Sound Machine: farty

By Christy Quang

Image of farty the fart box

Showcase / Description of Finished Piece

My sound machine project uses an Arduino Uno and a variety of components to create a simple but interactive prank device that outputs a random fart sound clip when motion is detected in front of the contraption. The sound exhibit begins with the device turned on and placed in an inconspicuous location, hidden in plain sight.

When the user turns on the battery box, there is an initial sound indicating that the machine is on and the sensor is immediately activated. When the sensor detects motion less than 50 cm away, the SD card module chooses a random fart clip and plays the .WAV audio from the speaker. The SD card module reads from the SD card which pre-emptively has 11 fart clips already stored. There is also a sound effect from the game Among Us that is sometimes randomly played. The box is able to be opened and the user can modify the audio amplifier to increase or decrease the fart audio output as well.

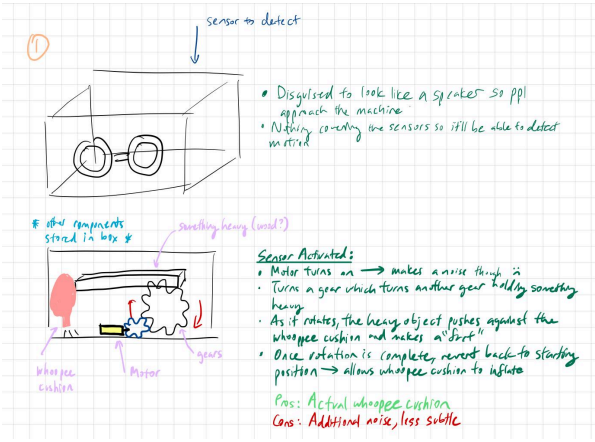
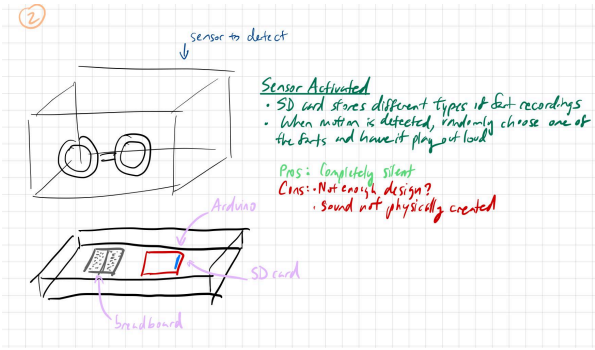
Full Video: Link to YouTube Video

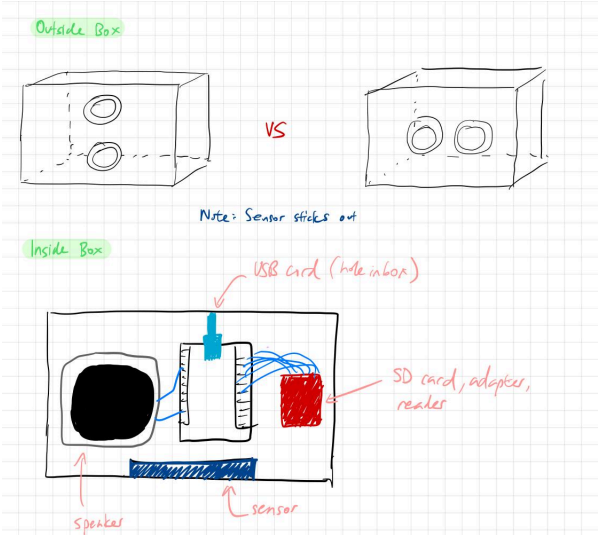
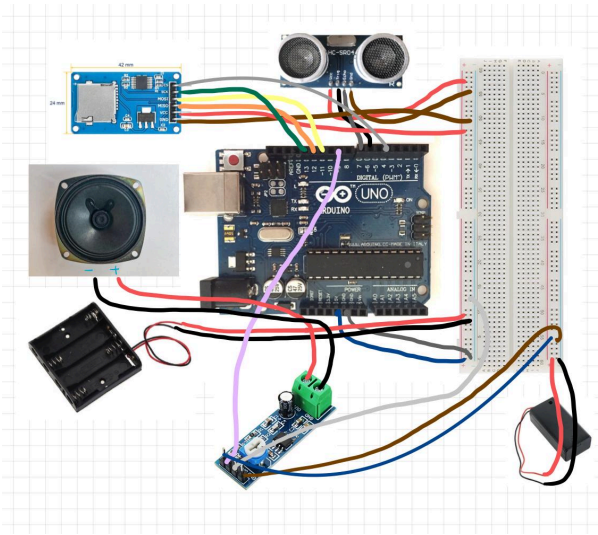
Bill of Materials:

