



FABRICADEMY

Textile & Technology Academy

TOUCH-FREE CLOTHING



Final Project 2025-2026

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Abstract

This project explores the development of touch-free clothing designed to enhance independence and inclusivity for individuals with physical disabilities. By integrating soft robotics, and adaptive fashion design, the study aimed to create garments that can be worn and adjusted with minimal physical effort. The project focuses on the design and fabrication of adaptive products that utilize textile pneumatic actuators and smart fastening systems such as magnets and Velcro. The ultimate goal is to merge technology and fashion to promote accessibility, comfort, and dignity for all users.

1. Introduction

1.1 Background

Fashion is a powerful form of identity and self-expression, yet it often excludes individuals with physical disabilities. Assistive clothing, a branch of adaptive fashion, addresses this gap by combining style with functionality to support independent dressing. Through features like magnetic closures, elastic adjustments, and smart textiles, it enhances comfort and accessibility. With advancements in wearable technology and soft robotics, assistive clothing is evolving into responsive garments that move and adapt autonomously, redefining fashion as both inclusive and empowering.

1.2 Research Questions

- How can physically disabled individuals be included in fashion technology?
- How can clothing be designed to simplify the lives of people with physical disabilities?



2. Rationale

According to the **World Health Organization (2024)**, approximately **1.3 billion people** live with significant disabilities worldwide. This represents a major portion of the global population whose needs are often overlooked in mainstream fashion. Addressing these challenges through adaptive and technological design can promote independence, self-esteem, and inclusivity.

3. Evolution of Adaptive Fashion

The development of adaptive fashion has evolved through several key stages:

- **Early Years:** Functional necessity inspired design.
- **World War II:** Rehabilitation needs drove innovation.
- **1980s:** Specialized adaptive brands emerged.
- **21st Century:** Integration of technology and fashion.

Examples include Levi's functional jeans for people with disabilities (1975) and modern adaptive brands such as **Intotum Fashion** and **Tommy Adaptive**.

4. Project Motivation

This project is driven by three main objectives:

- To promote **independence and self-esteem** for people with disabilities.
- To integrate **E-textiles, wearables, and soft robotics** into fashion.
- To sustain **inclusivity and accessibility** in clothing design.

5. Project Objectives

- The project aims to develop **touch-free clothing** that uses:
 - Textile pneumatic actuators for movement assistance.
 - Magnetic or Velcro closures for easy fastening.
 - Future integration of **gesture, proximity, or voice control** for autonomous dressing.

6. Reference Projects

Several pioneering projects informed this research:

- **Pola Demianiuk's robotic clothing:** assists the body in dressing (<https://youtu.be/c2xEdDUybDg>).



- **Silvert's Adaptive Clothing & Footwear for Women and Men** (<https://www.youtube.com/watch?v=eK9BOD1m6lM>)

- **Tommy Adaptive:** inclusive fashion with magnetic closures (<https://www.myseismic.com/>).



- **Suzhou Yidaibao's wearable airbags:** prevent falls among the elderly .



- **Intotum Fashion:** sustainable and inclusive adaptive wear.

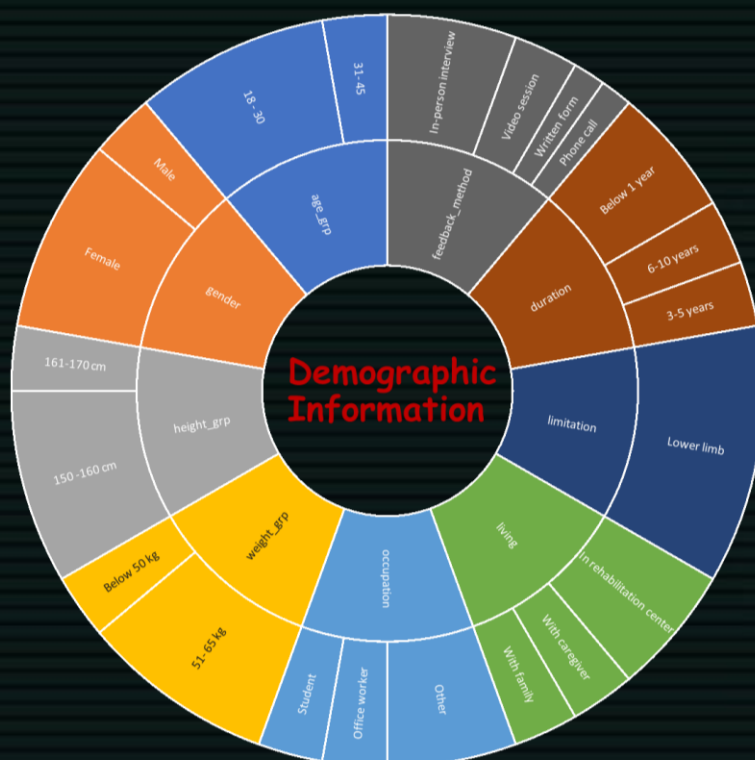


- **Seismic Powered Clothing:** robotic undergarments that support muscle movement.

