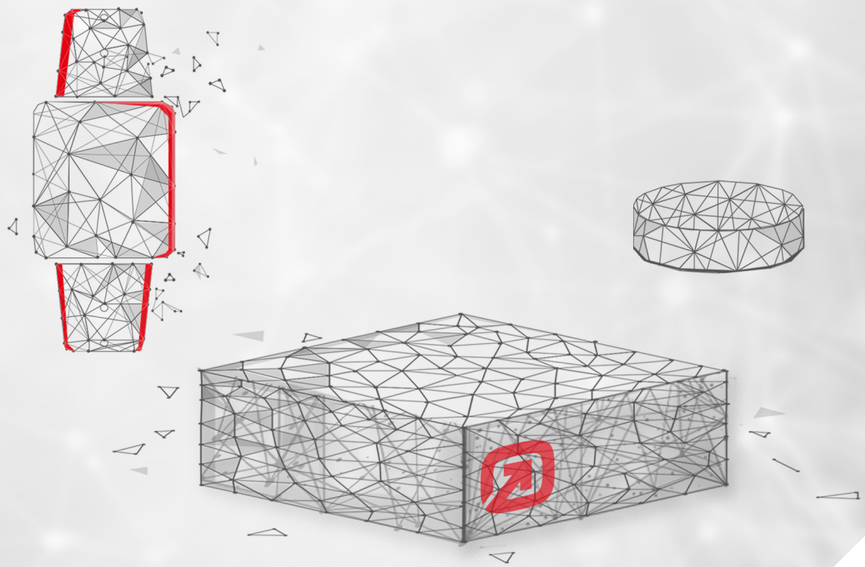
Furthermore, the Routes Library can be extended with additional functions. These include, for example, optional voice output, which makes navigation easier for people with visual impairments. It is also possible to connect haptic feedback to provide the user with additional orientation aids through vibrations or other tactile signals. These flexible extensions make the Routes Library a versatile solution for a wide range of applications, from barrier-free navigation to convenient everyday orientation.

GeoObjects Library

Points of Interest (POIs) are efficiently managed through the infsoft GeoObjects Library, offering a central platform for organizing and showcasing relevant locations within a designated area. These POIs can be visualized in both map and list views, providing users with intuitive navigation and an easy-to-read overview. The GeoObjects Library allows for detailed entries of each POI, offering in-depth information on every location. The management of these POI detail pages is seamlessly handled through the infsoft CMS, ensuring that content is easily maintained and updated as needed, thereby streamlining the overall process.



Users can enter texts, opening times, images, videos, and capacity details, ensuring that all relevant information is readily available and up-to-date. Multilingual content can be integrated, allowing users to access information in their preferred language, thus broadening the platform's accessibility. The integration of the GeoObjects Library with the CMS further enhances the platform's functionality, offering a comprehensive and user-friendly interface. This combination provides detailed orientation and real-time information on relevant locations, making navigation significantly easier and more intuitive for all users.



4 | Hardware for Indoor Positioning

To meet a customer's need for a reliable indoor tracking solution, we rely on our own hardware: infsoft Locator Nodes, infsoft Locator Beacons and infsoft E-Ink Display Beacons. We also present the versatile BLE Tags and Sensor Beacons.

Infrastructure Hardware

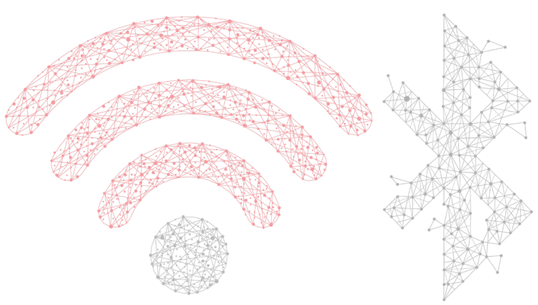
Infrastructure hardware interprets the transmitter's signals in order to determine its position. We offer flexible mounting options for our hardware products, which are available separately. The brackets are magnetic and also have holes for fixed mounting.

infsoft Locator Nodes

Depending on your use case and the requirements on site, two different infsoft Locator Nodes are available that can be used in a tracking project.

infsoft Locator Node Dongle

The infsoft Locator Node Dongle enables the localization of people and assets using Bluetooth Low Energy (Bluetooth 5). It also acts as a gateway for infrastructure components such as infsoft Locator Beacons and infsoft E-Ink Display hardware. It connects to the network via Wi-Fi. The infsoft Locator Node Dongle can be powered by any USB power supply, for example via access points or monitors. This ensures simple and uncomplicated installation and, if necessary, expansion or consolidation.



The resulting low installation and maintenance costs when using the infsoft Locator Node Dongle lead to a significant decrease in overall expenses, making it a highly cost-effective solution. This reduction is especially notable when compared to alternative technologies, which often involve higher initial investments and ongoing operational costs.

There is also no dependency on access point manufacturers when using Locator Node Dongles, as they operate completely independently. Unlike other solutions, the infsoft Locator Node Dongles do not require a Docker image to be installed on access points, ensuring greater flexibility and ease of integration.

infsoft Locator Node Dongle

infsoft Locator Node PoE

The infsoft Locator Node PoE differs from the infsoft Locator Node Dongle only in the type of data communication. While the infsoft Locator Node Dongle is limited to network connection via Wi-Fi, the infsoft Locator Node PoE can be connected via both Wi-Fi and Ethernet (PoE). Similar to the Locator Node Dongle, this gateway hardware enables the precise tracking of Bluetooth Low Energy (BLE) Tags used for asset and people tracking. Furthermore, it can detect smart devices with activated Bluetooth, allowing for expanded tracking capabilities.

infsoft Locator Node PoE

Integrated into the infsoft LocAware platform®, this opens up a wide range of possible applications from tracking solutions to analysis functionalities and location-based services.

To accurately determine their position, the Locator Node Dongles capture the signals received from a transmitter and forward this data to the infsoft LocAware platform®. Within the platform, the data undergoes advanced processing, enabling precise calculation of the transmitter's location in real time.

Data Communication

The infsoft Locator Nodes PoE's can be connected to any USB power source and must be connected to a network in order to transmit data to the infsoft LocAware platform®, whereby data communication can take place via Wi-Fi or Ethernet (PoE). In addition, the flexible connection option to various power sources enables easy integration into existing infrastructures.

Wi-Fi

To enable seamless communication with the infsoft LocAware platform®, the infsoft Locator Node PoEs can be integrated into the existing Wi-Fi network as a client, ensuring efficient data transfer. The Locator Node Dongles can be conveniently managed, configured, and maintained using the Locator Nodes software tool, providing a user-friendly and centralized administration interface.

Ethernet (PoE)

An RJ45 connection allows for reliable data transmission via Ethernet, ensuring stable and high-speed communication. Additionally, the Locator Node PoE can be powered directly through the Ethernet connection using Power over Ethernet (PoE), eliminating the need for separate power supplies and simplifying installation.

