PROJECT REPORT

TITLE
Music Reactive LED Strip

TEAM MEMBERS

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Project Demo:
https://drive.google.com/file/d/15RTq_sNeHwZ50CHL7wgeDpKxNRffhRmv/view?usp=share_link

ABSTRACT

This project improves the user's music listening experience by synchronising visuals with the audio. The project analyses music digitally and controls LEDs to create an audio-visual experience. This report describes the knowledge and materials used to develop a music-responsive LED lighting system.

INTRODUCTION

The project focuses on creating a sound reactive LED strip, that can sow patterns of different colours in sync with the music, which gives us a aesthetically pleasing effect. It visualizes the music or sound to a certain extent.

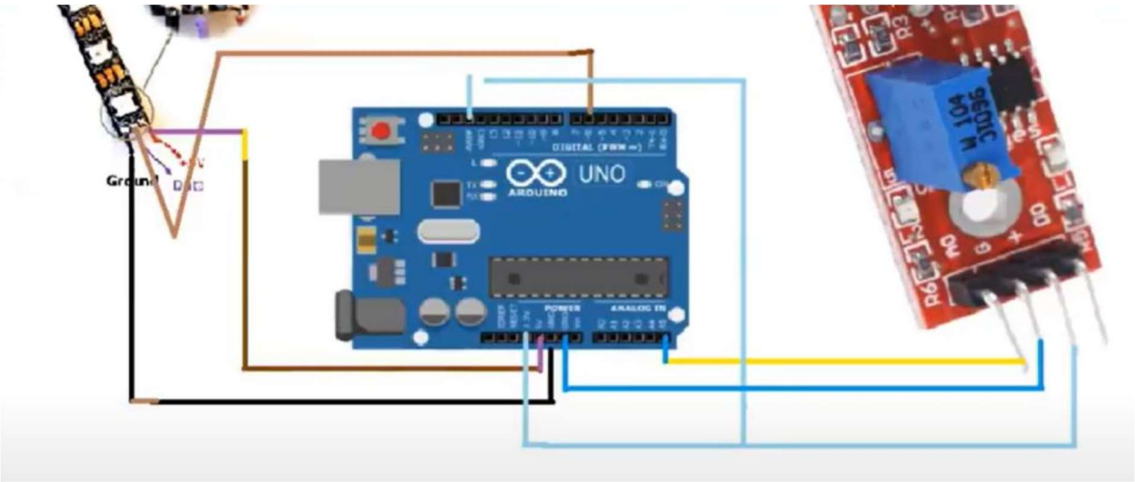
PROBLEM STATEMENT
To create a music or sound reactive LED strip.

PROPOSED SOLUTION
The solution we came up with, is to use an Arduino Board to make a circuit along with certain other equipment which will be listed down below.

COMPONENTS OF THE MODEL

- ARDUINO UNO R3
- WS2812B LED LIGHT STRIP
- SOUND DETECTION SENSOR MODULE (with Potentiometer)
- BREADBOARD
- JUMPER WIRES

SCHEMATICS



DESCRIPTION OF KEY COMPONENTS

- Arduino UNO R3
  Arduino Uno is a microcontroller board based on the ATmega328P. (datasheet). It comes equipped with a 16 MHz ceramic resonator (CSTCE16M0V53-R0), 6 analogue inputs, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It includes everything necessary for supporting the microcontroller.

- WS2812B LED LIGHT STRIP
  WS2812B is an intelligent control LED light source with an integrated control circuit and RGB chip in a 5050 component package. Its internal components consist of an intelligent digital port data latch and a signal-reshaping amplification drive circuit. Include a precision internal oscillator and a 12V voltage programmable constant current control component, effectively ensuring consistent pixel point light colour height.

- SOUND DETECTION SENSOR MODULE
  This module enables you to determine whether sound levels have risen above a chosen set point. A microphone is used to pick up sound, which is then sent into an LM393 op amp. An on-board potentiometer is used to change the sound volume set point.

RESULT (Video)

https://drive.google.com/file/d/15RTq_sNeHwZ50CHL7wgeDpKxNRffhRmv/view?usp=share_link

