Tech[HACK] Valley

Hosted by Georgia Tech Esports

Hardware Track: Adaptive Controls

The Challenge

Gaming is a universal form of entertainment, connection, and community. Yet for millions of gamers with physical disabilities, particularly those with paraplegia or quadriplegia, traditional gaming controllers present significant barriers to participation. The Adaptive Controls track challenges participants to innovate solutions that expand access to gaming for differently abled individuals.

Your mission is to design, prototype, or conceptualize hardware solutions that make gaming more accessible. Whether you build a functional device, create detailed engineering specifications, or develop a novel sensor methodology, your work could help bridge the gap between gamers and the games they love.

Problem Statement

An estimated 46 million gamers in the United States alone have some form of disability. Traditional gaming controllers assume a standard range of motion, grip strength, and fine motor control that many individuals simply do not have. For quadriplegic gamers, even pressing a single button can be impossible without specialized equipment. Current adaptive solutions, while groundbreaking, remain expensive, limited in availability, and often require extensive customization.

Key Challenges to Address

- **Physical Input Methods:** Traditional buttons, joysticks, and triggers require hand dexterity and strength that many users lack. Alternative input methods (sip-and-puff, eye tracking, head movement) need refinement and broader compatibility.
- **Mounting and Positioning:** Controllers must be positioned precisely for each user. Current mounting solutions are often expensive, difficult to adjust, or incompatible with standard wheelchairs and seating arrangements.
- **Cost and Accessibility:** Specialized adaptive controllers can cost hundreds of dollars, putting them out of reach for many who need them most.
- **Platform Compatibility:** Solutions must work across multiple gaming platforms (PC, Xbox, PlayStation, Nintendo Switch) to provide genuine flexibility.

Project Scope & Eligible Submissions

Submissions may include but are not limited to:

1. **New Controller Designs:** Complete adaptive controller prototypes or detailed design specifications for novel input devices.
2. **Sensor Innovations:** Theoretical or functional sensor systems using eye tracking, EMG (muscle signals), head movement, breath control, voice recognition, or other novel input methods.
3. **Mounting Solutions:** Adjustable, affordable, and easily-installed mounting systems that attach controllers to wheelchairs, beds, desks, or other surfaces.
4. **Accessibility Peripherals:** Switches, buttons, joysticks, or other input devices designed to work with existing adaptive controller ecosystems (e.g., Xbox Adaptive Controller, PlayStation Access Controller).
5. **Software-Hardware Integration:** Solutions that combine custom hardware with software mapping, profiles, or input translation to enhance accessibility.

Rules & Requirements

Team Composition

- Teams may consist of 1-4 members
- Interdisciplinary teams (engineering, design, healthcare backgrounds) are encouraged
- All team members must be registered hackathon participants

Submission Requirements

- A working prototype, detailed design document, or proof-of-concept demonstration
- Documentation explaining the problem addressed, solution approach, and implementation details
- A brief presentation (5 minutes maximum) demonstrating your solution to the judging committee
- Bill of materials and estimated production cost (if applicable)

Judging Criteria

Projects will be evaluated by a committee based on:

Criterion	Description
Innovation	Originality and creativity of the solution
Impact	Potential to meaningfully improve accessibility for target users
Feasibility	Technical viability and realistic path to implementation
Affordability	Cost-effectiveness and accessibility to end users
Presentation	Clarity and quality of demonstration and documentation

Awards

The overall winner of the Hardware Track will receive an award to be determined. All participants will receive recognition for their contributions to advancing adaptive gaming technology.

Industry Overview: Adaptive Gaming Controllers

The adaptive gaming market has grown significantly in recent years, driven by increased awareness of accessibility needs and advocacy from disability communities. Major gaming companies have begun investing in accessible hardware, though significant gaps remain.

