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EFFICIENT LOCALIZATION USING WIFI RTT

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INDOOR APPLICATION

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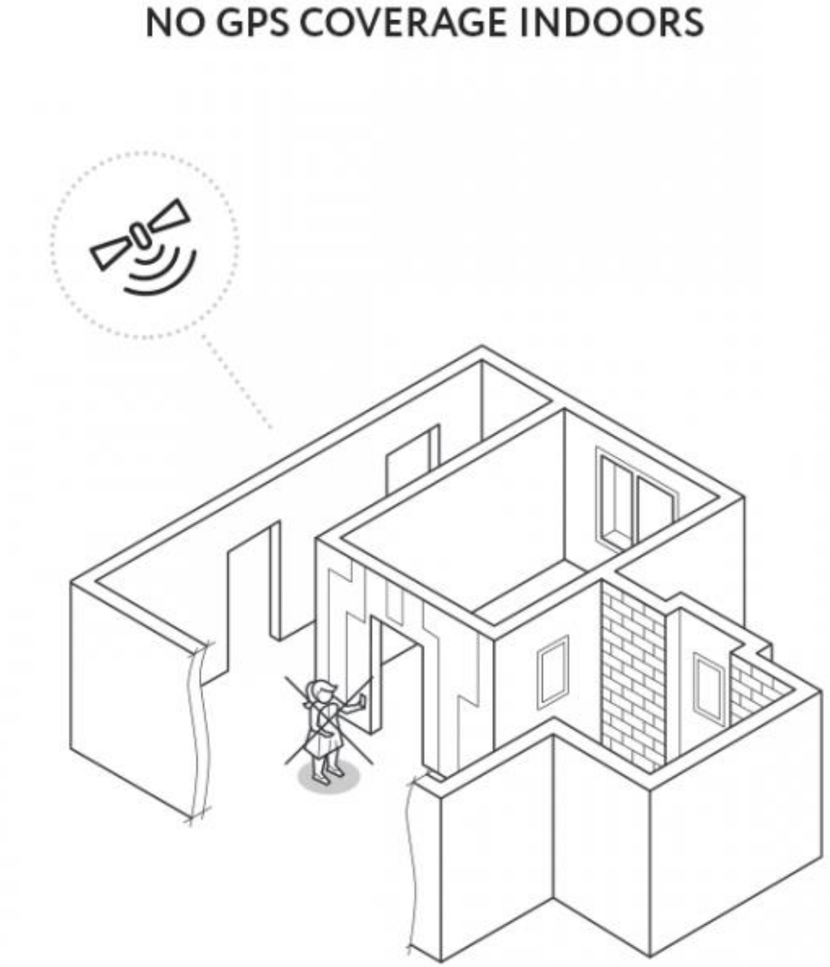
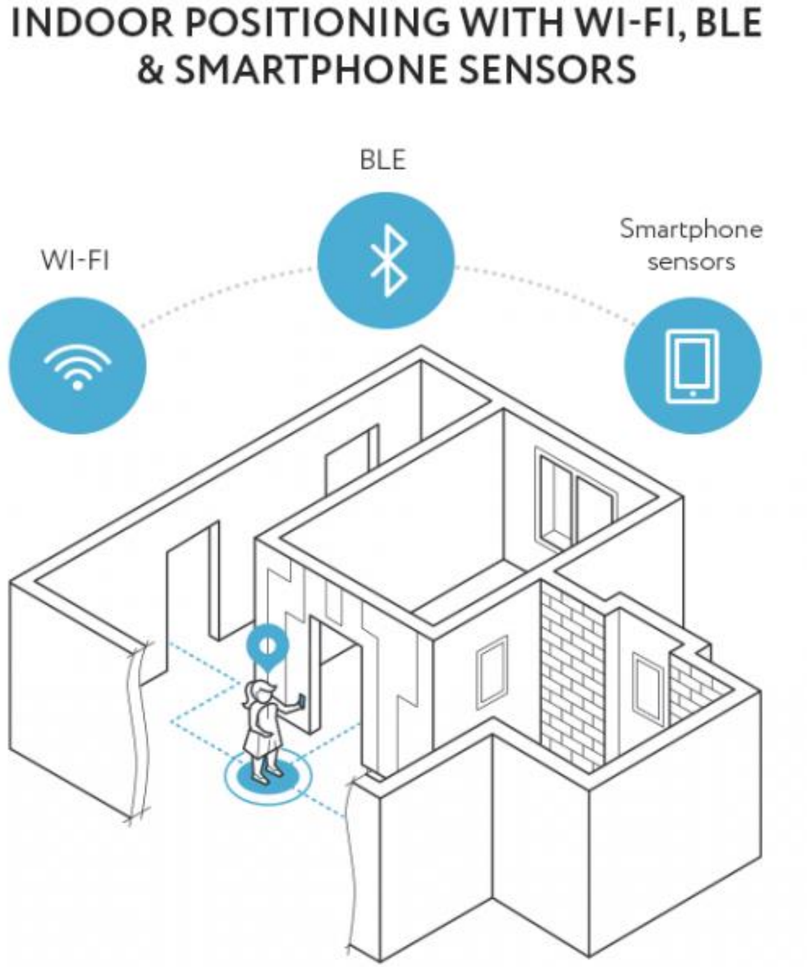
CHALLENGES





