DTMF RECOGNITION

Kefil Tonouewa
ECE 53800
Final Project Presentation,
November 14, 2020

SCHOOL OF ENGINEERING
AND TECHNOLOGY

INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

IUPUI

Kefil Tonouewa| Slide 2

WHAT IS DTMF ?

- DTMF stands for Dual Tone Multi Frequency and is also called touch tone. DTMF has been developed by the American company owned by NOKIA called Bell Labs.

- DTMF Represents the tones that is heard when pressing keypad buttons on a phone.

SCHOOL OF ENGINEERING
AND TECHNOLOGY
IUPUI | INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

HOW DOES DTMF WORKS?

- Pressing a key sends two tones on two different frequencies. Every number have their own, predestined frequencies as seen in the table below.

- As seen, #2 is composed of two frequencies which are 1336Hz and 697Hz. Therefore when those two frequencies are detected in a signal, it can be concluded that the signal was generated by pressing #2 on the keypad.

SCHOOL OF ENGINEERING
AND TECHNOLOGY
INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis
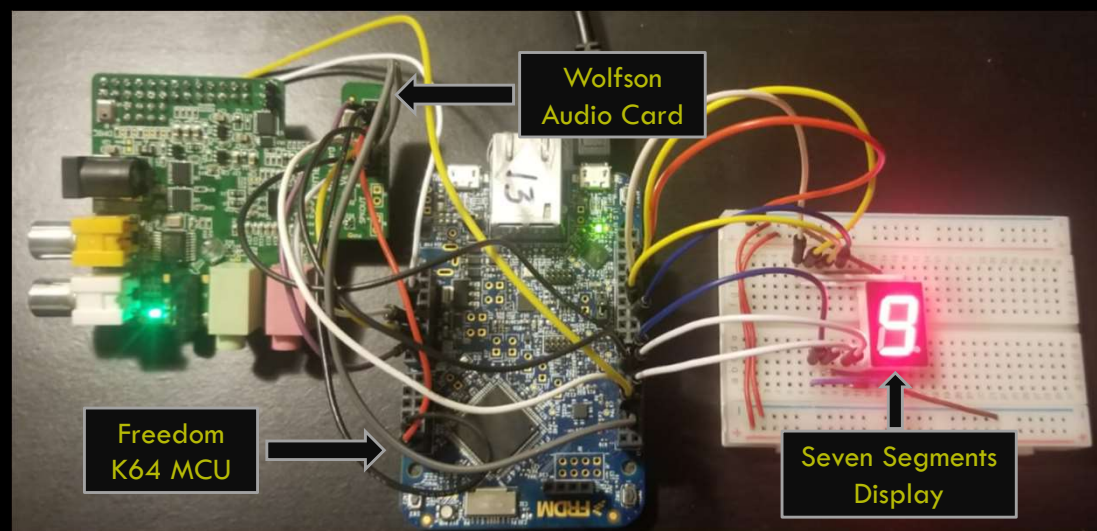
IUPUI

EQUIPEMENTS AND ROLES

HARDWARE

- <u>Wolfson Audio Card</u>: This will be used as a bridge between the signal and the microcontroller.

- <u>Freedom Development Platform for Kinetis® K64</u>:This will be the microcontroller used to receive and process the signal.

- <u>Seven Segment Display</u>: This will be used to display the decoded signal as a digit/letter.