SOURCE CODE

```
#include <Adafruit_NeoPixel.h>
#include <FastLED.h>
#include <math.h>
#include <SoftwareSerial.h>
#define N_PIXELS  60  // Number of pixels in strand
#define N_PIXELS_HALF (N_PIXELS/2)
#define MIC_PIN   A5  // Microphone is attached to this analog pin
#define LED_PIN    6  // NeoPixel LED strand is connected to this pin
#define SAMPLE_WINDOW   10  // Sample window for average level
#define PEAK_HANG 24 //Time of pause before peak dot falls
#define PEAK_FALL 20 //Rate of falling peak dot
#define PEAK_FALL2 8 //Rate of falling peak dot
#define INPUT_FLOOR 10 //Lower range of analogRead input
#define INPUT_CEILING 300 //Max range of analogRead input, the lower the value the more sensitive (1023 = max)300 (150)
#define DC_OFFSET  0  // DC offset in mic signal - if unusure, leave 0
#define NOISE     10  // Noise/hum/interference in mic signal
#define SAMPLES   60  // Length of buffer for dynamic level adjustment
#define TOP       (N_PIXELS + 2) // Allow dot to go slightly off scale
#define SPEED .20      // Amount to increment RGB color by each cycle
#define TOP2      (N_PIXELS + 1) // Allow dot to go slightly off scale
#define LAST_PIXEL_OFFSET N_PIXELS-1
#define PEAK_FALL_MILLIS 10  // Rate of peak falling dot
#define POT_PIN    4
#define BG 0
#define LAST_PIXEL_OFFSET N_PIXELS-1
#if FASTLED_VERSION < 3001000
#error "Requires FastLED 3.1 or later; check github for latest code."
#endif
#define BRIGHTNESS  255
#define LED_TYPE    WS2812B    // Only use the LED_PIN for WS2812's
#define COLOR_ORDER GRB
#define COLOR_MIN         0
#define COLOR_MAX       255
#define DRAW_MAX        100
#define SEGMENTS          4  // Number of segments to carve amplitude bar into
#define COLOR_WAIT_CYCLES  10  // Loop cycles to wait between advancing pixel origin
#define qsubd(x, b)  ((x>b)?b:0)
#define qsuba(x, b)  ((x>b)?x-b:0)
// Analog Unsigned subtraction macro. if result <0, then => 0. By Andrew Tuline.
#define ARRAY_SIZE(A) (sizeof(A) / sizeof((A)[0]))


struct CRGB leds[N_PIXELS];

Adafruit_NeoPixel strip = Adafruit_NeoPixel(N_PIXELS, LED_PIN, NEO_GRB + NEO_KHZ800);

static uint16_t dist;        // A random number for noise generator.
uint16_t scale = 30;        // Wouldn't recommend changing this on the fly, or the animation will be really blocky.
uint8_t maxChanges = 48;      // Value for blending between palettes.

CRGBPalette16 currentPalette(OceanColors_p);
CRGBPalette16 targetPalette(CloudColors_p);


//new ripple vu
uint8_t timeval = 20;                                 // Currently 'delay' value. No, I don't use delays, I use EVERY_N_MILLIS_I instead.
uint16_t loops = 0;                                   // Our loops per second counter.
bool     samplepeak = 0;                              // This sample is well above the average, and is a 'peak'.
uint16_t oldsample = 0;                               // Previous sample is used for peak detection and for 'on the fly' values.
bool thisdir = 0;
//new ripple vu

// Modes
enum
{
} MODE;
bool reverse = true;
int BRIGHTNESS_MAX = 80;
int brightness = 20;


byte
//  peak      = 0,      // Used for falling dot
//  dotCount  = 0,      // Frame counter for delaying dot-falling speed
 volCount  = 0;      // Frame counter for storing past volume data
int
 reading,
 vol[SAMPLES],      // Collection of prior volume samples
```

```
  lvl      = 10,     // Current "dampened" audio level
  minLvlAvg = 0,     // For dynamic adjustment of graph low
& high
  maxLvlAvg = 512;
float
  greenOffset = 30,
  blueOffset = 150;
// cycle variables

int CYCLE_MIN_MILLIS = 2;
int CYCLE_MAX_MILLIS = 1000;
int cycleMillis = 20;
bool paused = false;
long lastTime = 0;
bool boring = true;
bool gReverseDirection = false;
int         myhue =   0;
//vu ripple
uint8_t colour;
uint8_t myfade = 255;                    // Starting
brightness.
#define maxsteps 16                      // Case
statement wouldn't allow a variable.
int peakspersec = 0;
int peakcount = 0;
uint8_t bgcol = 0;
int thisdelay = 20;
uint8_t max_bright = 255;



  unsigned int sample;

//Samples
#define NSAMPLES 64
unsigned int samplearray[NSAMPLES];
unsigned long samplesum = 0;
unsigned int sampleavg = 0;
int samplecount = 0;
//unsigned int sample = 0;
unsigned long oldtime = 0;
unsigned long newtime = 0;

//Ripple variables
int color;
int center = 0;
int step = -1;
int maxSteps = 16;
float fadeRate = 0.80;
int diff;

//vu 8 variables
int
  origin = 0,
  color_wait_count = 0,
  scroll_color = COLOR_MIN,
  last_intensity = 0,
  intensity_max = 0,
  origin_at_flip = 0;
uint32_t
    draw[DRAW_MAX];
boolean
  growing = false,
  fall_from_left = true;
```

```
//background color
uint32_t currentBg = random(256);
uint32_t nextBg = currentBg;
TBlendType    currentBlending;

const int buttonPin = 0;     // the number of the pushbutton
pin

 //Variables will change:
int buttonPushCounter = 0;   // counter for the number of
button presses
int buttonState = 0;         // current state of the button
int lastButtonState = 0;


   byte peak = 16;     // Peak level of column; used for falling
dots
//    unsigned int sample;

   byte dotCount = 0;  //Frame counter for peak dot
   byte dotHangCount = 0; //Frame counter for holding peak
dot

void setup() {

    analogReference(EXTERNAL);

   pinMode(buttonPin, INPUT);
 //initialize the buttonPin as output
  digitalWrite(buttonPin, HIGH);

     // Serial.begin(9600);
     strip.begin();
     strip.show(); // all pixels to 'off'

     Serial.begin(57600);
     delay(3000);


LEDS.addLeds<LED_TYPE,LED_PIN,COLOR_ORDER>(leds,N_
PIXELS).setCorrection(TypicalLEDStrip);
  LEDS.setBrightness(BRIGHTNESS);
  dist = random16(12345);          // A semi-random number
for our noise generator

 }


float fscale( float originalMin, float originalMax, float
newBegin, float newEnd, float inputValue, float curve){

  float OriginalRange = 0;
  float NewRange = 0;
  float zeroRefCurVal = 0;
  float normalizedCurVal = 0;
  float rangedValue = 0;
  boolean invFlag = 0;


  // condition curve parameter
  // limit range
```

```
 if (curve > 10) curve = 10;
 if (curve < -10) curve = -10;

 curve = (curve * -.1) ; // - invert and scale - this seems more
intuitive - postive numbers give more weight to high end on
output
 curve = pow(10, curve); // convert linear scale into
lograthimic exponent for other pow function


 // Check for out of range inputValues
 if (inputValue < originalMin) {
  inputValue = originalMin;
 }
 if (inputValue > originalMax) {
  inputValue = originalMax;
 }

 // Zero Refference the values
