

Halloween 2019

The Project Final Report

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ABSTRACT

This report outlines the work that was done to complete our 2019 Halloween Project.

Experiment Performed on **1 October 2019**

Report Submitted on **11 November 2019**

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INTRODUCTION

- Over the course of the month of October, my partners and I (Renato Dua Cassipe & Youssef El Kattan) created an animated scene about Halloween. Following and respecting multiple constraints we created this idea: A scary jack-in-the-box (*using a scary witch as the pop-up figure*) programmed by an Arduino. What we wanted to simulate is the following. A display that would print: “See what I can do? n/ Come closer!” when a sensor wouldn’t pick up any movement, then when there was the display would change to: “Happy Halloween! n/ 247-106-VA” and the witch would pop out along with LEDs blinking and Ghost Lights turning on when the box would open and close when the box was closed. Using the material outlined under “Materials Used” we were able to create our animated scary jack-in-the-box (refer to “Final Product” under references). Below shows the teams we created and the team’s roles to enable us to have created this animated scene about Halloween. Following this introduction outlines the work we had done from week 5 to 10.

The team:

- Renato & Youssef:
 - Designed and built the box structure of the project.
 - Designed and built the “scary witch” mechanism.
 - Designed and decorated the box.
 - Contributed to the Arduino code.
 - Contributed to the Arduino circuitry.
- Leonardo:
 - Designed and built the Arduino circuitry.
 - Designed and built Ghost Lights circuitry (*with the help from Andreea!*).
 - Purchased and contributed to the decorating of the box.
 - Contributed to the Arduino code.
 - Contributed to building the box structure.
 - Contributed to building the “scary witch” mechanism.

OBJECTIVES

- To practice the process of creating a project.
- To practice/develop brainstorming.
- To chose a solution that respects constraints.
- Identification of required equipment.
- Prototyping.
- Programming of operation steps.
- Solve material/mechanical contingencies.
- Respecting timelines.
- Working as a team.

MATERIAL USED

- (1x) Arduino UNO.
- (1x) HC-SR04 Ultrasonic Sensor.
- (1x) 1602 LCD Display with I2C Module.
- (1x) Beefy DC Servo Motor.
- (6x) Red Ultra-Bright LEDs.
- (?x) Various lengths of wire and different colours.
- (2x) Electronics breadboards.
- (2x) Pieces of Black Cardboard.
- (?x) Mixed Halloween decorations (*refer to references for "Decorations" picture*).
- (1x) Glue gun.
- (1x) Pack of glue sticks.
- (1x) Wire strippers.
- (1x) Soldering station with accessories.
- (1x) Utility knife.
- (1x) Pair of chop sticks.
- (1x) String of scary eye-ball lights.
- (1x) String of ghost lights.
- (1x) NPN transistor.
- (1x) Photoresistor.
- (1x) 100K Ω ¼ watt resistor.
- (6x) 470 Ω ½ watt resistors
- (2x) 3V battery packs (*one for ghost lights & for scary eye-ball lights*)
- (?x) Zip-ties.
- (?x) Black electrical tape.

PROCEDURE

**This was the procedure that we followed. Here it's broken down into weekly summaries.*

- Procedure Week 1:
 - Experimented with Arduino before project assembly.
 - Experimented possible ideas for project.
 - Experimented possible Halloween Decoration ideas.
- Procedure Week 2:
 - Narrowed down on possible ideas for the project.
 - Created sketch for our project idea.
 - Wrote the proposal for the project.
- Procedure Week 3:
 - Began prototyping Arduino code.
 - Began prototyping Arduino circuitry.
 - Began prototyping circuitry components.

- Procedure Week 4:
 - Finalized Arduino code.
 - Finalized Arduino circuitry/components.
 - Began general assembly of project.
- Procedure Week 5:
 - Finalized general assembly of assembly.
 - Began assembly of Arduino circuitry/components.
 - Modified parameters in code based on assembly.
- Procedure Week 6:
 - Began final assembly.
 - Began final assembly of Arduino circuitry/components.
 - Finalized testing/debugging on project.
 - Began project PowerPoint presentation for next week.
- Procedure Week 7:
 - Performed last-minute adjustments for project.
 - Finalized project PowerPoint for project presentation.
 - Displayed final project outside in corridor.

