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https://learn.adafruit.com/adafruit-microphone-amplifier-breakout/measuring-sound-levels

Goal:

Use a microcontroller, peripheral(s), and component(s) to design and build a "product" prototype that uses one or more embedded systems that meets a human need. You can add components that you make yourself (e.g. a paper propeller or prosthetic limb). Be creative. If required, you can acquire or simulate data to be processed by your embedded system. You must create a poster to display on the last day of class and a TV commercial video that is put on YouTube. Be sure to specify the requirements of your project in the poster. The poster, video, and product should include what is described below.

I. Poster components:

1. *Title and Team Members* (5 pts)
2. *Abstract* – summary of project and outcomes (10 pts)
3. *Problem* – description of human or societal need using research (20 pts)
4. *Background* – related systems or products, interviews of people to find need, or research of problem. **Should include list of embedded systems concepts incorporated** (20 pts)
5. *Approach* – requirements and design of "product", include picture(s) and diagram(s) (30 points)
6. *Evaluation* – any (potential) customer feedback, cost of design, and YouTube video link (10pts)
7. *Conclusions* – description of results and any future work to be done (5 pts)
8. *References and acknowledgements* – cite referenced websites, papers, data, software, and code or designs that you used or modified (10 points)

Names:
Blake Morrell, Charlie Carr, Abdullah Alotibi, Christopher Benjamin, Warren Bower, Josh High

Abstract: Create an LED light show based off sound input.

Problem:

Background:

Approach:

Evaluation:

Conclusions:

References:

Parts

To Buy:

1) Arduino display:
    a) https://www.adafruit.com/product/2026?gclid=CjwKCAjwm-fkBRBBEiwA966fZBwN-vrPxjhVXPU58zyZp3aIStk2zZHpo96FnMZIrr0yGDdXg84NYRoC7dEQAvD_BwE
2) Arduino kit:
    a) https://store.arduino.cc/usa/arduino-starter-kit
3) Sound sensor
    a) https://www.newegg.com/Product/Product.aspx?Item=9SIADG45WJ3684&ignorebbr=1&source=region&nm_mc=KNC-GoogleMKP-PC&cm_mmc=KNC-GoogleMKP-PC-_-pla-Keyboardmall-_-Gadgets-_-9SIADG45WJ3684&gclid=CjwKCAjwm-fkBRBBEiwA966fZEC8o6-vpV0QzzqAXYOBYf6zHDDXqnlK5SEm4KVeHnwxBnnXwqpgKBoC7u0QAvD_BwE&gclsrc=aw.ds

Other Useful Information:

Info parts for led display:
https://learn.adafruit.com/rgb-matrix-featherwing

Link to code library for above part:
https://learn.adafruit.com/32x16-32x32-rgb-led-matrix/

Basically what we're going for:
https://learn.adafruit.com/assets/59612

Arduino sound sensor (maybe):
https://www.amazon.com/DAOKI-Sensitivity-Microphone-Detection-Arduino/dp/B00XT0PH10

Preliminary Design Report

Date 4/1/2019

Product Title: Sound Solutions

Team Members: Blake Morrell, Abdullah Alotibi, Charlie Carr, Josh High, Warren Bower, Chris Benjamin
Team Contact: Blake Morrell

I. INTRODUCTION (Blake)

– what is your product idea, what will it do, and why the customer would need it

1. Write a paragraph on what your product is, what it will do, and why a customer would want it. (20 points)

- Sound Solutions is a new company that was founded by six EECS students at the University of Kansas. Our team is capable of creating a product that will accurately detect the loudness of sound. The JAWB2C6 seeks to provide multiple sound-related functions, yet the company's first objective is to design a system that detects sound input and stores it as an integer value. From here, the user may pick how LEDs display the reading. When our team determines how to do this, the sky becomes the limit. Additional features we are considering adding at this point include volume comparisons, visual display, and picture games. The quality of the sound sensors caps our product's potential, as creating a nuanced game will require a highly accurate decibel reading. Overall, the product blueprint allows flexibility in the design process. Once our product hits the market, we expect consumers to take interest in an inexpensive feedback device that assists anyone concerned with loudness. Our target audience includes choirs, bands, and orchestras. While our target audience is likely to take interest in the JAWB2C6, we believe that ordinary music listeners will consider our product to supplement their own stereo systems. Those who are deaf can experience music in a completely different manner. Avid gamers may find a good use of our product, as certain in-game sounds may tip off a player of their surroundings. Sound plays a vital role in our society. The JAWB2C6 aims to expand the way humans look at sound.