 OriginalRange = originalMax - originalMin;

 if (newEnd > newBegin){
  NewRange = newEnd - newBegin;
 }
 else
 {
  NewRange = newBegin - newEnd;
  invFlag = 1;
 }

 zeroRefCurVal = inputValue - originalMin;
 normalizedCurVal  =  zeroRefCurVal / OriginalRange;   //
normalize to 0 - 1 float


 // Check for originalMin > originalMax  - the math for all
other cases i.e. negative numbers seems to work out fine
 if (originalMin > originalMax ) {
  return 0;
 }

 if (invFlag == 0){
  rangedValue =  (pow(normalizedCurVal, curve) *
NewRange) + newBegin;

 }
 else     // invert the ranges
 {
  rangedValue =  newBegin - (pow(normalizedCurVal,
curve) * NewRange);
 }

 return rangedValue;

 }

 void loop() {

  //for mic
 uint8_t  i;
 uint16_t minLvl, maxLvl;
 int      n, height;
 // end mic
// read the pushbutton input pin:
 buttonState = digitalRead(buttonPin);
  // compare the buttonState to its previous state
 if (buttonState != lastButtonState) {
  // if the state has changed, increment the counter
  if (buttonState == HIGH) {
   // if the current state is HIGH then the button
   // wend from off to on:
   buttonPushCounter++;
   Serial.println("on");
   Serial.print("number of button pushes:  ");
   Serial.println(buttonPushCounter);
   if(buttonPushCounter==16) {
   buttonPushCounter=1;}
  }
  else {
   // if the current state is LOW then the button
   // wend from on to off:
   Serial.println("off");
  }
 }
 // save the current state as the last state,
 //for next time through the loop
 lastButtonState = buttonState;


switch (buttonPushCounter){

  case 1:
   buttonPushCounter==1; {
   All2(); // NORMAL
    break;}

    case 2:
   buttonPushCounter==2; {
   vu(); // NORMAL
    break;}

   case 3:
   buttonPushCounter==3; {
    vu1(); // Centre out
    break;}

  case 4:
   buttonPushCounter==4; {
  vu2(); // Centre Inwards
   break;}

  case 5:
   buttonPushCounter==5; {
  Vu3(); // Normal Rainbow
   break;}

   case 6:
   buttonPushCounter==6; {
  Vu4(); // Centre rainbow
   break;}

    case 7:
   buttonPushCounter==7; {
  Vu5(); // Shooting Star
   break;}

     case 8:
   buttonPushCounter==8; {
```

```
   Vu6(); // Falling star
    break;}

       case 9:
    buttonPushCounter==9; {
   vu7(); // Ripple with background
    break;}

        case 10:
    buttonPushCounter==10; {
   vu8(); // Shatter
    break;}

        case 11:
    buttonPushCounter==11; {
   vu9(); // Pulse
    break;}

        case 12:
    buttonPushCounter==12; {
    vu10(); // stream
    break;}
       case 13:
    buttonPushCounter==13; {
    vu11(); // Ripple without Background
    break;}

        case 14:
    buttonPushCounter==14; {
    vu12(); // Ripple without Background
    break;}

             case 15:
    buttonPushCounter==15; {
    vu13(); // Ripple without Background
    break;}


        case 16:
    buttonPushCounter==16; {
   colorWipe(strip.Color(0, 0, 0), 10); // Black
    break;}
}

}

void colorWipe(uint32_t c, uint8_t wait) {
  for(uint16_t i=0; i<strip.numPixels(); i++) {
    strip.setPixelColor(i, c);
    strip.show();
    if (digitalRead(buttonPin) != lastButtonState)  // <----------
---- add this
     return;       // <------------ and this
    delay(wait);
}}


void vu() {

  uint8_t  i;
  uint16_t minLvl, maxLvl;
  int      n, height;

  n   = analogRead(MIC_PIN);                    // Raw reading
from mic
  n   = abs(n - 512 - DC_OFFSET); // Center on zero
  n   = (n <= NOISE) ? 0 : (n - NOISE);            // Remove
noise/hum
  lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)

  // Calculate bar height based on dynamic min/max levels
(fixed point):
  height = TOP * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

  if(height < 0L)       height = 0;      // Clip output
  else if(height > TOP) height = TOP;
  if(height > peak)     peak   = height; // Keep 'peak' dot at top


  // Color pixels based on rainbow gradient
  for(i=0; i<N_PIXELS; i++) {
    if(i >= height)               strip.setPixelColor(i,   0,   0, 0);
    else strip.setPixelColor(i,Wheel(map(i,0,strip.numPixels()-
1,30,150)));

  }


  // Draw peak dot
  if(peak > 0 && peak <= N_PIXELS-1)
strip.setPixelColor(peak,Wheel(map(peak,0,strip.numPixels(
)-1,30,150)));

    strip.show(); // Update strip

// Every few frames, make the peak pixel drop by 1:

    if(++dotCount >= PEAK_FALL) { //fall rate

      if(peak > 0) peak--;
      dotCount = 0;
    }


  vol[volCount] = n;                      // Save sample for dynamic
leveling
  if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

  // Get volume range of prior frames
  minLvl = maxLvl = vol[0];
  for(i=1; i<SAMPLES; i++) {
    if(vol[i] < minLvl)      minLvl = vol[i];
    else if(vol[i] > maxLvl) maxLvl = vol[i];
  }
  // minLvl and maxLvl indicate the volume range over prior
frames, used
  // for vertically scaling the output graph (so it looks
interesting
  // regardless of volume level).  If they're too close together
though
  // (e.g. at very low volume levels) the graph becomes super
coarse
  // and 'jumpy'...so keep some minimum distance between
them (this
```

```
  // also lets the graph go to zero when no sound is playing):
  if((maxLvl - minLvl) < TOP) maxLvl = minLvl + TOP;
  minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
  maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)

}

// Input a value 0 to 255 to get a color value.
// The colors are a transition r - g - b - back to r.
uint32_t Wheel(byte WheelPos) {
  if(WheelPos < 85) {
   return strip.Color(WheelPos * 3, 255 - WheelPos * 3, 0);
  } else if(WheelPos < 170) {
   WheelPos -= 85;
   return strip.Color(255 - WheelPos * 3, 0, WheelPos * 3);
  } else {
   WheelPos -= 170;
   return strip.Color(0, WheelPos * 3, 255 - WheelPos * 3);
  }
}


void vu1() {

  uint8_t  i;
  uint16_t minLvl, maxLvl;
  int      n, height;



  n   = analogRead(MIC_PIN);                  // Raw reading
from mic
  n   = abs(n - 512 - DC_OFFSET); // Center on zero
  n   = (n <= NOISE) ? 0 : (n - NOISE);            // Remove
noise/hum
  lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)

  // Calculate bar height based on dynamic min/max levels
(fixed point):
  height = TOP * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

  if(height < 0L)       height = 0;      // Clip output
  else if(height > TOP) height = TOP;
  if(height > peak)     peak   = height; // Keep 'peak' dot at top


  // Color pixels based on rainbow gradient
  for(i=0; i<N_PIXELS_HALF; i++) {
    if(i >= height) {
