Can Future Wireless Networks Detect Fires?


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Current Fire Alarm Methods

Smoke Alarms

Sprinklers

Thermal Cameras

Limitations

Smoke Alarms:
-Relies on smoke
-High alarm latency
-High nuisance alarms

Sprinklers:
-Relies on heat
-High alarm latency
-Range

Thermal Cameras:
-Expensive
-Limited to line-of-sight
-Privacy issues

This paper:

Can we use wireless signals to detect fires?

Past Work

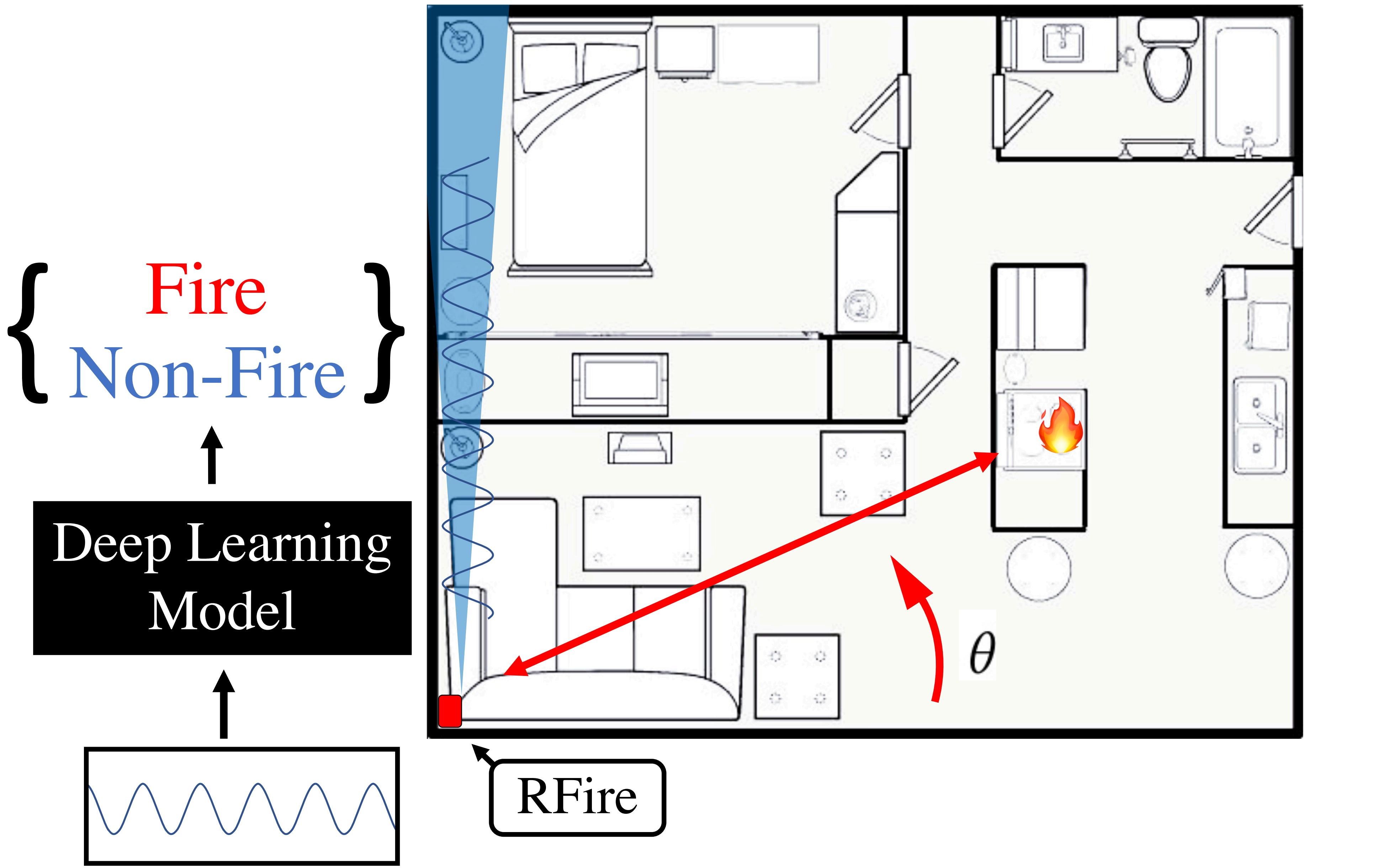
- Wi-Fire: Device-free Fire Detection using WiFi Networks (*ICC*, 2017)

Not robust to mobility and movements.
Not evaluated in non-line-of-sight.

