UWB

Magnetic Field

What have all these elements in common?

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Magnetic Field

What have all these elements in common?
Can be used for indoor positioning


5G
ANATEL

R&I

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Upgrading Wi-Fi Fingerprinting to 5G: A Hybrid Simulation Case

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Basic information for indoor positioning

- Cameras/Optics
- Acoustic Systems
- Radiofrequency
- Inertial Navigation
- Magnetic Field
- Electric Infraestructure

- WiFi
- Bluetooh
- RFID
- ZigBee
- UltraWideBand
- Celular networks
- Signals of radio and TV

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Techniques for indoor positioning

- Time of flight
- Angle of arrival
- Intertial
- Fingerprinting

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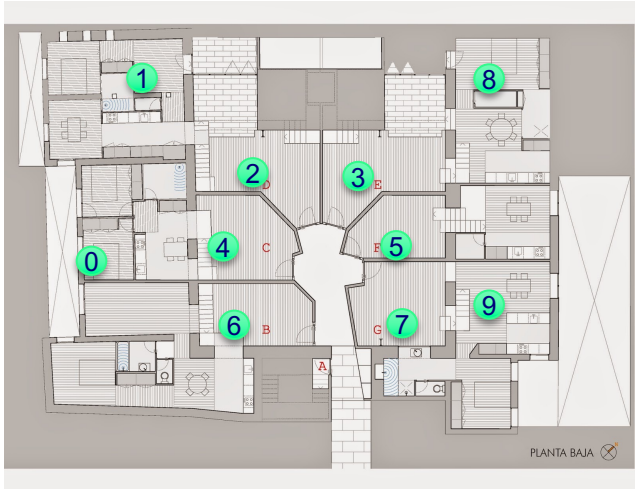
Fingerprinting

2 phases

- Offline



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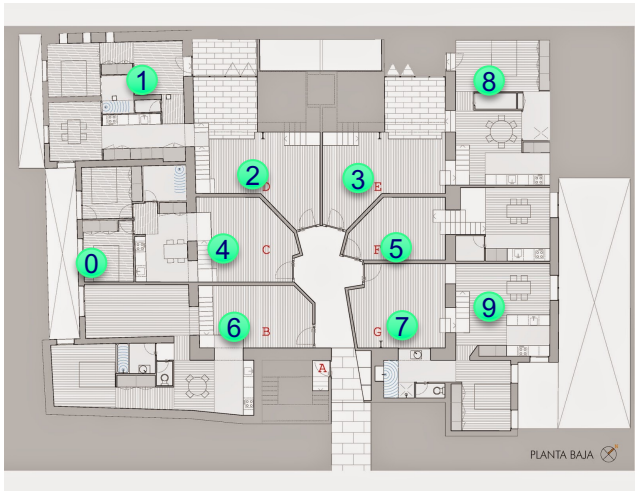