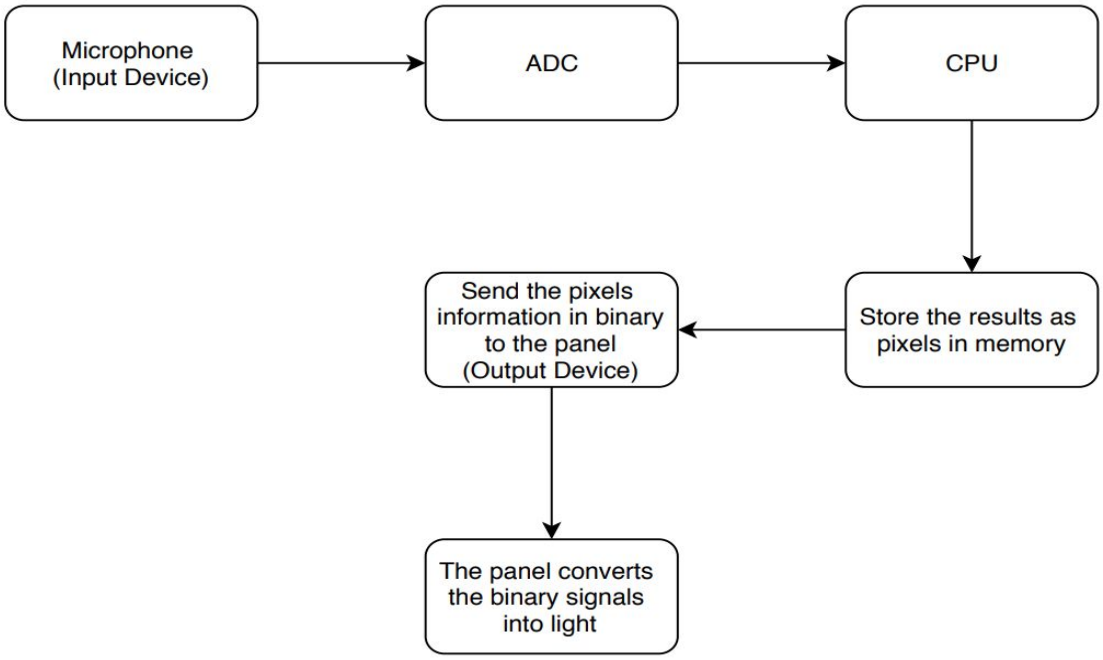
II. EMBEDDED SYSTEM (Charlie)

1. Describe what aspects of an embedded system your product will need in a paragraph (e.g. ADC). (20 points)

– what microcontroller is being used, and any required components or peripherals for embedded system

The Arduino is the microcontroller for the system. It will be operating in conjunction with the sound sensors and LED display. The sound sensors detect an input, while the LEDs give the response.

--Block diagram: how the components are connected together and how data flows



--User interaction:

The user emits a sound for the sound sensor to detect. Either the user or his/her environment can create this sound. Once the sensor reads the sound, it stores the value to be measured. Depending on the magnitude of the reading, a certain amount of bars will appear on the Arduino. A higher reading means more bars, and a lower reading means less bars. This gives the user a visual of the reading's magnitude. The user also has the ability to change the color of the display.

III. SPECIFICATIONS (Chris)

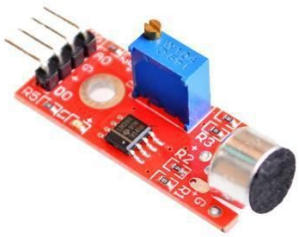
Research a microcontroller, sensor, and an actuator that can be used in your product. Describe each of these in a paragraph and use at least one image or plot for each of these three items. (30 points)

Specifications of microcontroller, sensor(s), actuator(s) – using images, plots, etc.