RESULTS AND DISCUSSION

- As this is the final project report, there are some differences from the initial proposal. First, this report goes way further in detail than the initial proposal. For example, in the initial proposal, there was no schematics and no detailed plans on how we were going to accomplish this project. Secondly, there were some modifications to our initial idea and we added some ideas. For example, we had to change our mechanism because it wouldn't be able to do what we initially wanted it to do. It's wise to follow a system like this as to we slowly step up our game to our final product. Think about it as a learning curve. We only had the idea in the initial proposal, now in the final project report we put the idea in motion.
- In the beginning, we had no idea what to possibly come up with as an idea for our project. We had sat down as a group and we discussed the possible ideas we could use. The ones that were presented deemed too difficult or did not respect the constraints that were given in the instructions. We finally decided unanimously on the scary jack-in-the-box idea for the project. The goal: pop open a scary figure and let the LEDs blink on and off when the sensor picked up any sudden movement (refer to "Original Sketch" picture under references). This all seemed easy on paper and in words, but it some challenges had to be overcome before we advanced any further.

The first challenge that was presented to us happened in the beginning during programming of the Arduino and the assembly of the circuit. We could not get the wiring down correctly the first try. The very small wires deemed to small for the Arduino's pins and would constantly fall out of place, causing frustrating unknown problems. The solution was to strip the wire twice as much as you would normally do, then bend the wire halfway to overlap the other half and crimp down. This way, there was no un-intentional wires popping out of their connections for no reason. So,

with that out of the way, we still had to debug our code. The situation was that the lights wouldn't blink and the motor wouldn't move. After some time of debugging, it turned out that our conditional statements were not coded correctly. Once that was corrected, the circuit behaved like it should have.

We still had one last problem and this only occurred about mid-way into the project. We had some mechanical issues to sort out! Turns out, this would be the hardest to solve. We ended up using a witch as our scary figure but the witch would lift up-and down like we intended it to do. We spent some time already stripping the witch down as much as we could, but that still wasn't enough for the motor to move. After already spending the amount of time we put into the mechanism to work, we decided to try swapping out the motor for a bigger one. When we swapped out the motor, the witch finally would move up and down like it should have! This and the correction in our code finally made the project work like we had thought of in the beginning.

So basically, we had spent three weeks or so figuring out all the troubles we had, afterwards we breezed onto the final product! Not only did it become easy afterwards, we still had some time left to make improvements. I had two ideas that I thought would make the project look even more cooler! First, I decided we could implement a 16 by 2 LCD! (refer to the LCD picture under references). The idea was, when the sensor picked any movement, the display would say "Happy Halloween!" and "Profession of C.E.T 207-106-VA" on the second line. If the sensor didn't pick any motion up, the display would read "See what I can do?" and "Come closer!" on the second line. This actually worked out well so we decided to keep it (take a look at the LCD picture under References!). My second idea was to implement a string of ghost lights on the box. The idea was, when the box lid opened, the photoresistor picked up the light causing the circuit to turn on. A circuit with an NPN transistor, Photoresistor and other general elements was created in order for this to work (take a look at the second schematic under References!). We now had one sick looking project so far and we didn't even start with the decorations yet!

We essentially spent the last week or so doing all the last-minute adjustments. I sorted out all the wiring, so that it didn't look like a mess in the box and placed the components where they belonged (refer to "Final Wiring" picture under references). The sensor and display were in the front, the LEDs were in pairs on three sides of the box, the servo was on the left-hand side of the box and the breadboards and the Arduino were in a separate smaller sized box attached to the back of the main big box. With that out of the way, we focused on decorating the entire box. Using the majority of the decorations we had and our handy glue gun, we stuck a few decorations at a time looking to see for any imperfections. At the end, we used a tombstone, some yellow "danger" ribbon, cobwebs, little critters and ghost lights to complete the cosmetics. We took a step back and compared from the beginning to the end product, we never imagined that it would look and work so well like we thought it would have! (refer to "Final Product" picture under references).