GPS signals are not available indoors

Common requirement for indoor applications is accuracy level ~1-5m

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OTHER AVAILABLE SIGNAL SOURCES

Type of signal	WI-FI (RSSI)	Bluetooth/ Beacons (RSSI)	UltraWideBand
Accuracy	5-15 meters	1-10 meters	0.1 meter
Cost	Medium	Low	High
Prevalence	High	Medium/Low	Very Low
Compatibility with smartphones	Yes (Android)	Yes	No

For consumer applications (shopping malls, museums, airports, hospitals):

- Submeter accuracy is usually not required.
- Compatibility with smartphones is crucial.
- Prevalence is also a major factor

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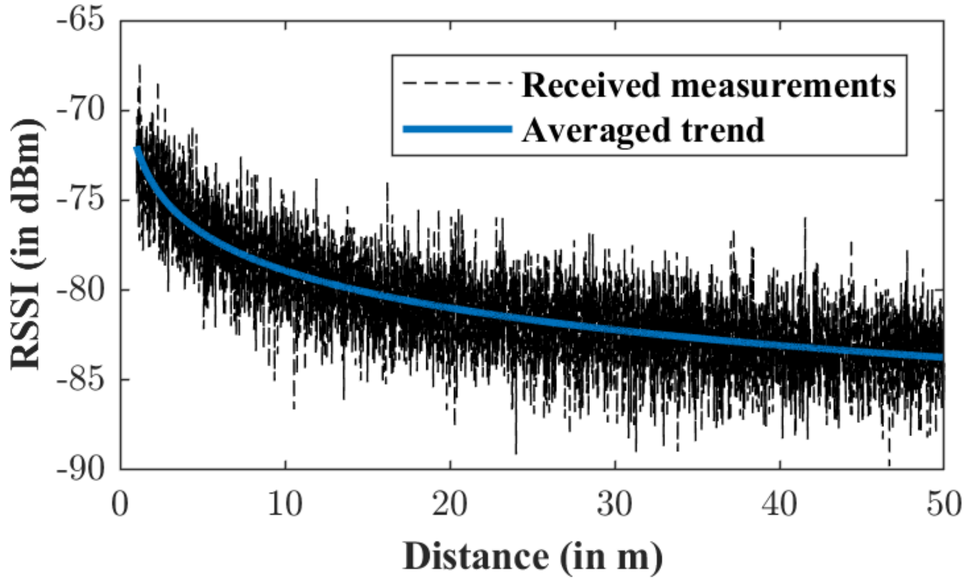
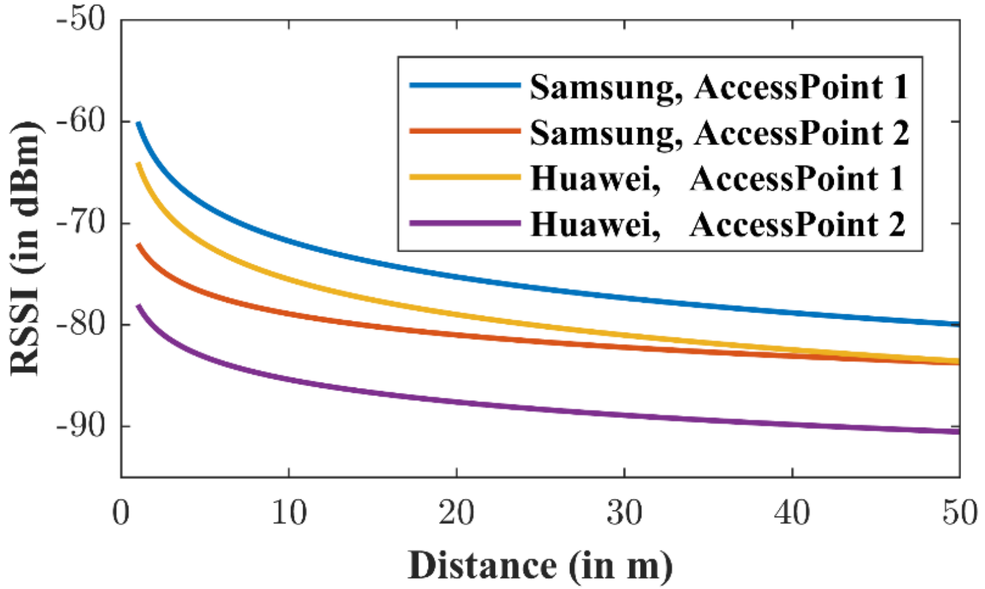
LIMITATIONS OF USING RSSI-BASED APPROACH