Application examples of infsoft Locator Nodes:

- Workplace and Room Occupancy Tracking
- Inventory and Localization with Paper Tags

Connection

- Wi-Fi
- USB power supply

infsoft Locator Node Dongle

Connection

- Wi-Fi
- Ethernet (PoE)

infsoft Locator Node PoE

infsoft Locator Node PoE vs infsoft Locator Node Dongle

infsoft Locator Beacons

The integration of infsoft Locator Beacons into the infrastructure of a Real-Time Locating System (RTLS) allows for seamless and efficient monitoring of beacon positions. This approach not only simplifies the management of beacon deployments but also minimizes the need for additional hardware, leading to a significant reduction in both installation complexity and overall system costs.

infsoft Locator Beacons are permanently installed, battery-operated hardware components that can be easily integrated into a network infrastructure consisting of infsoft Locator Nodes and Bluetooth Low Energy (BLE) Beacons. Long battery life and low installation and maintenance requirements make them an ideal solution for various asset tracking applications.

In addition to enabling asset tracking, infsoft Locator Beacons can serve as a robust beacon infrastructure for indoor navigation and various location-based services, enhancing positioning accuracy and enabling a wide range of applications.

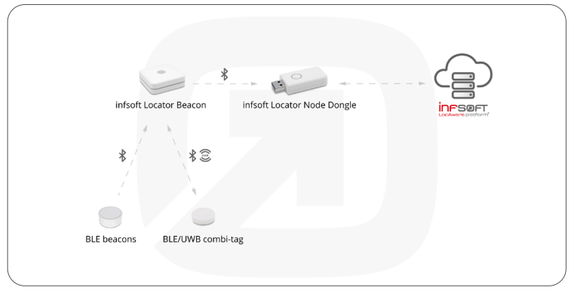
By integrating Bluetooth Low Energy (BLE) and Ultra-wideband (UWB) technologies, Locator Beacons enable highly precise localization with an accuracy of less than 30 centimeters, making them ideal for applications requiring exact positioning. They also support rapid position updates of up to 100 queries per second, ensuring real-time tracking capabilities. Currently, client-side positioning with UWB is exclusively available for newer iPhone models, leveraging their advanced hardware for enhanced location accuracy. Additionally, Locator Beacons facilitate time-shifted asset tracking through the use of combination tags (BLE/UWB), allowing for flexible and efficient tracking solutions.

infsoft Locator Beacon

infsoft Locator Beacons offer a reliable way to locate Bluetooth Tags (Beacons) and at the same time serve as infrastructure for client-based positioning solutions such as indoor navigation. Due to their low latency, they enable delayed tracking in the areas they monitor. This function is particularly suitable for large building complexes such as hospitals or office buildings where permanent real-time positioning is not required in all areas. For critical zones where real-time tracking is required, infsoft Locator Nodes are installed to enable live tracking.

The wireless locator beacons receive Bluetooth signals from nearby mobile Bluetooth Low Energy asset tags at regular intervals (e.g. every two minutes). These signals are forwarded to an infsoft Locator Node installed nearby. The Locator Node transmits the collected data either via Wi-Fi or Ethernet to the infsoft LocAware platform®. There, the data is processed and made available to the various infsoft backend tools, such as infsoft Assets and infsoft Analytics, for analysis.

By using infsoft Locator Beacons, the number of Locator Nodes required and therefore the cabling effort can be significantly reduced. The system is particularly efficient due to the combination of Bluetooth Low Energy (BLE) and Ultra-Wideband (UWB) technologies, which enable precise localization of less than 30 centimeters. This technology can perform position queries at a frequency of up to 100 times per second. A connection is first established between a combination tag (BLE/UWB) and the Locator Beacon via Bluetooth. High-precision positioning is then carried out via UWB. This guarantees fast and accurate detection of the position of objects or people.



Server-based Positioning with infsoft Locator Beacons

When infsoft Locator Beacons are used simultaneously for client-side applications, such as indoor navigation, the Beacons emit Bluetooth signals that are recognized by mobile devices, especially smartphones. These signals enable the devices to precisely determine their position. With newer iPhone models, ultra-wideband technology can also be activated as an additional medium to achieve even greater accuracy.

The combination of BLE and UWB not only offers advantages for determining location, but also for other areas of application. One particularly exciting area of application is augmented reality (AR), where precise and fast position detection is crucial for the user experience. With the high precision of UWB, AR applications can be made smoother and more precise, as virtual content can be adapted more exactly to the real environment.

infsoft Locator Beacon BLE-UWB

Application examples of infsoft Locator Beacons:

- First Responder Location in an Emergency
- Indoor and Outdoor Tracking on an Industrial Site
- Energy Monitoring and Control via BLE Socket

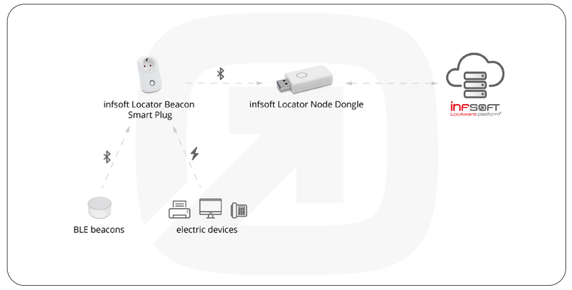
infsoft Locator Beacon Smart Plug

infsoft Locator Beacons Smart Plug create transparency about energy consumption and costs and ensure efficient energy management. In contrast to Locator Beacons and Locator Beacons Road Stud, the Locator Beacons Smart Plug are connected to the power grid. As a result, they are not affected by latency restrictions and BLE communication takes place without a time delay.

In addition to real-time monitoring of mobile BLE asset tags, the smart plugs enable continuous recording of power consumption data. Devices with high power consumption can be easily identified. In addition, energy saving plans can be stored that disconnect individual or all devices from the power supply at certain times.

By setting up a network of Locator Beacons Smart Plug acting as repeaters, the scan data collected by a tracking system based on infsoft Locator Beacons can be forwarded sequentially to the next Locator Node. This further minimizes the number of infsoft Locator Nodes required (usually one per floor) and significantly reduces installation effort and costs.

