Interface Definitions

Audio 11 Group | October 21, 2019

Microphone - Operational amplifier circuit

The microphone receives an audio signal from an external source and outputs it as an AC signal with the max amplitude of 50mV. The operational amplifier circuit receives this signal as Vcc input and amplifies the signal to max 5V peak to peak amplitude with a DC offset of 2.5V.

Operational amplifier circuit - Arduino Mega Microcontroller

The op amp circuit outputs the microphone's amplified signal so that the maximum voltage received by the Arduino is 5V. There may be some clipping due when the signal from the microphone is too loud. The current gain is set to 20. Adjusting this gain require changing the feedback resistor. The Arduino Mega microcontroller receives this signal through its A0 analog pin with reference to its GND pin.

Arduino Mega Microcontroller - LED circuit

Each LED is directly driven by a digital Arduino board pin. The Arduino code and FFT calculations return 3 bin values, which in this case represent the microphone's signal frequencies. Each bin has a certain level of amplitude, as determined by the Arduino code, and is run through a number of coded cases which determines how many LEDs need to be turned on at that time. This determination sends voltage through the corresponding digital pin(s) to light up the corresponding LED(s).

LED circuit - Matlab graph

The Arduino receives an amplified signal from the op amp circuit and records frequency and amplitude data from the signal. This data is output as serial data to Matlab, which receives it as a matrix and then uses the matrix to perform Fast Fourier Transform calculations on the data and plot a frequency vs. amplitude graph.