High signal-to-noise Ratio
Low signal gradient

Different power of access points
Smartphones antennas diversity



Rare scan rate
Android 6 – once per ~ 1 second
Android 7 – once per ~ 5 seconds
Android 8,9 – once per ~ 10 seconds
Android 10 – once per ~ 30 seconds

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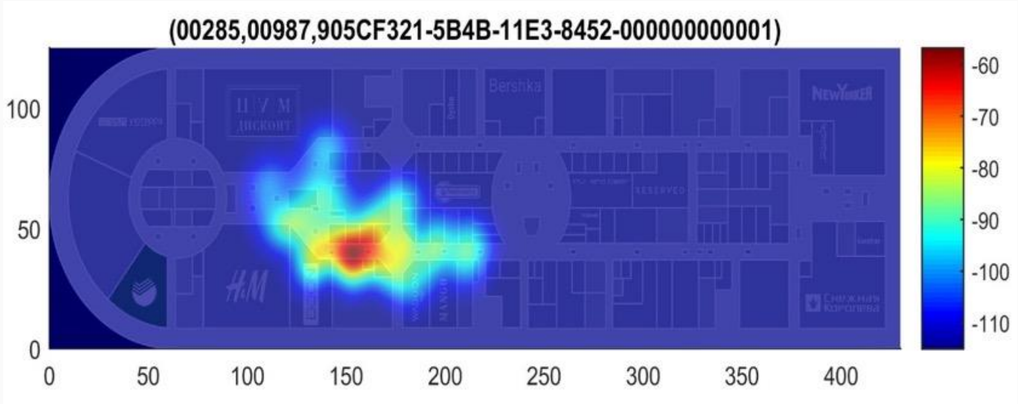
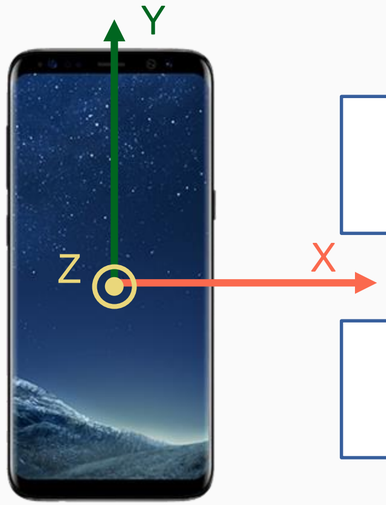
USING ADDITIONAL HETEROGENEOUS DATA