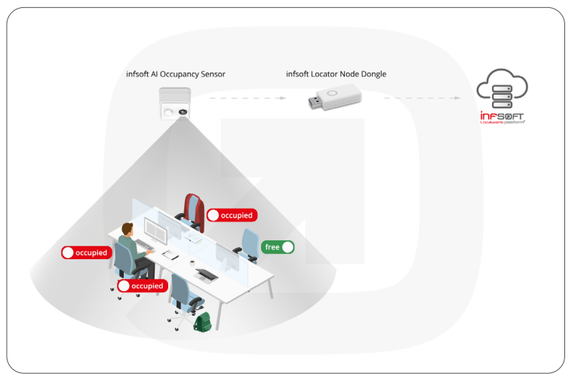
infsoft Locator Beacon Smart Plug



Energy Monitoring with infsoft Locator Beacons Smart Plug

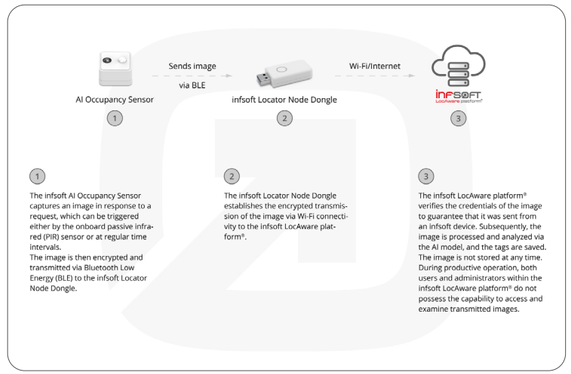
infsoft AI Occupancy Sensor

The infsoft AI Occupancy Sensor is a hardware component for occupancy detection with an integrated camera and a PIR Sensor. It enables intelligent person and object detection in which the camera images triggered by the sensor are analyzed and evaluated with the help of artificial intelligence. Smart detection and certain indicators of passive occupancy can be used to determine the occupancy status of a workstation or room. In the absence of people, the change in the object arrangement between the respective image intervals can be used to determine whether there is passive occupancy.



Use of the infsoft AI Occupancy Sensor

Essentially, the AI Occupancy Sensor works with two different sensor technologies: a combination of PIR Sensor and camera. The PIR sensor acts as a presence sensor; as soon as it detects a person, the camera takes an image in a predefined time interval, which is sent to an infsoft Locator Node (Dongle) or an access point via BLE. There, the data is sent to the infsoft LocAware platform® via a secure connection. There, the images are evaluated within a volatile seicher using an AI model and only the recognition results are stored. The original image is discarded and cannot be accessed.

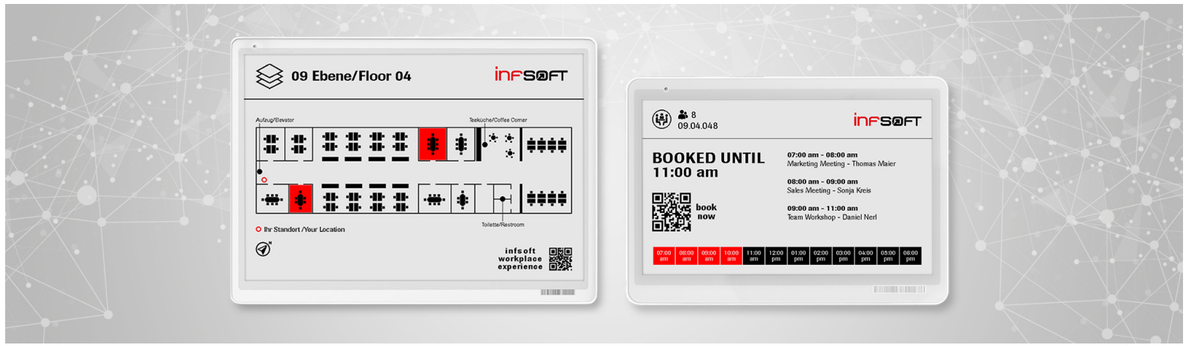


infsoft AI Occupancy Sensor Data Flow

The infsoft AI Occupancy Sensor, which can be used for real-time occupancy detection, people counting and intelligent object detection, enables energy-efficient battery operation over several years. The hardware is managed and connected via infsoft Locator Nodes or Cisco Access Points. The sensors can be installed using a bracket on ceilings where an occupancy or utilization analysis is to take place.

Application examples of infsoft AI Occupancy Sensor:

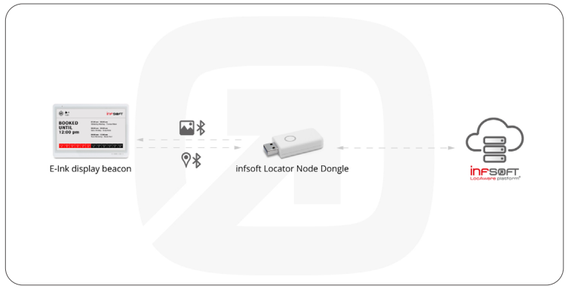
- Workplace and Room Occupancy Tracking



infsoft E-Ink Display Beacons

Electrophoretic Display, also known as electronic ink (E-Ink), is a technology that mimics the appearance of ink on paper. E-Ink Displays are easy to read from any viewing angle and offer design freedom, robustness and low power consumption. E-Ink devices are described as bistable, which means that the display only consumes power when content is being updated. This is the key reason for the long battery life of up to 5 years.

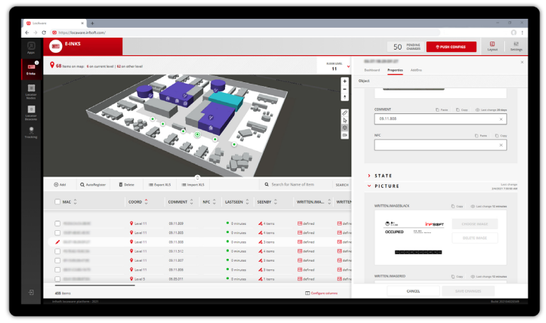
Bluetooth Low Energy (BLE) technology allows content to be transferred flexibly and automatically to infsoft E-Ink Display Beacons. In addition, the location of the display can be visualized on a digital map using infsoft software tools.



Information Transfer using E-Ink Display Beacons

infsoft E-Ink Display Beacons are available in different sizes. Larger Displays can be permanently installed in the infrastructure and used for digital signage applications such as the dynamic labeling of rooms, lockers, etc. The permanently installed E-Ink Beacons can display room or building information, reservation details, points of interest (POI), workstation occupancy and much more in real time. The displays can be automatically overwritten with individual information such as the current room occupancy or room booking status. It is also possible to interact with a QR code, which can be used to book a room or report a problem, for example.

The labeling on the E-Ink Displays can be updated automatically via an interface with infsoft Automation. The conditions for this can be configured individually for each display. Via interfaces to a room booking system or to employees' personal calendars, the labeling can also be automatically adjusted based on the information stored here. Additional information such as the equipment of the meeting room and its capacity can also be displayed.



infsoft E-Inks

Application examples of infsoft E-Ink Display Beacons:

- Digital Labeling of Lockers
- eCharging as a component of the Workplace Experience App

