Filtering and fingerprint matching methods for Wi-Fi radio map based indoor localization

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Indoor Localization for Elderly People

- Indoor localization for monitoring physical and mental condition of elderly people
- Motion analysis for people with dementia
- Wandering detection
- Smartwatch-based, wearable solution

Smartwatch has limited sensors

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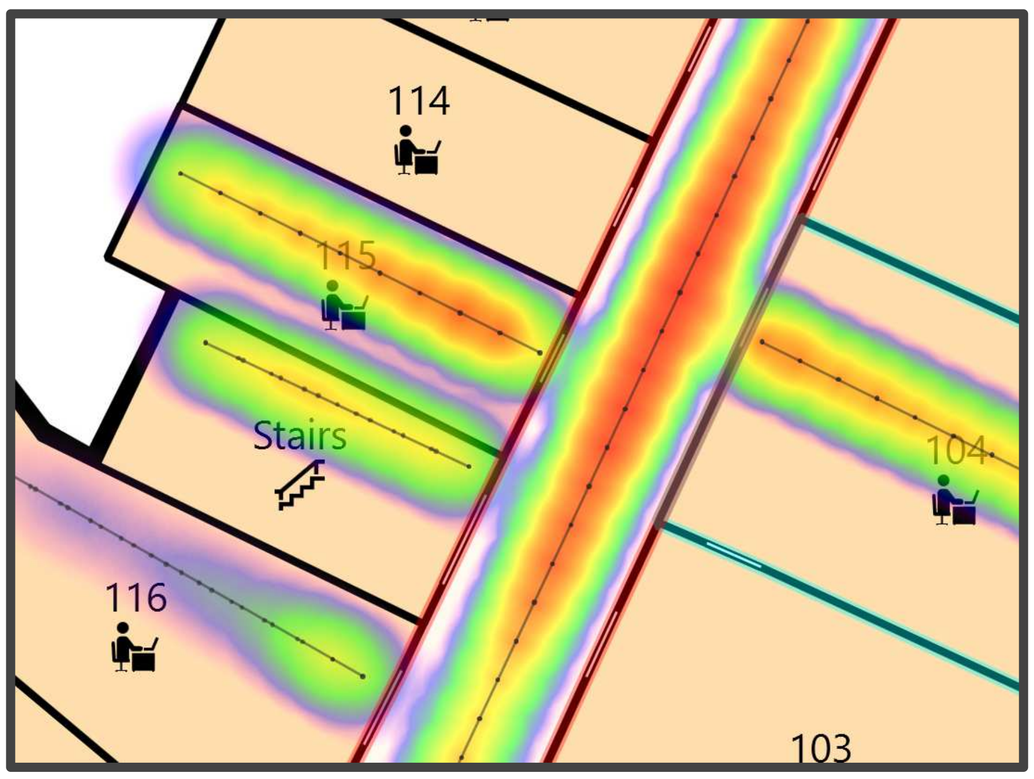
Indoor localization uses Wi-Fi fingerprinting methods

Wi-Fi Fingerprinting

- Uses prerecorded Wi-Fi field strength map
- The best matches of the actual field strength measurements are used for the location determination
- Measurement of several access points are used for the calculations



- Wi-Fi field strength measurement is imprecise
- Errors have different sources

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Different filtering methods need to be applied for the stabile and reliable location determination

Error Types

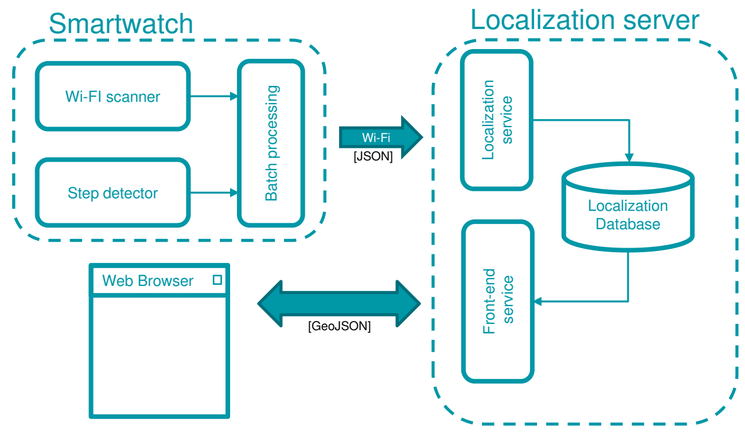
- AP power and radio wave propagation fluctuation
- Missing scans
- Directional sensitivity
- Device diversity
- Attenuation of the human body

Localization method

- Prefiltering Wi-Fi radio map: Virtual AP, Relevant AP filtering
- Building determination: based on the visible APs
- Floor determination: voting by the field strength of AP
- Localization: k-Nearest Neighbour Search, cosine distance function, sum of weighted k positions

System Architecture

- Smartwatch sends the measured field strength information to a web server
- The server calculates the coordinates and stores it locally



- Web browser is used to display the position information of the users

Conclusion

- The Wi-Fi fingerprinting based localization measurement has very low accuracy without any filtering since the field strength measurement is unreliable
- Several filtering technique needs to be used for the reasonable precision
- With the adequate filtering 2-3 meters accuracy can be achieved

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