- Microwaves in Fire Detection (*Fire Safety*, 2006)

- Microwave Radiometers for Fire Detection in Trains (*Sensors*, 2016)

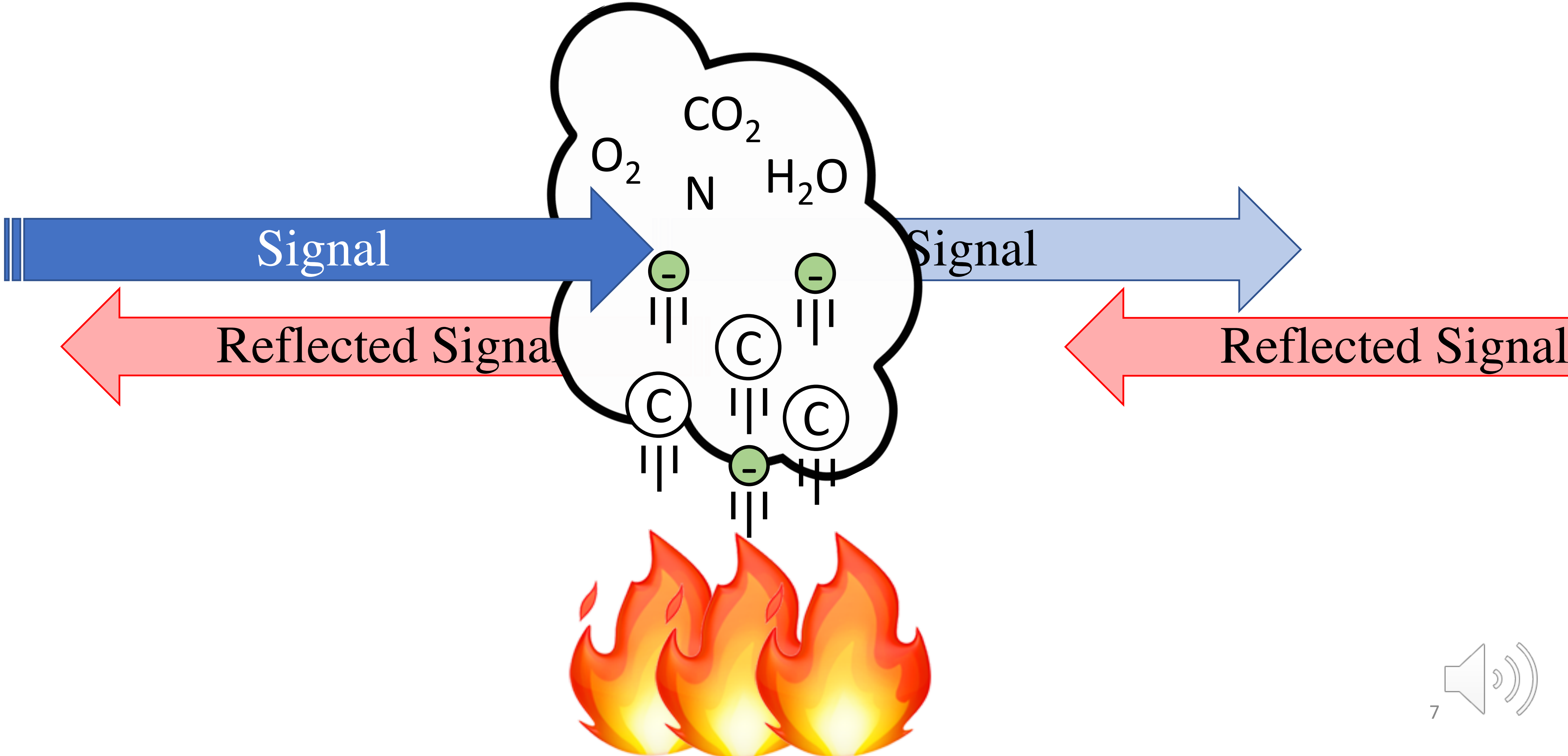
RFire