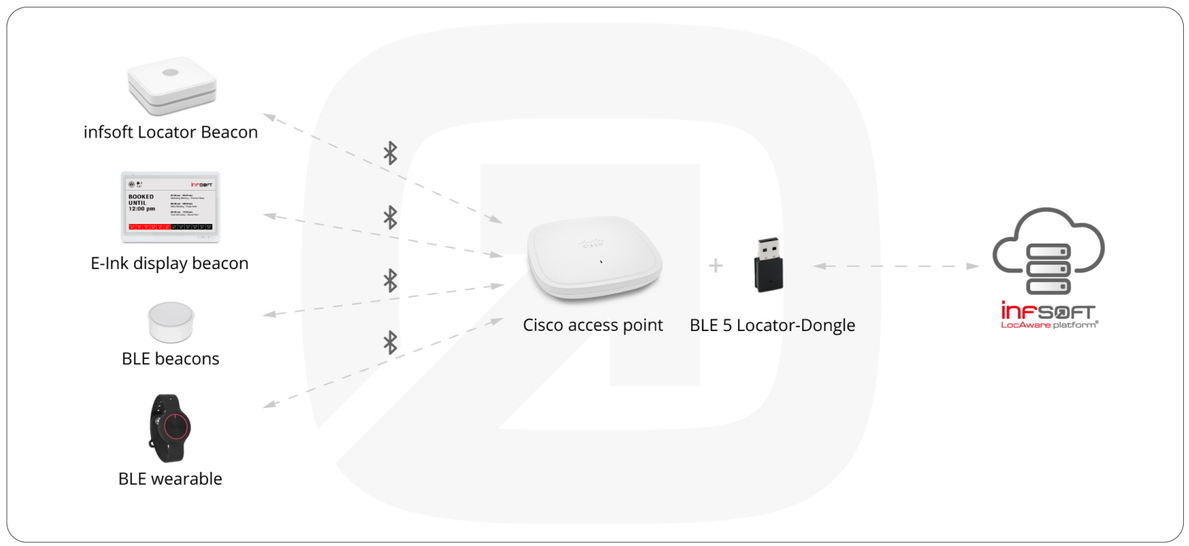
Cisco Access Points

In addition to infsoft Locator Nodes, existing Cisco access points (Cisco Catalyst 9100 or higher) can also be used as gateways. The firmware of the Locator Node is provided as a Docker image on the access point so that the full range of functions of the Locator Node is available. The access point is only extended by a USB dongle for BLE5 connectivity. As with the standalone Locator Node hardware, the connection to the infsoft LocAware platform® is established via the network.

The use of the existing Cisco access point infrastructure creates a significant cost saving in the costs otherwise incurred for the cabling (power or Ethernet) of the Locator Nodes.

Thanks to the Docker image and the extension via USB dongle for the Bluetooth 5 connection, all functions of the Locator Node can be used via the access point. This includes the connection of additional infrastructure hardware such as infsoft Locator Beacons, E-Ink Display Beacons and sensor tags, but also the location of mobile BLE tags with extended sensor technology.

Cisco Access Point



Using Cisco Access Points with infsoft Locator Node Firmware

Sensor Beacons

Environmental condition sensors and sensors for presence and motion detection are implemented in a wide variety of use cases. The monitoring of environmental conditions with infsoft Room Environment can improve room climate and ultimately employee health and productivity. Moreover, sensors can be used for infsoft Occupancy in order to monitor workspace occupancy over time and determine available meeting rooms and workplaces.

Types of Sensor Beacons

Sensor beacons can be equipped with a variety of functions and come in a lot of different shapes and sizes. Below is an overview of the most commonly implemented sensor types.

Temperature / Humidity

Beacons equipped with temperature and humidity sensors enable reliable room climate monitoring, for example in office buildings.

Door Sensor

Door sensors are capable of detecting whether a door or window is open or closed, and they can also track the frequency of door/window openings within a specified time frame, providing valuable data for security and access control purposes.

PIR/TOF sensor

PIR/TOF sensors combine two technologies for occupancy measurement. The hybrid approach enables more accurate presence analysis and is therefore particularly useful for occupancy applications.

Water-Leak Sensor

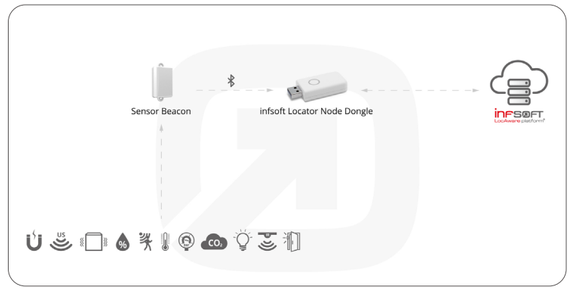
Water-Leak Sensors are specifically designed to monitor water leaks, particularly in sensitive environments like archive or server rooms, where early detection is crucial to prevent potential damage and ensure the protection of valuable assets and equipment.

Car Park Sensor

Car Park Sensors detect changes in the magnetic field caused by parked cars. They are used to report the occupancy of individual car parks.

Sensor Beacons (Door Sensor, PIR/TOF Sensor, Temperature/Humidity)

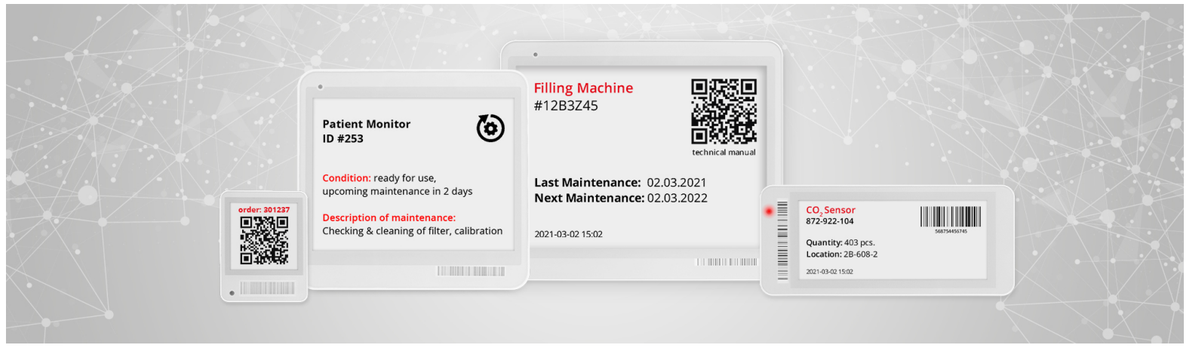
Sensor Beacons can be flexibly installed throughout a building to continuously monitor environmental conditions such as temperature, humidity, or air quality. The collected data is transmitted via Bluetooth Low Energy to an infsoft Locator Node, which then forwards it to the infsoft LocAware platform® for further processing. Within the platform, the data is intelligently analyzed, visualized, and evaluated using infsoft Sensors, providing valuable insights for optimizing indoor environments.



Data Enrichment using Sensor Data

Application examples of Sensor Beacons:

- Room Environment Monitoring in Offices
- Water Damage Prevention with Water-Leak Sensors



Tag Hardware

Tag hardware is usually battery-operated radio transmitters that are attached to the mobile goods to be tracked or carried by people. We present the most important types of tags that are used depending on the application.

