

# Ultra-Wideband

It's ultra-everything and the possibilities are endless



**QORVO**  
all around you

# THE VALUE OF LOCATION

## Shaping Our Lives for Over a Decade

Location technologies have been a part of our lives since the late 90s, when GPS began to proliferate, helping us navigate to the nearest ATM or gas station. No more asking for directions, struggling with paper maps or just plain getting lost. As individuals, this has made life significantly more convenient. For businesses, however, the benefits go way beyond convenience. It is a matter of increased efficiency and the ability to build sustainable business models. Just think how much harder it would be for big ecommerce companies to deliver our packages without the efficiency of using GPS technology.

We've experienced the benefits of being able to find people, places, and things, but what if there was more? The Internet of Things brings us the ability to collect data from billions of things. Now, in addition to the 'what' – the data from those sensors – and the 'when', we can now add the 'where'. This third dimension gives context to our devices, or what we like to call 'True Awareness', and it's being brought to life by ultra-wideband (UWB). UWB is an IEEE 802.15.4a/z standard technology optimized for secure and real-time precise location-based applications.

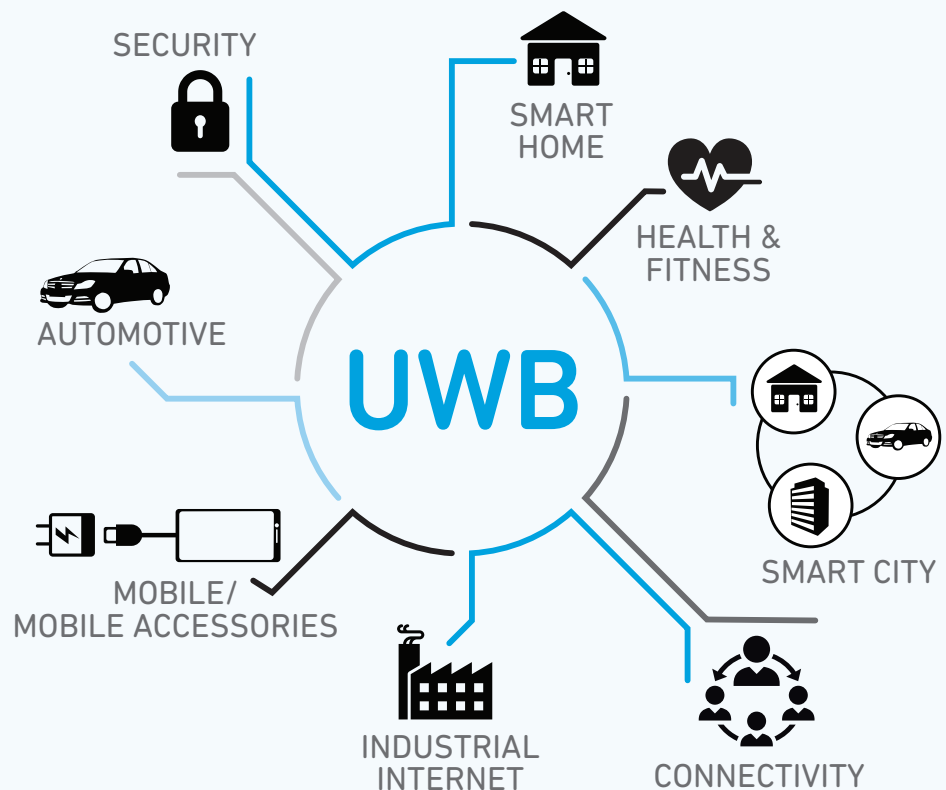


## Endless Possibilities with Ultra-Wideband

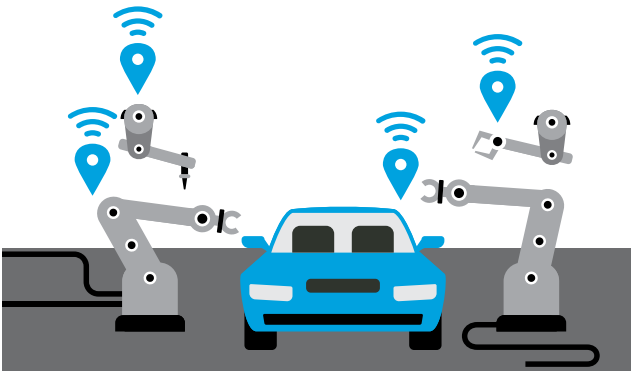
Business-to-business (B2B) and consumer retail industries already understand the major added value that a more reliable and accurate indoor location system brings. For example, it can help consumers navigate indoor venues, it adds more intelligent automation in homes and commercial buildings, and it drives operational efficiencies for businesses by giving them real-time insights into operations, assets and employees.