9. Design and Fabrication Process

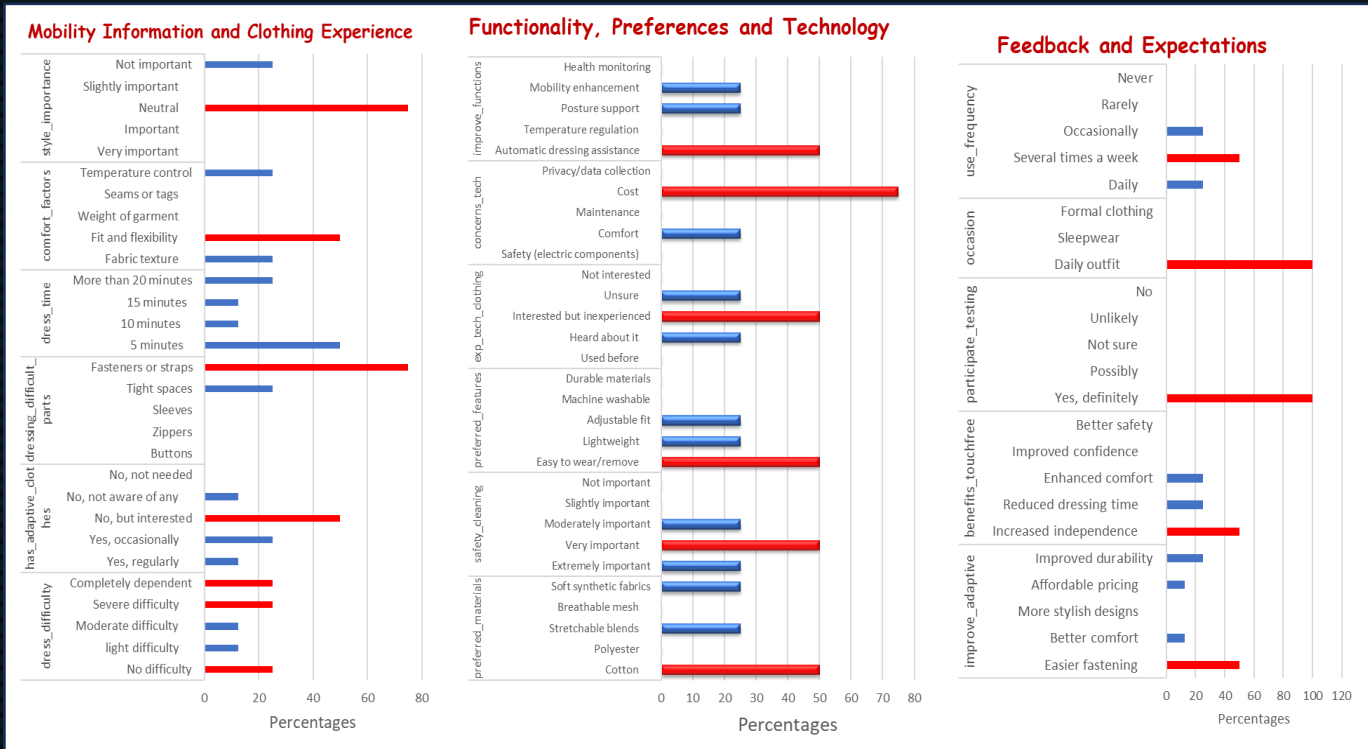
9.1 User Testimonies

Interviews and surveys were conducted with physically challenged individuals to identify key requirements.