**(Take a look at the pictures under references to see what we were dealing with!)*

CONCLUSION

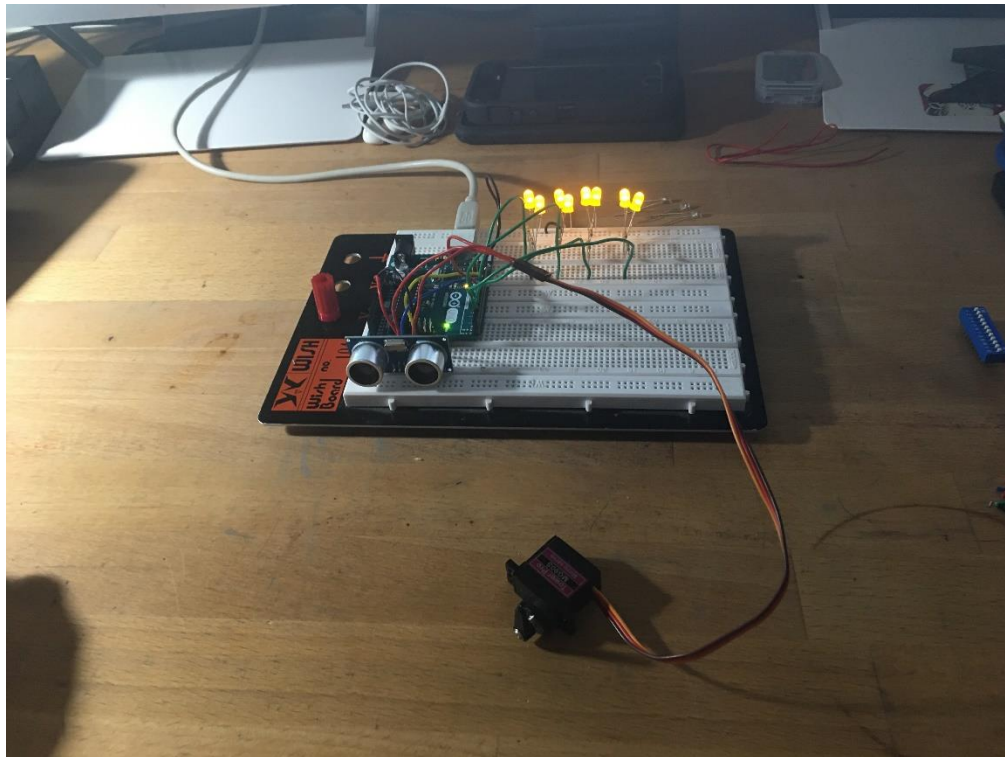
- Aside from all the difficulties we encountered, this was a fun project. Especially for me who likes to work with my hands and to try new things! I was intimidated at first with the whole idea using the Arduino as I still was getting used to programming in general. Once we completed the two labs that we spent on working with introducing the Arduino, I felt comfortable continuing on. Not only was this project fun, but also, I learned a lot from it too. I learned the importance of working in a team, how it meant to communicate and work properly amongst ourselves. Especially when we will be working in the workforce, we most likely will be working in a team/group so the experience attained from this project definitely helps. Also, I learned a little more about circuits and programming in general. I learned about some new components and what they do in circuits (ex: the transistor). I also learned how to structure and simplify my code as well (so it would be better than looking at a mess!). Now if we had all the experience as we have now, we would have done a little more. For example, we wanted to add a speaker to the Arduino UNO to play some scary sounds along with the other components when they would be triggered by the sensor, but because of lack of experience beforehand and time (a lot of time was spent on experimenting) we couldn't do so. Although the project took as long as it did, I can't complain now as when I look at what we achieved, I feel proud and could I say we did it!

[illegible]

