Design Proposal Template:

School: Reservoir High School **State:** Maryland **Division:** ~~Middle School~~ or High School

Team Members' Names: Cheren Song, Jonathan Ye, Dominic Ye, Ife Adeleye

Project Title: Readers should have a general sense for what the project is about and want to read more. (20 word maximum)
Game Changer: Engineering Adaptive Controllers for Barrier-Free Play *(8 words)*
Inequity Being Addressed: Describe the inequity that you will attempt to address with your proposed solution, and why you chose this inequity. Students are able to consider a global perspective related to their inequity. (75 word maximum)
People with limited dexterity face inequitable access to gaming—a socially, physically, and cognitively beneficial activity for billions—as traditional video game controllers are difficult to use. Furthermore, current adaptive controllers have high costs, complex setups, and limited compatibility. Neighboring a school for students with disabilities, we witnessed their struggles to socialize through gaming. Our project aims to address this, focusing on the UN SDGs #10 (Reduced Inequalities) and #3 (Good Health and Well-being). *(72 words)*
Community Research and User Identification: Explain the process used to identify the inequity and select your user. Include any research done to identify issues in your community and understand which groups face challenges because of these issues. (150 word maximum)
Inspired by the Cedar Lane School to tackle social isolation among students with disabilities, we interviewed 5 paraeducators. We found that **gaming was a popular "way of fitting in"** for individuals with disabilities (RHS Special Education Department). Looking outside our community, **over 6,000 students in our school district have disabilities**, and worldwide, **roughly 10% of video game players are hindered by a physical disability** (MD State BOE, "Disabled Gamers"). By interviewing adaptive technology professionals, we uncovered the prevalence of a disability stigma and expanded our target audience to all people with dexterity impairments. We sought to provide them with quality-of-life improvements, social integration through video games, and cognitive and physical benefits that allowed them to exercise their hand muscles while reducing strain. Through researching adaptive gaming controllers on the market, we considered unaddressed inequities and limitations for users, including high cost ($90+), complicated setup, and restricted device compatibility. *(149 words)*

User Profile: Provide a detailed description of your selected user. Include information about challenges they face, how those challenges impact their lives, and specific project needs based on user feedback. (150 word maximum)

Limited dexterity is defined as a reduced ability to perform delicate hand movements, which arthritis, neuromuscular disorders, injuries, etc, can cause. Many people with limited dexterity report difficulty using traditional video game controllers, as they struggle to push small, closely clustered buttons quickly while maintaining a stable grip on the controller. Consequently, they can feel excluded from video games, which provide a safe space against social stigma, improve cognitive abilities, and are a popular social activity: over **3 billion** people worldwide play video games (Media & Entertainment Video Games Sector).

Through our research, surveys, and interviews, the main project needs we found were:

1. Larger controller and buttons, with controls that are easy to press and spaced apart comfortably.
2. Adaptability, due to a wide variety of video games our survey's respondents reported playing and paraeducator insights.
3. An affordable product compared to the high cost associated with current adaptive controllers.

(147 words)

Project Goals: List your project goals and explain how these goals will address the inequity. Project goals should define the desired outcomes, not specific features of the proposed solution. (150 word maximum)

1. Make a keyboard-sized controller with large and easy-to-use buttons that can connect to the user's computer, maximizing convenience
2. Create an interchangeable layout and design for the buttons and joystick(s). This allows for the controller to be adaptable to the user's unique dexterity-related disabilities
3. Code a user-friendly app that can customize button-key mappings and joystick sensitivities based on the user's preferred video game control system
4. Keep the product cheaper than current alternatives to lessen the financial barriers

By achieving these goals, our team will ensure that our product is as accessible and effective as possible, granting those with dexterity impairments an equitable option to traditional gaming controllers. To do this, we will center our design around the individual so our controller can adequately accommodate each user and expand inclusivity in the gaming community, breaking down the stigma and bridging barriers that individuals with limited dexterity face in their everyday lives.

(150 words)

Proposed Solution: Describe your proposed solution, including any innovative and unique features, and explain how this solution will address your users' needs and the inequity they face. (150 word maximum)

Our proposed solution is a dual-faceted system with a controller and an app. Our controller design will feature larger, interchangeable buttons and joysticks with adjustable orientation. This will allow people with varying levels of limited dexterity to play diverse types of games by customizing their controller's layout. The Arduino Leonardo board inside the controller will connect to the tactile buttons and joystick, processing button presses and joystick potentiometer movements and sending this information to a computer. The app

will be on the user's device, allowing the user to map the controller buttons to various functions and change the controls at any time through Serial communication. This effective, intuitive app allows for all personalized setups, meeting our goal of an adaptable design. The product will also be cost-effective and sturdy, utilizing 3D-printed parts to lower material costs while maintaining durability.
(139 words)

Initial Design: A single graphic of your first design idea with key features adequately labeled. It should be easy to understand and the reader should have a general understanding of how the prototype functions by looking at the graphic. Max size 8.5" x 11"