      strip.setPixelColor(N_PIXELS_HALF-i-1,   0,   0, 0);
      strip.setPixelColor(N_PIXELS_HALF+i,   0,   0, 0);
    }
    else {
      uint32_t color = Wheel(map(i,0,N_PIXELS_HALF-
1,30,150));
      strip.setPixelColor(N_PIXELS_HALF-i-1,color);
      strip.setPixelColor(N_PIXELS_HALF+i,color);
    }

  }
  // Draw peak dot
  if(peak > 0 && peak <= N_PIXELS_HALF-1) {
    uint32_t color = Wheel(map(peak,0,N_PIXELS_HALF-
1,30,150));
    strip.setPixelColor(N_PIXELS_HALF-peak-1,color);
    strip.setPixelColor(N_PIXELS_HALF+peak,color);
  }

  strip.show(); // Update strip

// Every few frames, make the peak pixel drop by 1:

    if(++dotCount >= PEAK_FALL) { //fall rate

      if(peak > 0) peak--;
      dotCount = 0;
    }



  vol[volCount] = n;                      // Save sample for dynamic
leveling
  if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

  // Get volume range of prior frames
  minLvl = maxLvl = vol[0];
  for(i=1; i<SAMPLES; i++) {
    if(vol[i] < minLvl)      minLvl = vol[i];
    else if(vol[i] > maxLvl) maxLvl = vol[i];
  }
  // minLvl and maxLvl indicate the volume range over prior
frames, used
  // for vertically scaling the output graph (so it looks
interesting
  // regardless of volume level).  If they're too close together
though
  // (e.g. at very low volume levels) the graph becomes super
coarse
  // and 'jumpy'...so keep some minimum distance between
them (this
  // also lets the graph go to zero when no sound is playing):
  if((maxLvl - minLvl) < TOP) maxLvl = minLvl + TOP;
  minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
  maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)

}



void vu2()
    {
      unsigned long startMillis= millis();  // Start of sample
window
      float peakToPeak = 0;   // peak-to-peak level

      unsigned int signalMax = 0;
      unsigned int signalMin = 1023;
      unsigned int c, y;

      while (millis() - startMillis < SAMPLE_WINDOW)
```

```
    {
     sample = analogRead(MIC_PIN);
     if (sample < 1024)
     {
      if (sample > signalMax)
      {
       signalMax = sample;
      }
      else if (sample < signalMin)
      {
       signalMin = sample;
      }
     }
    }
    peakToPeak = signalMax - signalMin;

    // Serial.println(peakToPeak);



    for (int i=0;i<=N_PIXELS_HALF-1;i++){
     uint32_t color = Wheel(map(i,0,N_PIXELS_HALF-
1,30,150));
      strip.setPixelColor(N_PIXELS-i,color);
      strip.setPixelColor(0+i,color);
    }


    c = fscale(INPUT_FLOOR, INPUT_CEILING,
N_PIXELS_HALF, 0, peakToPeak, 2);

    if(c < peak) {
      peak = c;       // Keep dot on top
      dotHangCount = 0;    // make the dot hang before falling
    }
    if (c <= strip.numPixels()) { // Fill partial column with off
pixels
      drawLine(N_PIXELS_HALF, N_PIXELS_HALF-c,
strip.Color(0, 0, 0));
      drawLine(N_PIXELS_HALF, N_PIXELS_HALF+c,
strip.Color(0, 0, 0));
    }




    y = N_PIXELS_HALF - peak;
    uint32_t color1 = Wheel(map(y,0,N_PIXELS_HALF-
1,30,150));
    strip.setPixelColor(y-1,color1);
    //strip.setPixelColor(y-
1,Wheel(map(y,0,N_PIXELS_HALF-1,30,150)));

    y = N_PIXELS_HALF + peak;
    strip.setPixelColor(y,color1);

//strip.setPixelColor(y+1,Wheel(map(y,0,N_PIXELS_HALF+1
,30,150)));

    strip.show();

    // Frame based peak dot animation
    if(dotHangCount > PEAK_HANG) { //Peak pause length
     if(++dotCount >= PEAK_FALL2) { //Fall rate
       peak++;
       dotCount = 0;
      }
     }
     else {
      dotHangCount++;
     }
    }


void Vu3() {
 uint8_t i;
 uint16_t minLvl, maxLvl;
 int n, height;

 n = analogRead(MIC_PIN);           // Raw reading from mic
 n = abs(n - 512 - DC_OFFSET);      // Center on zero
 n = (n <= NOISE) ? 0 : (n - NOISE);  // Remove noise/hum
 lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)

 // Calculate bar height based on dynamic min/max levels
(fixed point):
 height = TOP * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

 if (height < 0L)      height = 0;     // Clip output
 else if (height > TOP) height = TOP;
 if (height > peak)     peak   = height; // Keep 'peak' dot at
top

 greenOffset += SPEED;
 blueOffset += SPEED;
 if (greenOffset >= 255) greenOffset = 0;
 if (blueOffset >= 255) blueOffset = 0;

 // Color pixels based on rainbow gradient
 for (i = 0; i < N_PIXELS; i++) {
  if (i >= height) {
   strip.setPixelColor(i, 0, 0, 0);
  } else {
   strip.setPixelColor(i, Wheel(
    map(i, 0, strip.numPixels() - 1, (int)greenOffset,
(int)blueOffset)
    ));
  }
 }
 // Draw peak dot
 if(peak > 0 && peak <= N_PIXELS-1)
strip.setPixelColor(peak,Wheel(map(peak,0,strip.numPixels(
)-1,30,150)));

  strip.show(); // Update strip

// Every few frames, make the peak pixel drop by 1:

  if(++dotCount >= PEAK_FALL) { //fall rate

   if(peak > 0) peak--;
   dotCount = 0;
  }
 strip.show();  // Update strip

 vol[volCount] = n;
```

```
 if (++volCount >= SAMPLES) {
  volCount = 0;
 }

 // Get volume range of prior frames
 minLvl = maxLvl = vol[0];
 for (i = 1; i < SAMPLES; i++) {
  if (vol[i] < minLvl) {
   minLvl = vol[i];
  } else if (vol[i] > maxLvl) {
   maxLvl = vol[i];
  }
 }

 // minLvl and maxLvl indicate the volume range over prior
frames, used
 // for vertically scaling the output graph (so it looks
interesting
 // regardless of volume level).  If they're too close together
though
 // (e.g. at very low volume levels) the graph becomes super
coarse
 // and 'jumpy'...so keep some minimum distance between
them (this
 // also lets the graph go to zero when no sound is playing):
 if ((maxLvl - minLvl) < TOP) {
  maxLvl = minLvl + TOP;
 }
 minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
 maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)
}


void Vu4() {
   uint8_t  i;
 uint16_t minLvl, maxLvl;
 int      n, height;

 n   = analogRead(MIC_PIN);                  // Raw reading
from mic
 n   = abs(n - 512 - DC_OFFSET); // Center on zero
 n   = (n <= NOISE) ? 0 : (n - NOISE);             // Remove
noise/hum
 lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)

 // Calculate bar height based on dynamic min/max levels
(fixed point):
 height = TOP * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

 if(height < 0L)       height = 0;     // Clip output
 else if(height > TOP) height = TOP;
 if(height > peak)     peak   = height; // Keep 'peak' dot at top
 greenOffset += SPEED;
 blueOffset += SPEED;
 if (greenOffset >= 255) greenOffset = 0;
 if (blueOffset >= 255) blueOffset = 0;

 // Color pixels based on rainbow gradient
 for(i=0; i<N_PIXELS_HALF; i++) {
  if(i >= height) {