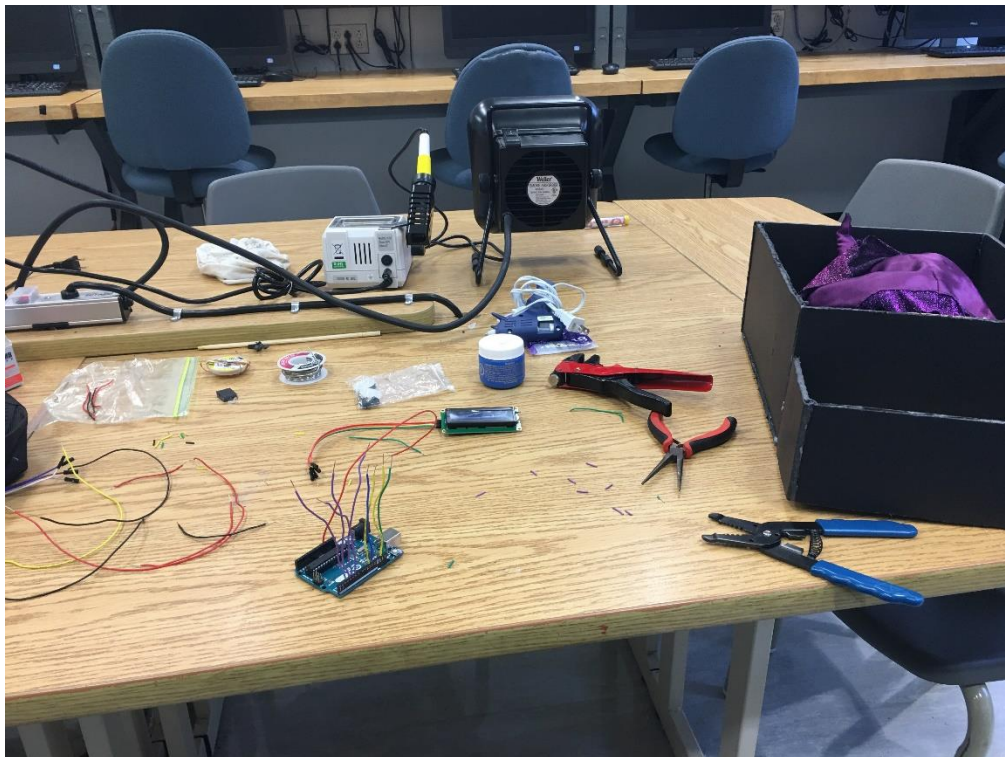
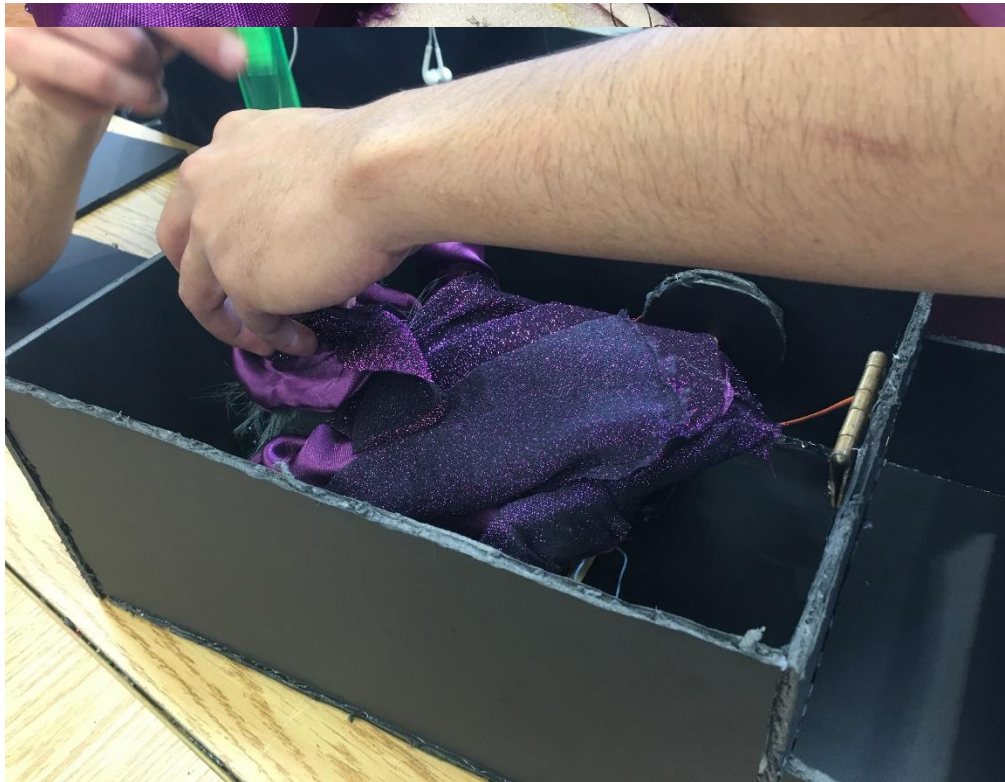
A Halloween-themed decoration is set up on a light-colored wooden table. The central piece is a black rectangular box. The front of the box is wrapped in yellow and black diagonal-striped caution tape. On the front, the words "CAUTION-DANGER" are printed in large, bold, black letters. A green plastic snake is coiled around the bottom left corner of the box. Two small white ghost figurines are placed near the bottom edge. The top of the box is covered with white artificial spider webs. A black plastic spider is positioned on the webs. A black plastic skull mask with a menacing expression is placed on top of the box. A red plastic snake is coiled around the mask. The background shows a kitchen area with white cabinets, a sink, and various items on the counter.



