Smart Sweet Spot of Your Home Stereos

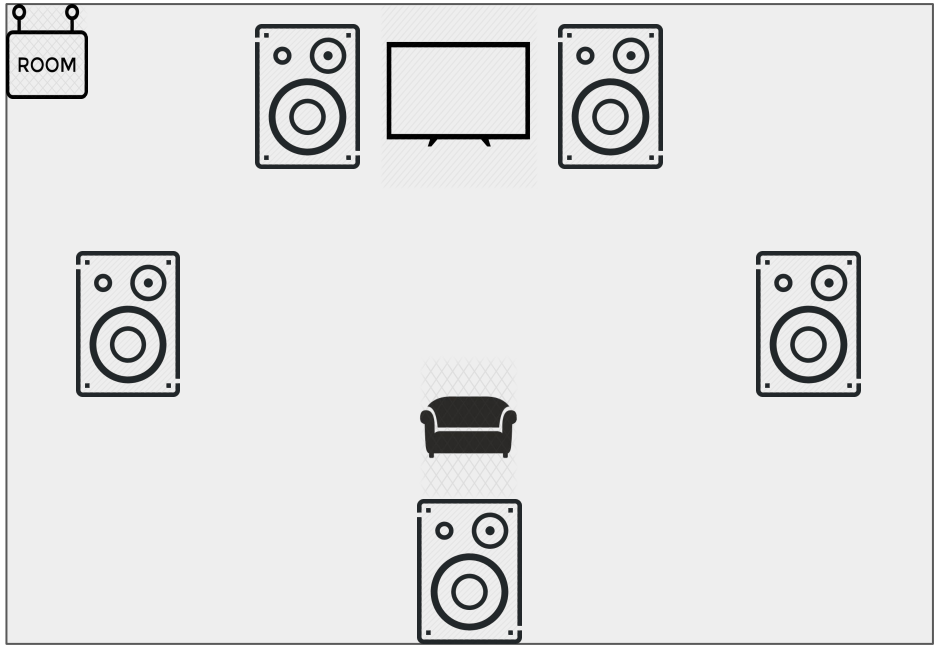
Instructor: Xiaoran Fan,

Richard Howard

Undergraduate Students:

ZHENZHOU (Tom) Qi

Background



- Takes a considerable time in adjusting the speakers.
- When new furnitures are added, all the work done previously have to be redone.

Objects

- Explore when and how the optimal point will occur.

  Develop a system where:

- A receiver that can receive the sound signal from the speaker and analyse them, further then send feedback to speakers.

- Speakers that can adjust automatically according to the user’s position.

Testbed and Tools

- Raspberry π 3 B+
- Linux
- MATLAB
- USB Sound Card
- Omnibearing Microphones
- Seperate channels of Speakers