9. Design and Fabrication Process

9.1 User Testimonies



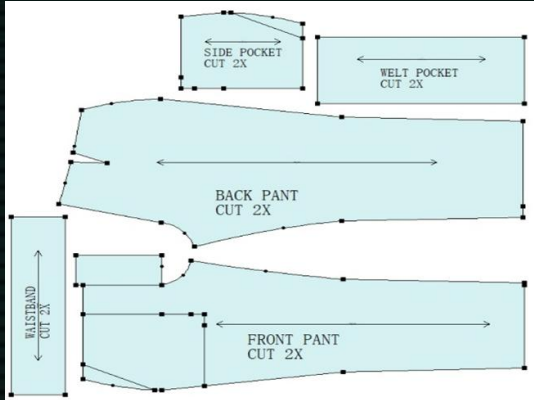
9.2 Findings

- Major dressing difficulties: zippers, buttons, tight spaces, and straps.
- Preferred materials: cotton, stretchable blends, and breathable mesh.
- Desired features: lightweight, adjustable fit, and machine washability.
- Concerns: safety, comfort, and maintenance of electronic components.
- Most participants expressed interest in adaptive and smart clothing.

9. Design and Fabrication Process

9.3 Product Development

Pattern drafting and sewing were carried out using adaptive pant designs with side zippers and elastic adjustments.



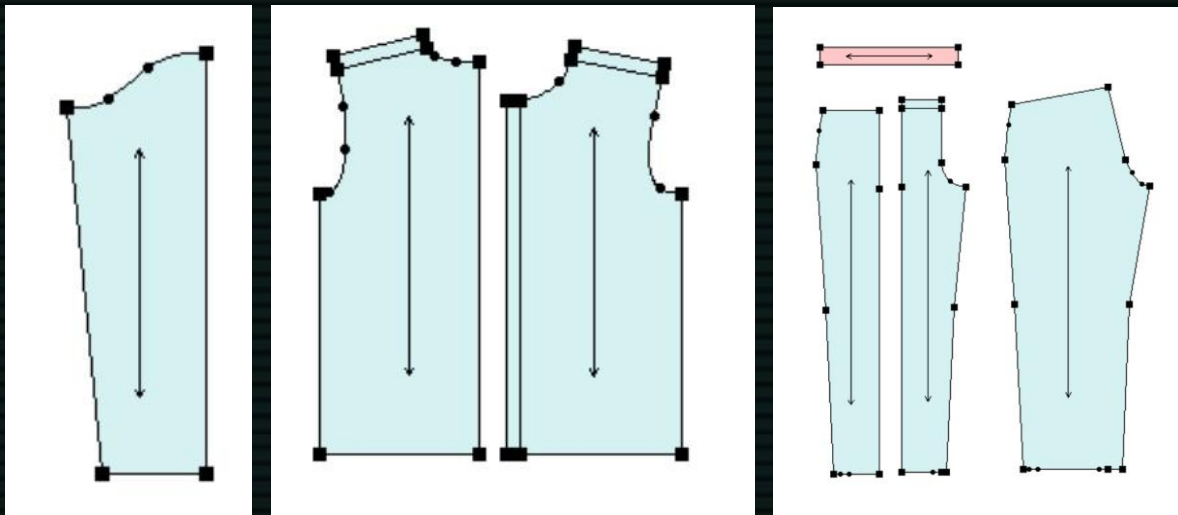
Testing confirmed good fit and ease of use.