The Early Beginnings of the Project

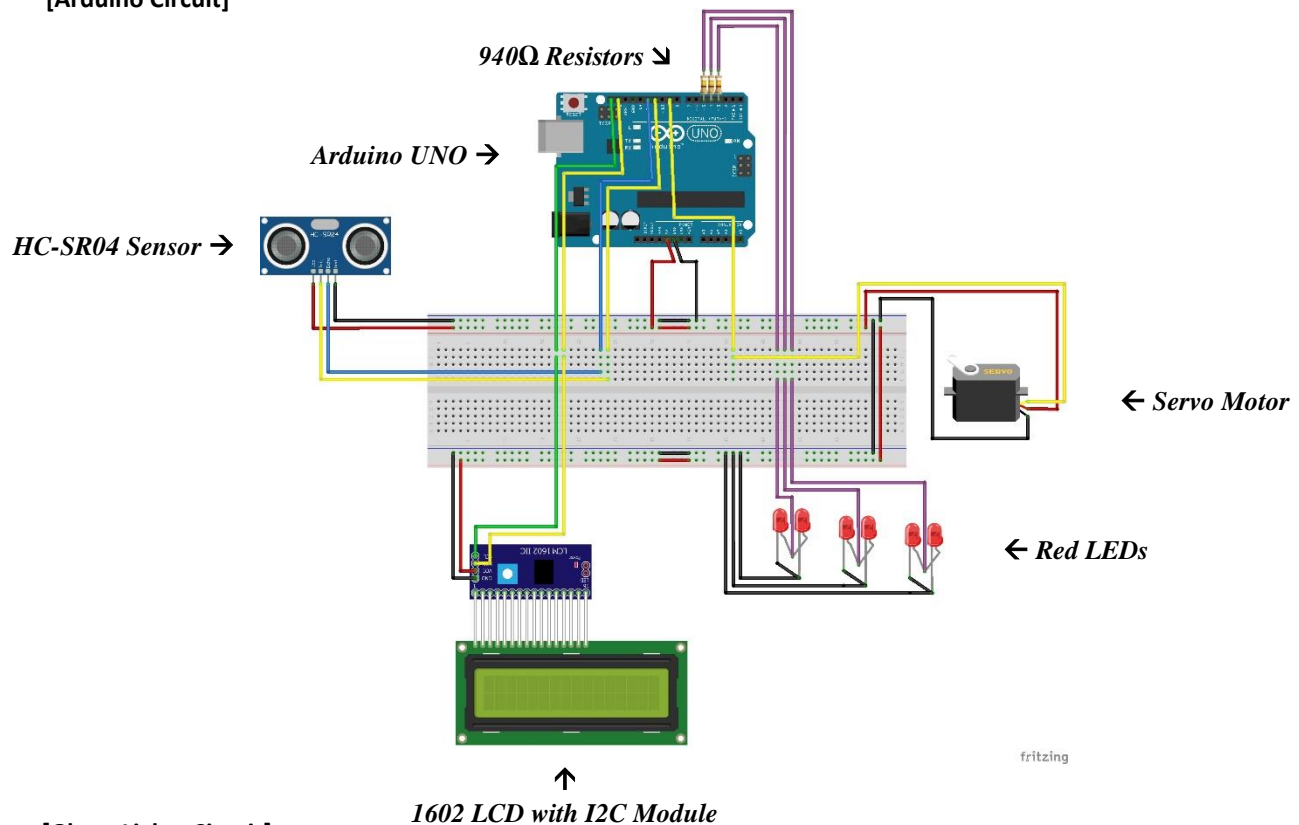


The Witch Assembly

