

MEMORANDUM

To: Jennifer Johnson

From: Audio Noise Cancellation Team

Subject: Introduction and Requirements Inquiry

Date: Wednesday, October 24th 2018

THIS WILL BE REMOVED ONCE THE MEMO IS COMPLETE, THIS IS FROM THE MEMO ASSIGNMENT

1. a general team introduction - you should consider saying how/why you are excited about working on this project
2. a team inventory - what are each of your skills, strengths, and interests
3. a description of what your team thinks this project is all about - utilize that brain storming and mind mapping you did
4. at least five questions you have for your client - more is fine too
5. a closing, thanking them for sponsorship of your project and providing them with contact information for you all

1 Introduction

Hello, this is the team working on the Audio Noise Cancellation capstone project for Northern Arizona University (N.A.U.). Our team is comprised of Daniel Torres, Xiwen Chen, Zuo Cheng, and Michael Finley. We are all particularly excited for this capstone project as it is one of the only capstone projects with concepts in Digital Signal Processing available this year. See below for a team inventory, a section containing questions/requirements inquiry, and a closing section with our contact information. We look forward to hearing back from you soon and appreciate your time greatly!

2 Team Inventory

Michael Finley:

I am currently a fourth year undergraduate student at N.A.U. pursuing degrees in Mathematics

and Electrical Engineering with an emphasis in Computer Engineering. I have completed coursework with fundamentals of DSP (EE348: Signals and Systems) and am currently enrolled in a Pattern Recognition & Algorithms class (EE543: Pattern Recognition) which I believe will be directly useful in this project. I have also have experience in coding C++ audio algorithms through reading Pirkle's *Designing Audio Effects Plug-ins in C++ with Digital Audio Signal Processing*. My work experience involves designing detection filters and developing SNR methods for small-animal UAV radio telemetry systems for an National Science Foundation funded project (The Unmanned Aerial Vehicle-Radio Telemetry Project (UAV-RT)) which allowed me to further develop my experience with C++ algorithm design and increased my knowledge of DSP concepts. I have over two years of research experience on multiple research projects at N.A.U. which has exposed me to many other disciplines of engineering.

Xiwen Chen:

I am a 3+1 program student (3 years in China and the last year in the US), and currently I am fourth-year majoring in Electric Engineering. I achieved a really good academic performance in DSP, the Principle of Communication, Signal and System, and Electronic System Design in China, and now I am enrolled in EE490(Embedded System) and EE430(Communication System). These courses may be useful in the Audio Cancellation Project. Although I did some projects and participated in some design competitions, however, most of them are about hardware, not about audio processing. Therefore, I think I can focus on hardware design in this project and I want to try my best to improve my knowledge about audio processing project. My reasons why I choose this project are I want to further my study in this filed and I want to work for a headsets company in the future.

Zuocheng:

Daniel Torres:

3 Questions/Requirements Inquiry

1. You mentioned "active noise cancellation is available using secondary microphones, but current helicopter microphones provide a single source of audio..." which seems to imply **our solution won't involve a microphone collecting ambient (audio) noise and removing that ambient noise from the audio channel with some analog circuitry. Is this correct?** This seems to be supported by the "DSP only solution" to improve intelligibility, but we want to make sure. One of our first concerns is how we will phase-match (or rather, 180 degree out-of-phase match) the ambient rotor noise without a secondary microphone in the system to help us understand the phase of the ambient rotor noise.
2. We also wanted to clarify how we are using "noise" for this problem. You mentioned "ambient background rotor noise" which seems to point to the issue being an ambient (audio) noise (i.e. audible noise, not signal noise) but you also mention that the ambient rotor noise is "impressed upon that single channel of audio signal" which has language that seems to imply it is electrical noise (i.e. an unwanted *electrical* disturbance in signal). **So is this project seeking to remove ambient noise or are we seeking to remove unwanted electrical signal (noise) from an audio channel?**
3. **Do you have any materials that we would be able to reference or utilize currently?** For example any scientific journal/databases that you have access to that we could utilize, or

development boards that your company typically works with that we should have in mind early on.

4. **Are passive filtering methods not the desired solution to this problem?** More specifically, would a bandpass filter over the human-speech range and a notch filter centered on the rotor noise frequency be a possible part of the solution to this problem or something to that effect?
5. **What does your preferred mode of communication look like?** Do you prefer our inquiries to you be done through e-mail, formal memo, or other methods? How often and or when can we communicate with you most efficiently? We understand being in different physical locations presents an obstacle we will have to navigate in this project.

4 Contact Information/Closing

In closing, we have given you an introduction to our team, as well as a brief inventory of what skill set we have to offer you in this project. Furthermore we have requested some more information about the project to further define the project requirements and confirm our team's understanding of the problem we are trying to solve. See below for our contact information and we look forward to being in touch with you over this semester! Our team is open to whatever venues of communication you prefer, be it Skype, e-mail, phone call, or e-mail, etc...

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