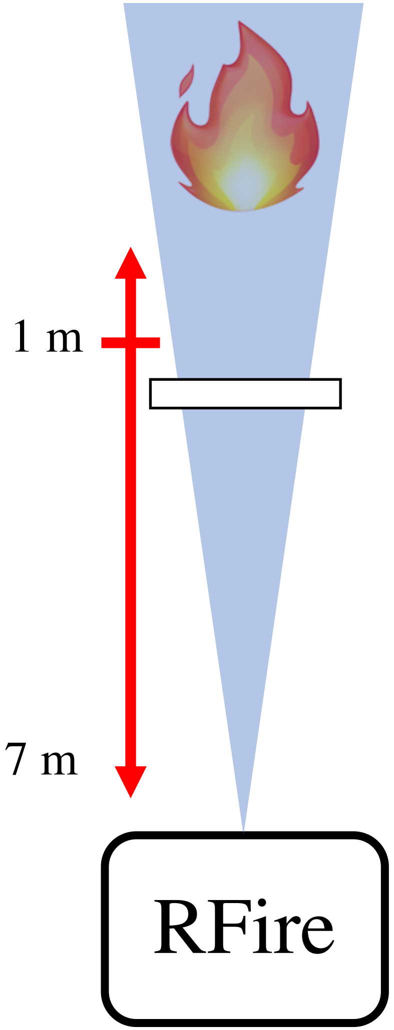
1. How does fire change the wireless signal?

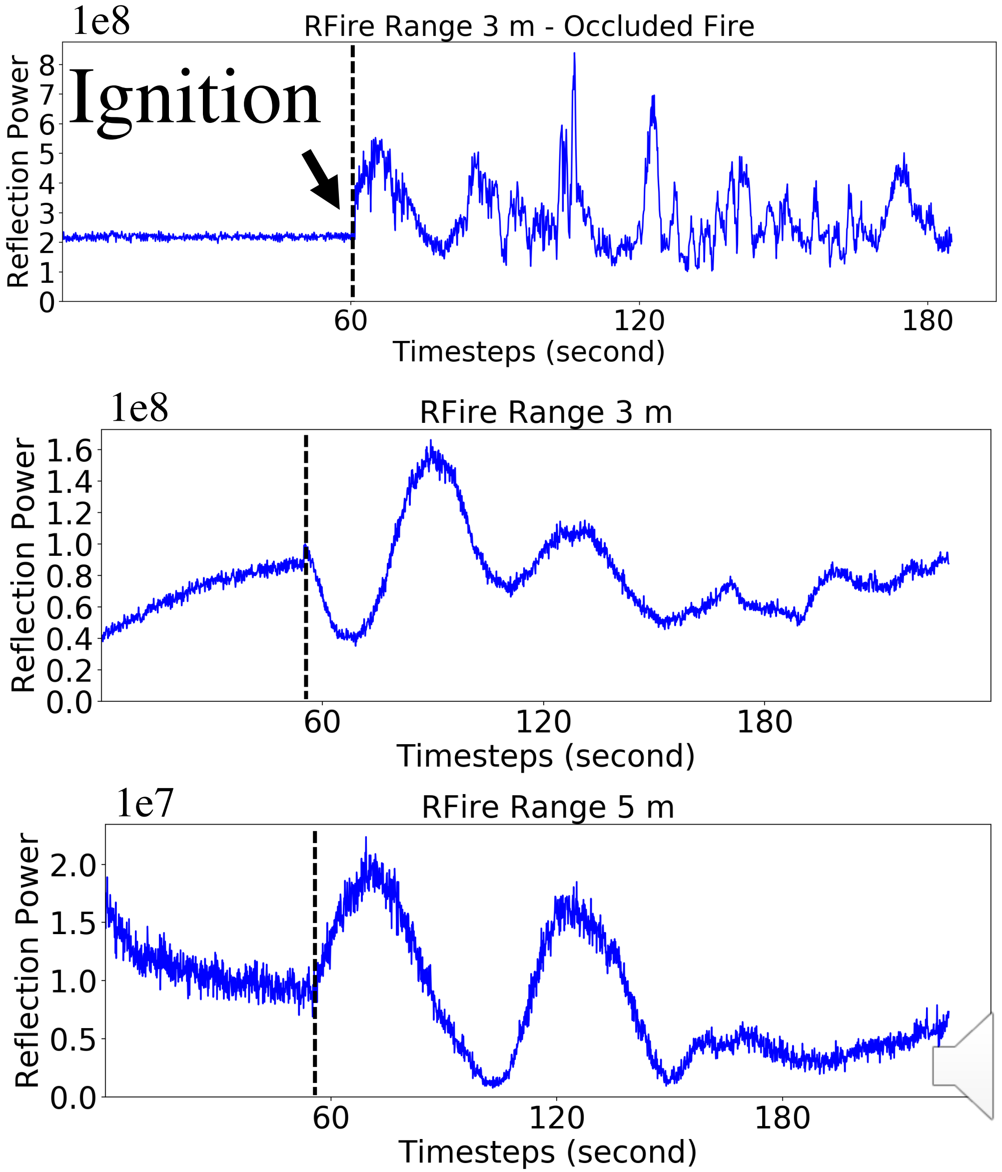
2. Do millimeter wave signals propagate through walls?