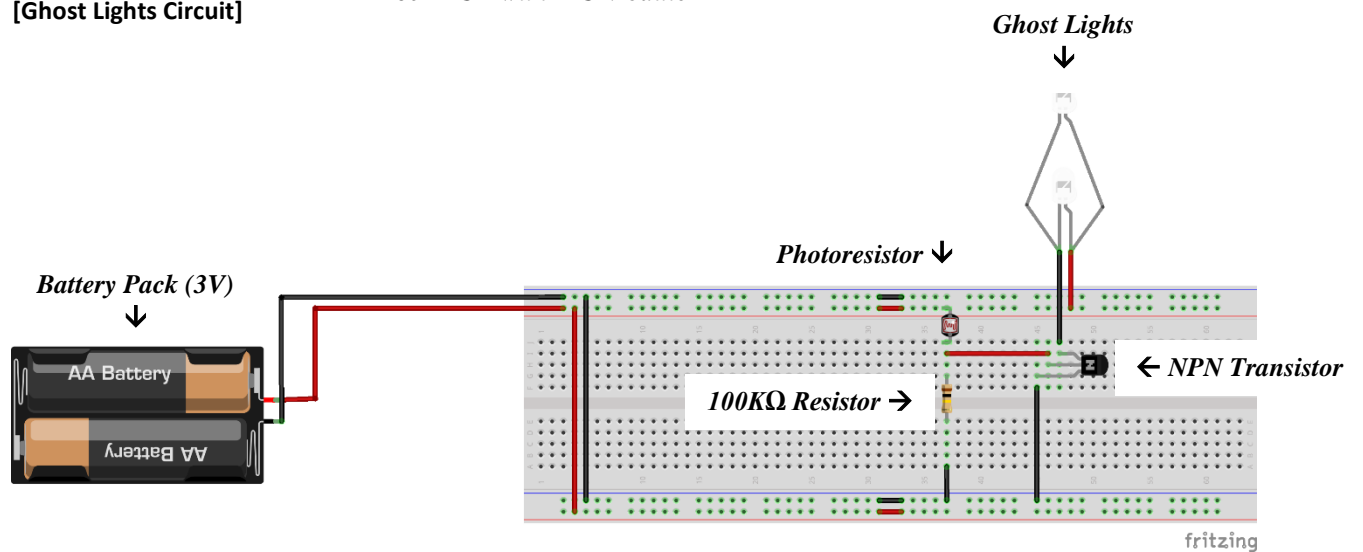


The Schematics

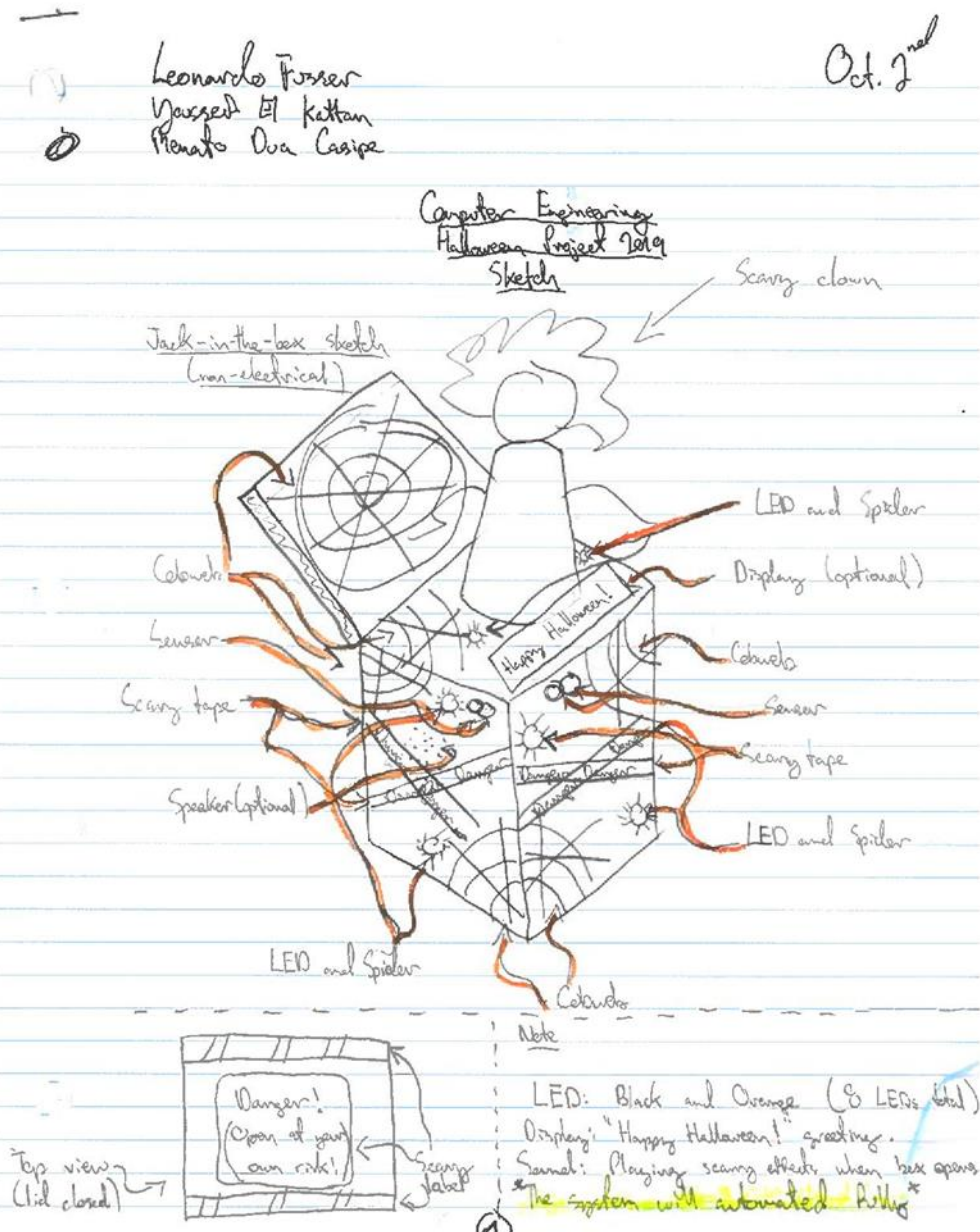
[Arduino Circuit]



