Localizing Multiple Target Using Bistatic MIMO Radar in Multi-path Environment

Keita KONNO, Dai SASAKAWA, Naoki HONMA, Yoshitaka TSUNEKAWA
(t2313011@iwate-u.ac.jp , Iwate University, Japan)
Kentaro NISHIMORI (Niigata University, Japan)
Nobuyasu TAKEMURA, Tsutomu MITSUI (R&D INSTITUTE JAPAN CO. LTD. SAMSUNG)

Introduction

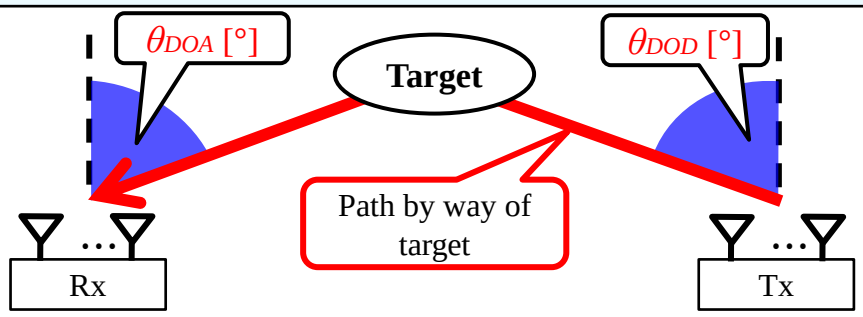
*1 MIMO (Multiple-Input Multiple-Output)
*2 DOD (Direction of Departure) *3 DOA (Direction of Arrival)

- **The increase in the elderly living alone**

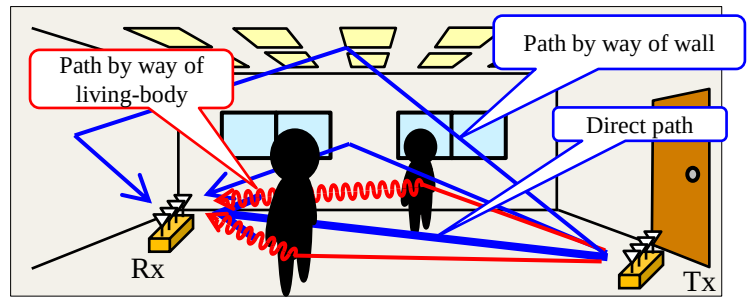
Need for a living-body localization system for the elderly

- **MIMO *1 Radar**

Able to localize targets using both DOD *2 and DOA *3 angles



- **Living-body localization Using MIMO radar in indoor environment**

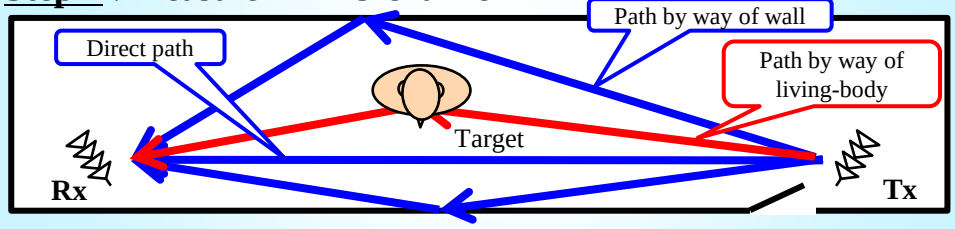


☹ Cannot estimate target locations in indoor environment due to the multi-path reflections

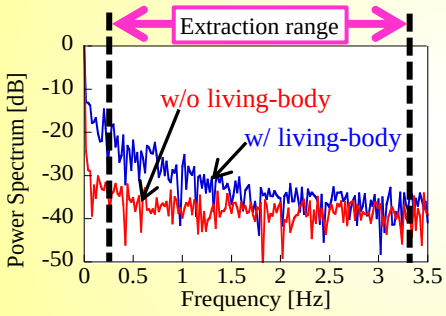
➔ **Localization method of living-body in multi-path environment is needed**

Method of Localizing Living-Body in Multi-path Environment

Step 1 : Measure MIMO channel



Step 2 : Extract fluctuating component due to human activity from Fourier transformed MIMO channel