   strip.setPixelColor(N_PIXELS_HALF-i-1,   0,   0, 0);
   strip.setPixelColor(N_PIXELS_HALF+i,   0,   0, 0);
  }
  else {
   uint32_t color = Wheel(map(i,0,N_PIXELS_HALF-
1,(int)greenOffset, (int)blueOffset));
   strip.setPixelColor(N_PIXELS_HALF-i-1,color);
   strip.setPixelColor(N_PIXELS_HALF+i,color);
  }

 }

 // Draw peak dot
 if(peak > 0 && peak <= N_PIXELS_HALF-1) {
  uint32_t color = Wheel(map(peak,0,N_PIXELS_HALF-
1,30,150));
  strip.setPixelColor(N_PIXELS_HALF-peak-1,color);
  strip.setPixelColor(N_PIXELS_HALF+peak,color);
 }

 strip.show(); // Update strip

// Every few frames, make the peak pixel drop by 1:

  if(++dotCount >= PEAK_FALL) { //fall rate

   if(peak > 0) peak--;
   dotCount = 0;
  }


 vol[volCount] = n;                  // Save sample for dynamic
leveling
 if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

 // Get volume range of prior frames
 minLvl = maxLvl = vol[0];
 for(i=1; i<SAMPLES; i++) {
  if(vol[i] < minLvl)      minLvl = vol[i];
  else if(vol[i] > maxLvl) maxLvl = vol[i];
 }
 // minLvl and maxLvl indicate the volume range over prior
frames, used
 // for vertically scaling the output graph (so it looks
interesting
 // regardless of volume level).  If they're too close together
though
 // (e.g. at very low volume levels) the graph becomes super
coarse
 // and 'jumpy'...so keep some minimum distance between
them (this
 // also lets the graph go to zero when no sound is playing):
 if((maxLvl - minLvl) < TOP) maxLvl = minLvl + TOP;
 minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
 maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)

}

void Vu5()
{
 uint8_t  i;
```

```
  uint16_t minLvl, maxLvl;
  int      n, height;

  n   = analogRead(MIC_PIN);                  // Raw reading
from mic
  n   = abs(n - 512 - DC_OFFSET); // Center on zero
  n   = (n <= NOISE) ? 0 : (n - NOISE);             // Remove
noise/hum
  lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)

  // Calculate bar height based on dynamic min/max levels
(fixed point):
  height = TOP2 * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

  if(height < 0L)       height = 0;      // Clip output
  else if(height > TOP2) height = TOP2;
  if(height > peak)     peak   = height; // Keep 'peak' dot at top


#ifdef CENTERED
 // Color pixels based on rainbow gradient
  for(i=0; i<(N_PIXELS/2); i++) {
    if(((N_PIXELS/2)+i) >= height)
    {
      strip.setPixelColor(((N_PIXELS/2) + i),   0,   0, 0);
      strip.setPixelColor(((N_PIXELS/2) - i),   0,   0, 0);
    }
    else
    {
      strip.setPixelColor(((N_PIXELS/2) +
i),Wheel(map(((N_PIXELS/2) + i),0,strip.numPixels()-
1,30,150)));
      strip.setPixelColor(((N_PIXELS/2) -
i),Wheel(map(((N_PIXELS/2) - i),0,strip.numPixels()-
1,30,150)));
    }
  }

  // Draw peak dot
  if(peak > 0 && peak <= LAST_PIXEL_OFFSET)
  {
    strip.setPixelColor(((N_PIXELS/2) + peak),255,255,255);
// (peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
    strip.setPixelColor(((N_PIXELS/2) - peak),255,255,255);
// (peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
  }
#else
  // Color pixels based on rainbow gradient
  for(i=0; i<N_PIXELS; i++)
  {
    if(i >= height)
    {
      strip.setPixelColor(i,   0,   0, 0);
    }
    else
    {
      strip.setPixelColor(i,Wheel(map(i,0,strip.numPixels()-
1,30,150)));
    }
  }

  // Draw peak dot
  if(peak > 0 && peak <= LAST_PIXEL_OFFSET)
  {
    strip.setPixelColor(peak,255,255,255); //
(peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
  }

#endif

  // Every few frames, make the peak pixel drop by 1:

  if (millis() - lastTime >= PEAK_FALL_MILLIS)
  {
    lastTime = millis();

    strip.show(); // Update strip

    //fall rate
    if(peak > 0) peak--;
    }

  vol[volCount] = n;                      // Save sample for dynamic
leveling
  if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

  // Get volume range of prior frames
  minLvl = maxLvl = vol[0];
  for(i=1; i<SAMPLES; i++)
  {
    if(vol[i] < minLvl)      minLvl = vol[i];
    else if(vol[i] > maxLvl) maxLvl = vol[i];
  }
  // minLvl and maxLvl indicate the volume range over prior
frames, used
  // for vertically scaling the output graph (so it looks
interesting
  // regardless of volume level).  If they're too close together
though
  // (e.g. at very low volume levels) the graph becomes super
coarse
  // and 'jumpy'...so keep some minimum distance between
them (this
  // also lets the graph go to zero when no sound is playing):
  if((maxLvl - minLvl) < TOP2) maxLvl = minLvl + TOP2;
  minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
  maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)
}

void Vu6()
{
  uint8_t  i;
  uint16_t minLvl, maxLvl;
  int      n, height;

  n   = analogRead(MIC_PIN);                  // Raw reading
from mic
  n   = abs(n - 512 - DC_OFFSET); // Center on zero
  n   = (n <= NOISE) ? 0 : (n - NOISE);             // Remove
noise/hum
  lvl = ((lvl * 7) + n) >> 3;    // "Dampened" reading (else
looks twitchy)
```

```
  // Calculate bar height based on dynamic min/max levels
(fixed point):
  height = TOP2 * (lvl - minLvlAvg) / (long)(maxLvlAvg -
minLvlAvg);

  if(height < 0L)       height = 0;      // Clip output
  else if(height > TOP2) height = TOP2;
  if(height > peak)     peak   = height; // Keep 'peak' dot at top


#ifdef CENTERED
  // Draw peak dot
  if(peak > 0 && peak <= LAST_PIXEL_OFFSET)
  {
    strip.setPixelColor(((N_PIXELS/2) + peak),255,255,255);
// (peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
    strip.setPixelColor(((N_PIXELS/2) - peak),255,255,255);
// (peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
  }
#else
  // Color pixels based on rainbow gradient
  for(i=0; i<N_PIXELS; i++)
  {
    if(i >= height)
    {
      strip.setPixelColor(i,   0,   0, 0);
    }
    else
    {
    }
  }

  // Draw peak dot
  if(peak > 0 && peak <= LAST_PIXEL_OFFSET)
  {
    strip.setPixelColor(peak,0,0,255); //
(peak,Wheel(map(peak,0,strip.numPixels()-1,30,150)));
  }

#endif

  // Every few frames, make the peak pixel drop by 1:

  if (millis() - lastTime >= PEAK_FALL_MILLIS)
  {
    lastTime = millis();

    strip.show(); // Update strip

    //fall rate
    if(peak > 0) peak--;
    }

  vol[volCount] = n;                      // Save sample for dynamic
leveling
  if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

  // Get volume range of prior frames
  minLvl = maxLvl = vol[0];
  for(i=1; i<SAMPLES; i++)
  {
    if(vol[i] < minLvl)      minLvl = vol[i];
    else if(vol[i] > maxLvl) maxLvl = vol[i];