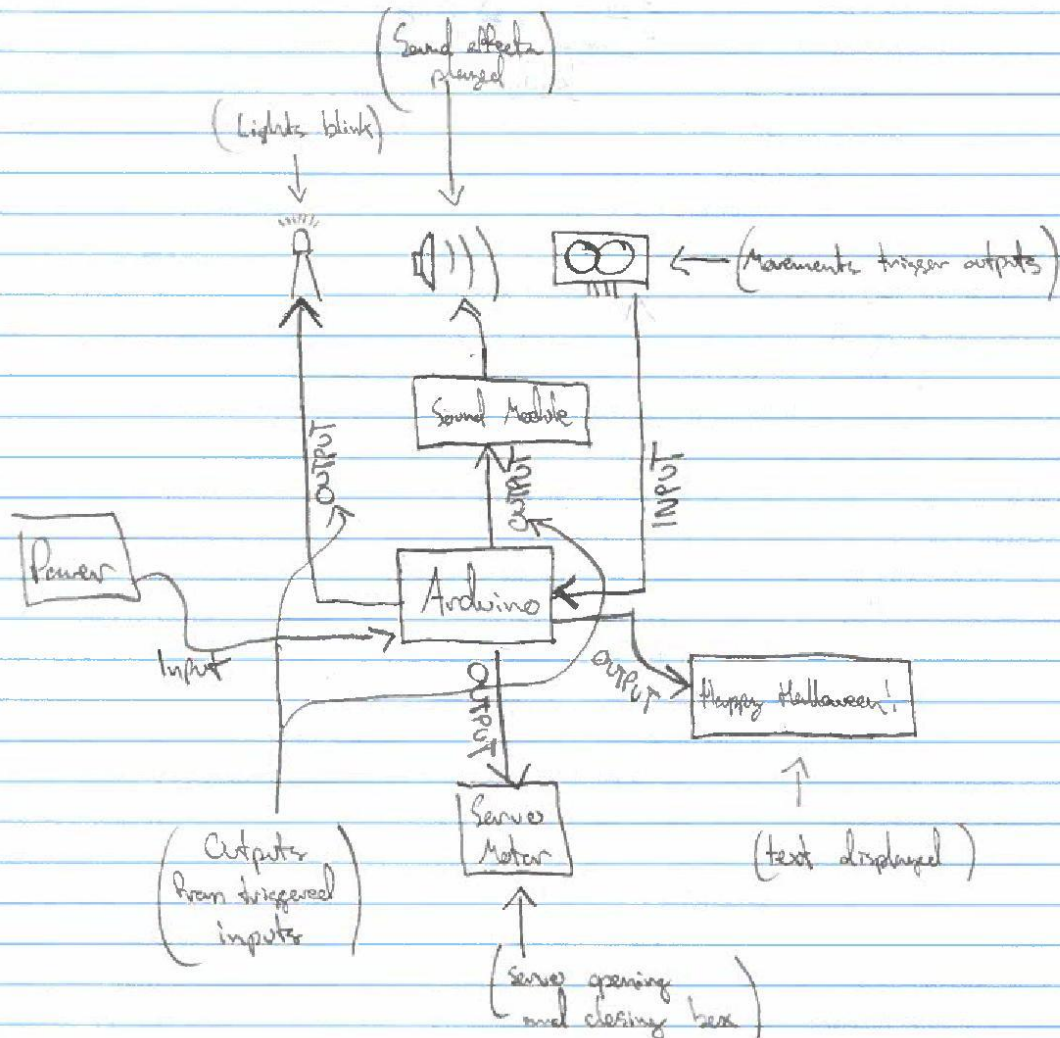
[Ghost Lights Circuit]