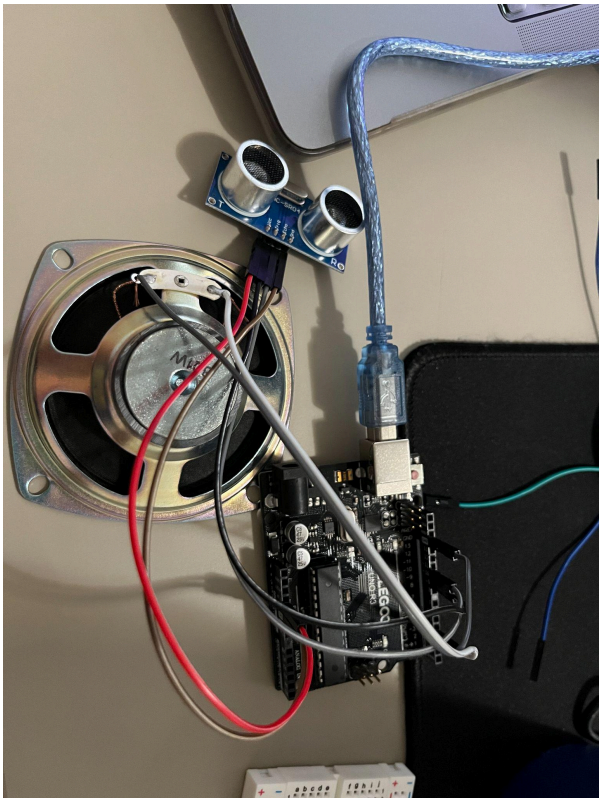
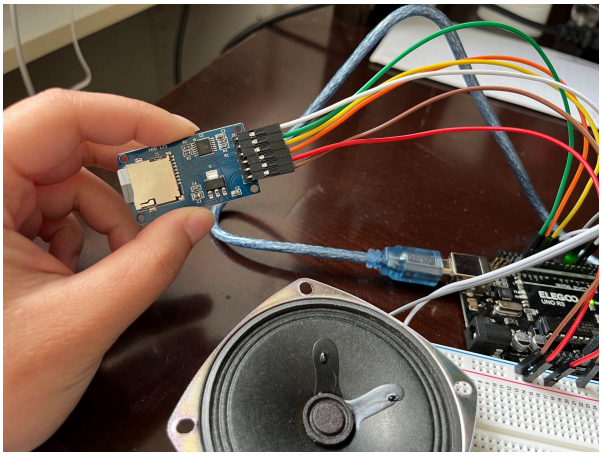
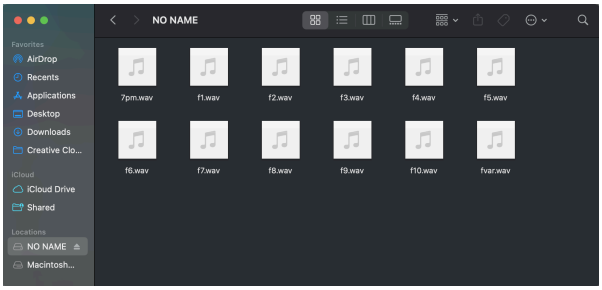
- 1 Arduino Uno board
- 1 breadboard
- 1 SD card module, SD card, SD card adapter
- 1 speaker
- 1 battery box and 4 AA batteries
- 1 9V battery and battery holder
- 1 switch
- 1 HC-SR04 sensor
- 1 LM386 audio amplifier
- 14 male-to-female wires
- 4 male-to-male wires
- Plywood
- Zip ties

