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Tutorials 4 and 5

Part 1

1.

I^2C interface (inter-integrated circuit): simple, 8-bit serial communication bus protocol that uses use just bus wires (serial data wire, and serial clock wire). Inside many ICs and allows devices to communicate directly with each other

Source: <https://www.microcontrollertips.com/i2c-k-squared-c/>

MEMS (micro-electromechanical system): mini machine that contains both mechanical and electronic components

Source: <https://internetofthingsagenda.techtarget.com/definition/micro-electromechanical-systems-MEMS>

PDM (pulse density modulation): form of modulation used to represent an analog signal with a binary one (source: PDM Wikipedia entry)

ADC and DAC: ADC is a system that converts an analog signal into a digital signal. DAC is the opposite. (Source: ADC/DAC Wikipedia articles)

IIR (infinite impulse) filter: digital filter that depends linearly on a finite number of input samples and finite number of previous filter outputs

Source: <https://www.sciencedirect.com/topics/computer-science/infinite-impulse-response-filter>

Digital Signal processing: Taking real-world signals that have been digitized and then mathematically manipulating them

Source: <https://www.analog.com/en/design-center/landing-pages/001/beginners-guide-to-dsp.html#>

High pass filter: filter that passes signals with a freq higher than a certain cutoff frequency and reduces signals of frequencies lower than the cutoff (source: Wikipedia HPF article)

Low pass filter: filter that passes signals with a freq lower than a selected cutoff. Reduces/ignores signals higher than cutoff (source: Wikipedia LPF article)

Wave frequency: number of waves that pass a fixed point in a given amount of time

Source: <https://www.ck12.org/physics/wave-frequency/lesson/Wave-Frequency-MS-PS/>

Wave amplitude: maximum amount of displacement of a particle on the medium from rest position

Source: <https://www.physicsclassroom.com/class/waves/Lesson-2/The-Anatomy-of-a-Wave>

2.

Low pass filter: high pitch part of “ss” can be heard. High pitch of “oo” howl can also be heard but that’s it

High pass filter: basically can’t hear the “oo” sound anymore. Only “ss” with high pass filter

3.

All Results

LOW PASS FILTER

“oo”

A close up of a device

Description automatically generatedA screenshot of a cell phone

Description automatically generated

4 times “ooo” sound. Sounds of predominately low frequency are preserved.

“ss”

A screenshot of a computer

Description automatically generatedA screenshot of a cell phone

Description automatically generated

4 times “sss” sound. We can see it is attenuated in volume

4kHz

A screenshot of a social media post

Description automatically generated

A picture containing person, riding, board, court

Description automatically generated

Can see the sine wave and low freq preserved.

1kHz

A picture containing screenshot

Description automatically generated

A close up of a screen

Description automatically generated

Can see the sine wave and low freq preserved.

HIGH PASS FILTER

“oo”

A picture containing bird

Description automatically generated

A picture containing clock

Description automatically generated

“ooo” sounds of predominately low freq components are now distorted

“sss”

A picture containing clock

Description automatically generated

A close up of a logo

Description automatically generated

“sss” sound increased in relative volume

4kHz

A picture containing screenshot, bird

Description automatically generated

A close up of a screen

Description automatically generated

Sine wave is way more obvious because amplitude is larger from high pass filter

1kHz

A picture containing screenshot

Description automatically generated

A screen shot of a computer

Description automatically generated

Sine wave is way more obvious because amplitude is larger from high pass filter

Part 2

4.

A screenshot of a computer

Description automatically generated