Radio (Wi-Fi / BLE) signals and information about radio environment



Smartphone (or some other device) sensors



- Accelerometer
- Magnetometer
- Gyroscope
- Barometer

Digital Map

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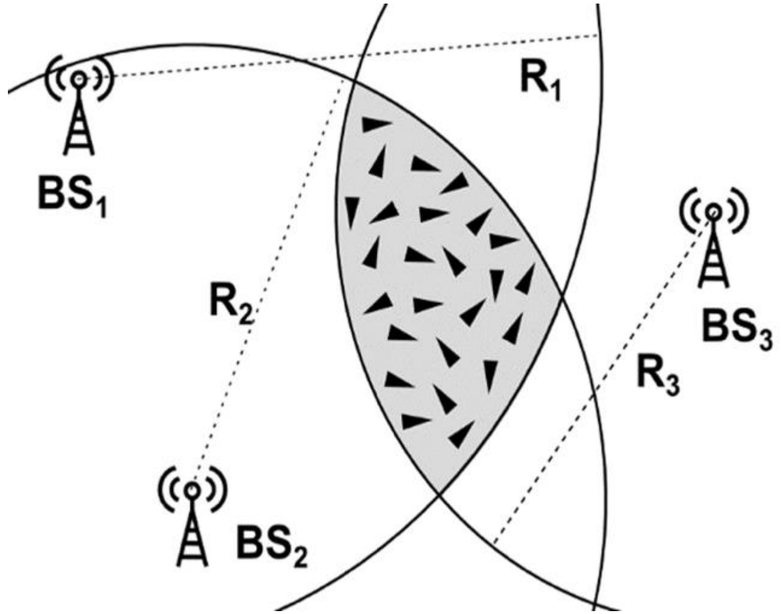
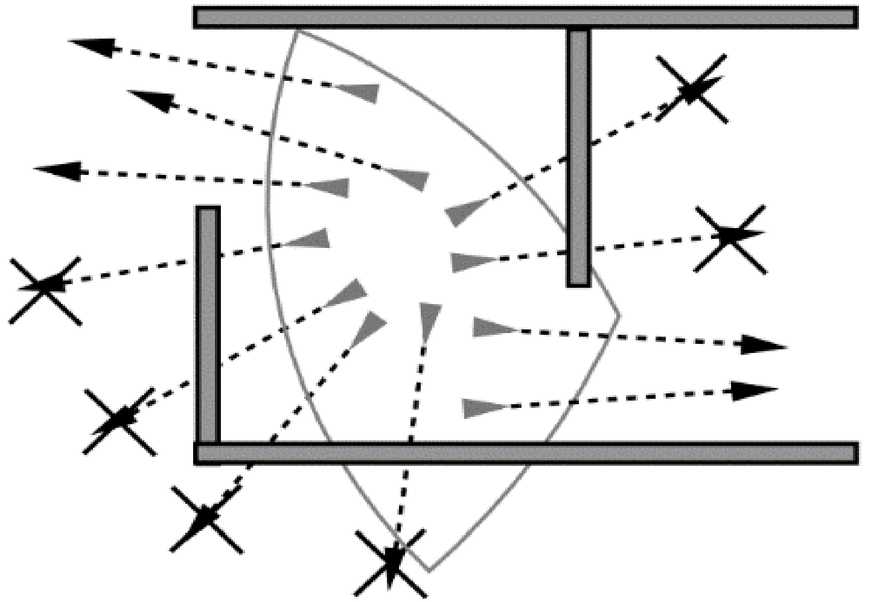
FUSING DATA TO IMPROVE ACCURACY

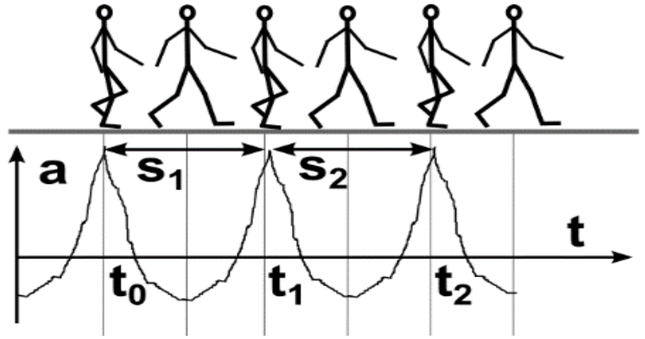


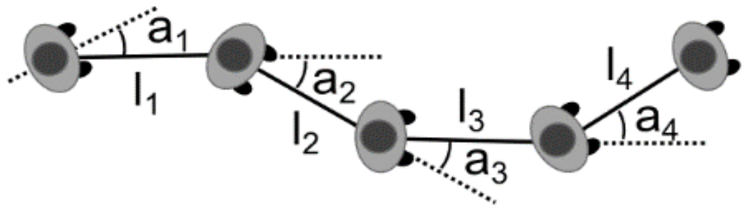
Multilateration methods for radio signals