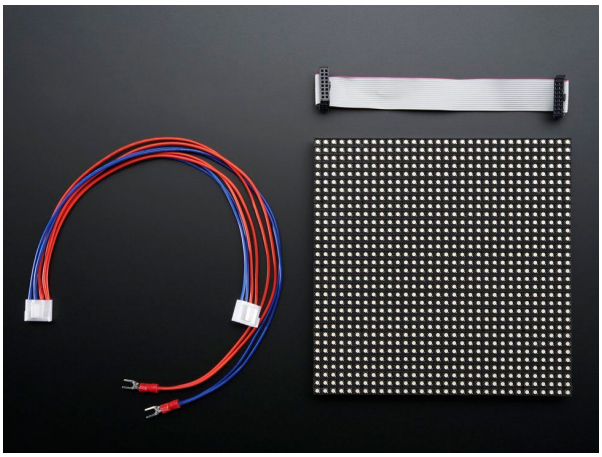
A. Microcontroller

ARDUINO UNO REV3	Specs:
	Microcontroller ATmega328P Operating Voltage 5V Input Voltage (recommended) 7-12V Input Voltage (limit) 6-20V Digital I/O Pins 14 (of which 6 provide PWM output) PWM Digital I/O Pins 6 Analog Input Pins 6 DC Current per I/O Pin 20 mA DC Current for 3.3V Pin 50 mA Flash Memory 32 KB (ATmega328P) of which 0.5 KB used by bootloader SRAM 2 KB (ATmega328P) EEPROM 1 KB (ATmega328P) Clock Speed 16 MHz LED_BUILTIN 13 Length 68.6 mm Width 53.4 mm Weight 25 g o **8-channel 10-bit ADC in TQFP and QFN/MLF package**

B. Sensor

Sound Microphone Sensor Detection Module for Arduino AVR PIC	Specs:
	Type :Logic ICs 1. AO, analog output, real-time output voltage signal of the microphone 2. DO, when the sound intensity reaches a certain threshold, the output high and low signal Module features: 1. there is a mounting screw hole 3mm 2. the use 5v DC power supply 3. with analog output 4. there are threshold level output flip 5. high sensitive microphone and high sensitivity. 6. a power indicator light 7. the comparator output is light

C. Actuator

32x32 RGB LED Matrix Panel	Specs:
	DATASHEET LINK: http://adafruit.com/datasheets/2026datasheet.pdf • 5V regulated power input, 4A max (all LEDs on) • 5V logic • 2000 mcd LEDs on 5mm pitch • 1/16 scan rate • Indoor display, 160 degree visibility

IV. TOOLS (Josh)

Describe what tools are needed to program your microcontroller. Download the tools and run through a sample program. Describe this process in a paragraph. (20 points)

A. Arduino Software

B. Java

I downloaded the Arduino Software IDE from https://www.arduino.cc/en/guide/windows#toc1. After downloading I simply ran the installer to install it onto my PC. The Arduino Software has several tabs, corresponding to their respective names. The tabs are Basics, Digital, Analog, Communication, Control Structures, Sensor, Display, Strings, USB, Starterkit, and Arduino ISP. Looking through the details of the different tabs, I expect our project to use the Basics, Digita, and Analog tab mainly in our project.

C. Github https://github.com/Bmorrell23/SoundSolutions

V. PARTS LIST (Abdullah)

Item	Description	QTY	Cost	URL
1	High sensitivity sound microphone sensor.	2	$9.98	https://www.newegg.com/Product/Product.aspx?Item=9SIADG45WJ3684&ignorebbr=1&source=region&nm_mc=KNC-GoogleMKP-PC&cm_mmc=KNC-GoogleMKP-PC-_-pla-Keyboardmall-_-Gadgets-_-9SIADG45WJ3684&gclid=CjwKCAjwm-fkBRBBEiwA966fZEC8o6-vpV0QzzqAXYOBYf6zHDDXqnlK5SEm4KVeHnwxBnnXwqpgKBoC7u0QAvD_BwE&gclsrc=aw.ds
2	Arduino Starter Kit Multi-Language	1	$87.90	https://store.arduino.cc/usa/arduino-starter-kit

3	32x32 RGB LED Matrix Panel	1	$44.95	https://www.adafruit.com/product/2026?gclid=CjwKCAjwm-fkBRBBEiwA966fZBwN-vrPxjhVXPU58zyZp3aIStk2zZHpo96FnMZIrr0yGDdXg84NYRoC7dEQAvD_BwE

VI. REFERENCES (Warren)

A list of links that lead to the locations of resources used to create our project. Most research can be found here.

