Implementaion of DTMF Decoding with Matlab

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***Abstract*—In this paper two method of decoding DTMF(Dual-tone multi-frequency) signaling are accomplished with Matlab. First of them uses the method of FFT and the other one with a filter approaching. Both methods decode an input wave file including multi-digits of code into a readable string of numbers accurately. The decoder can detect every single signal in the input multi-digits wave file then split them so periodic dial signals are not required.**

***Keywords*—DTMF, decoder, Matlab, multi-digits.**

I. Introduction

DTMF is used for telecommunication signaling over analog telephone lines in the voice-frequency band between telephone handsets and other communications devices and the switching center. To make the whole system of telephone communication works, a DTMF decoder plays an important role.

A. DTMF

In DTMF, a 4×4 matrix is formed by each row representing a low frequency, and each column representing a high frequency. Numbers from 0 to 9, letters from A to D and symbols $\star$ and $\#$ are represented by a combination of a low frequency and a high frequency. Also, special tone frequencies are used to represent busy signal, dail tone and so on. frequencies used here are all lower than 600 and differ by countries and will not be disscussed here.

Frequency/Hz	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	$\star$	0	$\#$	0

TABLE I. DTMF Keypad Frequencies Match

B. FFT

Fast Fourier Transform(FFT) is an algorithm to make computation of Discrete Fourier Transform(DFT) faster. By DFT, signals are converted from time domain to frequency domain, which makes it easier to do analysis. In this project, due to effect of noise, after DFT, there may be more than two frequencies having non-zero amplitude, but two of them should be relatively larger and they are actually the target frequencies.

The following figure shows an instance of the FFT of signal '5', two of the frequency peak can be easily found:

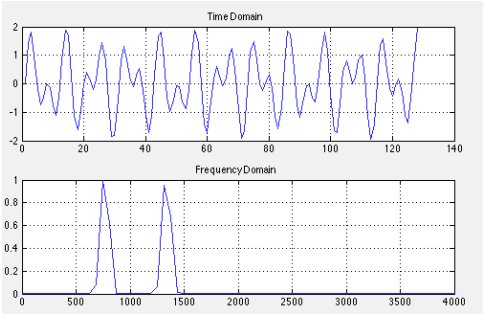

Fig. 1. Example FFT of dialing '5'

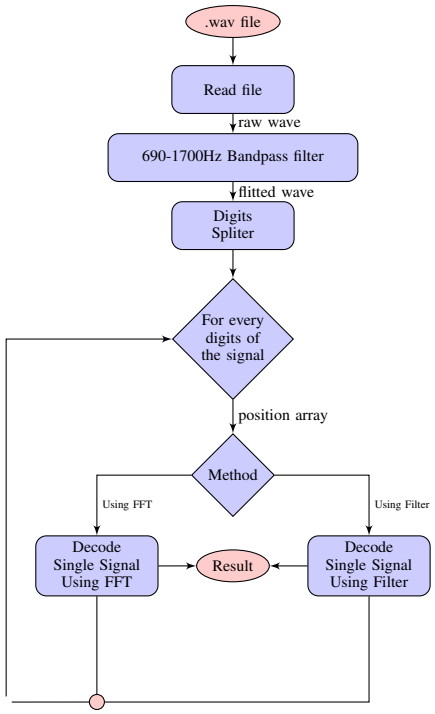

Fig. 2. Flow Chart for the decoder

II. Proposed Approach

The decoder is accomplished following the flow chart bellow:

III. Conclusion

The conclusion goes here.

Appendix A
Proof of the First Zonklar Equation

Appendix one text goes here.

Appendix B

Appendix two text goes here.

Acknowledgment

The authors would like to thank...

References

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