Effect of Fire on Signal



Experiments & Effect of Fire on Signal





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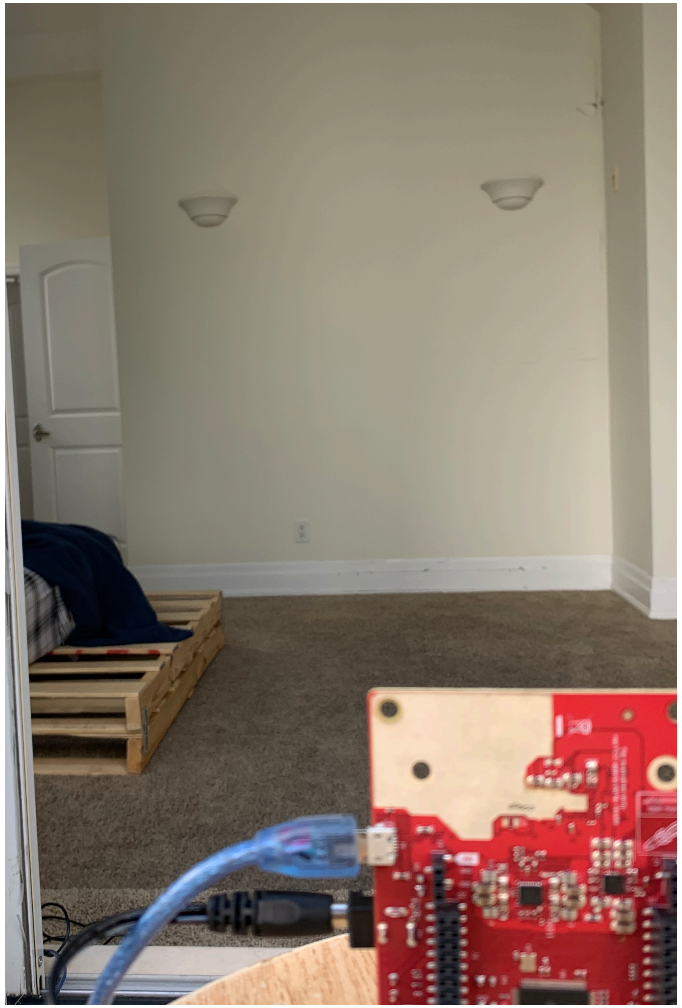
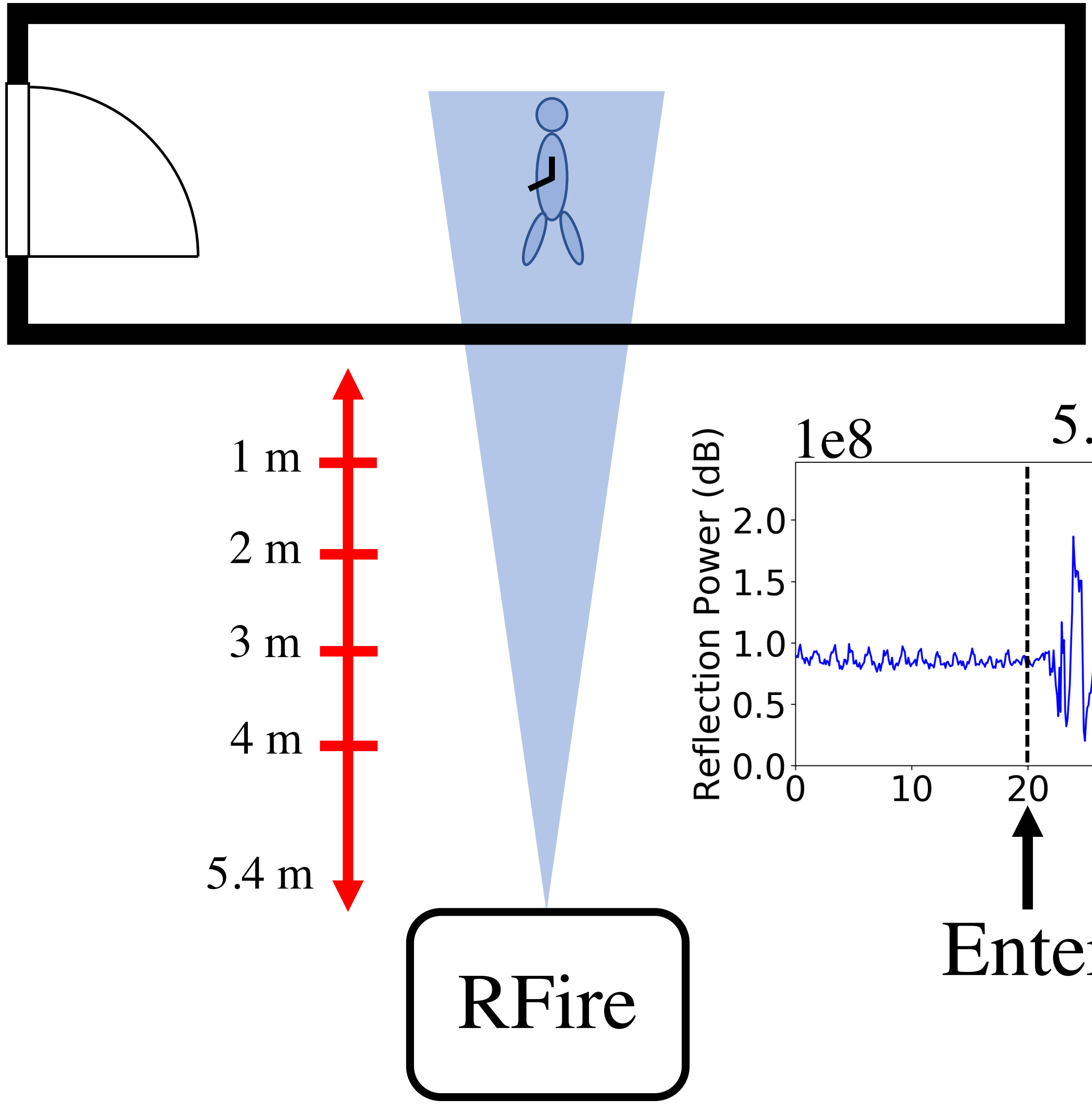