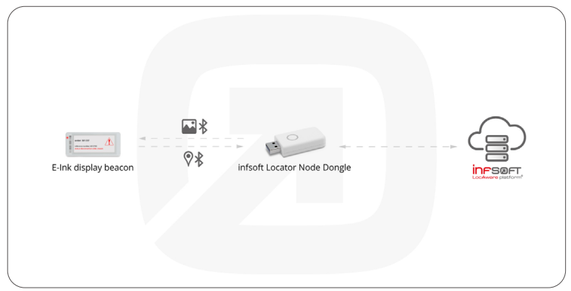
infsoft E-Ink Display Beacons

infsoft E-Ink Display Beacons convey the look and feel of paper and impress with good readability, very wide viewing angles, design freedom, robustness and excellent battery life. The combination of E-Ink (electronic ink) and Bluetooth Low Energy (BLE) technology offers the possibility of visualizing and tracking the location of the device in addition to the flexible transfer of content to the display. Smaller displays can be attached to objects and are therefore particularly suitable for tracking solutions, such as infsoft Lead Time Tracking. Beacons with E-Ink Displays, which are used as tag hardware, are very well suited for the electronic labeling of containers or product labels.

Interaction with a physical button is also possible. When the button is pressed, for example, a changed status relating to the labeled asset could be transmitted.

Enterprises can quickly and efficiently update content on the displays wirelessly, without the need to print paper labels and deploy staff to change them manually. In real time, E-Ink Beacons can display product information, status, stock levels, barcodes and much more. For example, when assets are tracked along the process chain in production or logistics, the display can be automatically rewritten with the current status and individual information such as instructions for the next work step.

To display content on the infsoft E-Ink Display Beacon, the device to be displayed and the desired content are selected in the infsoft CMS software tool or in the “infsoft E-Ink Writer” app. The content is transferred to the display via Bluetooth. The content can be updated not only manually but also automatically by defining the corresponding conditions in the infsoft Automation tool.



Information Transfer using infsoft E-Ink Display Beacons

To determine their position, the infsoft E-Ink Display Beacons send BLE signals to infsoft Locator Nodes installed in the area. The data provided is processed by the Locator Nodes, transmitted to the infsoft LocAware platform® and intelligently processed there.

Application examples of infsoft E-Ink Display Beacons:
- Tracking of Load Carrier Circulation
- Identification of Storage Boxes in the Sample Storage

BLE Tags

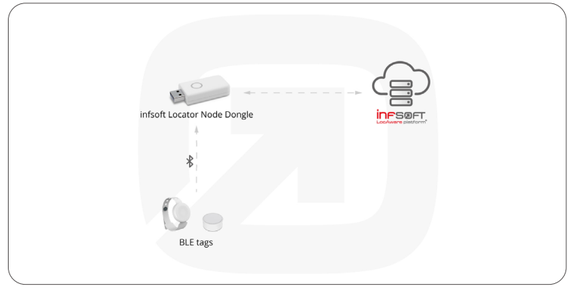
Bluetooth Low Energy (BLE) tags are small, battery-powered Bluetooth hardware components that have been specially developed for locating people or objects. This technology is based on the energy-efficient BLE standard, which is ideal for applications where long battery life and cost-efficient solutions are paramount.

BLE tags are often used in real-time location systems (RTLS), where the exact position of moving objects or people in indoor or limited outdoor areas needs to be tracked. The operating principle is based on a transmitter-receiver model in which the beacons act as transmitters. They regularly send Bluetooth signals to nearby receivers, such as smartphones or special gateway devices. These receive the signals and forward them to a server, which calculates the position of the beacons based on the signal strength (RSSI) and other metrics. This server-side solution enables the precise location of the objects or people equipped with the beacons to be determined.

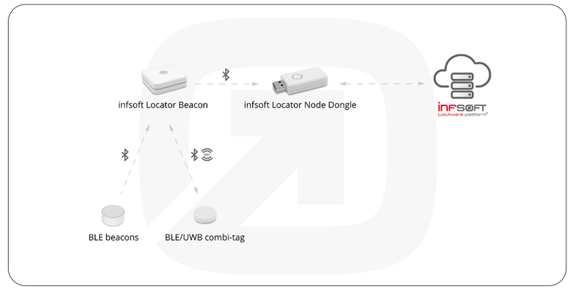
Anti tamper beacon, Paper Tag, Accelerometer Beacon

One of the main strengths of Bluetooth Low Energy (BLE) is its flexibility and versatility, making it highly adaptable across a wide range of industries. In industrial settings, for instance, BLE tags are utilized to track tools, machinery, and inventory levels in real time, leading to improved operational efficiency and enhanced safety. In healthcare, BLE-powered wearables enable the tracking of patients and medical staff, which not only improves the safety of individuals but also optimizes workflows, ensuring that care delivery is more efficient and responsive to real-time needs. Moreover, BLE’s low power consumption makes it ideal for continuous monitoring without significant energy drain, further enhancing its value across diverse applications.

Bluetooth Low Energy tags come in different shapes and sizes, which enables their application in numerous industries. They are broadly categorized into asset tags, which are used to track physical objects, and wearables, which are worn by people to determine their location. Furthermore, many BLE tags offer additional sensor functions, such as motion, temperature or humidity sensors. This additional data can be useful for numerous use cases, such as monitoring environmental conditions in warehouses or analyzing the movement behavior of people in public buildings. infsoft does not manufacture beacons itself, but is happy to put you in touch with the relevant manufacturers.

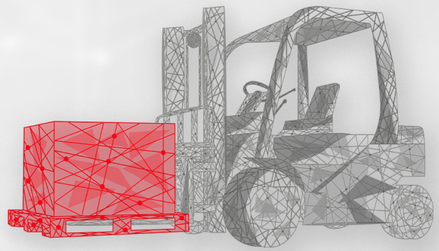


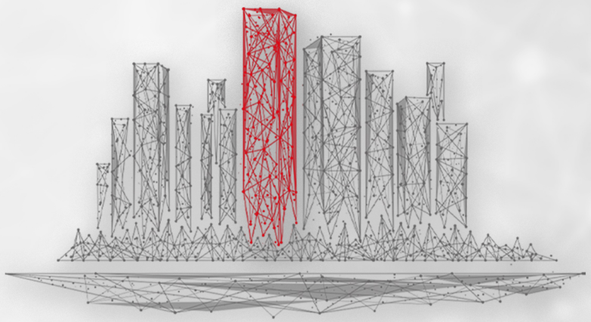
Server-based Indoor Positioning using infsoft Locator Nodes



Server-based Indoor Positioning using infsoft Locator Beacons

Application examples of BLE Tags (Beacons):
- First Responder Location in an Emergency
- People Tracking System for Industrial Facilities





5 | Industries & Examples of Use

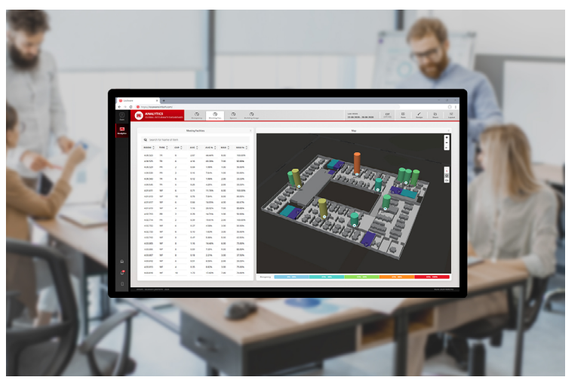
Offices & Smart Buildings

Indoor positioning and mobile services in office environments facilitate the management of large office buildings and company premises, contribute to the optimization of processes and increase both employee satisfaction and productivity. Indoor localization and smart office solutions can be implemented in many ways. Application scenarios range from utilization analyses and asset tracking to smartphone apps and the digital labeling of meeting rooms. In addition, companies benefit from solutions for monitoring indoor climate and energy consumption.