  }
  // minLvl and maxLvl indicate the volume range over prior
frames, used
  // for vertically scaling the output graph (so it looks
interesting
  // regardless of volume level).  If they're too close together
though
  // (e.g. at very low volume levels) the graph becomes super
coarse
  // and 'jumpy'...so keep some minimum distance between
them (this
  // also lets the graph go to zero when no sound is playing):
  if((maxLvl - minLvl) < TOP2) maxLvl = minLvl + TOP2;
  minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
  maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)
}

void vu7() {

  EVERY_N_MILLISECONDS(1000) {
    peakspersec = peakcount;                          // Count the
peaks per second. This value will become the foreground
hue.
    peakcount = 0;                                    // Reset the
counter every second.
  }

  soundmems();

  EVERY_N_MILLISECONDS(20) {
   ripple3();
  }

   show_at_max_brightness_for_power();

} // loop()


void soundmems() {                                    // Rolling
average counter - means we don't have to go through an
array each time.
  newtime = millis();
  int tmp = analogRead(MIC_PIN) - 512;
  sample = abs(tmp);

  int potin = map(analogRead(POT_PIN), 0, 1023, 0, 60);

  samplesum = samplesum + sample -
samplearray[samplecount];       // Add the new sample and
remove the oldest sample in the array
  sampleavg = samplesum / NSAMPLES;                   //
Get an average
  samplearray[samplecount] = sample;                  //
Update oldest sample in the array with new sample
  samplecount = (samplecount + 1) % NSAMPLES;
// Update the counter for the array

  if (newtime > (oldtime + 200)) digitalWrite(13, LOW);
// Turn the LED off 200ms after the last peak.
```

```
  if ((sample > (sampleavg + potin)) && (newtime > (oldtime
+ 60)) ) { // Check for a peak, which is 30 > the average, but
wait at least 60ms for another.
    step = -1;
    peakcount++;
    digitalWrite(13, HIGH);
    oldtime = newtime;
  }
}  // soundmems()



void ripple3() {
  for (int i = 0; i < N_PIXELS; i++) leds[i] = CHSV(bgcol, 255,
sampleavg*2);  // Set the background colour.

  switch (step) {

    case -1:                                        // Initialize ripple
variables.
      center = random(N_PIXELS);
      colour = (peakspersec*10) % 255;
// More peaks/s = higher the hue colour.
      step = 0;
      bgcol = bgcol+8;
      break;

    case 0:
      leds[center] = CHSV(colour, 255, 255);                    //
Display the first pixel of the ripple.
      step ++;
      break;

    case maxsteps:                                  // At the end of
the ripples.
      // step = -1;
      break;

    default:                                        // Middle of the
ripples.
      leds[(center + step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);      // Simple wrap from
Marc Miller.
      leds[(center - step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);
      step ++;                                      // Next step.
      break;
  } // switch step
} // ripple()



void vu8() {
  int intensity = calculateIntensity();
  updateOrigin(intensity);
  assignDrawValues(intensity);
  writeSegmented();
  updateGlobals();
}

int calculateIntensity() {
  int     intensity;

  reading   = analogRead(MIC_PIN);                  // Raw
reading from mic
  reading   = abs(reading - 512 - DC_OFFSET); // Center on
zero
  reading   = (reading <= NOISE) ? 0 : (reading - NOISE);
// Remove noise/hum
  lvl = ((lvl * 7) + reading) >> 3;    // "Dampened" reading
(else looks twitchy)

  // Calculate bar height based on dynamic min/max levels
(fixed point):
  intensity = DRAW_MAX * (lvl - minLvlAvg) /
(long)(maxLvlAvg - minLvlAvg);

  return constrain(intensity, 0, DRAW_MAX-1);
}

void updateOrigin(int intensity) {
  // detect peak change and save origin at curve vertex
  if (growing && intensity < last_intensity) {
    growing = false;
    intensity_max = last_intensity;
    fall_from_left = !fall_from_left;
    origin_at_flip = origin;
  } else if (intensity > last_intensity) {
    growing = true;
    origin_at_flip = origin;
  }
  last_intensity = intensity;

  // adjust origin if falling
  if (!growing) {
    if (fall_from_left) {
      origin = origin_at_flip + ((intensity_max - intensity) / 2);
    } else {
      origin = origin_at_flip - ((intensity_max - intensity) / 2);
    }
    // correct for origin out of bounds
    if (origin < 0) {
      origin = DRAW_MAX - abs(origin);
    } else if (origin > DRAW_MAX - 1) {
      origin = origin - DRAW_MAX - 1;
    }
  }
}

void assignDrawValues(int intensity) {
  // draw amplitue as 1/2 intensity both directions from
origin
  int min_lit = origin - (intensity / 2);
  int max_lit = origin + (intensity / 2);
  if (min_lit < 0) {
    min_lit = min_lit + DRAW_MAX;
  }
  if (max_lit >= DRAW_MAX) {
    max_lit = max_lit - DRAW_MAX;
  }
  for (int i=0; i < DRAW_MAX; i++) {
    // if i is within origin +/- 1/2 intensity
    if (
      (min_lit < max_lit && min_lit < i && i < max_lit) // range
is within bounds and i is within range
      || (min_lit > max_lit && (i > min_lit || i < max_lit)) //
range wraps out of bounds and i is within that wrap
    ) {
      draw[i] = Wheel(scroll_color);
```

```
   } else {
     draw[i] = 0;
   }
  }
}

void writeSegmented() {
  int seg_len = N_PIXELS / SEGMENTS;

  for (int s = 0; s < SEGMENTS; s++) {
    for (int i = 0; i < seg_len; i++) {
      strip.setPixelColor(i + (s*seg_len), draw[map(i, 0, seg_len,
0, DRAW_MAX)]);
    }
  }
  strip.show();
}

uint32_t * segmentAndResize(uint32_t* draw) {
  int seg_len = N_PIXELS / SEGMENTS;

  uint32_t segmented[N_PIXELS];
  for (int s = 0; s < SEGMENTS; s++) {
    for (int i = 0; i < seg_len; i++) {
      segmented[i + (s * seg_len) ] = draw[map(i, 0, seg_len, 0,
DRAW_MAX)];
    }
  }

  return segmented;
}

void writeToStrip(uint32_t* draw) {
  for (int i = 0; i < N_PIXELS; i++) {
    strip.setPixelColor(i, draw[i]);
  }
  strip.show();
}

void updateGlobals() {
  uint16_t minLvl, maxLvl;

  //advance color wheel
  color_wait_count++;
  if (color_wait_count > COLOR_WAIT_CYCLES) {
    color_wait_count = 0;
    scroll_color++;
    if (scroll_color > COLOR_MAX) {
      scroll_color = COLOR_MIN;
    }
  }

  vol[volCount] = reading;                    // Save sample for
dynamic leveling
  if(++volCount >= SAMPLES) volCount = 0; //
Advance/rollover sample counter

  // Get volume range of prior frames
  minLvl = maxLvl = vol[0];