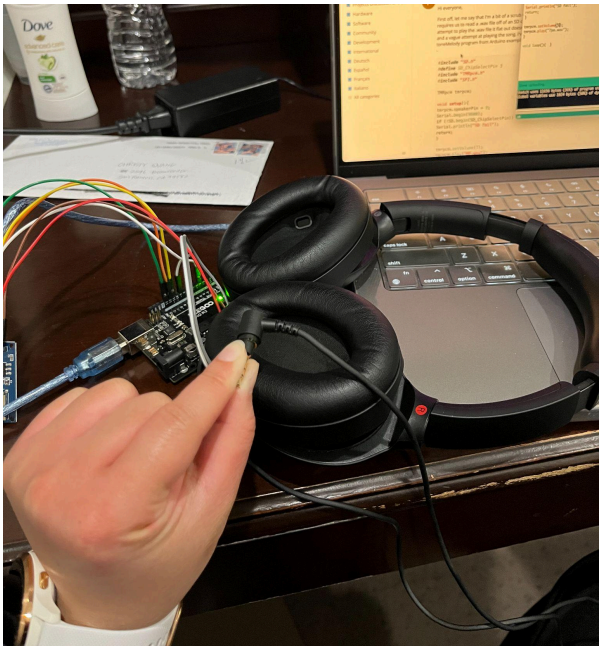
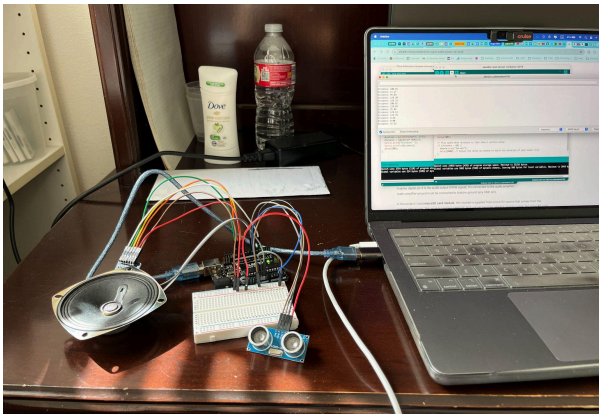
This is a back view of the fart box.

