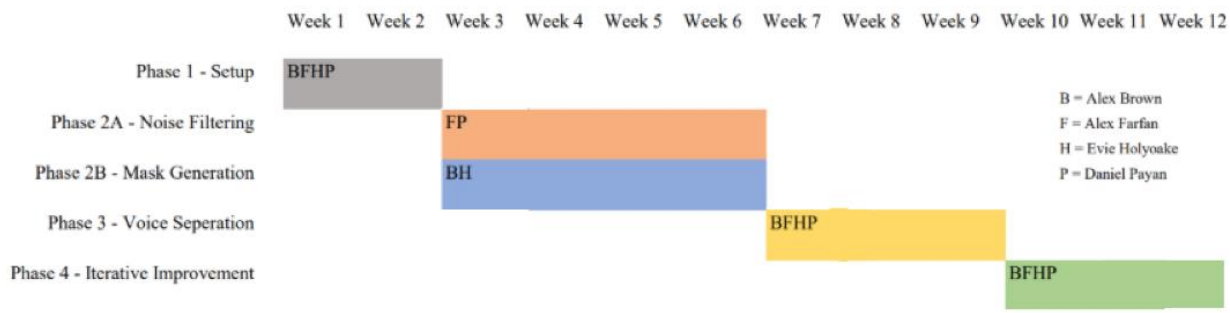
Alex Brown, Alex Farfan, Evie Holyoake, Daniel Payan

Team daea

Bi-Weekly Progress Meeting 5

4/19/2022

Gantt Chart:



Phase 1 - Setup:

- Set up workspace/environment
    - Version control using Git
    - Python3 development using Jupyter Notebook through in an Anaconda environment
    - Simulink and Matlab development using Matlab IDE
- Begin implementing initial filters
- Use Matlab to set up FIR/CIC filters to familiarize ourselves with noise reduction implementations
- Set up/Initialize Coral Board
    - Will need a similar development environment for testing of system implementation
    - Produce .wav files using on-board Digital PDM Microphones
- Research further into quantitative analysis system performance
    - As this is an investigative development, standards of performance may be subject to change
    - Performance may be relative across iterations, rather than compared to a known metric, as MFCC mask voice separation is a not well-explored domain

Phase 2A - Noise Filtering:

- Alex Farfan and Daniel Payan will lead this phase

- Attempt to implement separation of background noise from voices
    - Separate background noise from a single voice
    - Proceed to separate background noise from multiple voices
    - Proceed to separate background noise from stacked voices
- Implement MFCC feature vector production through Matlab
- Output MFCC feature vectors to file (for later use by Python3 code)
- Begin testing filter performance by comparing clean audio samples to artificial noise that was filtered by the program

Phase 2B - Mask Generation:

- Alex Brown and Evie Holyoake will lead this phase
- Develop infrastructure for interfacing with potential audio clip databases
- Implement MFCC feature vector production through Python3 (utilizing the Librosa library)
- Input MFCC feature vectors from file (previously output by Matlab code)
- Research into mask generation based on existing in generating masks in the Time-Frequency spectrogram domain
- Setup system to create an "enrollment profile" of audio clips for individuals from database sources
- Visualize MFCC time-domain data
- Implement a mask generation machine learning algorithm
    - Uses MFCC feature vectors produced from enrollment profiles
    - Produces a "mask" of multipliers/scalars that represent an individual's vocal presence in the MFCC-domain

Phase 3 - Voice Separation:

- Continue training mask generation model
- Use the MFCC feature masks to attempt to separate a known speaker from other speakers
    - Experimentally determine if MFCC feature mask multipliers are sufficient for attenuating non-target voices
    - Experimentally determine if a voice separation model is needed
- Reconstruct audio streams based on MFCC feature vectors with Python3 (utilizing the Librosa library)
- Implement the noise filtering algorithm on the Google Coral board, testing its performance

- Experimentally determine how to use both microphones concurrently whether this improves performance
- This must filter out noise recorded using the on-board microphone(s)
- Determine how to improve performance to meet latency requirements

Phase 4 - Iterative Improvement:

- Iteratively improve noise filtering implementation
- Iteratively improve mask generation model
- Iteratively improve voice separation implementation
- Iteratively improve testing mechanics

Git Repository:

1. Provide an update on your progress according to your Gantt chart in the proposal; provide over/under of your progress vs plan

We are currently working on developing our highlight video, developing a testing suite for the custom model and wrapper, and continuing to attempt to load the wrapper onto the Raspberry Pi. The iterative improvement of the model has been completed. This work / progress is in-line with our proposed timeline.

2. Provide an update of teamwork: who is doing which tasks

- Alex Brown & Evie Holyoake
  - ✓ Completed the audio profile pipeline
  - ✓ Trained model on a personalized audio dataset
  - ✓ Qualitative analysis of model
  - o Creating model testing suite
  - o Highlight video production
- Alex Farfan & Daniel Payan
  - ✓ Begin environment set-up on Raspberry Pi
  - ✓ Recorded audio for live-testing implementations
  - o Meet with Professor Bell to discuss Pi issues
  - o Reimplement FIR/CIC filters for less audio-stream management overhead

3. If any new bottleneck/hurdle is discovered, please describe; also describe your solution to address the hurdle

- ☹ Raspberry Pi is proving to be just as difficult as the Dev Board for environment set up. We will be meeting with Professor Bell to attempt to navigate and address the issues. This issue has been discussed with our sponsor and our sponsor is satisfied with the current scope of our implementation and no longer expects an embedded environment.

4. If you are behind schedule please provide a plan to address

We are not behind schedule.

5. Describe your next step for the next 2 weeks

- Alex Brown & Evie Holyoake
  - o Develop Testing Suite
  - o Producing high light video
- Alex Farfan & Daniel Payan
  - o Create a python CIC/FIR filter
  - o Set up Raspberry Pi environment
  - o Implement physical interface