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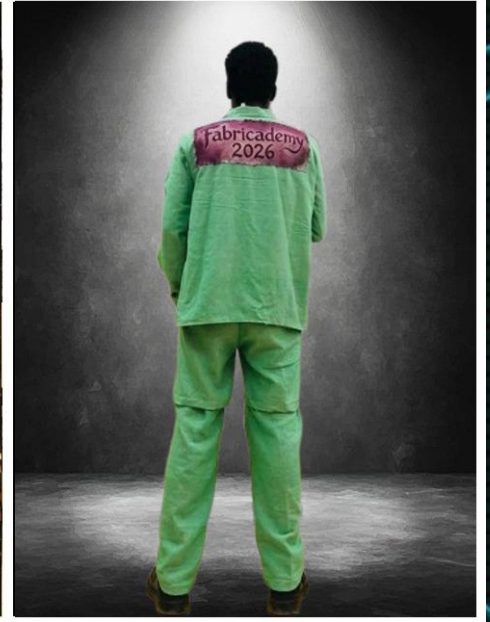
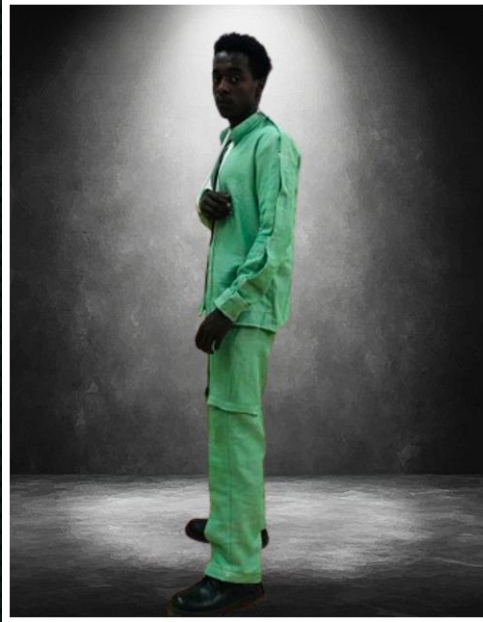
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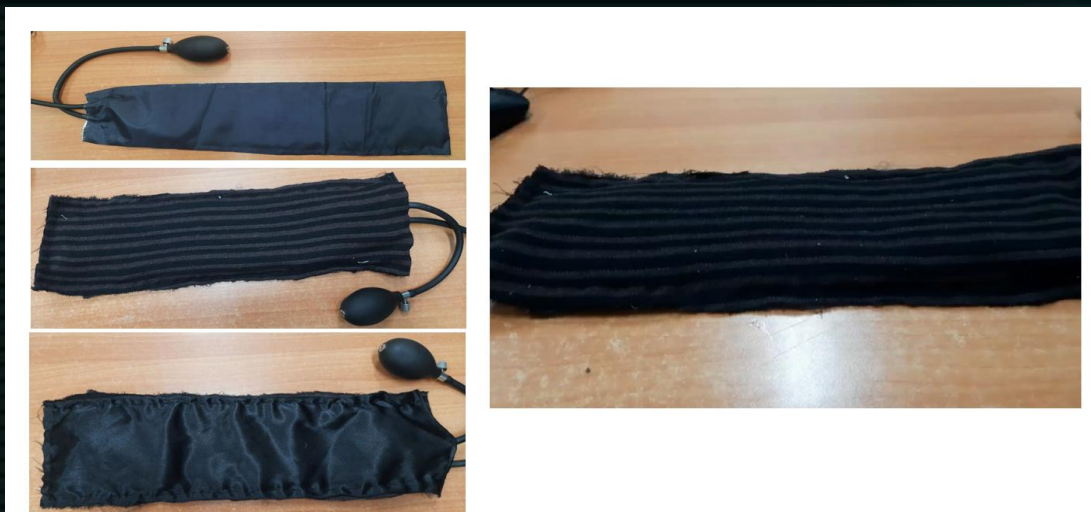
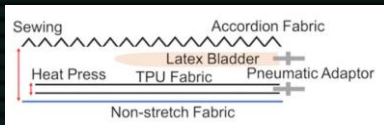
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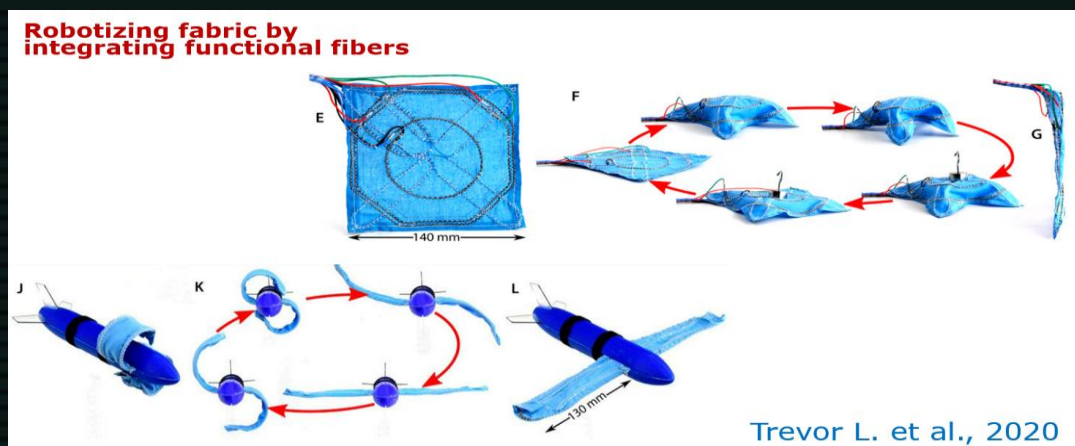


10. Textile Actuation Testing

Soft robotic actuators were developed using **TPU-coated nylon**, **latex bladders**, and **non-stretch fabrics**. The actuator construction and bending behavior under different pressures (Deimel & Brock, 2013; Yap et al., 2017). Prototype actuators demonstrated bending, straightening, and twisting motions suitable for integration into garments.