Area Management

Collecting occupancy information contributes to the efficient use and management of available office space.

For managers, the acquisition of space utilization data offers interesting insights and provides the basis for analyses and business decisions. Employees benefit from transparency regarding the occupancy of workstations and meeting rooms.



Employee Services

An App for employees increases employee satisfaction and productivity and supports efficient processes.

Various mobile services for employees can be bundled in such an app. Possible functions include indoor navigation, options for planning meetings and room booking, information on public transportation schedules and lunch menus, the ability to network with colleagues, and much more.

Digital Labeling

The use of E-Ink Display Beacons allows the digital labeling of meeting rooms and lockers.

The Displays, which are installed outside meeting rooms, show the current occupancy and available time slots. By scanning a QR code on the display, a room can also be booked conveniently via smartphone. On lockers, in addition to the employee's name and department, other relevant information such as current presence status (on-site, working from home, on a business trip) can be displayed.

Inventory Management

The implementation of a tracking solution allows for an automated, digital inventory of all assets, streamlining their management and providing comprehensive insights. Beyond tracking the location and movement patterns of assets, additional key information such as device serial numbers, acquisition dates, purchase prices, and manufacturers can be easily displayed. Furthermore, users can set up automatic notifications for important events, such as when assets are moved or require maintenance. Within the user interface, assets can be categorized, sorted, and filtered according to various parameters, enhancing the overall user experience and providing a clearer, more organized overview for efficient asset management.

Room Environment & Energy Monitoring

Environmental sensors continuously capture data, such as room temperature, humidity, CO_2 levels and brightness in the room. If one of the values deviates from the norm, a notification can be sent to the responsible personnel. Moreover, some parameters, such as the temperature, can also be controlled remotely via an app.

Monitoring the room climate leads to optimal working conditions, protects the health of employees and also facilitates energy cost savings. Another solution that leads to energy savings is energy monitoring using smart Bluetooth Low Energy sockets.

Demand-Oriented Cleaning

An occupancy analysis powered by sensor systems forms the foundation for a more efficient, demand-oriented cleaning process. These sensors track whether specific workstations or meeting rooms are currently occupied, as well as whether they have been in use since the last cleaning. This data ensures that cleaning efforts are focused on areas that need attention, minimizing unnecessary cleaning of unused spaces. Through the use of mobile devices, cleaning staff receive real-time updates, allowing them to quickly access detailed information on which desks and rooms require cleaning and disinfecting, optimizing both time and resources while maintaining a hygienic environment.

Location-based Employee Services with Bluetooth Low Energy

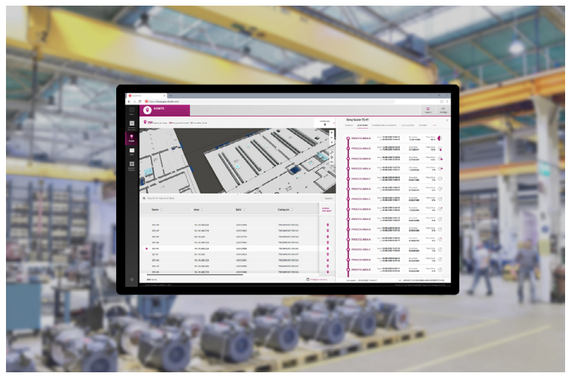
Industrial Applications & Logistics

infsoft offers tracking solutions for complex industrial sites. A Real-Time Locating System (RTLS) provides operators with location-relevant data and helps make the logistics process faster and smoother. Not only can a locating system help increase productivity, but it also enables automated real-time decision-making and identification of hidden costs.

Indoor positioning in industry and logistics makes the locations of goods and employees visible and allows for analysis, coordination, and optimization of manufacturing and logistics processes. Key benefits of these solutions include reduced search times, process optimization, increased efficiency, and greater safety for employees.

Asset Tracking & Lead Times

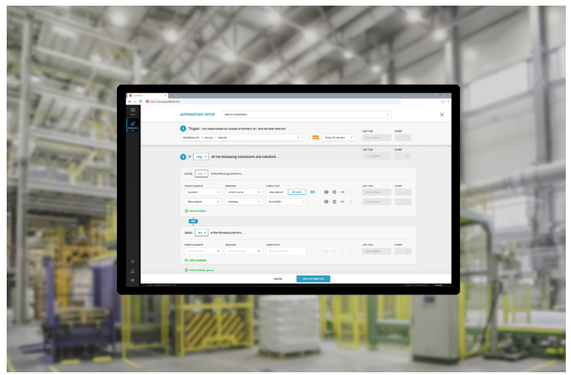
Indoor tracking of objects is in great demand in industrial and logistics applications, especially in terms of time and cost savings as well as process optimization. The current locations of goods, tools, and vehicles can be viewed along with the exact throughput times. The solution ensures process transparency, capacity utilization optimization, and adherence to delivery deadlines.



Lead Time Tracking enables the location of individual goods, pallets or vehicles to be viewed on a digital map at any time. Important process steps can be seamlessly documented and dwell times of certain assets can be optimized. Monitoring throughput times makes a significant contribution to holistic process optimization. In addition, assets to be tracked can be equipped with E-Ink Display Beacons, which offer the possibility of displaying various information such as the contents of the container or work instructions. E-Ink Display Beacons also make work much easier for order pickers. Long search times for specific goods can be avoided as beacons with integrated LED indicators are attached to containers.

Process Automation

Especially in the industrial environment, the focus with regard to Industry 4.0 is very much on the networking of man and machine. infsoft Automation makes a major contribution to comprehensive automation, as it can help to make processes more efficient, reduce search efforts and increase the degree of utilization of work equipment.

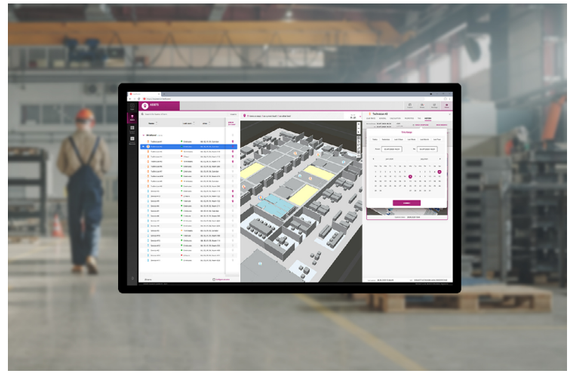


Various trigger logics can be defined along the process chain and hold potential for far-reaching optimization and automation of operational processes. A designated action can be triggered automatically when a tag hardware component enters, leaves, or remains in a virtual zone. Triggers without geo-reference (e.g., user- or hardware-specific) can also be defined. Common applications include notification and task configuration, alert messaging, and automatic status change or deregistration of orders.