Our Initial Sketch

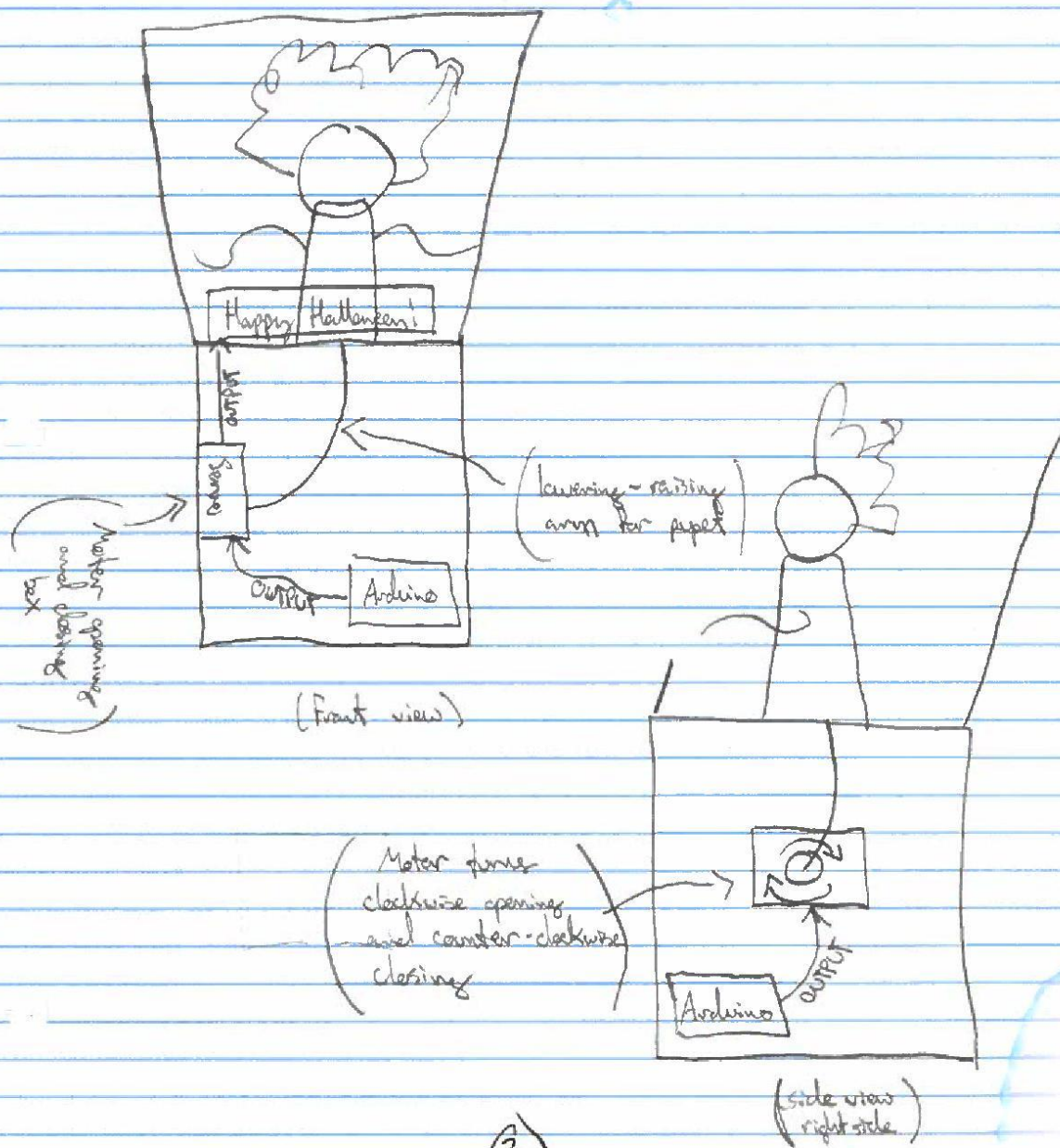


Jack-in-the-box sketch
(electrical)



(2)

Jack-in-the-box sketch
(serve motor)



(3)

The Final Wiring