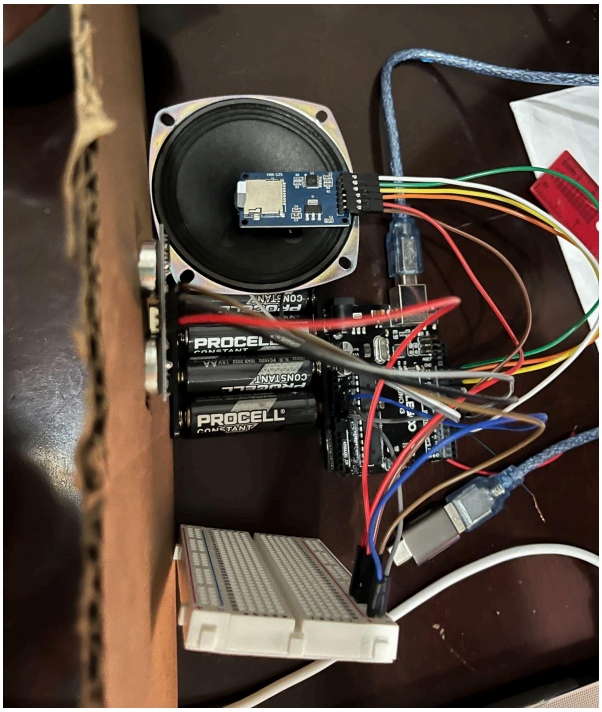
Process

Ideation/Design Process	
	Since I took DESINV 22 a couple of semesters ago, I was unsure of what to do for the sound machine project since I had already created the machine that I wanted during that semester. As a result, I spent a lot of time brainstorming what kind of machine I wanted to create. I felt like we were given a multitude of tools in class (ex: solenoids, sensors, servos, motors, etc) which left me more confused on what to make. However, once the sensors were introduced, this made me think of creating a machine that made a noise when the sensor was activated. This led me to think about creating a fart machine where when the sensor is triggered, a "fart noise" is played. I thought of two designs and wasn't sure which one to choose. The first option consists of more linear-to-rotary motion where a physical whoopee cushion is pressed down in order to make a sound.
	The second option was more electronics-based. With this option, I'm able to play an audio clip of any sound I want which would allow me to be able to choose from a variety of fart noises. However, I would need to obtain a few miscellaneous pieces that weren't supplied in class such as a speaker, SD card, and SD card adapter. I eventually decided to go with this option because I've already had experience with linear-to-rotary motion in DESINV 22 and haven't spent a lot of time on the electronics side with my projects. Most importantly, I wanted a diverse range of options for my fart noises.

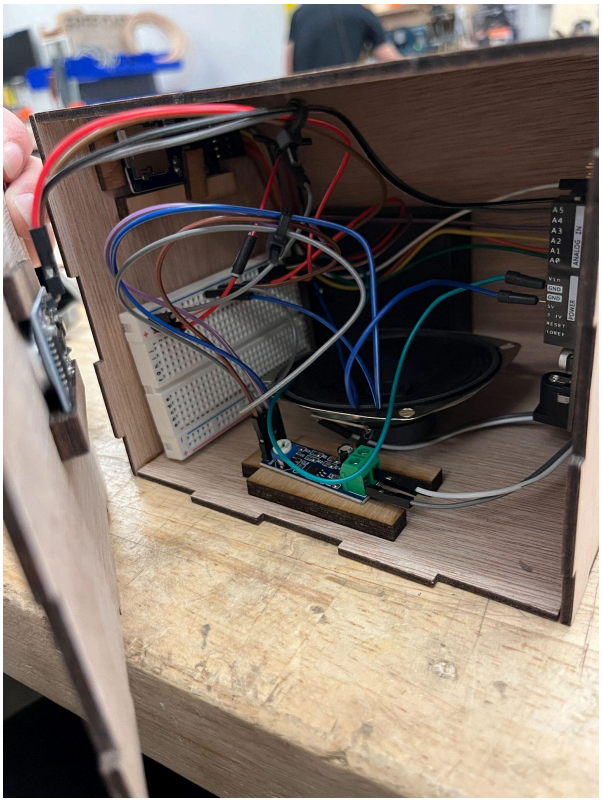
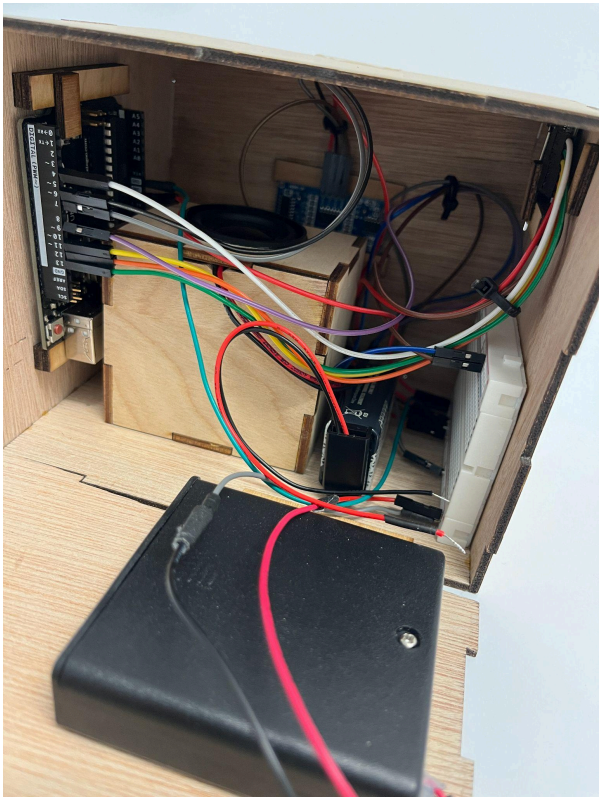
	I attempted drawing out the overall inside and outside layout of my sound machine. Since this machine is supposed to be inconspicuous, I want it to have a subtle appearance where people aren't likely to notice it. As a result, this allows the machine to be easily activated when someone walks past it. All of the electronics will be stored in the inside of the box and the sensor circles will be the only components sticking out. Within the box, I needed to properly arrange all of the different components and create "assigned spots"/barriers to keep the different parts from moving on top of each other.
	This is the diagram of all the different components and wiring in my sound machine. I drew this primarily because I was afraid that a wire would become loose and fall out, causing me to not know where its original location is. There were a lot of wires and moving parts to keep track of within the fart box.