People Tracking

Indoor positioning can significantly enhance the safety of employees in industrial and logistics environments by providing real-time location tracking and monitoring movement patterns. Bluetooth-enabled wearables, such as wristbands, allow employees to be continuously tracked, ensuring that their precise location is always known. In case of an emergency, individuals wearing the wristbands can instantly request assistance by pressing an emergency button, enabling rapid response. Furthermore, location-based task assignments help companies optimize workflows by directing employees to areas where their presence is most needed, improving both productivity and safety while reducing response times in critical situations.

With the help of real-time location tracking (infsoft People Tracking), particularly for industrial workers in high-risk environments, a safer working atmosphere can be maintained by continuously monitoring their movements and ensuring quick responses in case of emergencies. The use of BLE wearables not only reduces the time required for rescue operations by pinpointing worker locations but also provides timely alerts during evacuation procedures, ensuring employees are informed and can act swiftly. Additionally, the integrated emergency button allows workers to initiate a mobile emergency call at any time, offering an immediate line of communication in critical situations.



Tracking and Digital Labeling of Containers in Logistics

Healthcare & Pharmaceutical

There are a number of possible applications for indoor positioning in healthcare. Smart technologies help to optimize processes in hospitals: mobile devices can be found faster, hygiene regulations can be controlled, walking routes can be analyzed and appointments can be coordinated more efficiently. The main benefits are reduced search times, theft protection, increased safety for patients, relieving staff, and overall significant cost savings.

Clinic App & Wayfinding

The use of a mobile app supports patients and visitors at a hospital during their stay. The app's functions range from a patient portal with the option to make and manage appointments to a digital waiting room when at the hospital. In addition, the user benefits from indoor navigation to relevant destinations on the premises. The wayfinding solution can be integrated into the mobile app or provided at stationary terminals.

It includes a digital location map that provides an overview of the site and the individual buildings. Users can determine the destination via a search bar or select it directly on the map. The shortest routes are displayed automatically and turn-by-turn navigation is possible on mobile devices. This makes it easier for patients and visitors to health centers to find their way around.

Localization of Medical Equipment

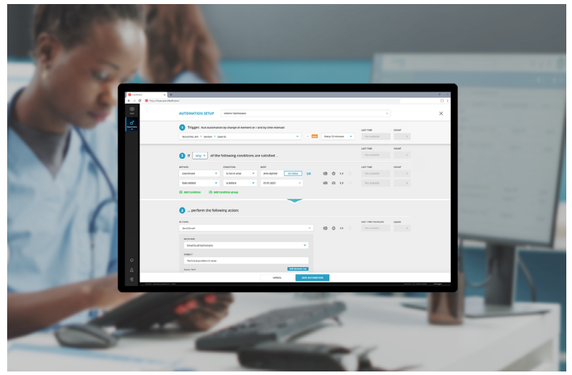
In healthcare, indoor tracking of objects is particularly useful in terms of time savings, process optimization and theft protection. The current location of mobile medical equipment and beds can be viewed on a digital map at any time. In addition, other relevant information and the status of the assets can be documented. This creates transparency regarding the availability, use and utilization of individual assets.

Furthermore, the assets can also be protected against theft. As soon as an asset leaves a defined area, an alarm is triggered and/or an automated message is sent to the responsible personnel. E-Ink Display Beacons offer the possibility of combining localization and display media. Relevant information about the object can be shown on the displays and located at the same time.

Maintenance & Service Processes

By setting up individual action logics, processes can be automated and workflows optimized. The triggers can be diverse, for example, geo- or time-based, related to the battery status of a device and much more. Possible applications include sending push notifications, configuring tasks or changing a device's status.

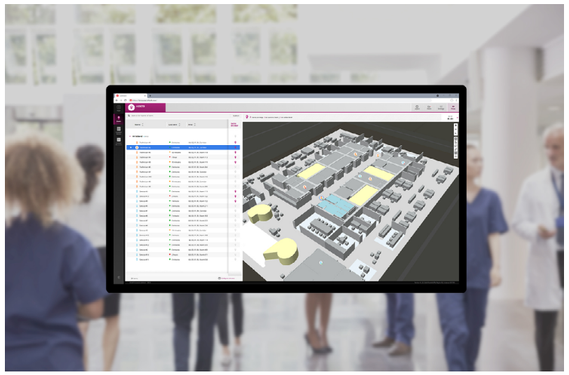
Automation of processes in healthcare centers can be implemented in different ways. For example, to protect people with dementia who are equipped with BLE wristbands. These send information about their location at certain intervals.