There are five main applications for ultra-wideband, with limitless use cases in each that will span almost every industry:

- **Location-based services:** to locate and track people and assets
- **Safety:** to enhance safety and security through real-time information
- **Indoor/outdoor navigation:** to provide turn-by-turn navigation no matter where you, or your devices, are located
- **User interfaces:** to interact seamlessly and intuitively with devices
- **Secure transactions:** to provide a secure connection between devices through centimeter accuracy and interference immunity



# Location-Based Services



Location-based applications make use of the real-time accurate location data from UWB sensors for use cases targeted at locating and tracking objects.

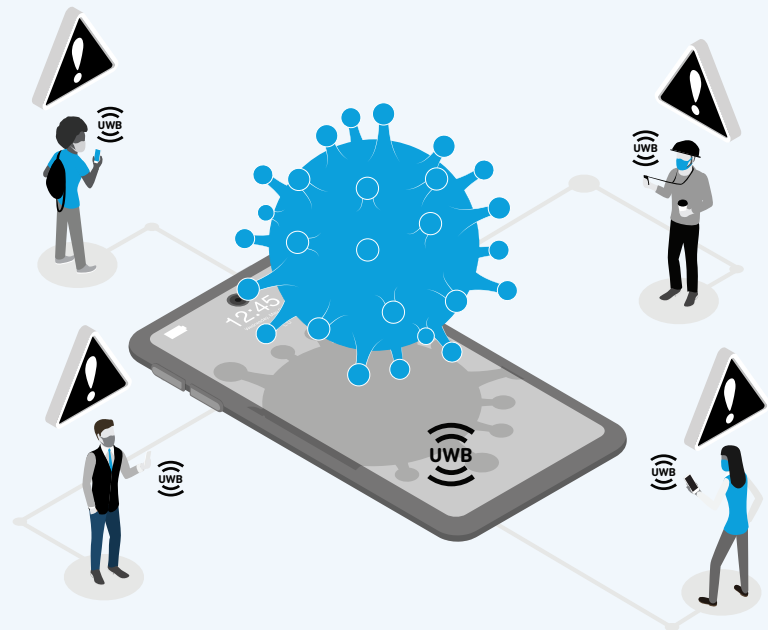
No more worrying about being late for work because you can't find your keys. Grocery shopping is a breeze, since you're not wasting time roaming the aisles trying to find items on this week's shopping list. Site managers in factories can enhance safety by warning workers if they're approaching hazardous areas. Tracking equipment and tools provides a real-time view of work in progress, increasing workflow efficiencies. And that's just the tip of the iceberg when it comes to this application.

The sports industry has already taken advantage of these services (centimeter accuracy and low latency). Athletes now wear UWB sensors that

ping to a series of anchors around a court, field or rink that provide precise direction, speed and location data for instant replay animations – a football's location, for example, is updated 2,000 times per second! The information provided by these sensors gives teams the opportunity to optimize training and provides individual athlete statistics for sports fans.

## Safety

Knowing the location of people, autonomous vehicles and robots in real time helps mitigate accidents by controlling interactions or keeping people away from hazardous areas in the workplace. UWB has proved to be the only solution capable of helping with contact tracing and social distancing in the fight against the COVID-19 pandemic in many industries. Sensors in tags can be worn as wrist bands or ID badges to measure the distance between people and provide a proximity warning time. If two people get too close to each other, the tag emits a sound to notify the wearer. The sensor is also able to track how long two people come into contact with each other. This provides cost efficiencies and help workers feel safer returning to and staying at work.



## Indoor/Outdoor Navigation



Believe it or not, location information was not readily available to the public 20 years ago! In the early 2000s we began to see the emergence of indoor navigation: think Google maps for malls, airports and other large buildings. Current indoor navigation technologies, like Bluetooth® Low Energy or Wi-Fi, are limited by the fact that they require a great deal of processing and measurement to obtain just one accurate location point. When Bluetooth Low Energy does find a location, its accuracy is in the meters and it's highly dependent on the environment. So began the rise of micro-location-based systems, which are a more accurate and reliable way to find just about anything.

