
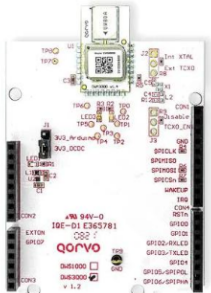


Matériels à disposition:

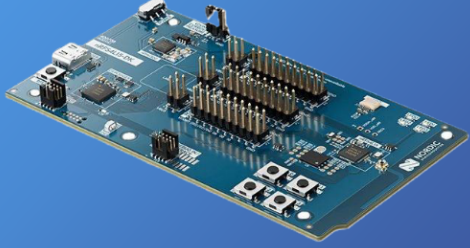
Hardware



A Windows OS computer



UWB : DWM3000EVB Qorvo

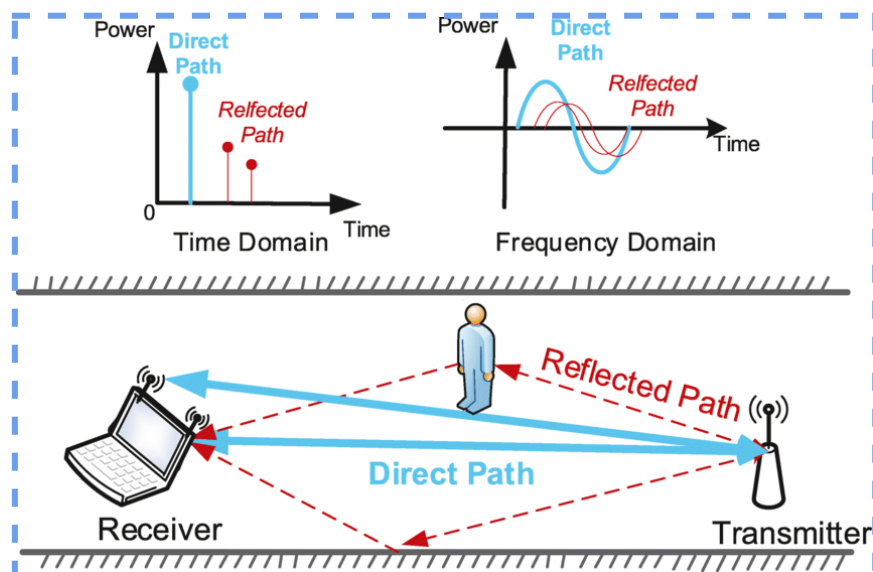


Development Board (nRF54L15 DK)

UWB : DWM3000EVB Qorvo -> DWM3001CDK (actually)

Glossary :

- **multipath:** Multipath refers to the phenomenon where a radio signal does not arrive via a single path, but through multiple different paths due to reflections.



UltraWideBand (UWB)

Link : <https://fr.mathworks.com/discovery/ultra-wideband.html>

Ultra-Wideband relies on time-of-flight measurements of radio signals with a very large bandwidth. This approach enables highly accurate distance estimation (down to the centimeter level), with low sensitivity to multipath effects and signal power variations.

Why is UWB weakly sensitive to multipath?

UWB transmits extremely short pulses (\approx nanoseconds).

This allows the receiver to separate signal paths in time:

the first received peak corresponds to the direct path

the following peaks correspond to reflections (multipath)

The UWB receiver can therefore identify the first path and ignore reflected paths. Unlike Wi-Fi or Bluetooth, which transmit **continuous waves**, UWB sends very short pulses (on the order of a nanosecond).

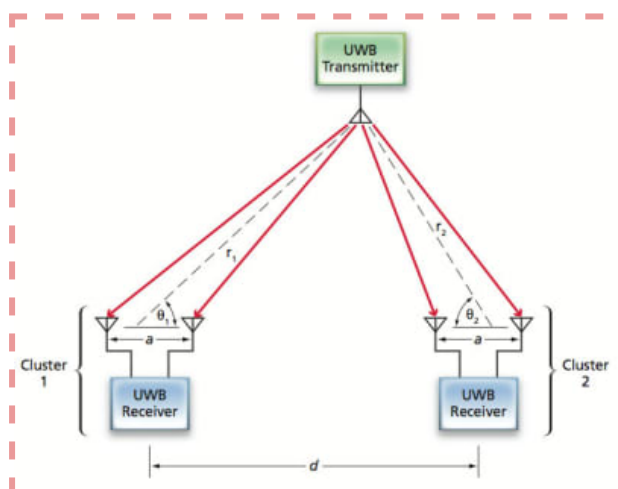
Mesure de la distance

Example

- Device **A** sends a UWB pulse
- Device **B** receives it and sends a response
- Device **A** measures the total elapsed time
- Distance = (time \times speed of light / 2)

Because the pulses are **ultra-short, extremely precise timing measurements** are possible \rightarrow **very accurate distance estimation**.

Orientation / Localization Measurement



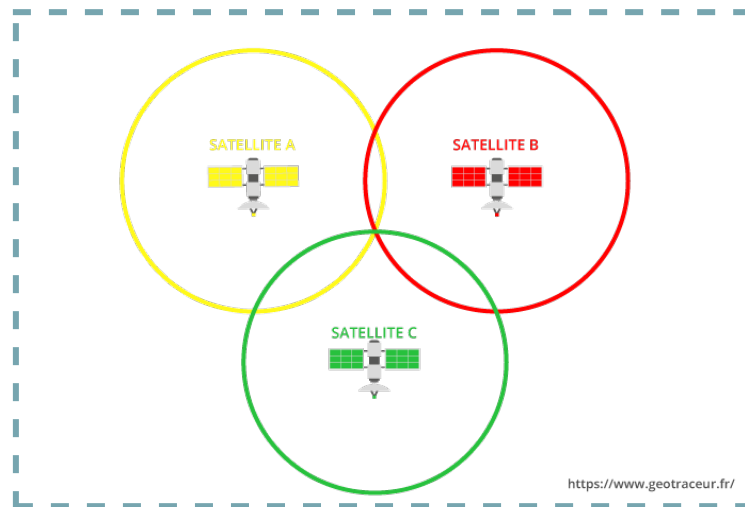
UWB does not rely on a single antenna but on multiple spaced antennas, and measures tiny time or phase differences between them.

Since the technology is based on very precise time measurements (on the order of nanoseconds), this enables **Angle of Arrival (AoA)** estimation.

The DWM3000EVB, based on the DWM3000 module / DW3110 chip, has only one antenna in its standard

configuration. Therefore, it cannot measure **AoA** or **PDoA**, and cannot determine receiver orientation using UWB alone.

However, by using multiple anchors, it is possible to perform **trilateration**. By knowing the distance between the receiver and three transmitters, its position can be estimated.



We will ultimately use the **DWM3001CDK (Ultra-Wideband Module Development Kit)**. This module **also does not support AoA**.

On the other hand, UWB involves higher hardware complexity, higher cost compared to Bluetooth solutions, and partial integration within the mobile ecosystem. These constraints raise questions about its suitability for mass-market solutions or cost-constrained applications.

Feature	Details / Values
Frequency band	Wide spectrum, typically between 3.1 GHz and 10.6 GHz
Bandwidth	Greater than 500 MHz (sometimes several GHz)
Range	Short range, approximately 10 to 30 meters under optimal conditions
Localization accuracy	Very high: between 5 and 10 cm
Data rate	Variable, from a few Mbps up to more than 480 Mbps depending on distance
Power consumption	Very low (impulse-based technology)
Security	Excellent (time-of-flight measurement is difficult to spoof with relay attacks).
Latency	Very low (< 1 ms).