Major Commercial Solutions

Xbox Adaptive Controller (Microsoft)

Released in 2018, the Xbox Adaptive Controller was developed through Microsoft's internal hackathon and represents a landmark in mainstream accessible gaming. It features two large programmable buttons, a D-pad, and 19 external 3.5mm jacks plus two USB ports for connecting switches, buttons, joysticks, and other assistive devices. The controller works with Xbox consoles and Windows PCs, with third-party adapters enabling PlayStation and Switch compatibility. Priced at $99.99, it established that accessible gaming hardware could be produced affordably at scale. Microsoft has continued expanding the ecosystem with the Adaptive Joystick and Thumbstick Toppers announced for 2025. (xbox.com)

PlayStation Access Controller (Sony)

Launched in December 2023, Sony's Access Controller was developed over five years in collaboration with accessibility organizations including AbleGamers, SpecialEffect, and Stack-Up. The circular modular design features a central joystick (repositionable to any cardinal direction), eight customizable buttons, and four 3.5mm expansion ports. Players can use two Access Controllers together or combine them with a DualSense controller. The software supports 30 custom profiles with quick switching. At $89.99, it provides a complete out-of-the-box solution. Sony designed even the packaging to be openable with one hand. (playstation.com)

Hori Flex Controller (Nintendo Switch)

The Hori Flex provides adaptive gaming for Nintendo Switch and Windows PC. Rather than a traditional controller shape, it functions as a hub with a D-pad, six customizable buttons, 16 front-mounted 3.5mm ports, two USB ports, and separate 3.5mm jacks for external joysticks. It can be mounted to camera tripods via a standard 1/4-inch screw thread.

Specialized Controllers

QuadStick

The QuadStick is a mouth-operated controller designed specifically for quadriplegic gamers. It features a joystick controlled by mouth movement, four sip-and-puff pressure sensors, and a lip position sensor, all connected to a 32-bit ARM processor. Users create custom game profiles mapping inputs to controller functions. The QuadStick FPS

($549+) provides enhanced precision for competitive gaming, while the Original model ($449+) offers the same functionality with a lighter joystick. The device works directly with PlayStation, Nintendo Switch, PC, and Mac, with adapters available for Xbox. (quadstick.com)

Input Technologies

Eye Tracking

Eye tracking technology has become increasingly viable for gaming accessibility. Tobii produces both gaming-focused eye trackers (Eye Tracker 5) and assistive technology devices (PCEye) through its Tobii Dynavox division. Over 100 games now support Tobii eye tracking natively. The technology enables hands-free control of games using gaze direction, with applications ranging from camera control in simulation games to full interface navigation for users with severe mobility limitations. Prices range from $229 for gaming devices to several hundred dollars for medical-grade assistive technology products. (tobii.com)

Voice Control

Software solutions like VoiceAttack allow PC gamers to map voice commands to keyboard keys, mouse actions, or controller inputs. This provides an additional input channel for gamers who can speak but have limited hand mobility. Windows 10 and later versions include built-in Eye Control features that can be combined with Tobii hardware for comprehensive hands-free computer control.

Mounting and Positioning

Proper mounting is critical for adaptive gaming setups. RAM Mounts has partnered with Microsoft to create wheelchair-compatible mounting solutions for the Xbox Adaptive Controller, including track mounts compatible with major wheelchair brands (Invacare, Permobil, Quickie) and universal body mounts. The PlayStation Access Controller includes AMPS-pattern mounting points for standard accessibility mounting systems. Companies like Rehadapt specialize in mounting solutions that work with wheelchairs, beds, tables, and floor stands, using aircraft-grade aluminum for lightweight durability with full 360-degree articulation.

Supporting Organizations

AbleGamers is the largest charity for gamers with disabilities. They provide free accessibility assessments through their Peer Counseling program, maintain a database of accessible game reviews, and have worked directly with Microsoft, Sony, and game developers on accessibility initiatives. (ablegamers.org)

SpecialEffect is a UK-based charity that helps people with physical disabilities enjoy video games. They provide equipment, training, and support, and have consulted on major accessibility hardware including the PlayStation Access Controller. (specialeffect.org.uk)

Warfighter Engaged modifies controllers and creates adaptive devices for wounded veterans at no cost. They also hold gaming clinics, workshops, and accessibility lectures. (warfighterengaged.org)

The Controller Project provides donated modified controllers customized to individual functional needs, run by founder Caleb Kraft. (thecontrollerproject.com)

Market Outlook

The adaptive gaming controller market continues to grow as major gaming companies recognize both the social importance and business opportunity of accessibility. Approximately 20% of gamers experience some form of disability. Industry analysts note increased collaboration between gaming companies and disability organizations, with accessibility features increasingly built into mainstream products rather than relegated to aftermarket solutions. The entry of major players like Microsoft, Sony, and Logitech has helped bring down costs while raising awareness and legitimacy of adaptive gaming needs.

We look forward to seeing your innovative solutions that will help make gaming accessible to all players!