POSITIONING TECHNOLOGY FROM WITTRA

MAKING THE IMPOSSIBLE POSSIBLE WITH ACCURATE POSITIONING USING NARROW-BAND RADIO

WiTTRA™

INTRODUCTION

Håkan Dackefjord was out on his routine run when he spotted a new bicycle leaning against a tree, passing the same bike every day for the next week, wondering if it had been stolen or misplaced. It was this thought that got Håkan thinking, where is my stuff and what is it doing?

Håkan began researching location technology and current solutions in the market and soon realized that the IoT technologies today were competing within two distinct positioning categories – indoor and outdoor. The indoor market was filled with LPWaN solutions and outdoor consisted mainly of satellite and cellular technologies. Neither of which were suitable to track objects like bikes, tools or machines. Thinking about the bike he understood that a multitude of tracked objects within the IoT space would be moving, and specifically between indoor and outdoor spheres, and in complex environments such as cities or construction sites. A viable asset tracking system would therefore need to work successfully within every type of environment. Unfortunately, no such tracking system existed.

In 2013, Wittra® Sweden AB was founded, Wittra technology has gained significant traction in the IoT industry and received several awards for its ground-breaking patent protected technology in location intelligence. This technology allows seamless tracking between indoor and outdoor spheres, no matter what the environment. In 2022 Wittra rebranded to Wittra Networks AB.

WITTRA POSITIONING TECHNOLOGY MAKES THE IMPOSSIBLE POSSIBLE

Start by doing what's necessary; then do what's possible; and suddenly you are doing the impossible. This has been the ethos of Wittra who sought a solution for accurate positioning over narrow-band radio technologies, something previously considered impossible.

Understanding that objects being tracked within the IoT space would be moving – and more specifically moving between the indoor and outdoor spheres, in complex environments such as cities or construction sites required a different solution. A viable asset tracking system would therefore need to be able to work successfully within every type of environment.

Asset's people and objects move, change location and operate in changing and evolving environments where there are challenges of reliable network connectivity, reliable data delivery and a need for total asset visibility to both locate and delivery meaningful sensor data.

Wittra offers the only solution that allows users to Connect, Sense and Locate their assets in the toughest environments in a single technology cost-effective deployment. Wittra combines a Data Transport Network along with Positioning Infrastructure to allow you to Locate, Sense and Track your assets.

Wittra offers a range of wireless network technologies covering most conceivable use cases within IoT. Our network solutions are based on open standards which help make systems and applications more functional and interoperable. The core elements within the Wittra Network consists of the Wittra Unified Gateway, Wittra's C{x}ameleon tag (our software defined hardware solution for the creation of Positioning Beacons, Mesh Routers and theTraksense360) and a range of additional click-on sensors and accessories.

WITTRA POSITIONING TECHNOLOGY:

Determining the position of an object in space can be challenging - environment, interference, accuracy and range are critical factors that need consideration when contemplating a solution. Technologies initially conceived to transfer data have in varying degrees been adapted to offer a way of positioning portable wireless devices. Familiar technologies such as Bluetooth (iBeacons), WiFi, Zigbee and Ultra-Wideband (UWB) represent a few. GPS is probably the most widely recognized technology however its high power consumption and the fact it is designed as an outdoor solution excludes it as viable option for many IoT applications.

There is no silver bullet, each approach has pros and cons – however, what we can say about the four technologies highlighted is that they are all limited in range, giving up to several tens of meters between the wireless device and network "anchor points" when used in indoor or industrial/harsh environments. Additionally, they offer positioning with varying degrees of accuracies or require exceptionally dense network deployments.

Considerable thought should be given to TCO (Total Cost of Ownership) when deploying positioning technology, how flexible is the solution, how much disturbance will occur during deployment, what are the ongoing maintenance costs, what if I need both indoor and outdoor positioning? The list is extensive.

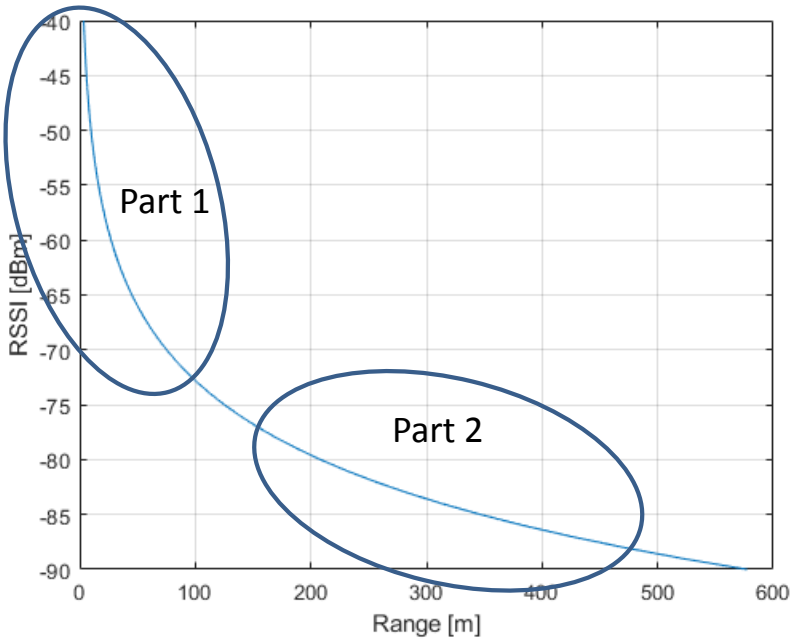
Wittra's approach is different, creating a technology for positioning based on a much lower radio frequency band (sub-GHz, license-free SRD/ISM). The primary advantage is achievable signal transmission range, both outdoors, underground and indoors in a single deployment. Implementing a reliable and relatively accurate positioning system (±5 meters 85% of the time) can be achieved at a low TCO, mostly because the density of "anchor points" throughout the site is much lower than the other short-range technologies. Benefits include:

- Much lower installation cost
- Lower operational cost, less administration
- Less disturbance on operations – independent of site IT network
- Quickly deploy and use without the hassle of constantly rebuilding network
- Better coverage due to range and penetration capacity

There are two well-known principles for performing positioning of devices using radio signals. The first method is based on the received signal strength indicator (RSSI) from a transmitter and the second method is based on estimating the range between a transmitter and a receiver known as ToF (Time-of-Flight). Wittra offers both in a single deployment.

RSSI POSITIONING (RECEIVED SIGNAL STRENGTH INDICATOR):

The RSSI based positioning is built on the relationship between RSSI and range, as illustrated in the following figure.



We can see from the above figure that there are two different parts in the range-to-RSSI mapping. In the first part (shorter ranges) we can see that small differences in the range give large changes in RSSI. This will make the conversion to range from RSSI robust against measurement errors. In the second part of the curve, we can see that the curve is very flat. This means that larger changes in the range will not influence the RSSI values that much. In this part of the curve, the conversion from RSSI to range is sensitive to measurement errors. As the mapping between range-to-RSSI can be different under different radio environments it is also difficult to apply an accurate model for all cases. RSSI-based positioning is very useful at shorter ranges. For larger ranges, the estimation error can be too large to be useful.

RSSI is used by most indoor positioning systems because it is easy to implement. The drawback is accuracy if the distance between tag and measuring infrastructure is too large (typically not more than 15 metres or so) and therefore to improve accuracy you need a very dense deployment of devices.

TOF (TIME OF FLIGHT) BASED POSITIONING:

You can divide ToF based positioning into two main cases: Time Difference of Arrival (TDoA) and round-trip time (RTT).

TDoA requires that the anchor points are synchronized, e.g., as in 3G/4G/5G cellular systems. A device can measure the time difference of the radio signal transmitted from the anchor points. You can then use these time differences in a "multilateration" algorithm to determine the position.

The RTT method does not require synchronized anchor points and is therefore less costly to implement. Instead, it requires that the round-trip time can be measured accurately using precise timestamps on the data packets in the network in two directions. Wittra's Time of Flight positioning involves measuring the distance between a TrakSense360 and several Positioning Beacons using such accurate timing signals. This is much more difficult to do than measuring RSSI signals, but the advantage is consistent accuracy over much larger distances. As an example, the Wittra network has shown an accuracy of plus/minus a few metres at a distance of 100 metres from the network infrastructure.

The combined method:

Wittra has actually implemented a combined RSSI and ToF positioning algorithm called WiPE (Wittra intelligent Positioning Engine). WiPE is configurable and can operate in different modes, RSSI only, ToF only, and a combined mode. The benefits of this approach to indoor and outdoor positioning are:

- Higher accuracy with more consistent results
- More robust... can work in a large variety of radio environments
- Economical... low-density network infrastructure (lower number of anchor points)

The WITTRA IoT OUT OF THE BOX network kit enables fast deployment of Wittra's market leading positioning technology, offering a wireless IoT sensor network kit with a cloud-based API, that can be deployed on a site to monitor objects and assets.

Wittra IoT OUT OF THE BOX is immediately available from Mouser Electronics or Farnell https://www.wittra.se/products/iot-network-kit/

About Wittra

In 2013, Wittra® Networks AB was founded as a consequence of the team's tireless research, insight, and ongoing development. Since that time, Wittra® technology has gained significant traction in the IoT industry and received several prestigious awards for its ground-breaking technology in location intelligence. This technology is currently protected by 51 patents, making it possible to seamlessly track assets between the indoor and outdoor spheres, no matter what the environment. The next step has been to utilize emerging standards to create products with the right market fit. As a result, Wittra® has launched its first applications into the market, providing a simple, practical solution for keeping track of your things.

Wittra Networks AB, Västra Järnvägsgatan 3 (9th Floor), 111 64 Stockholm
+46 8 387871 / info@wittra.se