Real-Time Localization of Intrafractional Lung Tumor Motion Using IR-UWB Radars

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August 1st, 2018 / Time: 3:25 PM, Room: Karl Dean Ballroom B1

Challenges of Soft Tissue Localization

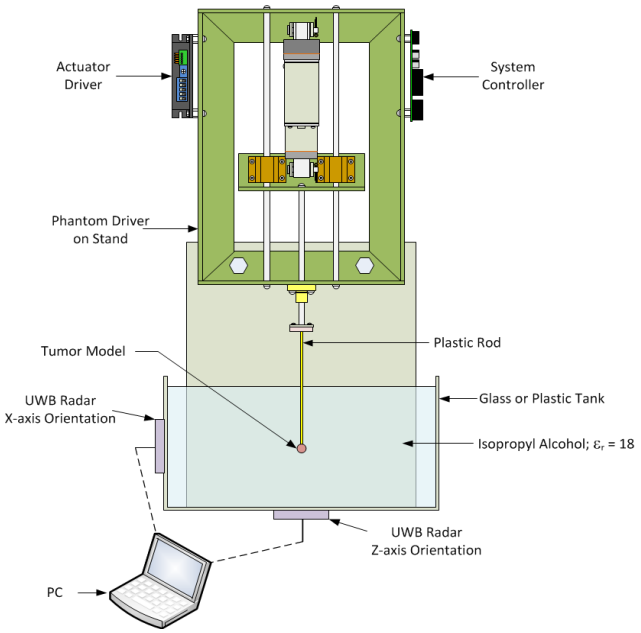
Inter-fraction monitoring: Snap shot		
kV CBCT, MV CT	3D anatomy	Ionizing radiation: poor soft tissue contrast
Intra-fraction (real-time) monitoring		
X-ray fluoroscopy	Marker-based	Ionizing radiation
EM method	Marker-based Non-ionizing	Invasiveness (large beacons)
Ultrasound Imaging	3D anatomy Non-ionizing	Operator dependence; deformation
MR-Linac	3D anatomy Non-ionizing	Change in infra-structure; high cost

Ultra-Wideband Radar

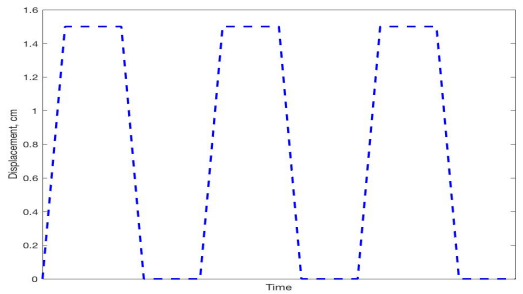
- Non-ionizing and non- or minimal-contact
- Minimally invasive for small fiducial marker tracking
- High range resolution and low cost

Real-Time Localization of a Moving Target using IR-UWB

Experimental Setup



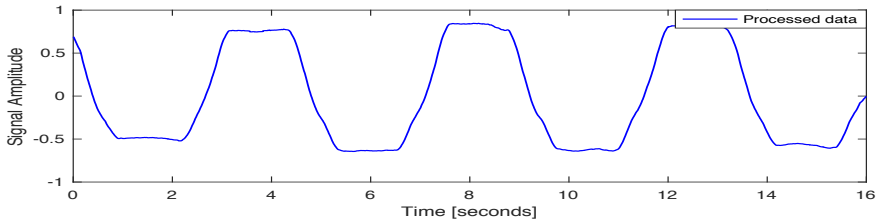
Simulated Tumor Motion



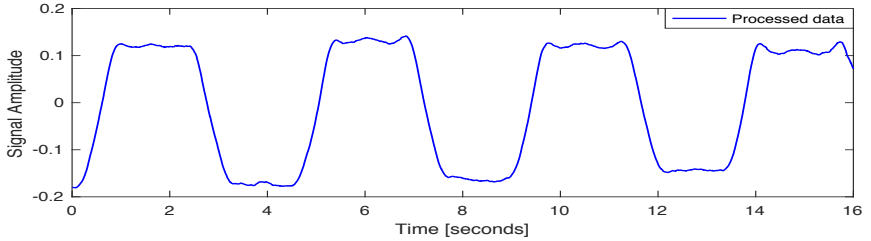
Results

Motion Detection by UWB Radar

X-axis Displacement



Z-axis Displacement



- IR-UWB measured the tumor motion of 1.54 cm for the 1.5-cm simulated motion.
- Initial experiments show great promise in real-time tracking of the moving object in the lung-tissue mimicking solution.

Future Work

- Experiment with a more sophisticated and realistic phantom
- Development of advanced radar system and signal processing algorithm for improved localization/tracking