10. Textile Actuation Testing



Testing actuation of knitted fabrics



11. Materials Used

- TPU-coated nylon
- Air tubes and rubber hoses
- Air compressor (Manual and BP Pressurizer)
- Stretchable and non-stretchable fabrics
- Sewing machine, Threads, and Velcro

12. Future Work

- Further research on the textile actuation materials and
- Integrate inflation and deflation systems into pants for automated dressing.
- Develop and test multiple textile actuator designs.

13. Conclusion

The Touch-Free Clothing project demonstrates how technology can transform adaptive fashion into a tool for empowerment. By merging soft robotics with textile design, this research contributes to the creation of inclusive, functional, and aesthetically pleasing garments that enhance autonomy for people with disabilities.

References

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Silvert's Adaptive Clothing & Footwear (2025). <https://www.youtube.com/watch?v=eK9B0D1m6IM>

Seismic Powered Clothing (2025). <https://www.myseismic.com/>

Appendix

Interview Question

I, Mr. Wendosen Seife, a Fabricademy 2026 student, is conducting a Touch-Free Clothing for Physically Challenged Persons.” To successfully carry out this project, your support is very important. Therefore, I kindly request you to provide appropriate answers to the following questions.

Section 1: Demographic Information

1. Age:

Under 18 18 - 30 31- 45 46 - 60 Above 60

2. Gender:

Male Female

3. Height:

Below 150 cm 150 -160 cm 161-170 cm 171-180 cm Above 180 cm

4. Weight:

Below 50 kg 51- 65 kg 66 - 80 kg 81- 95 kg Above 95 kg

5. Occupation or daily activity:

Student Office worker Homemaker Retired Other: _____

6. Living situation:

Independent With family With caregiver In rehabilitation center

Other: _____

7. Type of physical challenge or mobility limitation:

Upper limb limitation Lower limb limitation Paralysis Muscle weakness

Other: _____

8. Duration of condition:

Less than 1 year 1-3 years 3-5 years 6-10 years More than 10 years

9. Preferred method for providing feedback:

In-person interview Online survey Phone call Video session Written form

Appendix

Section 2: Mobility Information and Clothing Experience

10. How does your condition affect your ability to dress or undress independently?

No difficulty Slight difficulty Moderate difficulty Severe difficulty

Completely dependent

11. Do you have any special clothes that are adaptable to your situation that are easier to wear?

Yes, regularly Yes, occasionally No, but interested No, not aware of any

No, not needed

12. What are the most difficult parts of dressing?

Buttons Zippers Sleeves Tight spaces Fasteners or straps

13. How long does it take you to get dressed?

5 minutes 10 minutes 15 minutes More than 20 minutes

14. What features make clothing comfortable or uncomfortable for you?

Fabric texture Fit and flexibility Weight of garment Seams or tags

Temperature control

15. How important are appearance and style in your clothing choices?

Very important Important Neutral Slightly important Not important

Section 3: Functionality, Preferences and Technology

16. What are your preferred materials or fabrics:

Cotton Polyester Stretchable blends Breathable mesh Soft synthetic fabrics

17. How do you express importance of safety and ease of cleaning:

Extremely important Very important Moderately important Slightly

important Not important

18. What are your preferred garment features:

Easy to wear/remove Lightweight Adjustable fit Machine washable

Durable materials

19. Do you have any Experience with technology-integrated clothing:

Used before Heard about it Interested but inexperienced Unsure Not

interested

Appendix

20. Concerns about technology-integrated garments:

- Safety (electric components) Comfort Maintenance Cost

Privacy/data collection

21. What would you like to improve in your clothing to make them more adaptive.

- Automatic dressing assistance Temperature regulation Posture support
 Mobility enhancement Health monitoring

Section 4: Feedback and Expectations

22. What improvements do you like to be made in your adaptive clothing.

- Easier fastening Better comfort More stylish designs Affordable pricing Improved durability

23. What are the benefits you believe you will have with touch free clothing

- Increased independence Reduced dressing time Enhanced comfort
Improved confidence Better safety

24. Are you interesting in participating in testing and giving feedback to my prototypes

- Yes, definitely Possibly Not sure Unlikely No

25. For which occasion you would like to have adaptive clothing

- Daily outfit Sleepwear Formal clothing

26. How often would you use touch-free clothing if available?

- Daily Several times a week Occasionally Rarely Never

27. How would your dream clothes would look like _____

_____.



Especial Thanks for

- Anastasia Pistofidou
- Adriana Cabrera
- FabLab Rwanda
- For all Fabricademy Team