Basic information and examples of how to work with an Arduino unit
https://www.arduino.cc/en/Tutorial/HomePage?from=Main.Tutorials

Link to code library for above part:
https://learn.adafruit.com/32x16-32x32-rgb-led-matrix/

Arduino sound sensor (maybe):

6. Include in your report the names of each team member (4-5), their roles, and contributions to the design report (10 points).

Future Game Play:

Connection Tutorial

SOUND SENSOR CODE WEBSITE
http://sensorkit.en.joy-it.net/index.php?title=KY-038_Microphone_sound_sensor_module

https://www.youtube.com/watch?v=TOuKnOG8atk

https://learn.adafruit.com/32x16-32x32-rgb-led-matrix/connecting-with-jumper-wires

https://learn.adafruit.com/32x16-32x32-rgb-led-matrix/powering
//Power connection

4.22 Updates and Assignments

Main task: Initializing environment and testing the sound sensor.

1) Make sure you have the arduino IDE installed, located at https://www.arduino.cc/en/Main/Software
2) Install the 2 libraries via: https://learn.adafruit.com/32x16-32x32-rgb-led-matrix/test-example-code
3) READ DOCUMENT ABOVE ^^^
4) To use the Arduino ide and upload functions to the board:
    a) Copy and paste code (or upload from github) into the IDE white space
    b) Compile, aka click the “Verify” button at top left of application
    c) Click “Upload” to upload it to the arduino, Note that the usb must be connecting the computer to the arduino!
5) This relates to 168, please try your best to google problems and communicate errors in the G.M.

Current Task: Downloading proper libraries for sound sensor and making sure it is functioning correctly.

Josh, this is your main task and we need it done by this week. Plan accordingly and I’m requiring at least an hour/day until we get this initialized. I will be helping with this so I need your full attention.

We have the poster due. **Charlie and Abdullah** Until we get everything set up, I’ll have you guys focused on the poster. View the requirements via BlackBoard
POSTER REQS:
https://courseware.ku.edu/bbcswebdav/pid-7449052-dt-content-rid-32355588_1/courses/4192-61194/Poster%20AssignmentEECS%20388%20Embedded%20Systems.pdf

Chris and Warren. Y’all can help me and Josh in the time being. Once we have the sound sensor configured, you will be in charge of testing and figuring out what data we’re working with.

Hope this works for everyone, please let me know if you think we can do something better!
IF ANYONE COMPLETES LAB 8, HELP US OUT SO WE CAN FOCUS ON THIS!!!

Burndown info:
https://www.youtube.com/watch?v=8Ey89cAI4LE

Updates on Sound Sensor

The connection of the RGB Display to the Bread-board is buggy

Please Fix

Important info about the sensor is that the Arduino's ADC is 10 bits, thus the smallest fluctuation of measurable intensity is 5[V] / 2^10[Bits] = **4.8 [mV]**
This is a very small intensity change
THUS THE ATTENUATOR ON-TOP OF THE SENSOR NEEDS TO BE RELATIVELY HIGH OR ALL YOU WILL PICK UP IS FULL 5V FUZZ!

Currently we have it measuring and transmitting real-time data and need some coding work on the patterns displayed.

