2 x 16-Band Audio Spectrum Analyzer with LCD © GPL3+

2 x 16-band audio spectrum analyzer with Arduino Nano and 2 x 16 chars LCD display. This project is based on Shajeeb's project.

About this project

This little and easy-to-do project is based on an idea to represent audio spectrum data: 32-Band Audio Spectrum Visualizer Analyzer by Shajeeb. However, I have a 2 x 40chars big LCD, and I don't wanted to create LED based bars, plus not willing to use additional hardwares. Additionally, my friends asked me to create a bit smaller version. So I changed the codes and created a 2 x 16 bars, stereo audio spectrum analyzer.

The code is changed to read data from analogue pin 0 and pin 1. Changed the hum/noise ellimination level and the voltage reference. You can change it for your needs later on as well.

https://youtu.be/kuIKAfXzQjg

Code

```
/*
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SOFTWARE.
*/

/*
Changed by ThomAce
*/

#include <arduinoFFT.h>
#include <LiquidCrystal.h>

#define SAMPLES 64    //Must be a power of 2

#define  xres 16      // Total number of  columns in the display, must be <=
SAMPLES/2
#define  yres 8       // Total number of  rows in the display

LiquidCrystal lcd(11, 10, 7, 6, 5, 4); // pins to LCD

//LCD Bars.
byte v1[] = {
  B00000, B00000, B00000, B00000, B00000, B00000, B00000, B11111
};
byte v2[] = {
  B00000, B00000, B00000, B00000, B00000, B00000, B00000, B11111
};
byte v3[] = {
  B00000, B00000, B00000, B00000, B00000, B11111, B11111, B11111
};
byte v4[] = {
  B00000, B00000, B00000, B00000, B11111, B11111, B11111, B11111
};
byte v5[] = {
  B00000, B00000, B00000, B11111, B11111, B11111, B11111, B11111
};
byte v6[] = {
  B00000, B00000, B11111, B11111, B11111, B11111, B11111, B11111
```
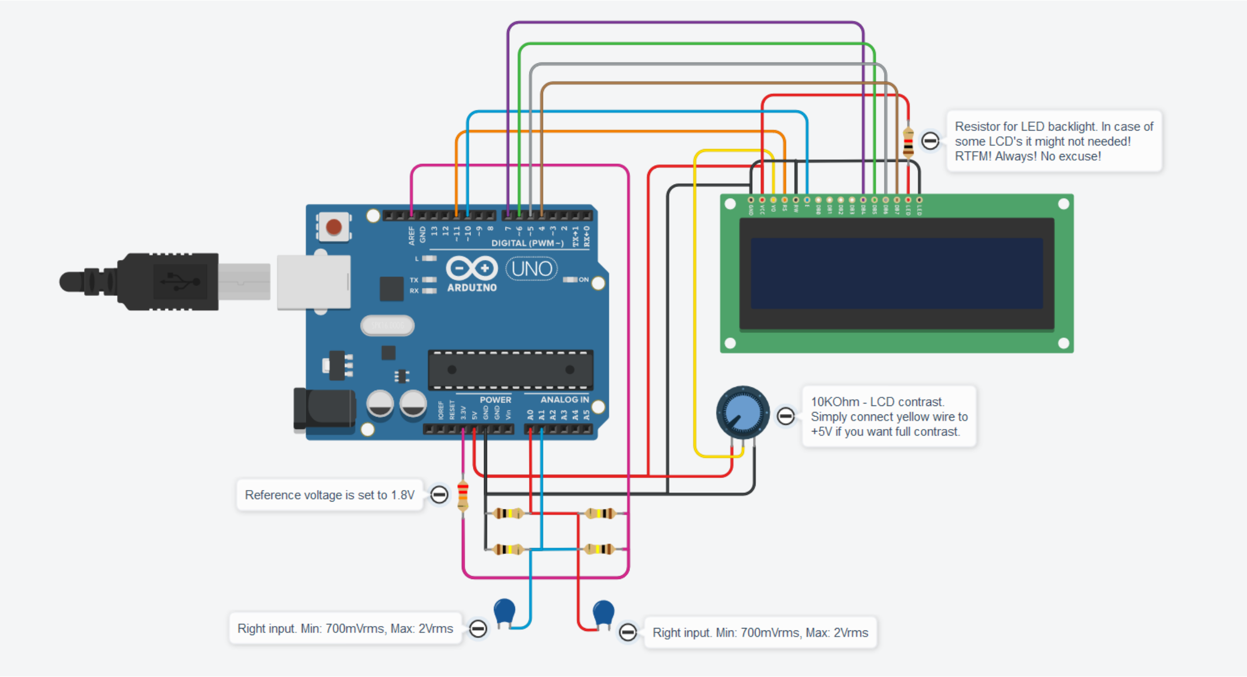

```
};
byte v7[] = {
  B00000, B11111, B11111, B11111, B11111, B11111, B11111, B11111
};
byte v8[] = {
  B11111, B11111, B11111, B11111, B11111, B11111, B11111, B11111
};
byte v9[] = {
  B00000, B00000, B00000, B00000, B00000, B00000, B00000, B00000
};

int MY_ARRAY[]={0, 1, 2, 3, 4, 5, 6, 7, 8};

double vReal[SAMPLES];
double vImag[SAMPLES];
char data_avgs[xres];

double vRReal[SAMPLES];
double vRImag[SAMPLES];
char Rdata_avgs[xres];

int yvalue;
int displaycolumn , displayvalue;
int peaks[xres];
int Rpeaks[xres];

int steps = (SAMPLES / 2) / xres;

unsigned long lastDebounceTime = 0;  // the last time the output pin was
toggled
unsigned long debounceDelay = 50;    // the debounce time; increase if the
output flickers

arduinoFFT FFT = arduinoFFT();                                    // FFT
object

void setup()
{
  ADCSRA = 0b11100101;      // set ADC to free running mode and set pre-
scalar to 32 (0xe5)
  ADMUX = 0b00000000;       // use pin A0 and external voltage reference

  lcd.createChar(1, v1);
  lcd.createChar(2, v2);
  lcd.createChar(3, v3);
  lcd.createChar(4, v4);
  lcd.createChar(5, v5);
  lcd.createChar(6, v6);
  lcd.createChar(7, v7);
  lcd.createChar(8, v8);
  lcd.createChar(9, v9);
  lcd.begin(xres, 2);
  lcd.clear();

  String loading = "LOADING..    [0%]";
  int percentage = 0;
  for (int i = 0; i < xres; i++){
    lcd.setCursor(0, 0);

    percentage = (int) ((i / (float)xres) * 100);

    if (i < (xres / 3) && percentage % 2 == 0)
    {
      loading = "LOADING.  [" + String(percentage) + "%]";
      lcd.print(loading);
    }
    else if (i < ((xres / 3) * 2) && percentage % 2 == 0)
    {
