Human Activity Detection Using Radio Waves
Report 1

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1 Abstract

The project aim is to create a short range wireless target (human) detector using radio signals in the form of a radar.

The device should be able to detect movement of the human located on the other side of the wall. There is a wide spectrum of signals which can be used for human detection.

Simulation of the environment and radar is done on MatLab and SimuLink. The A wide-band radar system is used as the application is for short range detection. The wide-band is divided into multiple narrow-band signals (sub-bands) and these are aggregated on the receiver end.

2 Progress status

In the simulink model(as shown in fig 1), a linear FM waveform is simulated as it is an ideal signal to detect targets as it a combination of high and low frequencies by using pulse compression. High frequencies improve the range resolution and low frequencies provide better target detection.

These pulses are transmitted through a wide-band 2-ray channel. It is a multi-path channel which simulates 2 propagation paths - the line of sight and a boundary reflection path. This channel simulates a real time room environment.

A wide-band backscatter target has been simulated and its position and velocity is determined. We have considered the estimate position to be 7m from the radar and its velocity as 0m/s. The cross section of the target is fixed as $1m^2$. A backscatter target is used because the incident and reflection angles are the same.

The reflected signal passes through the same wide-band 2-ray channel and is received at a receiver preamplifier which amplifies the signal using the gain and adds AWGN to the signal.

The next step is to process the signal. In real time case, this signal will be received by the RTL-SDR and fed into the signal processing block.

The main component of processing is the a stretch processor (also known as dechirping). The target range (6.5m - 7.5m) is fed into this block and it performs pulse compression to increase SNR and maintains range resolution which will be later required to distinguish between 2 targets.

FIR Decimation is performed by providing a decimation value of 4. This signal is reshaped into a 1D matrix and stored in the buffer of size 10. The output of the buffer is fed into a range-Doppler response block which outputs a range-Doppler matrix.

3 Next Step

- Visualize current output.
- Implement moving targets.
- Implement 2 targets one behind the other.
- Eliminate signal reflected from stationary target i.e. the wall.
- Visualize movement of the target based on direction relative to signal source.

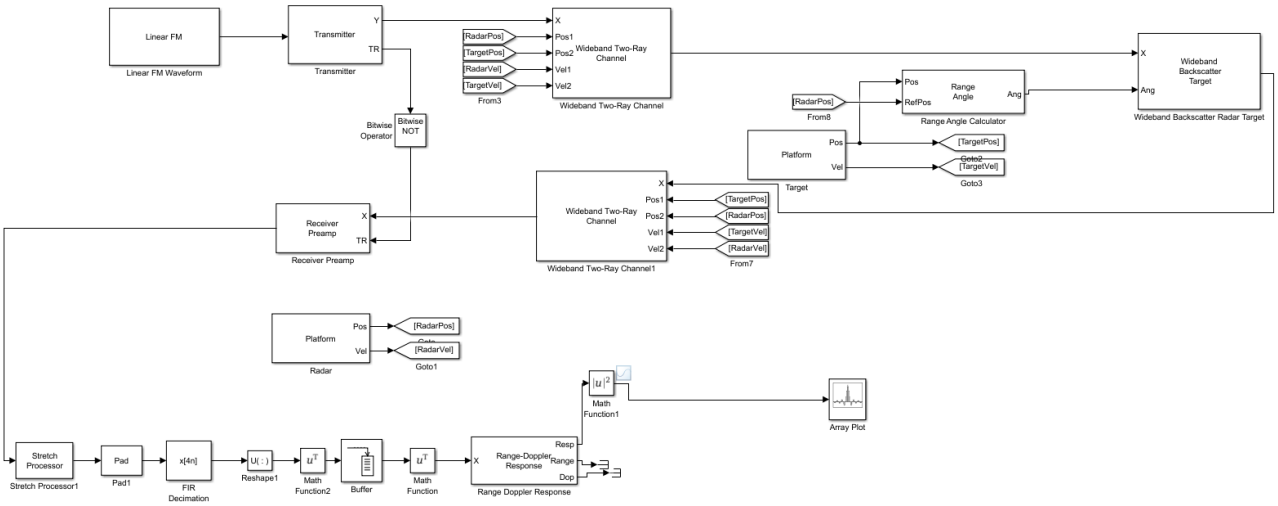

Figure 1: Simulink model of static target detection.