SOFTWARE

- <u>Keil uVision 5</u>: This will be utilized to implement the algorithm designed to program the microcontroller used to process the signal.
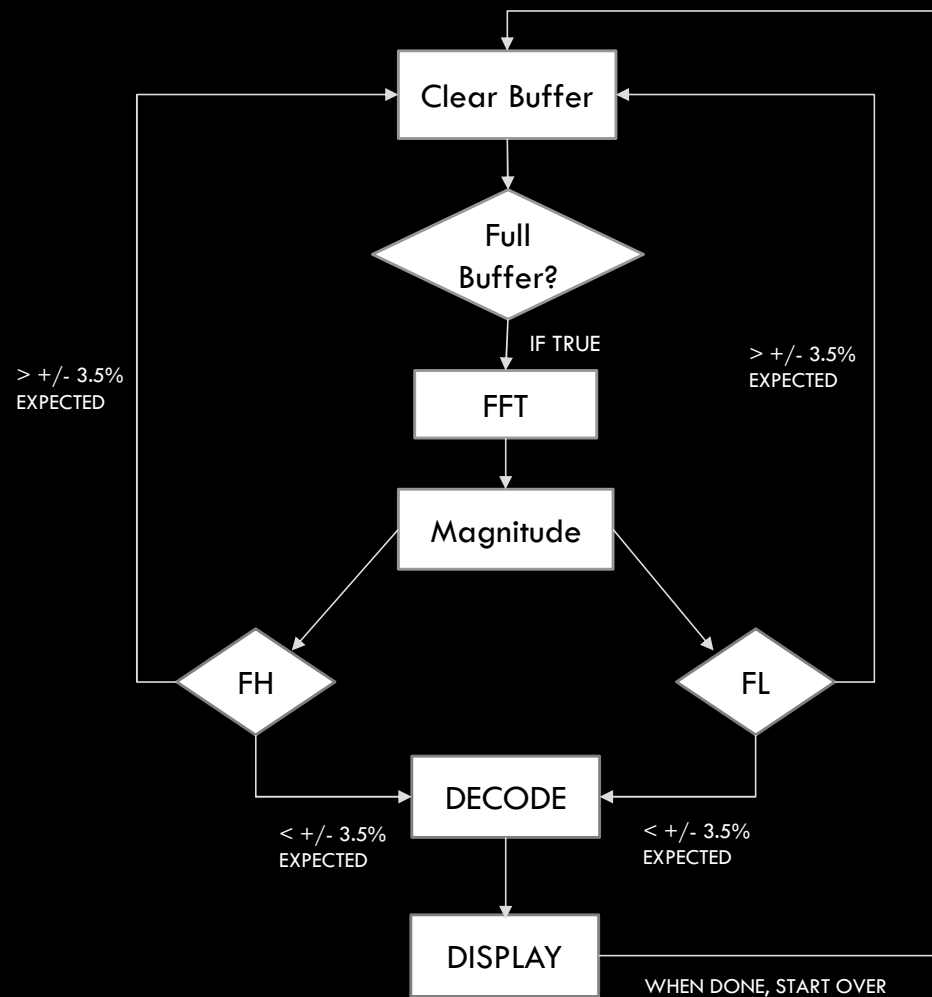
SCHOOL OF ENGINEERING
AND TECHNOLOGY
INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

IUPUI

HARDWARE SETUP

Wolfson Audio Card

Freedom K64 MCU

Seven Segments Display

SCHOOL OF ENGINEERING AND TECHNOLOGY
INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

SOFTWARE SETUP (ALGORITHM)

- Obtain the signal using Wolfson audio card either by using the building mic or the line in with a sampling frequency greater or equal to 2954 Hz.

- Populate a buffer of N elements using the signal obtained. (NB: The minimum duration of a tone is 65ms)

- Perform a Fast Fourier Transform on the obtained signal to get the frequencies.

- Find the magnitude of samples issued from FFT.

- Find the Highest frequency(FH) and the lowest frequency(FL).

- Use FL, FH and the previously discussed table to detect the number pressed.

- Display the detected number to a seven segments display.

SCHOOL OF ENGINEERING
AND TECHNOLOGY

INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

IUPUI

SOFTWARE FLOWCHART

Clear Buffer

Full Buffer?

IF TRUE

FFT

Magnitude

> +/- 3.5% EXPECTED

> +/- 3.5% EXPECTED

FH

FL

DECODE

< +/- 3.5% EXPECTED

< +/- 3.5% EXPECTED

DISPLAY

WHEN DONE, START OVER

SCHOOL OF ENGINEERING
AND TECHNOLOGY

INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis
Indianapolis

IUPUI

Kefil Tonouewa| Slide 8

CONCLUSION & FUTURE IMPROVEMENT

- The objective of this project was to put everything that students learned throughout the semester together in order to build a product that can be used in real life circumstance regarding Digital Signal Processing.

- In this case, the notion of Fast Fourier Transform was used to replicate a real-life example of digital signal processing.

- In the future, this project will be extended to interact with some home appliances and more.

SCHOOL OF ENGINEERING
AND TECHNOLOGY
IUPUI | INDIANA UNIVERSITY–PURDUE UNIVERSITY
Indianapolis

QUESTIONS?