Frequency response of MIMO channel

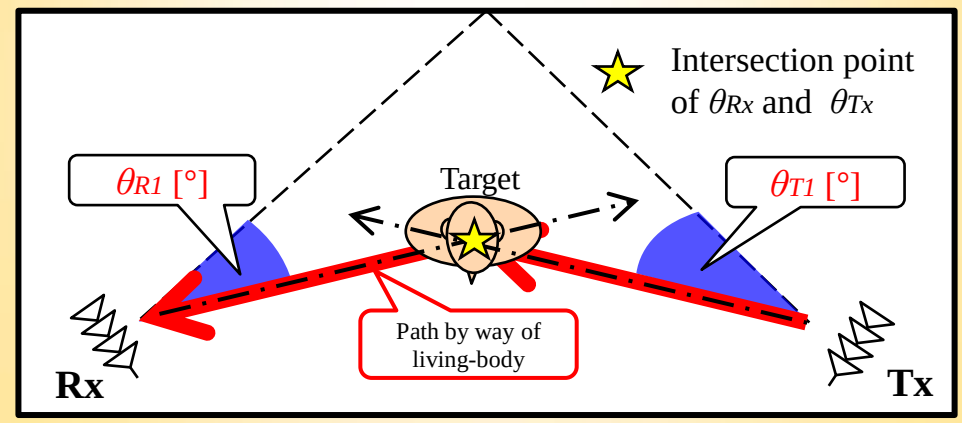
- Frequency range influenced by human activity

Heart beat 0.33 ~0.5 Hz

Respiration 0.6 ~3.3 Hz

Step 3 : Estimate living-body direction at the receiver, θ_{Rx}, and at the transmitter, θ_{Tx}, by MUSIC method

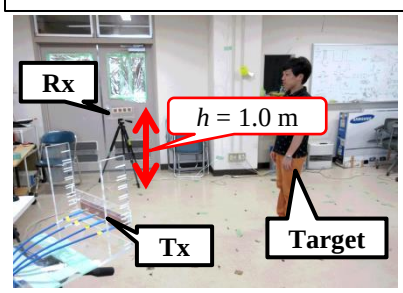
Step 4 : Estimate living-body locations by finding the intersection point of θ_{Rx} and θ_{Tx}

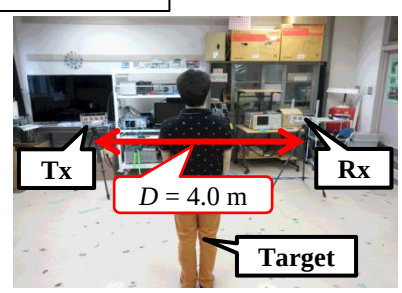


MUSIC (Multiple Signal Classification)

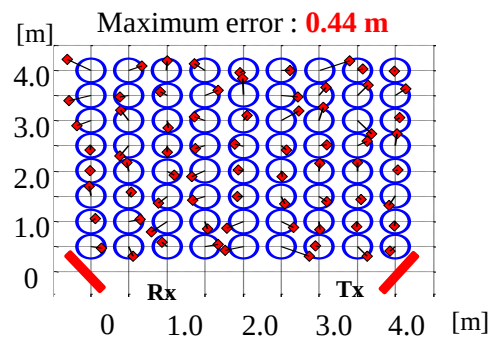
Measurement Results

D : Spacing between the transmitter and receiver
h : Height of antenna

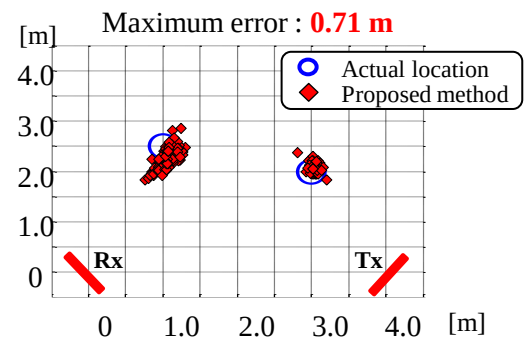




Measurement condition	
Measurement environment	Indoor
Antenna element (Tx/ Rx)	4 horizontally patch antennas
Frequency	2.47125 GHz
Channel measurement time	50 s
Sampling frequency	7.0 Hz
Extracting frequency range	0.33 ~ 3.3 Hz



Localization results in 72 measurement positions when single target exists



Localization accuracy evaluation over 100 trials when two targets exist at same time

Conclusion

Proposed method can accurately estimate the locations of multiple living-bodies even in multi-path environments !!