  for(uint8_t i=1; i<SAMPLES; i++) {
    if(vol[i] < minLvl)      minLvl = vol[i];
    else if(vol[i] > maxLvl) maxLvl = vol[i];
  }
  // minLvl and maxLvl indicate the volume range over prior
frames, used
  // for vertically scaling the output graph (so it looks
interesting
  // regardless of volume level).  If they're too close together
though
  // (e.g. at very low volume levels) the graph becomes super
coarse
  // and 'jumpy'...so keep some minimum distance between
them (this
  // also lets the graph go to zero when no sound is playing):
  if((maxLvl - minLvl) < N_PIXELS) maxLvl = minLvl +
N_PIXELS;
  minLvlAvg = (minLvlAvg * 63 + minLvl) >> 6; // Dampen
min/max levels
  maxLvlAvg = (maxLvlAvg * 63 + maxLvl) >> 6; // (fake
rolling average)
}




void vu9() {
  //currentBlending = LINEARBLEND;
  currentPalette = OceanColors_p;                 // Initial
palette.
  currentBlending = LINEARBLEND;
  EVERY_N_SECONDS(5) {                            // Change the
palette every 5 seconds.
    for (int i = 0; i < 16; i++) {
      targetPalette[i] = CHSV(random8(), 255, 255);
    }
  }

  EVERY_N_MILLISECONDS(100) {                     //
AWESOME palette blending capability once they do change.
    uint8_t maxChanges = 24;
    nblendPaletteTowardPalette(currentPalette, targetPalette,
maxChanges);
  }


  EVERY_N_MILLIS_I(thistimer,20) {                // For fun,
let's make the animation have a variable rate.
    uint8_t timeval = beatsin8(10,20,50);         // Use a
sinewave for the line below. Could also use peak/beat
detection.
    thistimer.setPeriod(timeval);                 // Allows you
to change how often this routine runs.
    fadeToBlackBy(leds, N_PIXELS, 16);            // 1 =
slow, 255 = fast fade. Depending on the faderate, the LED's
further away will fade out.
    sndwave();
    soundble();
  }
  FastLED.setBrightness(max_bright);
  FastLED.show();

} // loop()



void soundble() {                                 // Quick and dirty
sampling of the microphone.
```

```
  int tmp = analogRead(MIC_PIN) - 512 - DC_OFFSET;
  sample = abs(tmp);

}  // soundmems()



void sndwave() {

  leds[N_PIXELS/2] = ColorFromPalette(currentPalette,
sample, sample*2, currentBlending); // Put the sample into
the center

  for (int i = N_PIXELS - 1; i > N_PIXELS/2; i--) {      //move to
the left     // Copy to the left, and let the fade do the rest.
    leds[i] = leds[i - 1];
  }

  for (int i = 0; i < N_PIXELS/2; i++) {                 // move to the
right    // Copy to the right, and let the fade to the rest.
    leds[i] = leds[i + 1];
  }
  addGlitter(sampleavg);
}

void vu10() {

EVERY_N_SECONDS(5) {                                     // Change the
target palette to a random one every 5 seconds.
    static uint8_t baseC = random8();                    // You can
use this as a baseline colour if you want similar hues in the
next line.

    for (int i = 0; i < 16; i++) {
      targetPalette[i] = CHSV(random8(), 255, 255);
    }
  }

  EVERY_N_MILLISECONDS(100) {
    uint8_t maxChanges = 24;
    nblendPaletteTowardPalette(currentPalette, targetPalette,
maxChanges);   // AWESOME palette blending capability.
  }

  EVERY_N_MILLISECONDS(thisdelay) {                      //
FastLED based non-blocking delay to update/display the
sequence.
    soundtun();
    FastLED.setBrightness(max_bright);
    FastLED.show();
  }
} // loop()



void soundtun() {

  int n;
  n = analogRead(MIC_PIN);                               // Raw
reading from mic
  n = qsuba(abs(n-512), 10);                             // Center on
zero and get rid of low level noise

  CRGB newcolour = ColorFromPalette(currentPalette,
constrain(n,0,255), constrain(n,0,255), currentBlending);
  nblend(leds[0], newcolour, 128);

  for (int i = N_PIXELS-1; i>0; i--) {
    leds[i] = leds[i-1];
  }

} // soundmems()


void vu11() {

  EVERY_N_MILLISECONDS(1000) {
    peakspersec = peakcount;                             // Count the
peaks per second. This value will become the foreground
hue.
    peakcount = 0;                                       // Reset the counter
every second.
  }

  soundrip();

  EVERY_N_MILLISECONDS(20) {
   rippled();
  }

   FastLED.show();

} // loop()


void soundrip() {                                        // Rolling average
counter - means we don't have to go through an array each
time.

  newtime = millis();
  int tmp = analogRead(MIC_PIN) - 512;
  sample = abs(tmp);

  int potin = map(analogRead(POT_PIN), 0, 1023, 0, 60);

  samplesum = samplesum + sample -
samplearray[samplecount];  // Add the new sample and
remove the oldest sample in the array
  sampleavg = samplesum / NSAMPLES;                      // Get
an average

  Serial.println(sampleavg);


  samplearray[samplecount] = sample;                     //
Update oldest sample in the array with new sample
  samplecount = (samplecount + 1) % NSAMPLES;            //
Update the counter for the array

  if (newtime > (oldtime + 200)) digitalWrite(13, LOW);
// Turn the LED off 200ms after the last peak.

  if ((sample > (sampleavg + potin)) && (newtime > (oldtime
+ 60)) ) { // Check for a peak, which is 30 > the average, but
wait at least 60ms for another.
    step = -1;
    peakcount++;
```

```
   oldtime = newtime;
 }

}  // soundmems()



void rippled() {

 fadeToBlackBy(leds, N_PIXELS, 64);                    // 8 bit, 1
= slow, 255 = fast

 switch (step) {

   case -1:                                  // Initialize ripple
variables.
     center = random(N_PIXELS);
     colour = (peakspersec*10) % 255;                  // More
peaks/s = higher the hue colour.
     step = 0;
     break;

   case 0:
     leds[center] = CHSV(colour, 255, 255);              //
Display the first pixel of the ripple.
     step ++;
     break;

   case maxsteps:                                // At the end of the
ripples.
     // step = -1;
     break;

   default:                                  // Middle of the ripples.
     leds[(center + step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);       // Simple wrap from
Marc Miller.
     leds[(center - step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);
     step ++;                                  // Next step.
     break;
 } // switch step

} // ripple()


 //Used to draw a line between two points of a given color
   void drawLine(uint8_t from, uint8_t to, uint32_t c) {
     uint8_t fromTemp;
     if (from > to) {
       fromTemp = from;
       from = to;
       to = fromTemp;
     }
     for(int i=from; i<=to; i++){
       strip.setPixelColor(i, c);