Prototyping/Building Process	
	When the HC-SR04 sensor was introduced in class, I was intriguied and wanted to incorporate it somehow in my sound machine. I had never worked with this component before so I had to search online for a tutorial guiding me. Additionally, I was given a speaker by Dr. Sudhu and I also have never worked with it before so I had to search online for guides. I copied and pasted example code to test that the parts functioned the way intended to before modifying it.
	Since I chose Option 2 (which involves less physical prototyping), I needed to buy a couple of extra components that weren't supplied in case. The first one was an SD card, SD card adapter, and SD card module. The SD card adapter is utilized so I can upload the audio files that I wanted to output from the Arduino/SD card.
	I selected 11 "fart sound" videos from YouTube and needed to first convert them to MP3 files using a site I found online. I downloaded the MP3 files then used a different site that converts MP3 files into WAV files which is essential since that is the audio frequency that Arduinos read

	from SD cards using the TMRpcm library. This involved a lot of troubleshooting since I had no idea how to get the audio files I wanted to play and had no idea if it would even work in the first place.
	After referencing a bunch of online guides and YouTube videos regarding how to play audio files from an Arduino, I was able to finally get my files onto my SD card and wire my configuration correctly to have the files be read from the SD card module and output sound. The speaker wasn't outputting sound correctly so I ended up using my headphones as a "speaker" and touching the wires to the headphone jack. This ended up working and I was also able to fix my "static" issue by looking on the Arduino forum and adjusting the volume to be lower (5) than the max volume (7).
	Now that the speaker is able to produce output, I needed to combine both working parts (speaker and sensor) together. This resulted in the largest bug I was stuck on because the audio code didn't integrate well with the sensor code. The sensor wouldn't detect an object correctly and would output strange numbers as the distance. Some of the distances seemed to have a pattern since there were a lot of repeated numbers but I wasn't able to figure out the pattern. After a lot of debugging, research, and help from ChatGPT, I was able to get both parts working together to read the distance correctly and output sound when the distance is less than 50 cm away.



Since I was designing this during Spring Break, I didn't have access to the makerspace to print out the enclosure I wanted to put all of the components in. Instead, I created the box layout using cardboard, specifically the wall of the box that would have the two sensors sticking out. I needed to come up with an efficient layout of all of the different parts since there are many and I wanted the enclosure to be compact. This was difficult to do since I couldn't laser cut. I also wanted to remove the cord from my configuration and replace it with a battery box so there is less clutter and the machine is more mobile. Additionally, the output from the speaker wasn't as loud as I wanted it to be so I bought an amplifier and modified my configuration to utilize that part. I was a little disappointed because the amplifier didn't make the sound significantly louder.

