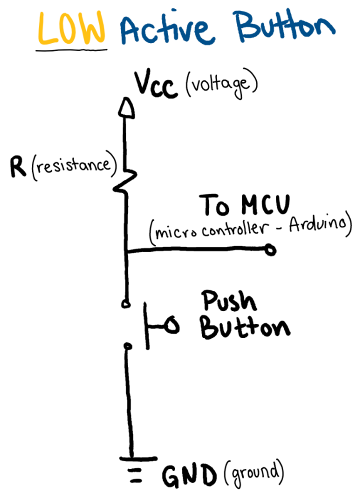
Arduino SoundBoard 2.0 Documentation

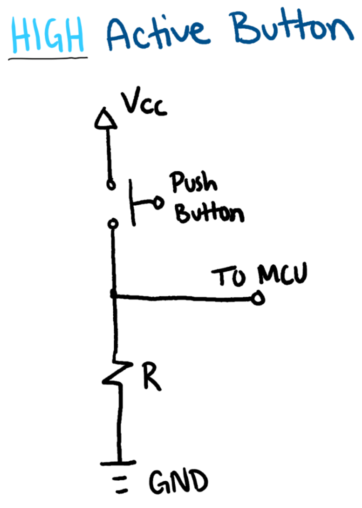
The Engineering process:

Initially the plan was to design and play an arduino piano using a buzzer and only 5 buttons. Each button was coded to produce a different tone of buzzing once pressed and it closely resembled most of the youtube tutorials on how to build an arduino piano. Once the piano was built and tested we knew the tones that the buzzer was producing was not like an ideal piano, and we knew we could do better. The decision was made to then use soundbites of different piano notes that could replace these buzzing tones. Once learning about how to use and convert different tones for use we had a working arduino piano with multiple notes. After playing around with the piano a bit more we decided, why not do more? The idea was then to add any sounds and create a soundboard instead! We were able to add 10 buttons each with its own soundbite, and include an audio operational amplifier to amplify the output sounds from the speaker.

Background Info:

Buttons -
This soundboard circuit relies on the use of many buttons and for this design we decided to use a low active button just to make circuit connections and coding a bit easier. There are two options for buttons that we could have used, a low active button or a high active button and the schematics are shown below.





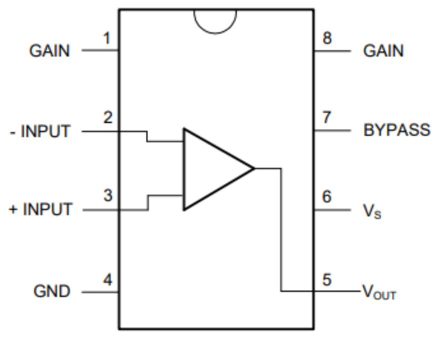
When the microcontroller (arduino) receives a certain voltage it reads it as a high signal (or a 1), otherwise it receives a low signal or a 0.These zeros and ones can be programmed to mean whatever the programmer would like. In the cases of using buttons, a high active button works intuitively, outputting a high once the button is pressed and outputting a low when it isn't. When the button is not pressed there is an open circuit from the source (Vss) to the microcontroller (MCU),and the current is forced to flow through to ground. When it is pressed however the current flows through that branch of least resistance, sending a voltage to the MCU indicating a 1. The low active button works exactly the opposite way.

When designing our button we decided on the use of a low active button, this way it was easier to implement and code. In the code we forced the button to output a high at all times until a ground is introduced. So when constructing the button we used one wire to connect the MCU to the button and the other wire from the other end of the button to ground. This way the button is on HIGH at all times until the button is pressed then it connects straight to ground indicating a LOW or a zero.

LM386 Audio Amplifier

The LM386 is a low power circuit with a maximum power of 1 Watt (1W) that can be used in a variety of applications such as portable speakers, laptop speakers, and so on. The LM386 is an operational amplifier (Op-Amp). The purpose of operational amplifiers is to take an input potential (voltage) and generate an output potential that is tens, hundreds, or thousands of times greater than the input potential. The LM386 in an amplifier circuit increases the potential of an audio input signal by 20 to 200 times.