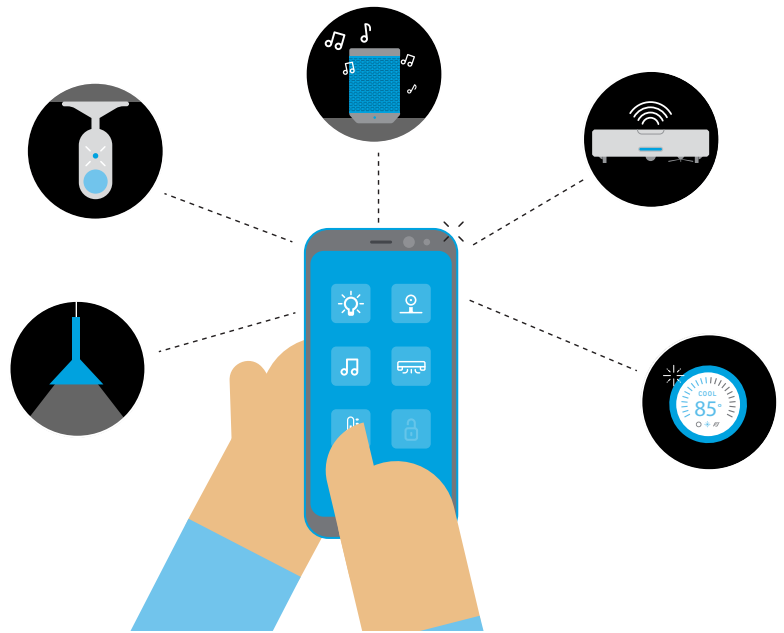
UWB has made it possible for autonomous vehicles and robots to take advantage of precise location for indoor and outdoor navigation. For example, a garden can be equipped with a few UWB anchors, used as reference points, to guide an autonomous lawnmower. Unlike existing technologies, you no longer need a fenced in yard or to bury wire to create a boundary. Now, an all-day chore can be completed in a few hours at the touch of a button.

## User Interfaces

Thanks to centimeter accuracy, UWB enables more intuitive user interfaces that provide seamless interaction between people and multiple objects. The scalability and reliability of UWB makes it ideal for these interface use cases that require intuitiveness, because they are required to communicate with more than one device simultaneously. UWB only needs single measurements to determine accurate and reliable positioning, while other RF technologies require multiple samples plus filtering to get to a location result. It has high immunity to both multipath and interference, which is typically a challenge for other RF systems due to signal reflections and other obstructions. These benefits bring to life the dream of a truly smart home like never before.

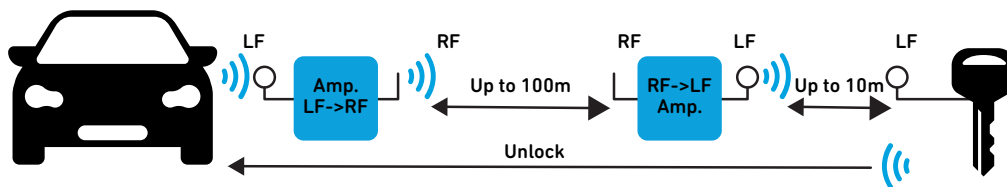
Now, the sound coming from your high-tech speaker system, or your smart lighting, can follow you as you move from room to room. By simply pointing at the UWB-

enabled smart devices in your home, your smartphone can now quickly display control interfaces. UWB is not limited by the number of devices it can manage at the same time – this has become more and more important in smart homes with multiple devices. All these use cases can be handled simultaneously with UWB tags and UWB-enabled devices.



## Secure Transactions

You can't hack time and UWB uses time of flight (ToF) to calculate the precise location of a device. The distance bounding communication technique defined by the IEEE standard provides a level of security that makes it extremely difficult to hack. In the automotive industry, key fobs using UWB technology create a secure communication and distance measurement that deters car theft. By using different location measuring topologies and security measures per the IEEE standard, UWB technology can prevent relay attacks and thefts. A UWB enabled key fob uses your precise location, meaning you must be physically near your vehicle to unlock it.



### WHAT'S A RELAY ATTACK?

Typically, a relay attack consists of two parties who are working together. One stands by the vehicle, while the other stands near the key fob with a device that can pick up the signal being emitted. The device then relays the key fob signal directly to the car, allowing the thieves to get in and immediately drive away.

To learn more about Qorvo's UWB, visit [www.qorvo.com/go/uwb](http://www.qorvo.com/go/uwb). Or contact [customer.support@qorvo.com](mailto:customer.support@qorvo.com) and find out how UWB fits into your product.