      loading = "LOADING..[" + String(percentage) + "%]";
      lcd.print(loading);
    }
    else if (percentage % 2 == 0)
    {
      loading = "LOADING...[" + String(percentage) + "%]";
      lcd.print(loading);
    }

    for (int load = 0; load <= i; load++)
    {
      lcd.setCursor(load, 1);
      lcd.write(8);
    }

    delay(50);
  }

  lcd.setCursor(0, 0);
  loading = "LOADING...[100%]";
  lcd.print(loading);

  delay(500);                                     // wait to get reference
voltage stabilized and show the progress a bit longer time :)
  lcd.clear();
}


void Sampling(byte ADCBit, bool Right)
{
  ADMUX = ADCBit;//0b00000000;
  int value = 0;
  // ++ Sampling
  for(int i = 0; i < SAMPLES; i++)
  {
    while(!(ADCSRA & 0x10));                     // wait for ADC to complete
current conversion ie ADIF bit set
      ADCSRA = 0b11110101 ;                      // clear ADIF bit so that
ADC can do next operation (0xf5)

    value = ADC - 128; //- 256;// - 512 ;        // Read from ADC and
subtract DC offset caused value

    if (Right)
    {
      vRReal[i]= value / 8;                       // Copy to bins after 
compressing
      vRImag[i] = 0;
    }
    else
    {
      vReal[i]= value / 8;                        // Copy to bins after 
compressing
      vImag[i] = 0;
    }
  }
  // -- Sampling
}

void loop() {
  Sampling(0b00000001, false); //Left channel on pin 0
  Sampling(0b00000000, true); //Right channel on pin 0

  // ++ FFT
  FFT.Windowing(vReal, SAMPLES, FFT_WIN_TYP_HAMMING, FFT_FORWARD);
  FFT.Compute(vReal, vImag, SAMPLES, FFT_FORWARD);
  FFT.ComplexToMagnitude(vReal, vImag, SAMPLES);
  // -- FFT

  // ++ FFT
  FFT.Windowing(vRReal, SAMPLES, FFT_WIN_TYP_HAMMING, FFT_FORWARD);
  FFT.Compute(vRReal, vRImag, SAMPLES, FFT_FORWARD);
  FFT.ComplexToMagnitude(vRReal, vRImag, SAMPLES);
  // -- FFT

  // ++ re-arrange FFT result to match with no. of columns on display ( xres 
)
  Display(0, ReArrange(steps, data_avgs, vReal), peaks);
  Display(1, ReArrange(steps, Rdata_avgs, vRReal), Rpeaks);
}

char * ReArrange(int steps, char * dataAvgs, double * realValues)
{
  int c = 0;

  for(int i = 0; i < (SAMPLES / 2); i += steps)
  {
    dataAvgs[c] = 0;

    for (int k = 0 ; k < steps ; k++)
    {
      dataAvgs[c] = dataAvgs[c] + realValues[i + k];
    }

    dataAvgs[c] = dataAvgs[c] / steps;
    c++;
  }

  return dataAvgs;
}

void Display(int line, char * data_avgs, int * data_peaks)
```

```
{
  displaycolumn = 0;
  displayvalue = 0;
  yvalue = 0;

  // ++ send to display according measured value
  for(int i = 0; i < xres; i++)
  {
    data_avgs[i] = constrain(data_avgs[i], 0, 80);            // set max &
min values for buckets
    data_avgs[i] = map(data_avgs[i], 0, 80, 0, yres);        // remap
averaged values to yres
    yvalue = data_avgs[i];

    data_peaks[i] = data_peaks[i] - 1;    // decay by one light

    if (yvalue > data_peaks[i])
      data_peaks[i] = yvalue ;

    yvalue = data_peaks[i];

    lcd.setCursor(displaycolumn, line);
    if (MY_ARRAY[yvalue] == 0)
      lcd.write(" ");
    else
      lcd.write(MY_ARRAY[yvalue]);

    displaycolumn++;
  }
}
```

Schematics



Resistor for LED backlight. In case of some LCD's it might not needed! RTFM! Always! No excuse!

10KOhm - LCD contrast. Simply connect yellow wire to +5V if you want full contrast.

Reference voltage is set to 1.8V

Right input. Min: 700mVrms, Max: 2Vrms

Right input. Min: 700mVrms, Max: 2Vrms