

Claps HW

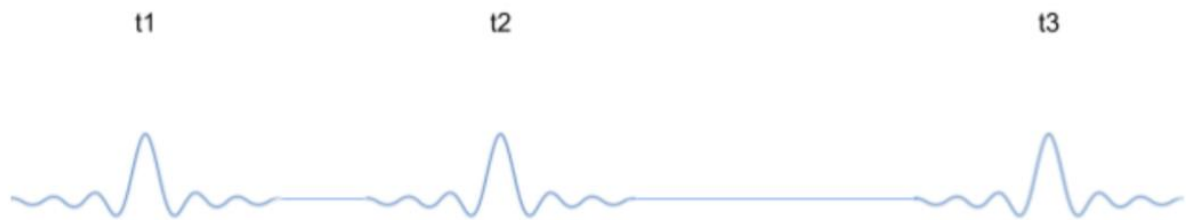
The problem:

A person claps his hands in a room with two walls and a mic at (0,0), speed of sound in the room is 1m/s.

The room:



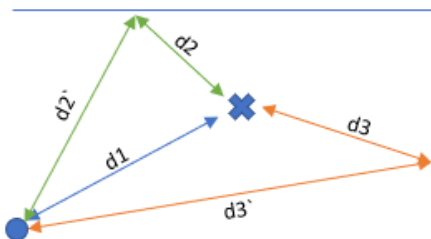
The recorded signal by the mic is:



My solution:

By looking at the recorded signal it is impossible to know whether the recording began at the time of the clap or not, so in order to pinpoint the clap I must look at the time differences between the peaks in the signal. The time of each peak is equal to $\frac{\text{wave's path length}}{\text{wave speed}}$.

$$t_1 = \frac{d_1}{v}, t_2 = \frac{d_2 + d_2'}{v}, t_3 = \frac{d_3 + d_3'}{v}$$

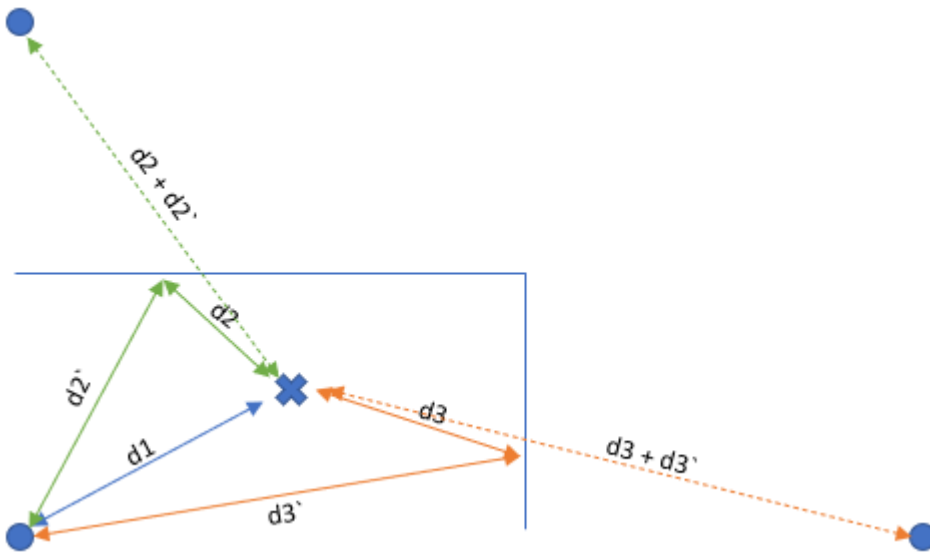


And the time deltas are: $dt_1 = t_2 - t_1$, $dt_2 = t_3 - t_2$, $dt_3 = t_3 - t_1$.

I will pinpoint the claps location by calculating the time differences based on the geometry and compare them to the time differences that can be extracted from the signal.

3 peaks are given in the signal, one is the clap itself and the other two are the reflections from the walls, under the assumption that the walls are ideal walls (no absorption), I can add two "virtual"

mics, in (0,20) and (30,0), For easier calculation of the distances.



In my code, for each pixel in the room I will calculate dt_1 , dt_2 and dt_3 of the pixel. After that I will find the point in the room which dt 's is the closet to the dt 's from the signal – that is the claps location.