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- Online

Fingerprinting

2.4 GHz

5 GHz.

Fingerprinting

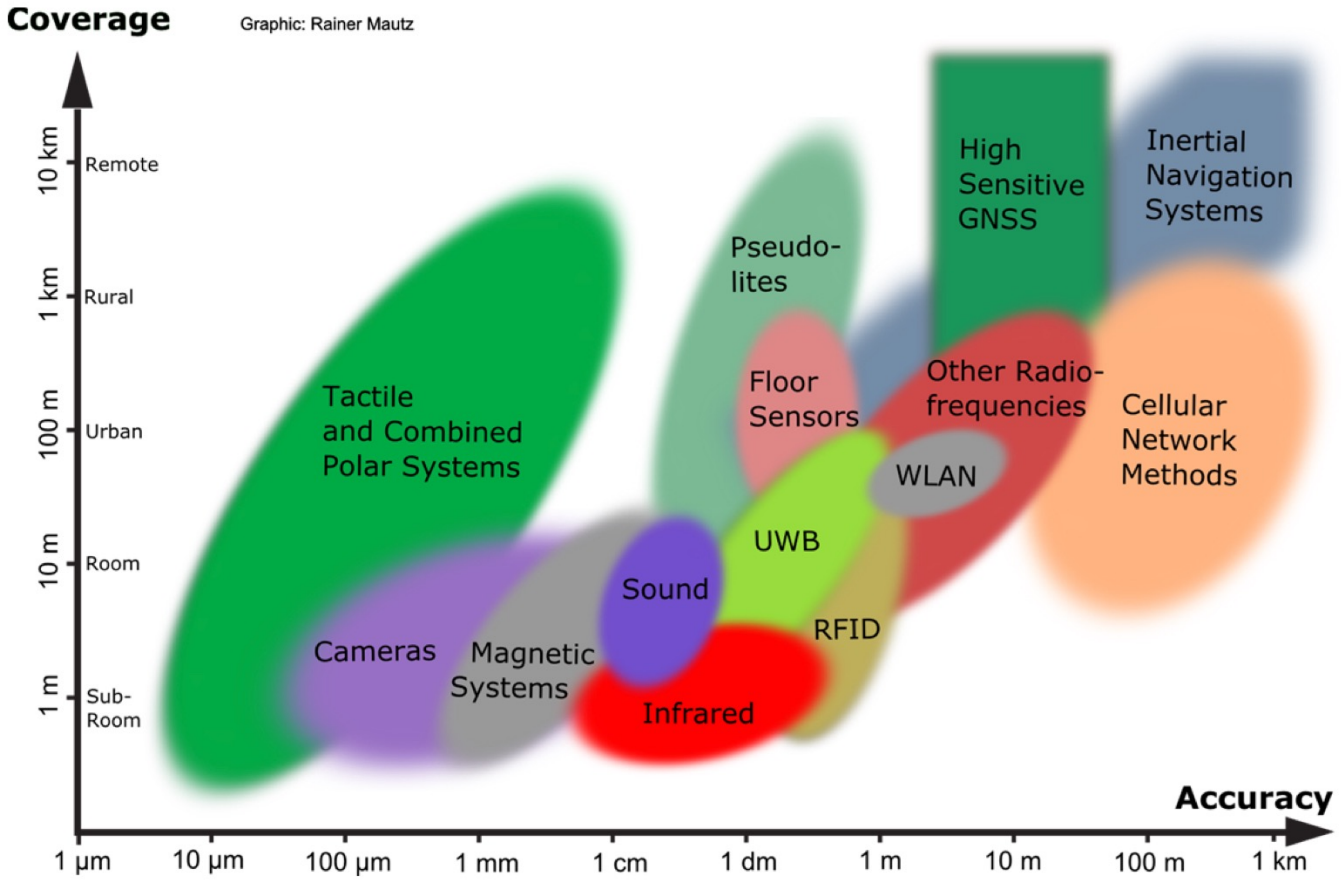
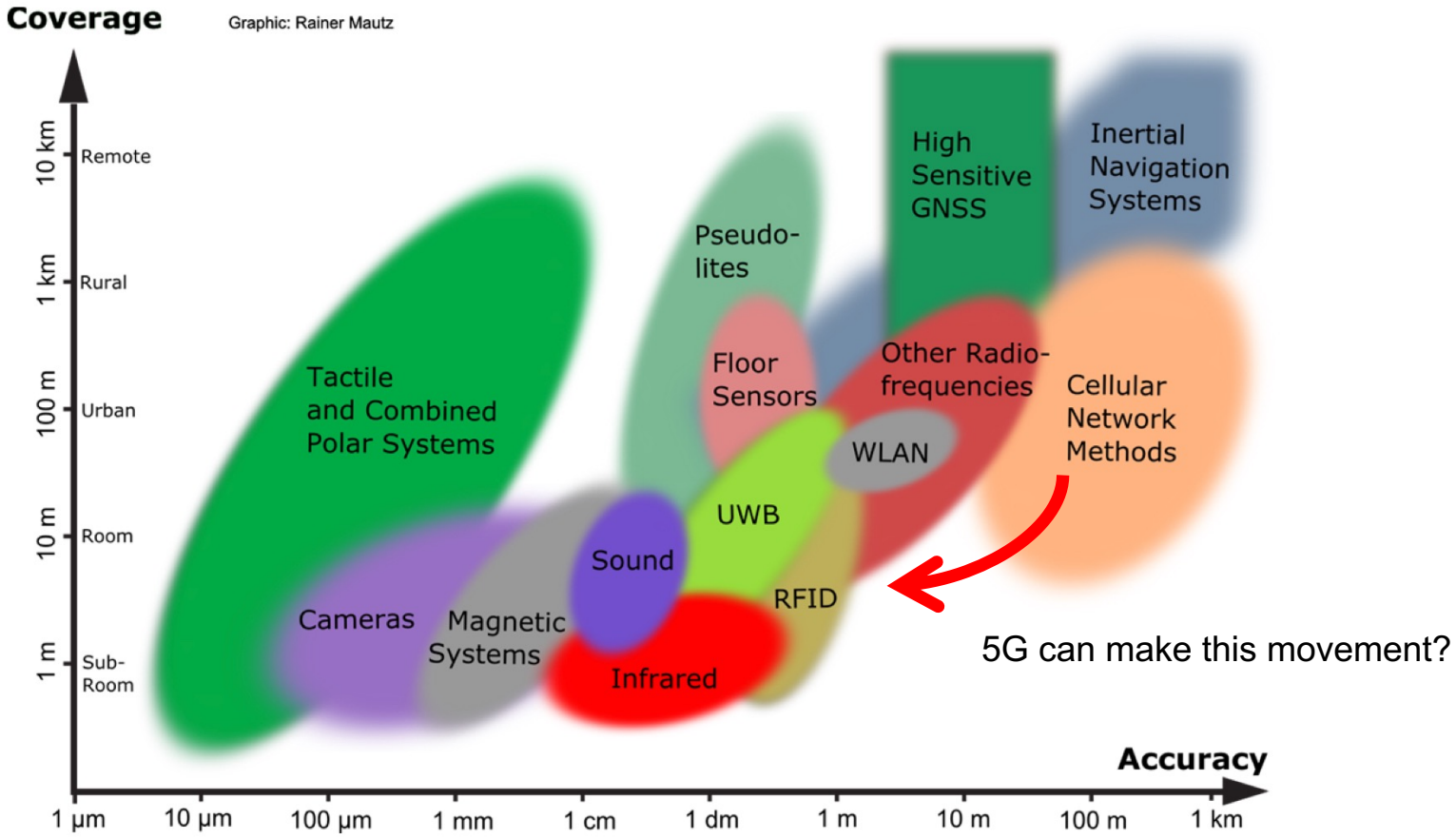