Accounting for building topology

Reconstructing human motion from inertial sensors data





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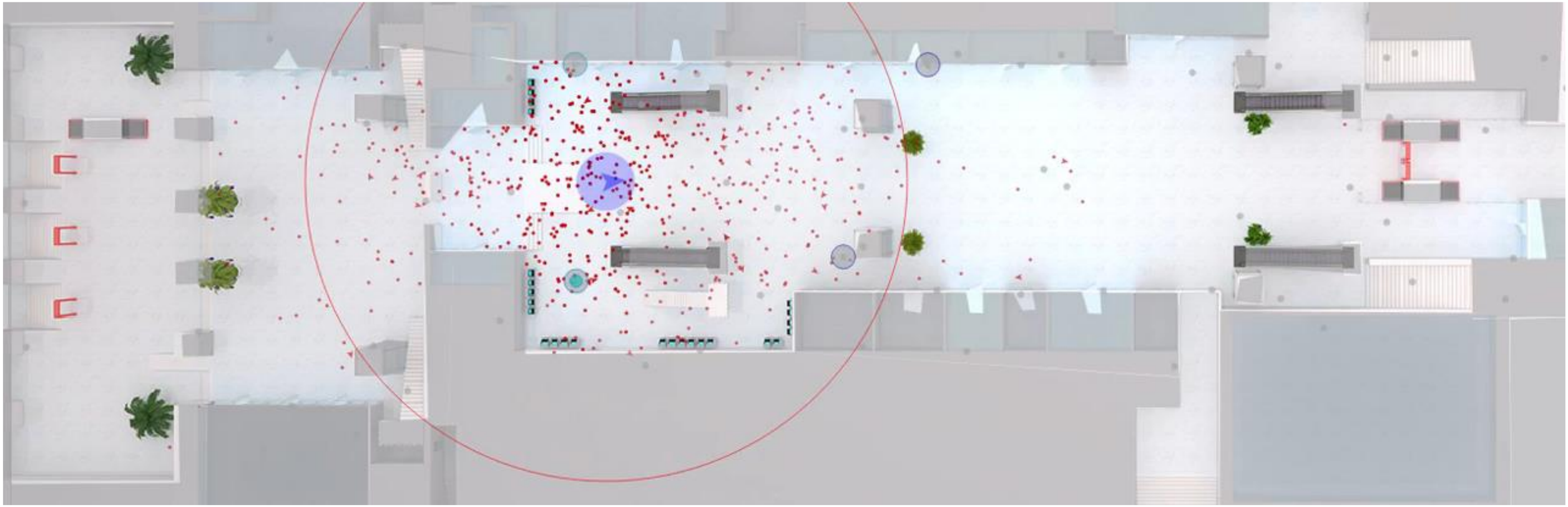
PERFORMANCE OF PARTICLE FILTER



Unable to cross 1m accuracy threshold due to high noise level of WiFi and Bluetooth RSSI measurements

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WIFI Round-Trip-Time (RTT) CHRONOLOGY

- New IEEE 802.11mc standard inroduced (2016)
- Support added in Android 10 (2018)
  - Right now only few smartphones support this technology
  - However, it can be unlocked on software level, because the hardware is already supporting this
- Google releases full support of WiFi RTT in its new WiFi access points (2019)

