2026 Spring High School Research Program

Project Topic

Wearable Robotics for Assistive Healthcare: Designing Textile-Based Haptic Devices for Diverse Patient Populations

Background

Wearable haptic technologies use vibrations, pressures, or motions to provide sensory feedback to the human body. By integrating **fiber-shaped actuators** into textiles, students can design soft, lightweight, and comfortable devices for real-world applications. Potential user groups include:

- **People with diabetes who experience foot insensitivity**
- **Blind or deaf individuals** who rely on navigation aids
- **General human–computer interaction users** (VR/AR, gaming, training tools)

Students will investigate:

1. Target user group and needs.
2. Placement of the wearable device on the body.
3. Type of haptic signal (motion types, force level, frequency).
4. Control methods and test strategies.

Project Description

This program introduces high school students to the fundamentals of **wearable technology, human-centered design, and soft robotics**. Over 4 weeks, students will learn the basics of textiles, and how to design and test wearable haptic devices, combining creativity, engineering, and problem-solving. Students will engage in a **capstone project**: conceptualizing a wearable haptic device designed for a chosen user group.

Prerequisites

- **Grade Level:** 10th grade and above.
- **Interest:** Curiosity about engineering, textiles, robotics, or assistive technologies.
- **Skills:** No prior experience required, but basic STEM knowledge helpful.
- **Technology:** Access to a computer.

Project Outcomes

By the end of the program, students will be able to:

1. **Understand Wearable Robotics Basics**: Explore the principles of haptic feedback and fiber-shaped actuators.
2. **Identify User Needs**: Analyze the challenges faced by amputees, people with diabetes, or sensory-impaired individuals.
3. **Design Wearable Prototypes**: Choose wearable locations and haptic signal types.
4. **Test Methods**: Develop methods to evaluate device effectiveness (comfort, signal clarity, user response).
5. **Communicate Ideas**: Present research in written and oral forms, including a final capstone showcase.

Tentative Schedule (4 Weeks)

Week 1: Introduction to Wearable Haptics & Fiber Actuators

- Introduction of textile engineering and technologies
- Overview of wearable robotics and assistive technologies.
- Literature review: Case studies (prosthetics, VR gloves, navigation belts).

Week 2: User-Centered Design

- Identify user groups (amputees, diabetic patients, blind/deaf navigators).
- Define needs and challenges.
- Brainstorm wearable placement and functions.

Week 3: Haptic Signals & Control

- Types of devices: Motion, force, frequency
- Design testing methods (signal detection, comfort evaluation).

Week 4: Project Refinement and Showcase

- Peer feedback and iteration.
- Refine based on peer feedback
- Present capstone wearable haptic device concept.

- Peer review and final reflections.

Deliverables

- **Research Report**: User needs analysis, design process, technology description, and testing protocols.
- **Presentation**: A group showcase summarizing the design, testing, and potential impact.

Research Workshop: Mon. & Wed. 7-8 PM EST