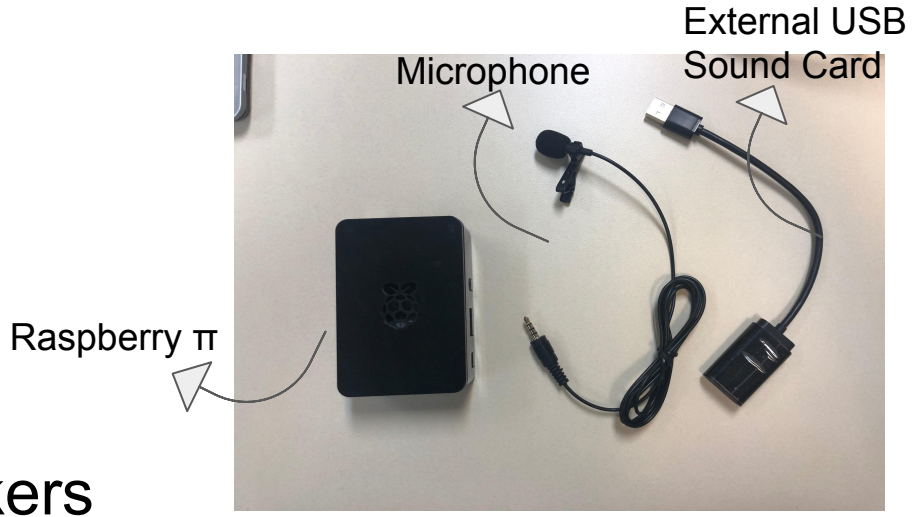
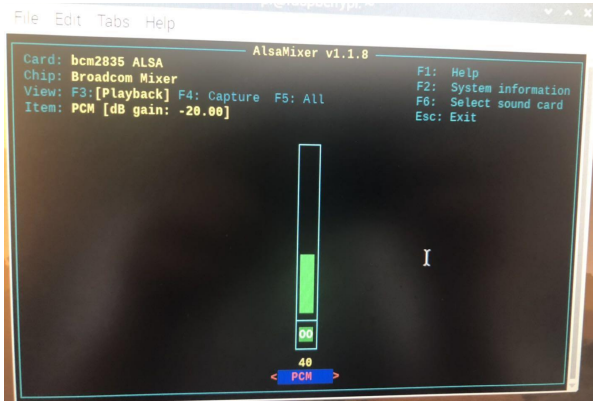


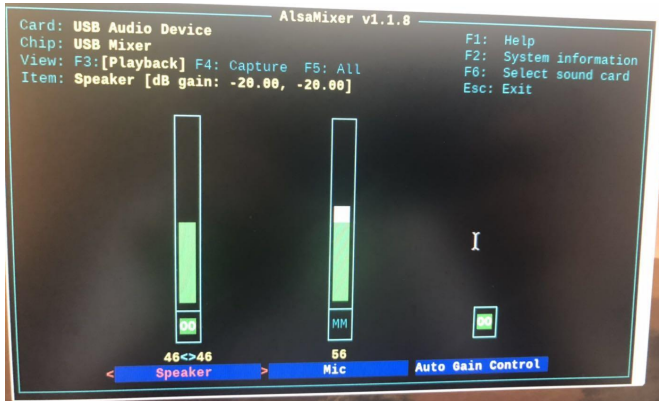
Image of our testbed

System Development I

- We connect our Raspberry π to an external sound card to enable it of recording.
- We changed the default setting in Raspberry π so we could access the external sound card interface.



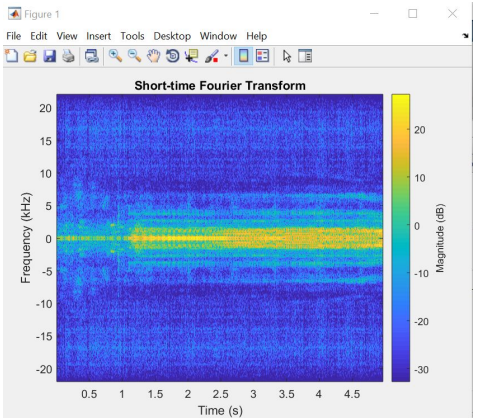
Default Sound Card Interface



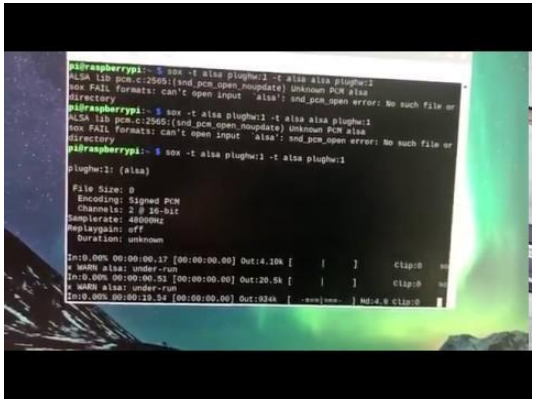
External Sound Card Interface

System Development I

- A simple recording command can be run to save the recorded information to mp3 or wav format. (In Linux)
- We use python to perform short-time Fourier Transformation of those sound files to visualize and analyse the sound signals.