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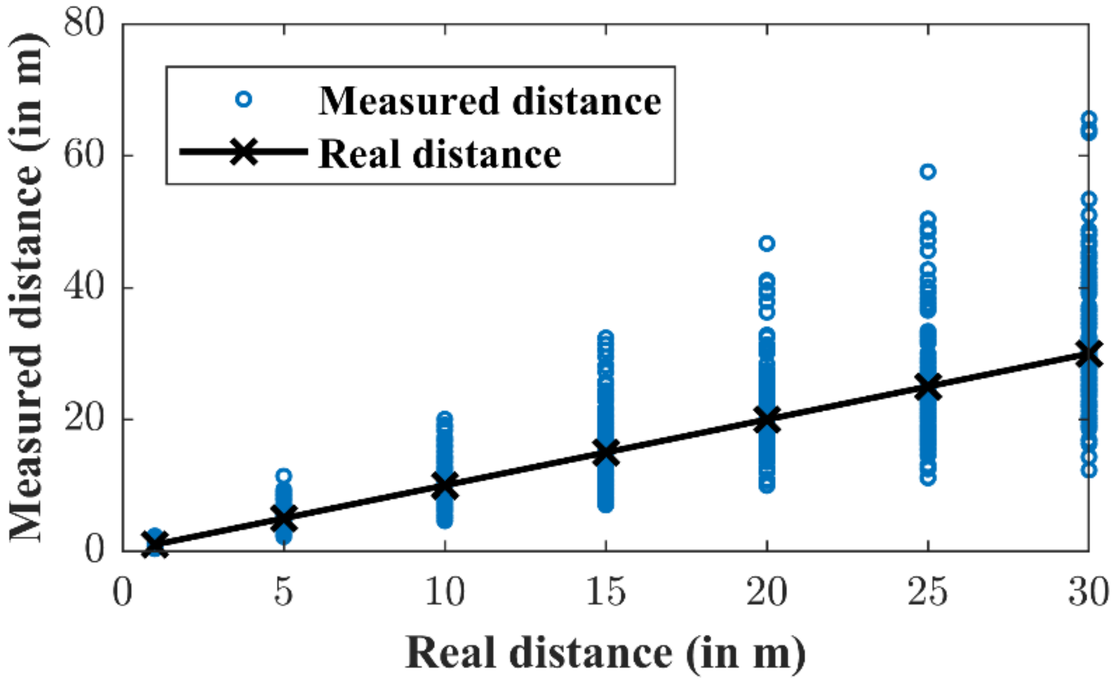
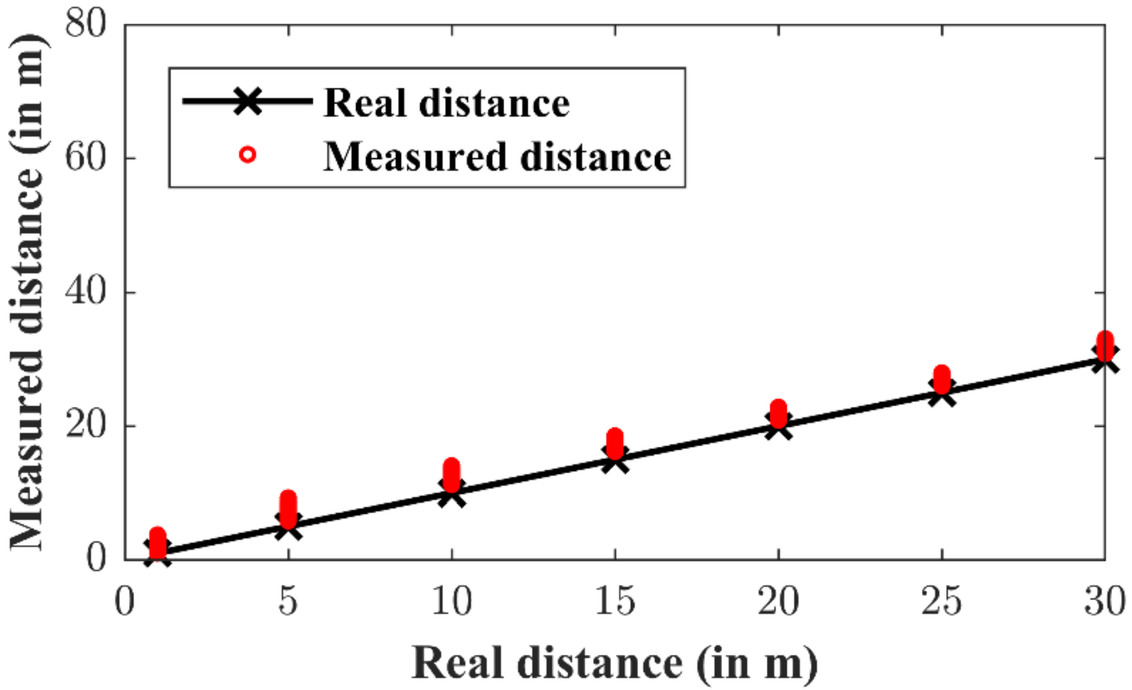
Comparison of RSSI-based and RTT-based distance measurements

RSSI



Error up to 40 meters at large distances

RTT



Max. error less than 5 meters

Independent of distance

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BENEFITS OF WIFI-RTT

- Higher accuracy compared to RSSI-based methods
- Will be a part of existing eco-system
- Promoted by techno-giant Google
- Is not a separate technology but and evolution of common-known Wi-Fi technology
- It is almost real time, without lag

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What now?

- Register at client.navigine.com & create a location
- Download Navigine App at Google Play & try navigation
- Go to Github, download our SDK and create new App
- Contact damir.zambelli@navigine.com if you have any questions

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