

Design Review 4

Hangdi Hu, Stuart Jackson, Maximillian Jones, Anjun Zhang

GTA: Han Peng

Work Breakdown Structure 1 - HRTF Improvements

- Sample HRTF sets
- Include ability to choose HRIR set in GUI
- dSPACE boards may allow for direct portability
- Demo - <https://youtu.be/8tYuaz100-8?t=33>

Person Primarily Responsible: Stuart Jackson				
ID	ACTIVITY/TASK	DESCRIPTION	DELIVERABLE(S)	OTHER PEOPLE
1	HRTF IMPROVEMENTS			
1.1	Improve 3d emulation in elevation plane	Improve accuracy in elevation plane of HRTF implementation	Working method to accurately simulate audio in the elevation plane	Research help – all
1.2	Add new HRTF methods to current design	Synthesize MATLAB code based on improvements discovered in 1.1	Working MATLAB code that can generate accurate sounds in both azimuth and elevation planes	Ensure ability to integrate with GUI – <u>Anjun</u> and <u>Hangdi</u>
2	Portability			
2.1	Ensure code can be easily ported to other environments	The code may have to be remade in a new environment / language, ensure it does not rely heavily on MATLAB specific plugins	Code that can be easily transferred between environments, ideally using as few MATLAB toolboxes as possible	Requires knowledge of what hardware will be used - Max

Updated WBS - Audio Processing

- Record input from microphone, convolve with HRTF, replay
- Add ability to select different data set based on GUI input
- Creation of separate functions which fetch HRIR data based on Azimuth and Elevation

Person Primarily Responsible: Stuart Jackson				
ID	ACTIVITY/TASK	DESCRIPTION	DELIVERABLE(S)	OTHER PEOPLE
1	Audio Processing Improvements			
1.1	Enable HRTF filters in real time	Implement filter in real time upon microphone input	Working function which records, filters, and replays audio	None
1.2	Create ability to pick HRIR sample set	Ensure that sample set picked in GUI is selected and used for HRIR set	MATLAB code that can select between different sets of data for use in filtering	Ensure ability to integrate with GUI – <u>Anjun</u> and <u>Hangdi</u>
2	Integration			
2.1	Ensure code is written with later integration with GUI in mind	Allow for selection of different locations, as well as different HRIR sets	MATLAB code that allows for changes in azimuth, elevation, HRIR data set	Ensure ability to integrate with GUI – <u>Anjun</u> and <u>Hangdi</u>

Work Breakdown Structure - GUI

- Users select desired direction
- Pass coordinates to HRTF

	Task	Description	Deliverables	Other People
1	Build a PC based GUI			
1.1	Build a standalone GUI	Build a GUI in MATLAB that has no connection of program	<ul style="list-style-type: none"> • Fundamental buttons on the interface: coordinates, volume, run function • Can let users input three dimensional coordinates (x,y,z) 	
1.2	Improve the GUI	Improve and test		
1.2.1	Connect with code or program	When Stuart finishes his HTRF, I will edit code to let GUI connect with program	<ul style="list-style-type: none"> • This part can't delivery individually and needs to test in 1.2.3 to see whether it works well 	Need code to be completed by Stuart Jackson
1.2.2	Interactive	Make program run the users' input data	<ul style="list-style-type: none"> • When inputting coordinates, these data can be seen from the variables window in MATLAB • The data equals to input coordinates 	Help from Anjun Zhang
1.2.3	Test	Test the GUI, at the same time test the HTRF	<ul style="list-style-type: none"> • Can hear the positional sound • Change the location, can feel that the direction of sound changes • The volume of sound can be changed 	Testing help from Stuart Jackson, Anjun Zhang, and Max Jones

Work Breakdown Structure — Integration

- Integration of the HRTF database and MATLAB GUI.
- Translate MATLAB language into hardware language and integrate translated language into hardware.

Person Primarily Responsible: Anjun Zhang

ID	Activity / Task	Description	Deliverable(s)	Other People
1	Integration (step 1)			
1.1	Integration of GUI and HRTF database	After we have a nice-looking GUI and a functional HRTF database, we need integrate those together in to a user friendly and functional MATLAB based application.		
1.1.1	Integration	Actual work to integrate GUI and HRTF database.	1.GUI 2.HRTF database 3.MATLAB application	
1.1.2	Simulation and Test	Build up the application and run test.	1.Test data; 2.Simulation result 3.Application	All team members would take part in the testing.
1.2	Integration (step 2)	Stretch goal. We need put our app into a standalone device.		
1.2.1	Translate	Translate MATLAB language into hardware language	1.MATLAB application 2.Translated hardware language 3.Hardware standby.	Lots of work to do, could use some help from team.
1.2.2	Integration	Integrate translated language into hardware like VHDL (haven't deiced yet)	1.Hardware working with positional sound. 2.Working with different type of headset 3.Working with different sound source.	

Work Breakdown Structure - Hardware Implementation

- Choices of using a DSpace board or not.
- Simulink coder or Matlab coder to translate MATLAB code to C for simple translation to hardware.

Person primarily Responsible: Maximillian Jones				
ID	Activity/Task	Description	Deliverables	Other People
1	Choosing hardware			All team members should be present for the choosing
1.1	Determining the necessary peripherals	Things like usb ports or audio jacks	1. Amount of people using the device at one time	
1.2	Determine the correct processor for the job	Use an arduino or a FPGA?	1. Amount of people using the device at one time 2. Processing strain from our program	
1.3	Putting together our hardware implementation	The assembly of our end product	1. Durability of Hardware 2. sufficient power needed to run hardware properly	
2	Coding in our hardware			Needs the MATLAB program to be completed by Stuart Jackson
2.1	Using a program to Translate to C code	MATLAB Coder or Simulink Coder would be used. Whether or not a Dspace board is needed is yet to be determined	1. MATLAB program 2. C Program	
2.2	Use the C code to Program our hardware	Translate our C code to VHDL if needed	1. C Program 2. VHDL Program	

Review

- New focus on implementing our HRTF model in real time
- Must have the ability to integrate GUI with this real time audio processing, without a large delay
- Implement ability to choose between subjects, so that listener can pick whichever most closely matches them
- Once software implementation is complete, move forward in porting solution to hardware