     }
   }

void setPixel(int Pixel, byte red, byte green, byte blue) {
   strip.setPixelColor(Pixel, strip.Color(red, green, blue));

}

void setAll(byte red, byte green, byte blue) {

 for(int i = 0; i < N_PIXELS; i++ ) {

   setPixel(i, red, green, blue);

 }

 strip.show();

}
void vu12() {

 EVERY_N_MILLISECONDS(1000) {
   peakspersec = peakcount;                          // Count the
peaks per second. This value will become the foreground
hue.
   peakcount = 0;                                  // Reset the counter
every second.
 }

 soundripped();

 EVERY_N_MILLISECONDS(20) {
 rippvu();
 }

  FastLED.show();

} // loop()


void soundripped() {                                 // Rolling
average counter - means we don't have to go through an
array each time.

 newtime = millis();
 int tmp = analogRead(MIC_PIN) - 512;
 sample = abs(tmp);

 int potin = map(analogRead(POT_PIN), 0, 1023, 0, 60);

 samplesum = samplesum + sample -
samplearray[samplecount];  // Add the new sample and
remove the oldest sample in the array
 sampleavg = samplesum / NSAMPLES;                   // Get
an average

 Serial.println(sampleavg);


 samplearray[samplecount] = sample;                  //
Update oldest sample in the array with new sample
 samplecount = (samplecount + 1) % NSAMPLES;         //
Update the counter for the array

 if (newtime > (oldtime + 200)) digitalWrite(13, LOW);
// Turn the LED off 200ms after the last peak.

 if ((sample > (sampleavg + potin)) && (newtime > (oldtime
+ 60)) ) { // Check for a peak, which is 30 > the average, but
wait at least 60ms for another.
   step = -1;
```

```
    peakcount++;
    oldtime = newtime;
  }

}  // soundmems()
void rippvu() {                                         // Display
ripples triggered by peaks.

fadeToBlackBy(leds, N_PIXELS, 64);                      // 8 bit, 1 =
slow, 255 = fast

  switch (step) {

    case -1:                                    // Initialize ripple
variables.
      center = random(N_PIXELS);
      colour = (peakspersec*10) % 255;                  // More
peaks/s = higher the hue colour.
      step = 0;
      break;

    case 0:
      leds[center] = CHSV(colour, 255, 255);            //
Display the first pixel of the ripple.
      step ++;
      break;

    case maxsteps:                              // At the end of the
ripples.
      // step = -1;
      break;

    default:                                    // Middle of the ripples.
      leds[(center + step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);       // Simple wrap from
Marc Miller.
      leds[(center - step + N_PIXELS) % N_PIXELS] +=
CHSV(colour, 255, myfade/step*2);
      step ++;                                  // Next step.
      break;
  } // switch step
   addGlitter(sampleavg);
} // ripple()



void vu13() {                                           // The
>>>>>>>>>> L-O-O-P <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
is buried here!!!11!1!


  EVERY_N_MILLISECONDS(1000) {
    peakspersec = peakcount;                        // Count the
peaks per second. This value will become the foreground
hue.
    peakcount = 0;                              // Reset the counter
every second.
  }

  soundripper();

  EVERY_N_MILLISECONDS(20) {
  jugglep();
  }

  FastLED.show();

} // loop()


void soundripper() {                                    // Rolling
average counter - means we don't have to go through an
array each time.

  newtime = millis();
  int tmp = analogRead(MIC_PIN) - 512;
  sample = abs(tmp);

  int potin = map(analogRead(POT_PIN), 0, 1023, 0, 60);

  samplesum = samplesum + sample -
samplearray[samplecount];  // Add the new sample and
remove the oldest sample in the array
  sampleavg = samplesum / NSAMPLES;                     // Get
an average

  Serial.println(sampleavg);


  samplearray[samplecount] = sample;                    //
Update oldest sample in the array with new sample
  samplecount = (samplecount + 1) % NSAMPLES;           //
Update the counter for the array

  if (newtime > (oldtime + 200)) digitalWrite(13, LOW);
// Turn the LED off 200ms after the last peak.

  if ((sample > (sampleavg + potin)) && (newtime > (oldtime
+ 60)) ) { // Check for a peak, which is 30 > the average, but
wait at least 60ms for another.
    step = -1;
    peakcount++;
    oldtime = newtime;
                                        // Change the current pattern
function periodically.
    jugglep();
  }

} // loop()


void jugglep() {                                        // Use the
juggle routine, but adjust the timebase based on sampleavg
for some randomness.

// Persistent local variables
  static uint8_t thishue=0;

  timeval = 40;                                         // Our
EVERY_N_MILLIS_I timer value.

  leds[0] = ColorFromPalette(currentPalette, thishue++,
sampleavg, LINEARBLEND);

  for (int i = N_PIXELS-1; i >0 ; i-- ) leds[i] = leds[i-1];

  addGlitter(sampleavg/2);                              //
Add glitter based on sampleavg. By Andrew Tuline.
```

```
} // matrix()



// Input a value 0 to 255 to get a color value.
// The colours are a transition r - g - b - back to r.
uint32_t Wheel(byte WheelPos, float opacity) {

 if(WheelPos < 85) {
  return strip.Color((WheelPos * 3) * opacity, (255 -
WheelPos * 3) * opacity, 0);
 }
 else if(WheelPos < 170) {
  WheelPos -= 85;
  return strip.Color((255 - WheelPos * 3) * opacity, 0,
(WheelPos * 3) * opacity);
 }
 else {
  WheelPos -= 170;
  return strip.Color(0, (WheelPos * 3) * opacity, (255 -
WheelPos * 3) * opacity);
 }
}


void addGlitter( fract8 chanceOfGlitter) {
// Let's add some glitter, thanks to Mark

 if( random8() < chanceOfGlitter) {
  leds[random16(N_PIXELS)] += CRGB::White;
 }

} // addGlitter()
// List of patterns to cycle through.  Each is defined as a
separate function below.
```

```
typedef void (*SimplePatternList[])();
SimplePatternList qPatterns = {vu, vu1, vu2, Vu3, Vu4, Vu5,
Vu6, vu7, vu8, vu9, vu10, vu11, vu12, vu13};
uint8_t qCurrentPatternNumber = 0; // Index number of
which pattern is current

void nextPattern2()
{
 // add one to the current pattern number, and wrap around
at the end
 qCurrentPatternNumber = (qCurrentPatternNumber + 1)
% ARRAY_SIZE( qPatterns);
}
void All2()
{
 // Call the current pattern function once, updating the 'leds'
array
 qPatterns[qCurrentPatternNumber]();
 EVERY_N_SECONDS( 30 ) { nextPattern2(); } // change
patterns periodically
}
```

Source code reference:
https://www.mediafire.com/file/n0g8d6bc0yk24y6/VU_METER_HI_TECH_GALLERY.zip/file