

Last semester in my DSP class, we had a partner project that would attend the design expo. The assignment was open ended. Basically, we had to use DSP techniques to create something cool. We had nearly two months to complete the project and present to peers who may not know the DSP for the educational purpose.

Our project name is called MAZE SPACE which is a vocoder to reconstruct the space reverberation when you wear on a headphone and talk to microphone it make you feel you were in that space.

At the beginning of our project, we searched online to get more about the details underhood. Then we follow one of the research paper, collected claps echo of the space and did the prototype on MATLAB. The simulation result went very well. However, when I tried to translate the algorithm onto the digital signal processor, it was totally failure. The sound space reverb was totally distorted.

We tried to figure it out. We walked through the algorithm step by step and also tried to fine tune the parameters of the filter functions. It took us nearly two weeks to debug it but still cannot solve the problem. In the end, we ask our professor who was an expert in DSP design for help. We describe our problem and finally, we were told that our idea works in theory, but in practice, cascade more than 100 IIR filters was very unstable. It is impossible to do it in this way on the DSP hardware.

deal with failure/ problem/ challenge and showed creative

At that time, we have two ways of dealing with it. One was get rid off the IIR cascades and make it stable. The advantage of using this method was we can quickly fix our problem but the disadvantage was we will lose the quality. The other way was trying to find a new method and thus we can get higher quality of the space reverb but it would takes us more time to prototype again and implement it.

At that time, we realized we were running out of time.

Some of my partners wanted to find another way to solve it because they really cared about the quality of the reverberation. I wanted to fix it immediately because we were running out of time. Our prioritization was at least had a complete product to display on the day of design expo.

After losing some time debating our positions, I suggested that we could try to fix our problem to check whether it meet our needs and it would not take too long to fix it. If most of us are not satisfied with the quality, we could try an another method. They agreed.

It turns out that reduced the number of IIR filters was a dead end. The quality of the space reverb was inaudible. So we have to try another method. After working days and nights in the last two weeks before the design expo. We tried a lot of ways of reconstructing the space reverb, it was a long story during these weeks, our final version was created by our own. Using the decaying feedback control loop to imitate the space reverb based on our knowledge and understanding of the characteristics of different spaces reverb. It turns out that our model achieves very good performance, the error below 1% under the mean square root criterion. Our project was successfully when we displayed it on the design expo and was evaluated by our professor and earned an A on the project.