Figure 1.1 Overview of indoor technologies in dependence on accuracy and coverage

Fuente: https://www.research-collection.ethz.ch/handle/20.500.11850/54888, doi:10.3929/ethz-a-007313554.



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Problem

5G is between 3 and 30 GHz, mmWave

These frequencies are regulated and we cannot deploy a 5G network without government permision

How can we test if 5G is suitable for fingerprinting technique?

The answer

Simulation software: EMSlice

EMSSlice

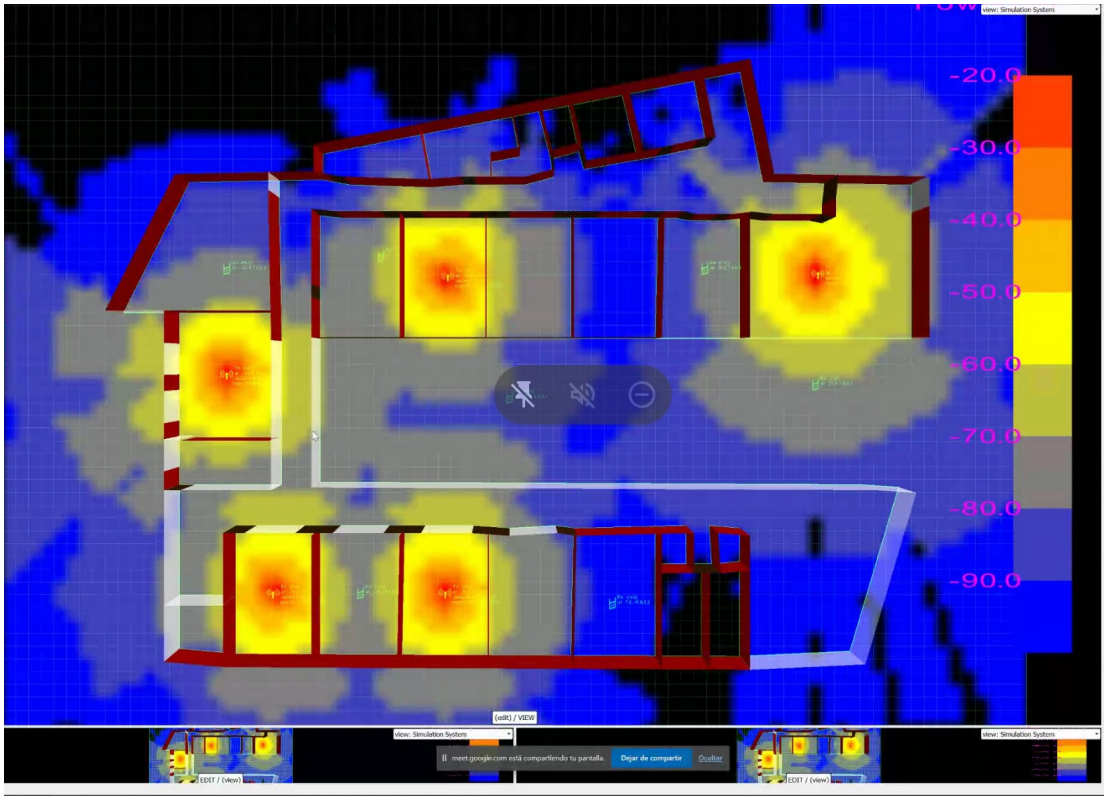
- https://www.emslice.com.
- Electromagnetic simulation software.
- Simulates the propagation of an electromagnetic signal.
- Takes into account walls, doors, different materials, etc.
- Can simulate signals of different frequencies.

Methodology

- To reproduce, in the simulator, the deployment of a 2.4 GHz and a 5 GHz WiFi of a real environment.
- To get real data of RSSI WiFi intensity in several points of the environment.
- → GetSensorData (https://github.com/lopsi/GetSensorDataSuite_Original)
- To tune the parameters of the simulator in order to get, in the equivalent points, the same values of the RSSI, obtained from the real measurements.
- To simulate results of the unknown and hypothesized 5G mmWave data.
- To get indoor positioning using 5G signal.

Results

- Methodology Is tested in a secondary school



Preliminary findings

- Early results indicate challenges with 5G technology in overcoming signal loss through walls, a problem less significant in current Wi-Fi technologies. → Expected result due to the higher frequency.

- 5G with fingerprinting shows promising results for room-level localization.

Conclusions

- Density of the 5G deployment opens new possibilities for indoor positioning.
- Simulation software can overcome the legal problems to deploy 5G networks for testing.
- Combining real data in WiFi frequencies with WiFi simulated data can help to get reliable 5G results.
- Preliminary simulations shows that walls are less transparent to 5G frequencies than to WiFi frequencies, as expected. That makes it a promising technology for room level localization.

Future Work

- To get real 5G data.
- To compare fingerprinting with 5G with different localization methods in a 5G stand alone scenario

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Questions?