

Contact tracing use case

- To stop the spread of the disease, tracking of close contacts while ensuring privacy are the requirements that drove our solution.
- The solution can decide if the safe distance and contact duration has been broken with high accuracy.
- The contacts (other radios addresses) can be kept in the tag or uploaded to a trusted database.
- In case of a Positive COVID result, the system will be able to track all the contacts and notice the matching results.

UWB technology

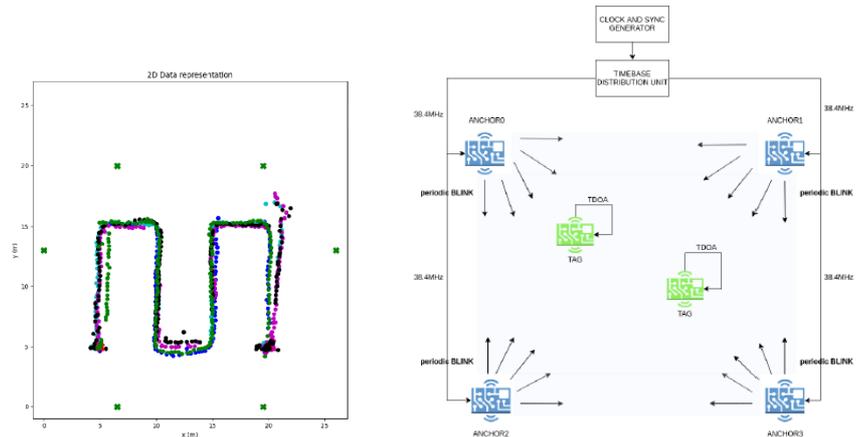
- Ultra Wide Band (UWB) utilizes a train of impulses which makes it perfect for precise ranging applications.
- UWB pulses can be distinguished even in noisy environments, plus the signals are resistant to multipath effects.
- UWB transmit power lies at the noise floor, which means that UWB does not interfere with other radio communication systems making it ideal for indoor positioning.
- Thanks to the architecture, you can cover a venue with a cost-effective number of anchors.

DENSE SCENARIOS UWB POSITIONING

Scalability of users while keeping accuracy.

UWB Positioning is a solution based on UWB radio technology and Reverse Time Difference on Arrival architecture. This i2CAT development enables a scalable solution for dense scenarios, where there are a lot of users to be tracked within an area. It can be the base of contact tracing application and other accurate positioning demanding applications on dense scenarios.

There are several methods to calculate the positioning depending on the UWB signal, our innovative solution is based on Reverse TDoA architecture. In this case, the Anchors blink to mobile devices (Tags) who compute their own location. The key element is the Anchor synchronization to ensure that their blink doesn't collision on the access medium. i2CAT solved this key issue with a novel hardware design of clock and synchronization module that distributes the signal to the anchors via UTP cable.

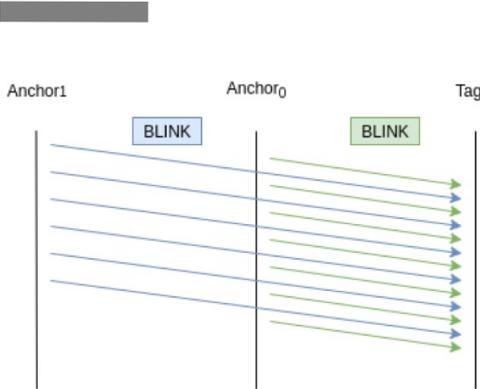


The solution is composed of the following elements:

1. **Clock and Synchronization generator and distributor over UTP cables.** A hardware designed to generate the SYNC signal, with nanoseconds width, to distribute SYNC and CLOCK. It adapts both signals to allow transmission over a UTP cable. It consists of 2 main parts:
 - Clock signal distributor
 - Sync signal generator and distributor
2. **SYNC and CLK Receiver:** A hardware design to convert the differential signal provided over the UTP cable to single signals, to be used by the anchor (based on radino32 hardware).
3. **Anchor:** Static elements which position is well known by the system. They are based on radino32 hardware with the additional attachment of the SYNC and CLK receiver module. The firmware has been modified to send the beacon based on the arrival of the SYNC signal.
4. **Tag:** Hardware based on radino32 with modified firmware and ESP32 microcontroller. It executes the algorithm to calculate its own location.



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About i2CAT

i2CAT is a nonprofit research and technology center that promotes R&D activities in advanced digital technologies. The center has pioneered a new model of innovation based on collaboration between companies, public administrations, academia and users. Our activities are focused on three objectives:

- **Research:** playing a key role in EU Framework Programme for Research and Innovation, participating in 23 H2020 projects.
- **Strategic projects:** leading local initiatives and projects to deploy digital strategies and policies of the public administrations.
- **Technology:** Fostering R&D collaboration with companies to develop innovative market-oriented solutions.

Problem solved

Dense scenarios, in the order of thousands of devices, pose a high stress on location systems due to the noise generated by the moving objects and the multipath signal propagation they imply. The use of UWB solution combined with the paradigm change that reverse TDOA brings (offloading the calculation to the Tags) solves the problem.

The key for the proper work of the system is the accurate synchronization of the anchors. They need a common clock and a synchronization signal for transmitting their beacons (blink) without colliding with each other on the access medium. They require nanosecond accuracy. For this need i2CAT has designed a dedicated hardware comprising the clock signal distribution and the synchronization signal generation and distributor. The Clock and Synch generator and distributor systems adequate to be sent via UTP cable and distribute it to the required ports. On the Anchors a new hardware is designed to receive the signals from the UTP cable and adapt them to be used by the positioning system.

Key Benefits

- Less than 30 cm accuracy, better than some Bluetooth and WiFi based solutions.
- Better behaviour in noise environments
- Clock and synchronization distribution to anchors with nanosecond precision.
- Reverse TDoA enables dense scenarios by executing the position computation on tags.
- The traced object holds the information, it does not need to disclose its position unless required by the use case.
- Compatible with mobile apps to deliver more features such as indoor navigation and other location based services (LBS).

Applications & uses cases

Precise location of moving objects is a big demand for today's world. Verticals from manufacturing and Industry 4.0 environments to mass consume culture events can benefit from this technology that enable dense scenarios. This positioning solution could be a great tool for companies that offer solutions for event or fair identification: from tag to business analytics.

Due to the current pandemic situation contact tracing has become one of the most demanded applications. This solution enables the possibility to locate accurately the position of the users wearing the tag to determine if they have been in close contact. The 30cm accuracy make possible the any event organized could benefit from an application relying on the benefits of this technology.