	An unanticipated obstacle I had was utilizing a battery box. I had 2 battery boxes — one had male wires while the other just had bare wires. The box with male wires has an on/off switch while the other box doesn't, hence why I wanted to use the box with the switch to allow the user to interact with the machine. However, my battery box wouldn't power on my machine and the issue was that one of the coils in the box was broken. I ended up needing to purchase a new battery box and used zip ties to keep all of the wires for a certain component together since it was very cluttered in the box. I also laser cut small rectangles to keep individual parts in place.
	Another big challenge was getting my audio to amplify louder. I bought better speakers and an external audio amplifier but this didn't cause significant change to the sound. After getting help from Shm, Dr. Sudhu and Chris, I encapsulated the speaker and powered it using a 9 volt battery, allowing the audio to amplify louder. When the fart box is open, there is a clear audible difference compared to when the box is closed. I also ended up frying my first audio amplifier (LM386) because I shorted it and also passed in too many volts.

	This is the final outside appearance of fart box. A laser cut box encapsules all of the electronics and the sensors serve as the “eyes” of the box. I engraved a slight smile to give more emotion and humanification to the static object. The sides of the box are removable, providing the ability to remove, move, or inspect the components powering the machine. The pieces of plywood are also sanded.

Conclusion / Reflection

I plan on adding mobility to the fart box since currently, the user has to set up the box prior to pranking someone. By being able to move the box to different locations, this greatly increases the comedic value gained from using this machine since it now has the ability to “sneak up” behind someone. Even though this machine isn’t done, I want to showcase this because I think it’s hilarious and will cause anyone to smile. I feel somewhat satisfied with how the project turned out because there were many initial bugs that I was facing at the start of the project but I was able to fix them over Spring Break. The part that is not as satisfactory for me is the amount of additional money I spent buying extra parts for the project. Some of the items were necessary (such as the SD card components) but other pieces were purely for additional comedic relief. Through the process of creating this piece, I was able to get firsthand experience with working with distance sensors and audio output since I’ve never really worked with those areas significantly before. Now, I definitely feel like I have a better understanding of how to navigate through those sectors.

There is one bug that I want to fix – it’s a little “spotty” when the HC-SR04 detects motion which is probably due to the integration of reading from the SD card alongside detecting motion. Additionally, wire management inside the box is a little messy and I think that adding an LED inside would be super cool as well.

Links

Code	https://github.com/christyquang/desinv23/blob/main/sound-machine.ino
Final video	https://youtu.be/IClwqSAuPi8

Sources

Dr. Sudhu's Arduino Tutorial	https://github.com/loopstick/ArduinoTutorial.git
HC-SR04 Ultrasonic Sensor Code	https://projecthub.arduino.cc/Isaac100/getting-started-with-the-hc-sr04-ultrasonic-sensor-7cabe1
3 Options for Playing Audio on Arduino	https://youtu.be/UN9XPWHamHw?si=qHDlMbxwTM_estNa
How to use SD Card Module with Arduino	https://youtu.be/12EAznKjOZ0?si=f4LSWs1aiju-dgrh
Static Sound from Speaker Debugging Help	https://forum.arduino.cc/t/reading-audio-files-from-sd-card-yields-static/448205
Convert mp3 to wav	https://audio.online-convert.com/convert-to-wav
Convert YouTube Videos to MP3 Files	https://ytmp3.plus/VWCo/
Amplifier + Potentiometer	https://docs.arduino.cc/tutorials/generic/simple-audio-player/
SD Card Example Code	https://github.com/abhijitbrain/creative-research/blob/master/_1mp3.ino
LM386 Example Picture	https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.techtonics.in%2Flm386-audio-amplifier-module-200-times-input-10k-adjustable-resistance&psig=AOvVaw30CuCOzslPLtTjmXrtkDu_&ust=1711948863306000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCOC889DgnYUDFQAAAAAdAAAAABAL