Acousticrypt: Communication via Audio

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Introduction

Can mobile devices communicate (send and receive text) via audio signals?

Goals:

- Use a high frequency encoding to reduce the perceived loudness of audio signal
- Build a communication scheme that is robust to background noise and device separation

System Design

Our project consists of:

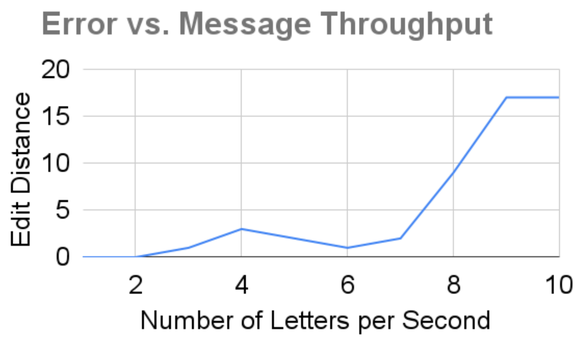
- An Android app that allows you to enter text to encode, record audio from computer, and decode
- A Flask API that handles the encoding and decoding audio logic

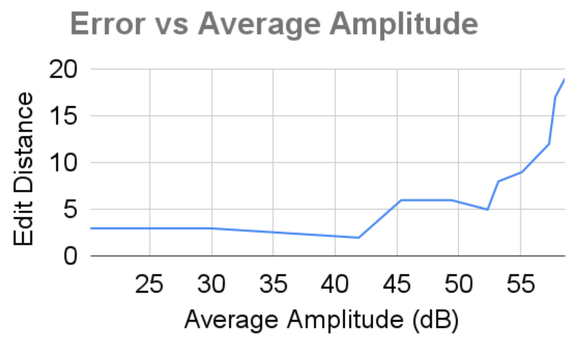
Process

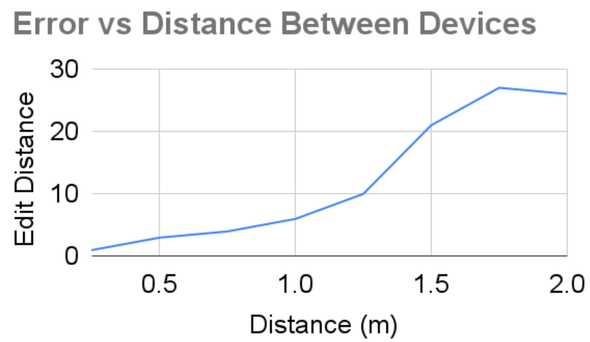
- Each character in alphabet is designated a frequency between 17-18 kHz
- Audio file is generated by concatenating frequencies
- On played back audio file, linear search is performed to find start of encoded text
- Peak finding algorithms are used on the frequency domain representation of audio segments to find designated frequency
- Frequencies are converted back to letters according to mapping

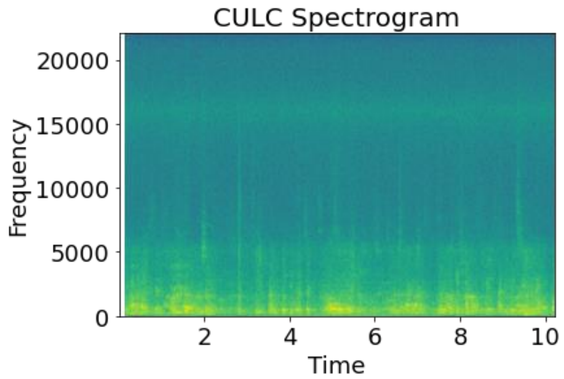
Results

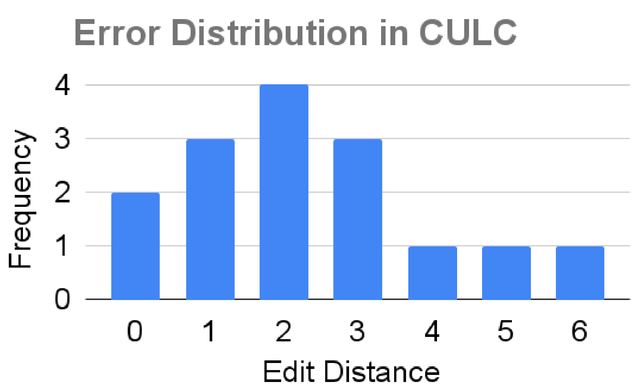
- Edit distance between sent and received messages is used as a measure of error
- Experiments measure error as a function of varying throughputs, degrees of noise in environment, and separation between devices
- Message used: *“the quick brown fox jumps over the lazy dog”*

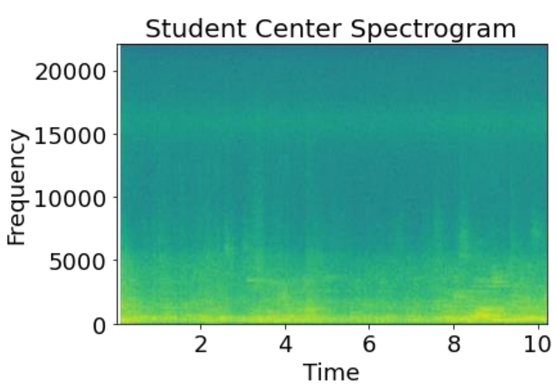


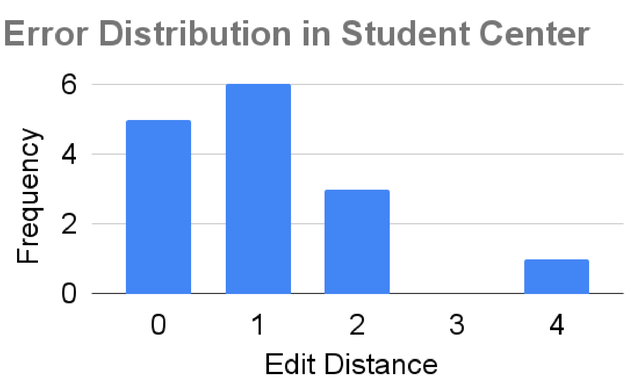












Conclusion

Communication is robust to:

- Separation under 1.25 m
- Throughputs up to 7 letters per second
- Various noisy environments

Future work:

- Privacy-preserving communication
- Smoothen letter frequency transitions