D Package
8-Pin MSOP
Top View



Pin Functions

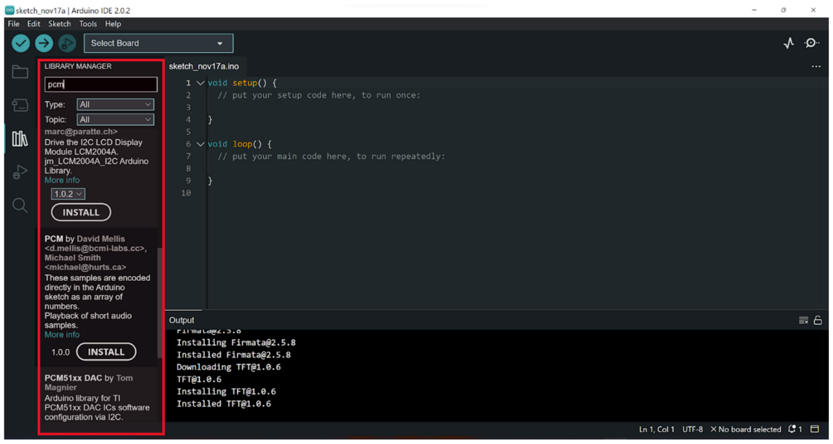
PIN		TYPE	DESCRIPTION
NAME	NO.		
GAIN	1	–	Gain setting pin
–INPUT	2	I	Inverting input
+INPUT	3	I	Noninverting input
GND	4	P	Ground reference
V_{OUT}	5	O	Output
V_S	6	P	Power supply voltage
BYPASS	7	O	Bypass decoupling path
GAIN	8	–	Gain setting pin

Materials

- 2 Arduino Uno boards (extra one optional)
- Breadboard
- Jumper-Wires
- 10 pushbuttons
- LM386 Low Voltage Audio Power Amplifier (optional)
- 1 8 Ohm 2 Watt Speaker

Installations

Install PCM on left hand side:


sketch_nov17a | Arduino IDE 2.0.2
File Edit Sketch Tools Help
Select Board
LIBRARY MANAGER
sketch_nov17a.ino
INSTALL
Output
Ln 1, Col 1 UTF-8 × No board selected

pcm

Type: All

Topic: All

marc@paratte.ch>
Drive the I2C LCD Display Module LCM2004A.
jm_LCM2004A_I2C Arduino Library.
More info
1.0.2

PCM by David Mellis <d.mellis@bcmi-labs.cc>, Michael Smith <michael@hurts.ca>
These samples are encoded directly in the Arduino sketch as an array of numbers.
Playback of short audio samples.
More info
1.0.0

PCM51xx DAC by Tom Magnier
Arduino library for TI PCM51xx DAC ICs software configuration via I2C.