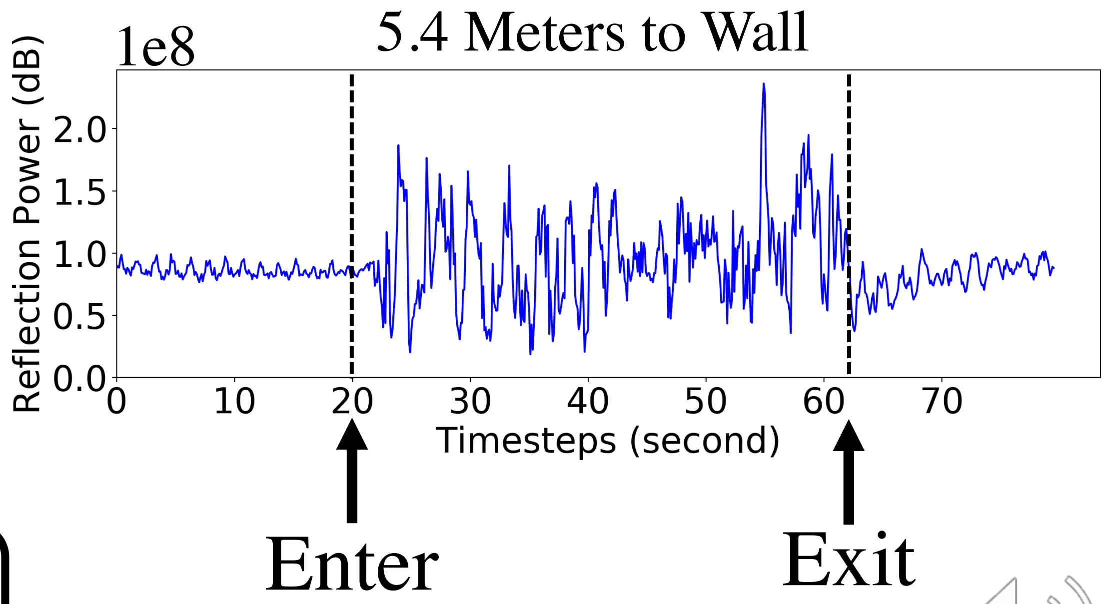
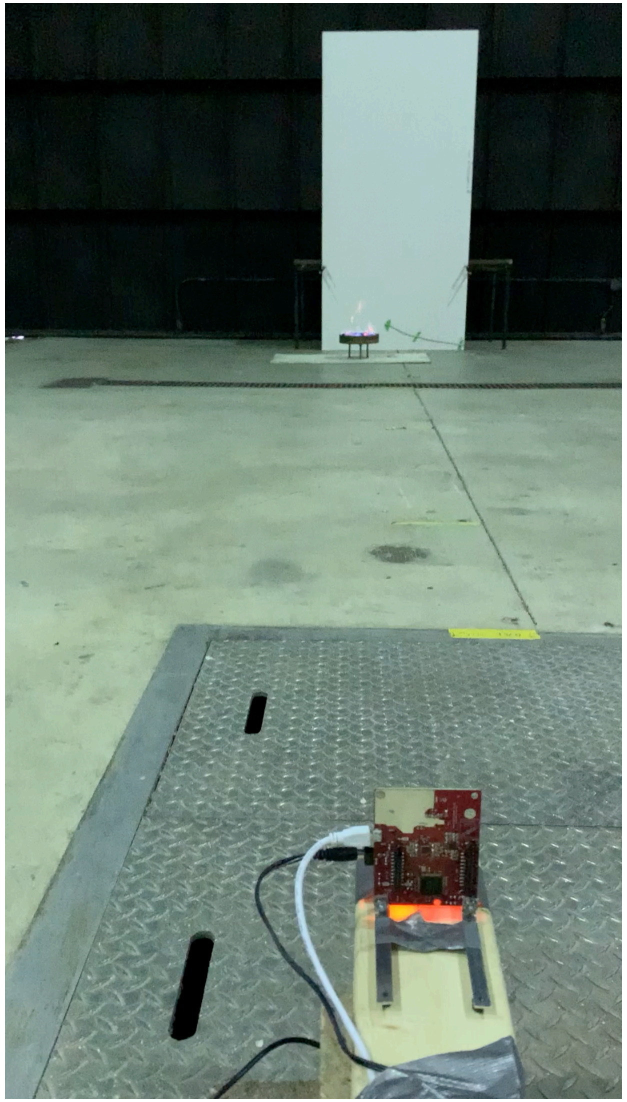
Effect of Movement and Occlusions on Signal







Results



	Version 1	Version 2
Accuracy:	**100%**	**91.3%**
False Alarms:	**0%**	**0.1%**
Mean Latency:	24 seconds	29 seconds

4 times lower latency than existing alarms

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