# Current trend on Indoor Localization for smart devices

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# Motivation

- Large number of mobile and wireless applications are based on indoor localization technique.
- Now a days, smart devices comes with potential number of sensors that is being used by number of Indoor localization technique.
- New technologies in physical layer of wireless communication such as OFDM, MIMO etc. brings an addition dimension for Indoor localization technique.
- Find out the opportunity of using some addition metrics such as audio in regards indoor localization.

# Indoor Localization in Different Perspective

- Nowadays, researcher addresses the indoor localization problem in mainly two perspective:
  - Indoor positioning
  - Logical location
- The granularity of the logical location is highly sensitive and that is defined by application requirements.

# Different Categories

- Existing proposed approach of determining indoor localization can be broadly categorized in two classes:

  i) Fingerprint approach and

  ii) Measurement based approach.

- Fingerprint based indoor localization approach can be further categorized based on requirement:
  - Infrastructure
  - Non-Infrastructure

# Fingerprint based approach

- Current trend
  - Using multiple sensors in smart phones.
  - Reduce the dependency over infrastructure requirement.
  - Utilizing certain signature/pattern in indoor environment.
  - Utilizing the advancement of PHY layer in WiFi stack

# Utilizing Mobile phone Sensors

- Acoustic Signature of Background. [SurroundSense'09, Batphone'11]
- Utilizing the accelerometer, gyroscope and compass sensor in order to reduce the dependency over infrastructure. [UnLoc'12, WILL'12]
- Certain location in an indoor environment present certain properties which can be utilize to reduce the error indoor localization. [UnLoc'12, WILL'12]

# PHY layer Information

- Utilizing Channel Frequency Response over multiple subcarrier of OFDM. [PinLoc'11]
- Reducing the impact of multipath effect over RSSI value by utilizing the Channel State Information. [FILA'12]
- Increase number of antennas in AP creates new opportunity to revisit indoor localization problem [Jie Xong, HotMobile'12]

# Measurement Based Approach

- The measurement approach directly estimate the distance of the location with respect to some infrastructure.(Time of Arrival, Time Differences of Arrival etc)
- Utilize smartphone sensor to determine the distance traveled and direction to find out the indoor location.[CompAcc]
- Utilizing the characteristics of RSSI at different spectrum channels to identify the signal amplitude from the Line-of-Sight path. [Zhang'12]

# Multimodal Based Approach

- Combining all sort of sensors( accelerometer, Compass, acoustic, camera, wifi, Bluetooth interface) for improvising the Indoor localization performance. [Vinyals'10]

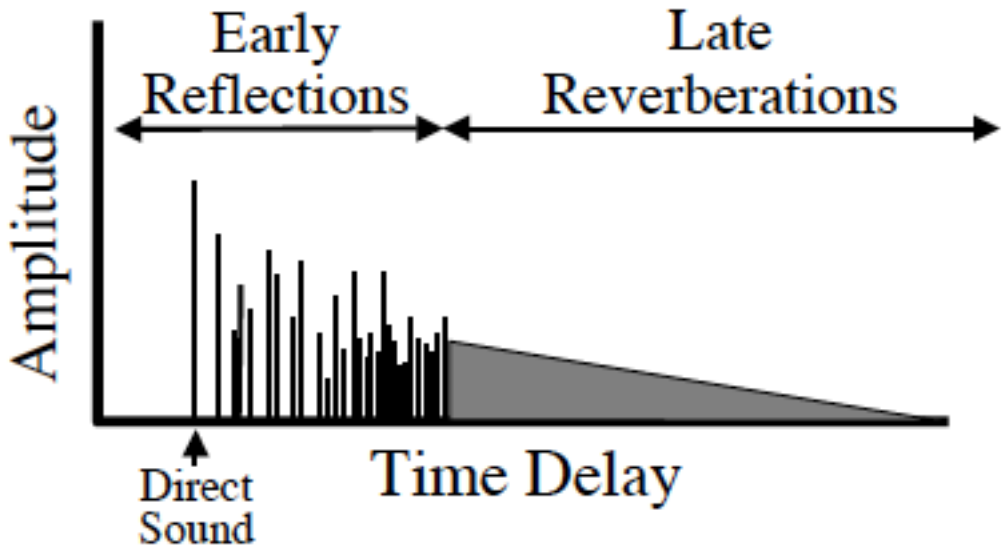
# Opportunity of using Sound

Sound wave has some interesting properties compare to radio wave that made it interesting in regards of indoor localization

- Wavelength: large wave length
- Speed: Due to lower speed the delay and amplitude of sound arriving along different propagation path are easily perceptible.
- Coherence Phenomenon: the phase of the sound wave traveling along each propagation path highly depends on accurate path length.

# Opportunity of Using Sound

- Impulse Response:



# Thank you

Questions and Suggestions?