



UMBRELLA BACKPACK

by JACLYN CANLAS, LUCAS PETERSEN, MICHAEL GLANZNIG, MOHAMED ELHADARY, and RACHEL CUMMINGS

Integrated Engineering - University of British Columbia



PROBLEM

Living in rainy Vancouver as a student can be a challenge. Most Vancouverites already have their own umbrellas, but running errands while carrying an umbrella can be a hassle. Additionally, being a student is taxing enough. Needing to pack up notes and computers while getting drenched in the rain makes student life that much more demanding.



The Umbrella Backpack solves these issues by providing easy, convenient, and hands-free protection from the elements to provide the freedom and comfort a person deserves. A hands-free operation of an umbrella eliminates the tired arms and awkward clasp that normally accompanies holding an umbrella. With the Umbrella Backpack, multitasking in the rain can be achieved in a practical way.

Main Goals	Stakeholders
<ul style="list-style-type: none"> Hands-free use Minimize mass Waterproof Durable Fast and controlled activation 	<ul style="list-style-type: none"> Students Vancouverites Disabled individuals Hikers Photographers

FINAL PRODUCT



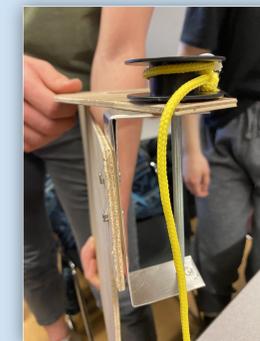
Our final prototype consists mainly of a resin 3D printed arm which holds the umbrella, a latching mechanism, and a servo motor to provide torque. These are connected to an arduino and a joystick which can be controlled by the user. All components are firmly attached to a lightweight acrylic mount, which slides into the backpack, and can be taken out for testing.

The rotation of the umbrella can be controlled easily with a joystick, which controls the servo motor to rotate the umbrella, and allows the umbrella arm to be rotated with zero effort from the user. The umbrella is then held in the correct upright position with the help of the latch mechanism which can be easily disengaged to retract the umbrella to the starting position.

Our final design was able to meet most of the design goals we set at the start of the year. Our design is hand free when in use and only requires one hand to deploy and retract. The design also takes less than 30 seconds to deploy or retract and can safely deploy without hitting the user or causing them any harm. The system is compact and does not take up much space in the backpack.

DEVELOPMENT + ITERATION

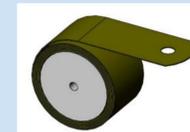
First Design



Issues:

- External mounted shaft not strong enough to support torque on the rope
- Small radius of shaft compared to umbrella arm means force is too great to overcome moment
- Baseplate not strong enough

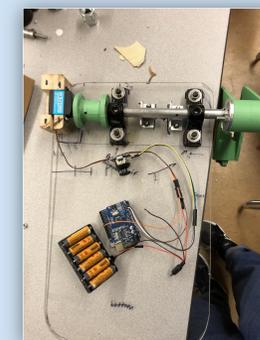
Iteration 1



Issues:

- Constant force springs still don't deliver enough force to overcome the arm moment

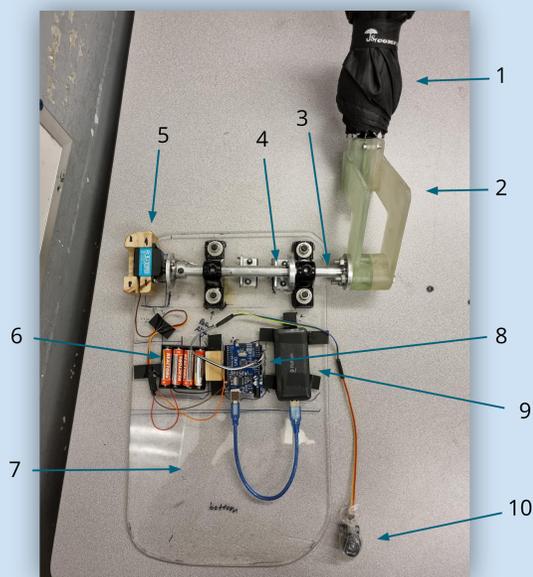
Iteration 2



Issues:

- Failure occurred on green PLA servo connector as it was under a significant amount of torque
- PLA arm also prone to failure
- Arduino wires bent when base plate was placed inside backpack

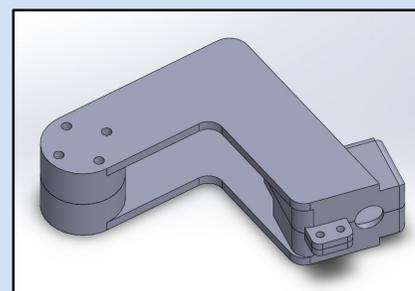
A LOOK INSIDE



1. Umbrella
2. Arm
3. Shaft
4. Latching Mechanism
5. Servo Motor and Mount
6. Servo Battery Pack
7. Baseplate
8. Arduino
9. Arduino and Joystick Battery Pack
10. Joystick

DESIGN

ARM



- Compact design to hold and store umbrella
- Modeled on SolidWorks and 3D printed
- Printed in resin for waterproofness and high toughness
- One piece, easy to attach and remove
- Easy to access opening button

SERVO



- Compact design allows it to fit inside the backpack
- 35kg*cm of torque allows it to easily rotate the arm
- Powered by 4 AA batteries, making it easy to replace
- Controlled by waterproofed joystick which is located on the shoulder

LATCH



- Made from steel rod and spring
- A metal disk is mounted to the shaft that latches the pin
- Tension in the spring locks the pin automatically
- Latch is unlocked when the rope is pulled by the user
- Lightweight spring allows for easy retraction
- The pull tab is located on the shoulder strap for easy access

FUTURE WORK

If we had more time to continue the project we would have liked to integrate an **automatic deployment and retraction** system for the umbrella itself to make operation even easier for the user. We would also explore ways to more efficiently place the umbrella canopy to maximise effective coverage.

Bibliography:

reporters, I. T. (2018, November 27). Storm Diana: Met éireann issues orange weather warnings. The Irish Times. Retrieved April 4, 2022, from <https://www.irishtimes.com/news/environment/storm-diana-met-%C3%A9ireann-issues-orange-weather-warnings-1.3711974>
Constant Force Spring Design Worksheet. Hunterspringandreel.com view government systems. (n.d.). Retrieved April 4, 2022, from <https://www.governments.info/sites/hunterspringandreel.com/>