NYU TANDON SCHOOL OF ENGINEERING

EG1003 Introduction to Engineering & Design

Rapid Assembly & Design (RAD)
Preliminary Design Investigation

SmartBrella

Team Members: Selena Cheung, Kai Shinozaki-Conefrey, Erica Wang, Jack Yang

1. Introduction

1.1 Purpose

The purpose of this project is to provide an accessible, convenient, and smart innovation on the classic umbrella design. While umbrellas are very useful in protecting people from the rain, they can be cumbersome to open and close, especially for those with disabilities. This umbrella is paired with an application that allows the remote opening and closing of the umbrella, as well as the ability to connect with weather APIs and remind the user to bring their umbrella should rain be predicted.

1.2 Background Information

This umbrella would be able to detect any form of precipitation through a rain sensor and a weather API that would be connected to an application. The application would notify the user if it will rain or not and allow users with disabilities to be able to open and close the umbrella through the app.

1.3 Goals

By accomplishing this project, we hope to create convenience and improve daily lives with an umbrella made of higher quality. Not only does this umbrella offer greater protection against harsh weather compared to the common alternative, but it also creates a world better suited for people with disabilities. By creating an app that controls the umbrella, we hope to make bigger strides toward building a more friendly environment for the disabled. Through the process of this project, we will also gain experience in prototyping and coding.

2. Resources

2.1 Physical Components

We plan to use a variety of materials in our initial prototype. At the moment, these materials include but are not limited to: utility cords, pulley(s), a handheld umbrella, an Arduino kit, and raindrop sensor(s).

- Utility Cord - part of the automatic closing and opening of the umbrella
- Pulleys - make up the automatic closing and opening of the umbrella
- Handheld Umbrella - main component of the product
- Arduino Kit - connect the umbrella functions to the app
- Raindrop Sensor - sense if there is rain

2.2 Software Requirements

The final product will be complemented with an app; to code our software, we intend to use Python via the tinypy interpreter and convert this to C++ to be compiled in XCode as a phone app.

2.3 Cost Estimate

Resource	Costs Per Unit	Milestone 1	
		Quantity	Cost
Umbrella	15	1	15
Arduino Kit	20	1	20
Utility Cord Pack	16	1	16
Miscellaneous	–	–	15
Projected Labor	50	50	2,500
Total			$ 2,566
Total & 20% Slack			$ 3,079.2

3. Procedures

3.1 Physical Construction

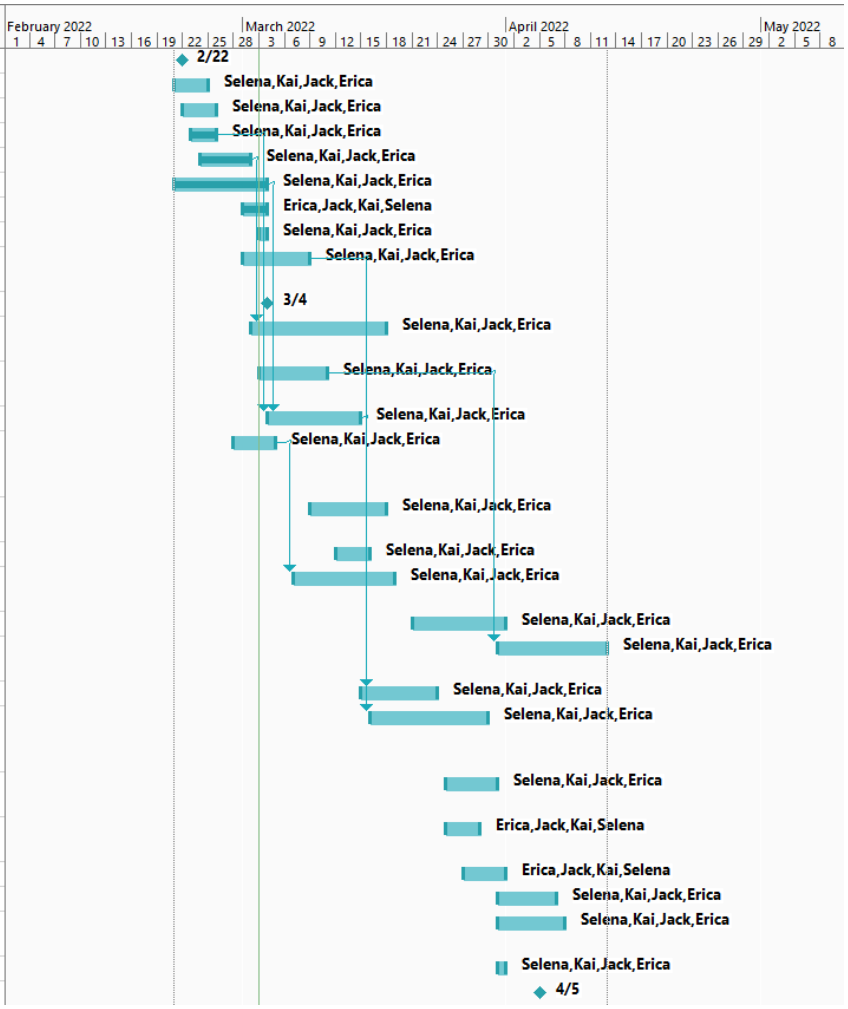
We will begin by coating the outer layer of the umbrella with water-repellent spray. For the opening and closing of the umbrella, we will use a motor and a pulley made of wires to pull the umbrella closed and release the umbrella open. This action will be controlled by an Arduino microcontroller secured to the handle of the umbrella.

3.2 Software Setup

When the paired application sees a prediction for rain on the weather API, it will alert the user to bring an umbrella via a phone notification. Through the app, the user will at any point be able to choose to open or close the umbrella. Once either of these options are chosen, the app will communicate with the umbrella via a Bluetooth module attached to an Arduino.

3.3 Project Schedule

ID	Task Mode	Task Name	Duration
1		**Milestone 1**	0 days
2		Preliminary Design	4 days
3		Material Purchase	4 days
4		Preliminary CAD Model	3 days
5		Flowchart of code	4 days
6		Soldering Training	9 days
7		Modifications Period	3 days
8		Benchmark A	1 day
9		Preliminary Design for the App	6 days
10		**Milestone 2**	0 days
11		Code of Open/Close Umbrella	12 days
12		Add Bluetooth Capabilities	6 days
13		Add Sensors to Prototyp	7 days
14		Design/Brainstorm Idea on how to dry the Umbrella	5 days
15		Add a pulley to the umbrella	7 days
16		Buy more materials	3 days
17		Prototype the drying aspect of the umbrella	10 days
18		Code the arduino	9 days
19		Connect the Bluetooth to Prototype	9 days
20		Code of the sensors	7 days
21		Design the interface of the app/App development	10 days
22		Connect the app to the umbrella	4 days
23		Add weather API to the app	2 days
24		Edit code of app	5 days
25		Finalize code	5 days
26		Modify Umbrella structure	6 days
27		Benchmark B	1 day
28		**Milestone 3**	0 days



4. Conclusion

4.1 Challenges

This umbrella aims to provide a genuinely beneficial tool for any person, especially those with disabilities. The challenges for this umbrella will likely come from making this umbrella practical for its intended audience and ensuring its features are intuitive, efficient, and well-functioning.