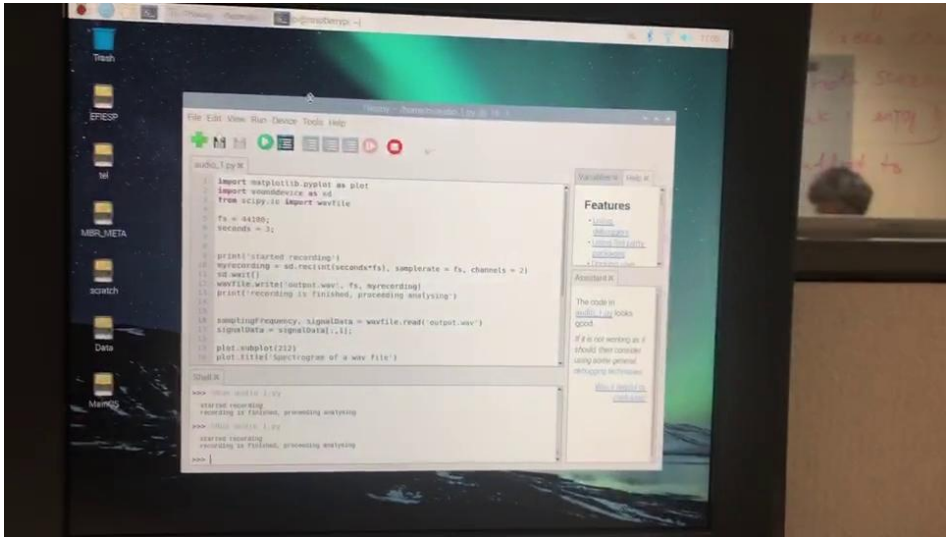
Short-time Fourier Transform



Recording Process

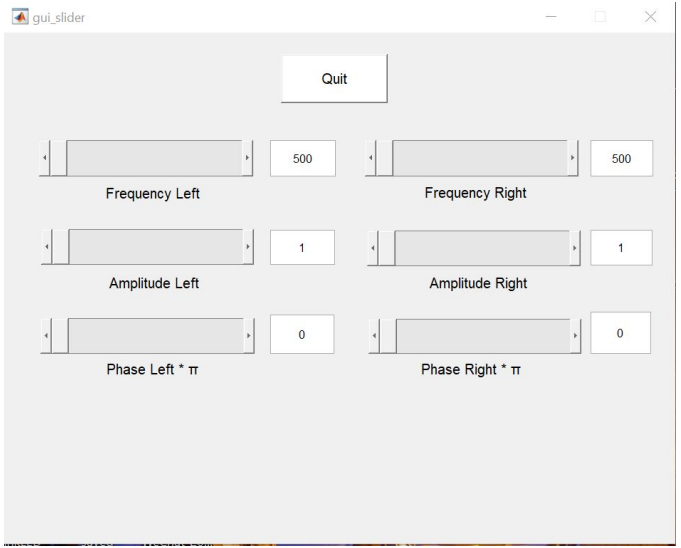
System Development I

- We combined the previous two process of recording and analysing.
- We write a python algorithm to perform the real time short time fourier transform which is a combination of recording and analysing. (We can also access this py file remotely through our laptop)



System Development II

- To simulate the real-time stereo system, we use MATLAB to control the channels of the speaker and furthermore explore how human perceive sound signals and when the ‘sweet spot’ will appear.



MATLAB GUI of the Speaker Control System

Video Demo

Future Direction

- Find out how human perceives sound and when does the sound has the most impact on our hearing.
- Come up with a feedback method so that the receiver (Raspberry π) can communicate with the speaker.
- Come up with a method that the speaker can move accordingly to the feedback send by the receiver (Raspberry π).

Thank You !

Special thanks to:

Xiaoran Fan

Richard Howard

Jennifer Shane

Ivan Seskar