Data about the sound sensor that is helpful:

Type :Logic ICs

1. AO, analog output, real-time output voltage signal of the microphone
2. DO, when the sound intensity reaches a certain threshold, the output high and low signal

Module features:

1. there is a mounting screw hole 3mm
2. the use 5v DC power supply
3. with analog output
4. there are threshold level output flip
5. high sensitive microphone and high sensitivity.
6. a power indicator light
7. the comparator output is light

Arduino data sheet with the ADC info:
https://www.fecegypt.com/uploads/dataSheet/1522237550_arduino%20uno%20r3.pdf

Chris's program idea:

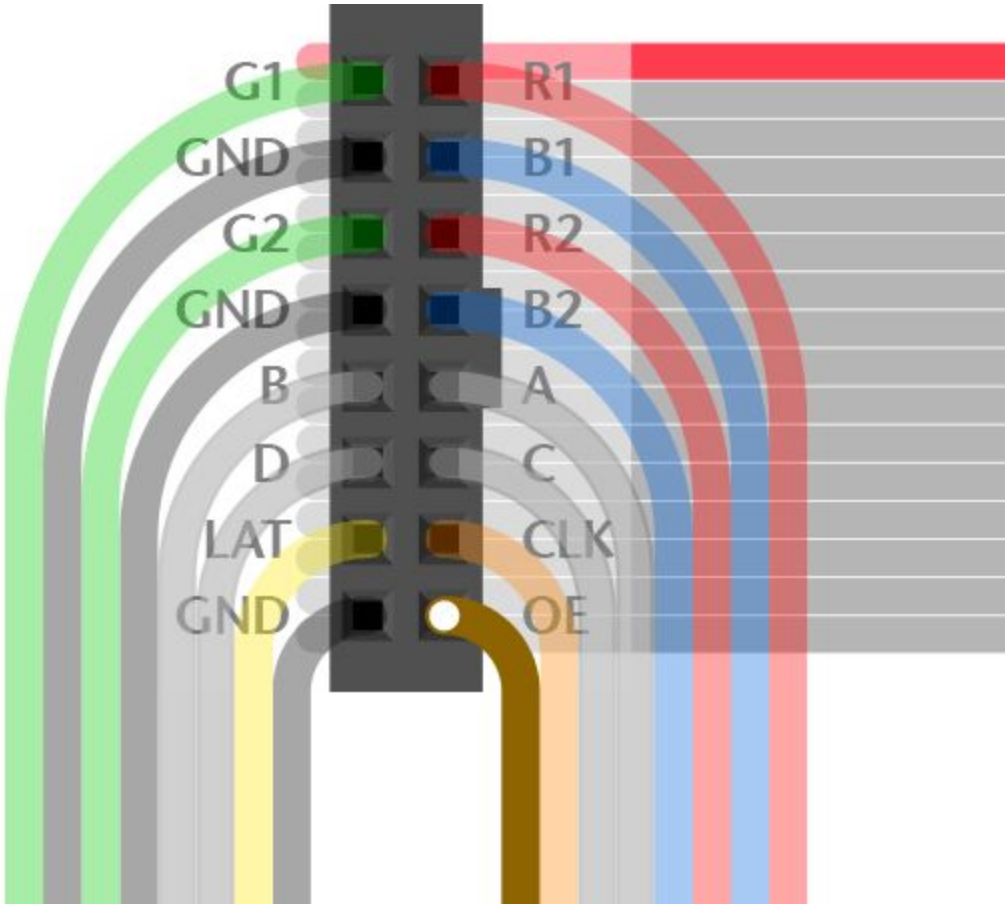
1. Infinite while loop
2. Sensor gets value
3. Value sent to a function
4. Function is a series of IF statements

```
If (50<SensorValue<80)
{
      Make whole screen purple;
}
If (80<SensorValue<120)
{
      Make whole screen blue;
}
```

The progression of the IF statements will be
Black < Purple < Blue < Green < Red < Yellow < White

The screen will stay the same color until a new sensor value is picked up by the sensor

Diagram:



Approach: Our design requires a sound sensor, an LED matrix, a breadboard, an Arduino Uno, a computer with a USB port, and a power supply. The sound sensor, LED display, and Arduino will be wired to the breadboard. The LED matrix requires sixteen connections to the breadboard.

II. Video (TV commercial components):

1. YouTube link with working 2-minute video including title and team members (30 pts)
2. Demo of working “product” (30 pts)
3. Include human or societal need that is met by the product and how embedded system product meets the need (30 pts)