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

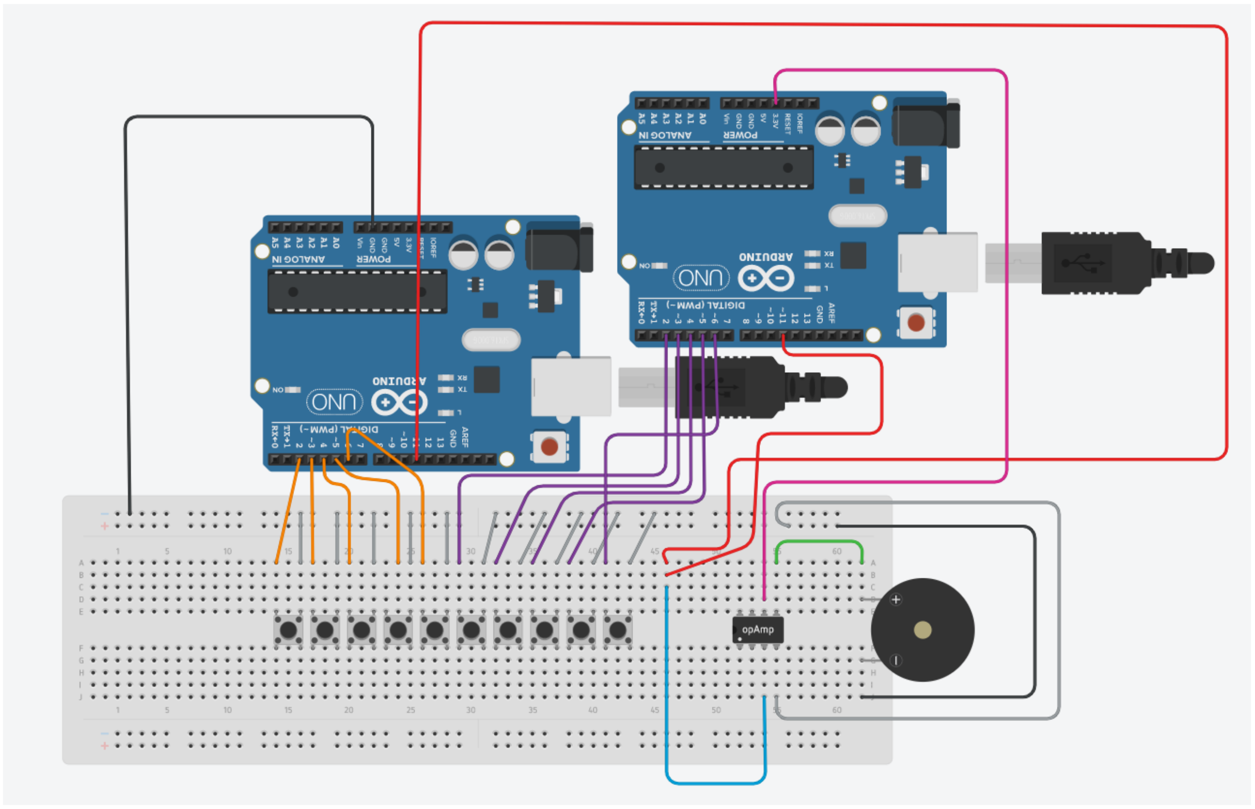
}
```

```
Firmata@2.5.8
Installing Firmata@2.5.8
Installed Firmata@2.5.8
Downloading TFT@1.0.6
TFT@1.0.6
Installing TFT@1.0.6
Installed TFT@1.0.6
```

PCM By David Mellis:

The PCM library allows us to playback short audio samples. These samples are encoded directly in the Arduino sketch as an array of numbers. This allows us to code and use these audio samples in our soundboard. To download this library, use the library manager on the left side of the screen and type in PCM and install the one labelled “PCM by David Mellis” Shown above.

Schematic



Code (Using C++):

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const int A = 2;
const int B = 3;
const int C = 4;
const int D = 5;
const int E = 6;

const int Buzz = 11;

void setup()
{
  pinMode(A, INPUT);
  digitalWrite(A,HIGH);

  pinMode(B, INPUT);
  digitalWrite(B,HIGH);

  pinMode(C, INPUT);
  digitalWrite(C,HIGH);

  pinMode(D, INPUT);
  digitalWrite(D,HIGH);

  pinMode(E, INPUT);
  digitalWrite(E,HIGH);
}
void loop()
{
  while(digitalRead(A) == LOW)
  {
    startPlayback(win_shut, sizeof(win_shut));
```

```
   delay(1750);
  }
  while(digitalRead(B) == LOW)
  {
   startPlayback(oof, sizeof(oof));
   delay(750);
  }
  while(digitalRead(C) == LOW)
  {
   startPlayback(yeet, sizeof(yeet));
   delay(750);
  }
  while(digitalRead(D) == LOW)
  {
    startPlayback(bruh, sizeof(bruh));
    delay(750);
  }
  while(digitalRead(E) == LOW)
  {
   startPlayback(nope, sizeof(nope));
   delay(750);
  }
  noTone(Buzz);
}
```

Explanation of Code

🟪 ⇒ In order to use the necessary functions/arrays for this soundboard (such as "startPlayback", an Ardunio library by the name of "PCM" should be installed and it must include "`#include <PCM.h>`" at the top of your code prior to uploading it onto the Arduino.

🟥 ⇒ We're using the function PROGMEM to store data in an array as flash memory. The long array of numbers represents the audio file that will play when the corresponding button is pressed.

🟧 ⇒ Assigning pin values to the pushbuttons and the Speaker in order to connect them to the Arduino.

🟩 ⇒ Assigning which components will be an input or an output.

🟪 ⇒ So long as a pushbutton is pressed, an audio file that corresponds to a specific push button will play.

🟨 ⇒ To ensure that the speaker doesn't infinitely play a sound once a button is pressed.

Resources:
How to get sounds:
https://www.youtube.com/watch?v=m1HEwgHSBrs&t=97s
How to make piano:
https://create.arduino.cc/projecthub/executeli/unravel-preset-piano-easy-arduino-even-a-ghoul-can-make-it-17c472?ref=tag&ref_id=piano&offset=2