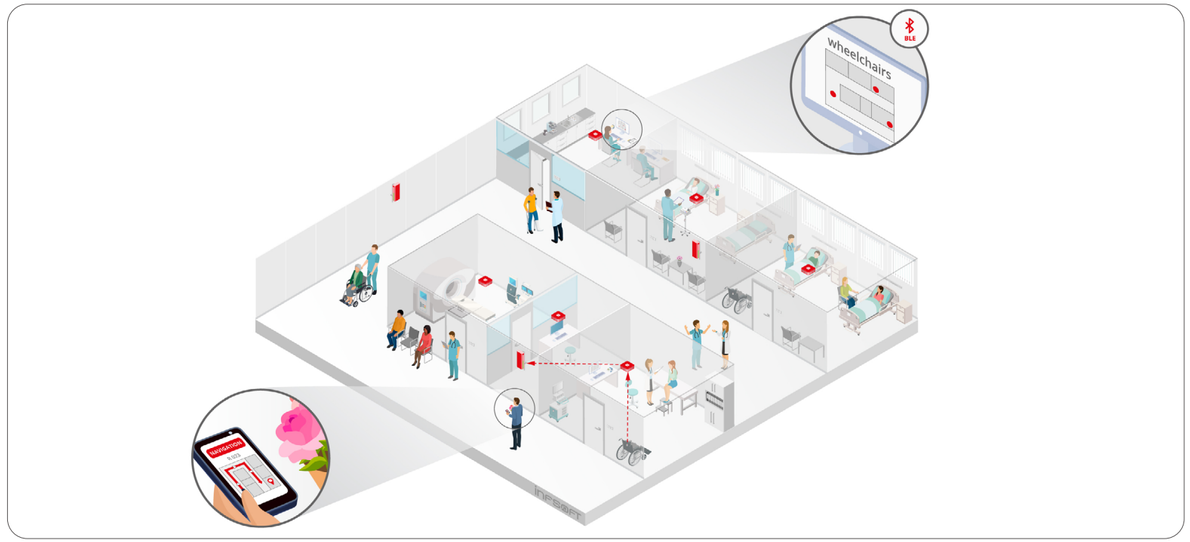


Patient Localization & Emergency Call

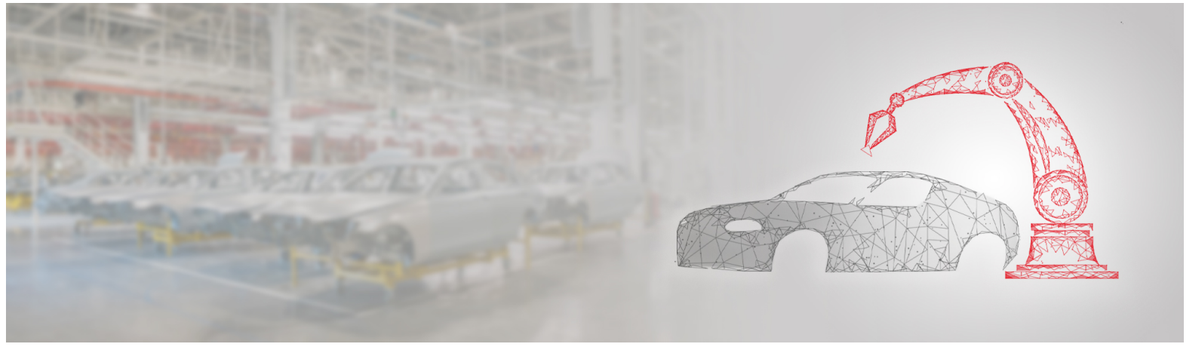
Indoor tracking of people can be useful in many situations. On the one hand, safety aspects play a role, for example in the monitoring of particularly vulnerable patients and in the evacuation of employees and patients in emergencies. On the other hand, the recorded walking paths provide the basis for process optimization.

Wristbands with an emergency button, for example, can make a decisive contribution to increasing the safety of patients and employees. In an emergency, the button on the wristband can be pressed and the location of the person concerned is automatically shared so that help can be provided promptly.





Indoor Navigation and Asset Tracking in Hospitals



Automotive & Assembly

Especially with regard to the high-quality standards demanded in the production cycle, the automotive industry is highly advanced in the adoption of precision automation technology. In this context, the use of intelligent location tracking systems is becoming increasingly common in this industry.

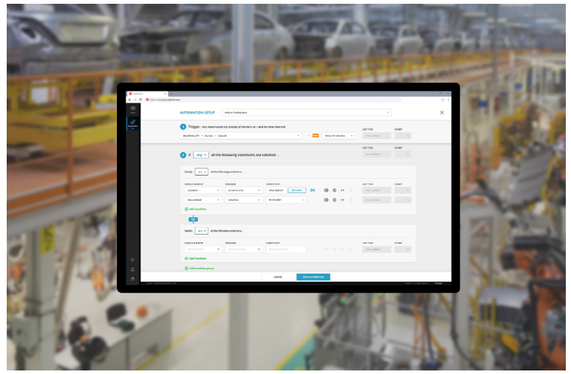
infsoft's solutions span the entire automotive manufacturing chain. They may be used for vehicle identification and tracking, quality control in production, or asset management. At car dealerships and service centers, the use of an RTLS (Real-Time Locating System) can also improve internal processes.

Component & Equipment Tracking

Indoor tracking of objects can reduce search times, document process steps, and ensure comprehensive management of tracked assets.

Automated Status Updates

Various triggers (e.g., location or time-based) ensure automated processes and more efficient operations. Bottlenecks can be identified, optimization potentials revealed, and decision-making improved.



Worker Safety & Automated Time Recording

The location and movements of employees in the automotive industry can be monitored with the help of a tracking system. This increases personnel safety and contributes to the organization of efficient processes.

By connecting to a payroll accounting system, working hours can be logged automatically. The individual wages of each employee can be calculated reliably based on the data from the tracking system. The solution also ensures greater transparency regarding work processes and actual hours worked.

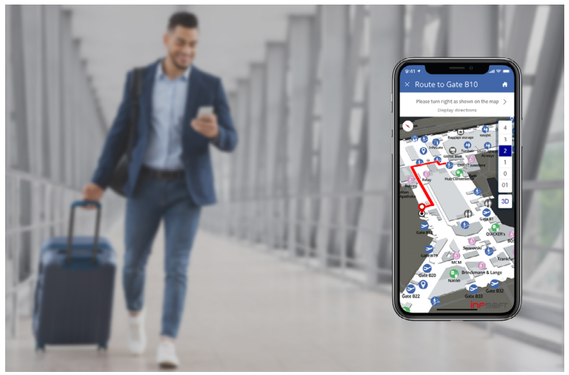
Travel & Transportation

The use of real-time locating systems and mobile services allows travelers at train stations and airports to enjoy a smooth, efficient, and stress-free experience, with features like real-time updates and personalized guidance. Simultaneously, operators gain valuable insights from real-time tracking and analytics, enabling them to optimize operations, improve customer service, and make data-driven decisions to enhance overall efficiency.

infsoft's smart technologies can be used not only for indoor navigation and location-based services but also to monitor passenger flows or identify busy areas, for example. A tracking system is used to trace valuable goods and/or personnel and plays a key role in optimizing processes.

Mobile Services for Travelers

A mobile app for travelers can offer a comprehensive suite of features designed to enhance the travel experience. These features include access to timetables, the ability to book tickets, real-time travel updates, parking assistance, and integrations with car rental services. Additionally, travelers can benefit from digital maps, indoor navigation, and other useful tools for seamless navigation throughout their journey.



Alternatively, many of these services can also be made available to travelers within a stationary terminal, providing convenient access to essential travel information while on-site.

Tracking & Monitoring of Lead Times

The localization of assets enables operators to increase the efficiency of processes along the travel chain and provides the basis for business decisions.

Utilization Analyses & Monitoring of Movement Profiles

Tracking the location of people provides interesting insights into movement profiles and reveals optimization potential. For example, in terms of staff deployment, routing on the premises, or the placement of stores and advertisements. In addition, internal processes can be optimized by tracking employees.

About infsoft

infsoft GmbH, based in Großmehring near Ingolstadt, has been offering comprehensive platform solutions for large companies since 2005. The focus is on the location of people and assets, utilization analyses of space and equipment, room sensor evaluations and the provision of workplace experience systems. E-labeling components for mobile assets and situational room labeling complete the portfolio.

smart connected locations: The infsoft LocAware platform® forms the basis of the full-service offering as a central cloud IoT hub. Extensive web applications for data management and visualization are available within the platform. infsoft LocAware offers a bi-directional connection to third-party systems via numerous interfaces in order to bundle internal and external data streams.

Long-standing customers include F. Hoffmann-La Roche, Roche Diagnostics, Audi, Frankfurt Airport and the Swiss Federal Railways (SBB). infsoft's quality management is certified according to DIN EN ISO 9001, and our information security management is certified according to ISO/IEC 2700. Our quality management encompasses all measures to improve processes, services and products in order to consistently meet customer and regulatory requirements.

ISO 9001 Quality Management **CERTIFIED**

ISO/IEC 27001 Information Security Management **CERTIFIED**

infsoft smart connected locations

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