LOW COST AUDIO SPECTRUM ANALYZER

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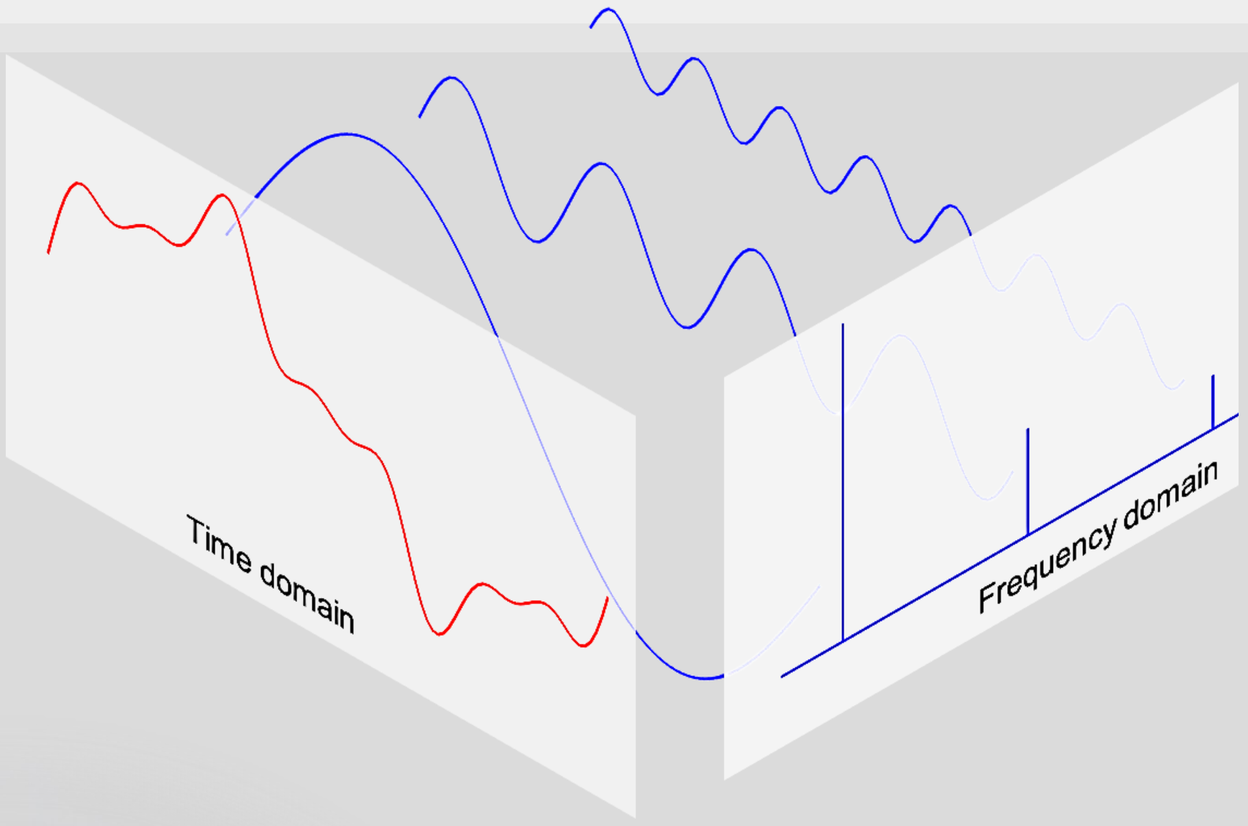
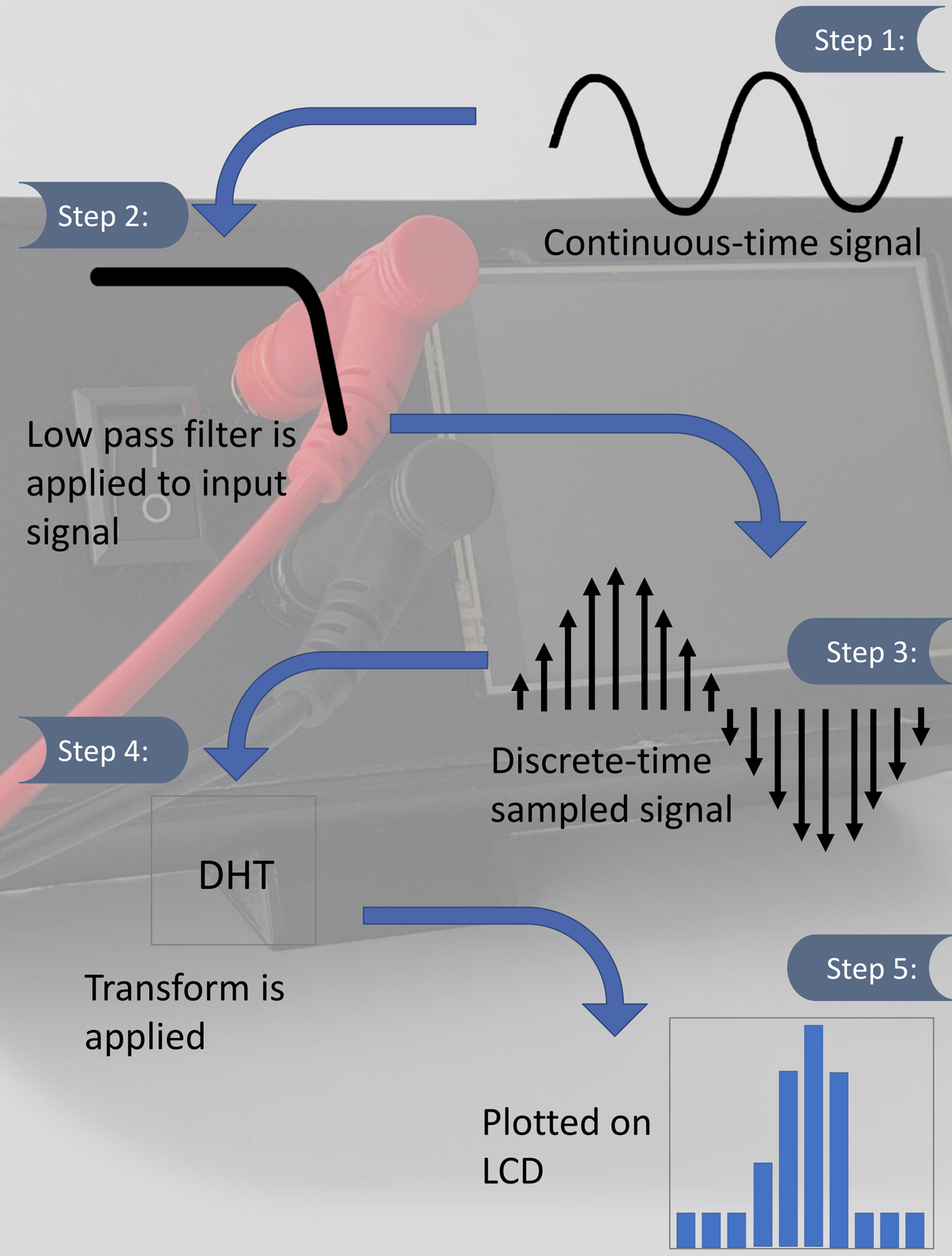
INTRODUCTION

Today, with the advancement of technology and science, technological developments that provide solutions to or help education problems has an important place. To reducing the size of measuring devices in the field of education, developing easily accessible and affordable systems ensures to the solution of education problems.

The aim of the project is to easily reach measuring instruments without the need for a laboratory environment and to achieve the necessary gains.





DESIGN

In this design, the spectrum analyzer has a frequency range of 400Hz-20kHz. To meet this goal, the audio signal is filtered with a low pass filter to remove high frequency components.

The filtered signal is digitized to calculate the spectrum of a signal. Sampling, which is the reduction of a continuous-time signal to a discrete-time signal, is performed. The sampling frequency needs to be at least twice as much as the highest frequency observed. Otherwise, the sampling will become inaccurate, and the process will introduce aliasing artifacts. To get higher sampling frequency, AVR register is opted to use which gives more control over the ADC operation.

The samples obtained is transformed to frequency domain with Discrete Hartley Transform which is a Fourier-related transform of discrete, periodic data. The primary reason to use FHT over FFT is that the real number input represents a significant saving in RAM (since only a single array is required) and it is relatively easy to implement the FHT efficiently on low-power microcontrollers.

The results of the frequency transformation are plotted on the 320x240 high resolution LCD screen to increase intelligibility and ease of use.