SciVizHub Technical Overview

Modern Architecture for Interactive Learning

SciVizHub is built with a modern, web-based technology stack designed for accessibility, performance, and seamless integration with educational environments:

Core Technology Stack

- **React Framework**: Powers our interactive user interfaces with smooth, responsive performance across devices
- **JavaScript Visualization Libraries**: Uses industry-standard tools like D3.js and Recharts for scientific-grade visualizations
- **Canvas & SVG Rendering**: Enables both high-performance animations and precision graphics that work across all modern browsers
- **Progressive Web App Capabilities**: Allows offline access to visualizations in low-connectivity environments

The architecture follows a component-based design, making it both maintainable and extensible. Each visualization module is self-contained, allowing us to rapidly develop new health AI modules without rebuilding the entire system.

User-Centered Design


SciVizHub Platform Architecture Diagram

Our platform separates the visualization logic from the presentation layer, enabling:

- Responsive design that automatically adapts to different screen sizes and devices
- Consistent performance across desktop, tablet, and mobile environments
- Background computation that maintains smooth interactivity even with complex calculations

Accessibility: Designed for Everyone

SciVizHub is built with accessibility as a foundational principle, not an afterthought:

Core Accessibility Features

- **Screen Reader Compatibility**: All visualizations include ARIA attributes and descriptive text alternatives
- **Keyboard Navigation**: Complete functionality without requiring mouse interaction
- **Color Contrast Compliance**: WCAG AA-level contrast ratios with customizable color schemes
- **Text Scaling**: Interface elements that adapt to user font size preferences
- **Reduced Motion Options**: Alternative animations for users with vestibular disorders
- **Multi-language Support**: Internationalization framework for content translation

Data Sonification Capabilities

For complex data patterns, we incorporate audio representations that:

- Translate visual patterns into sound for visually impaired users
- Reinforce learning through multi-sensory engagement
- Provide alternative ways to understand frequency relationships in signal processing

Seamless Integration with Learning Environments

SciVizHub is designed to work within existing educational technology ecosystems:

Integration Methods

- **LTI Compliance**: Learning Tools Interoperability support for direct Canvas, Blackboard, and Moodle integration
- **Embeddable Components**: Individual visualizations can be embedded in any web page or LMS
- **API Access**: Programmatic access for custom applications and research platforms
- **Learning Analytics**: xAPI compatibility for tracking learner interactions and progress
- **SSO Support**: Single sign-on capabilities with common authentication providers

Deployment Options

- **Cloud-hosted SaaS**: Ready-to-use platform with no installation required
- **Institutional Installation**: Self-hosted option for universities with specific privacy requirements
- **Hybrid Model**: Core platform in the cloud with sensitive data processing on local infrastructure

Data Security & Privacy

Built with health education in mind:

- **No PHI Collection**: Platform design avoids collecting protected health information
- **Anonymized Analytics**: Learning data collected without personally identifiable information
- **User Control**: Transparent data collection with opt-out capabilities
- **FERPA Compliance**: Educational record handling aligned with privacy regulations

Development Roadmap

Our flexible architecture enables us to prioritize AIM-AHEAD's specific needs:

- **Content API**: Allowing partner institutions to contribute health equity examples
- **Custom Authentication**: Support for institution-specific identity systems
- **Expanded Accessibility**: Ongoing enhancements for diverse user needs
- **Mobile-Optimized Experience**: Dedicated mobile interfaces for key visualizations

SciVizHub combines technical sophistication with user-centered design to create a platform that's powerful enough for advanced concepts yet accessible to diverse learners regardless of their computational background or physical abilities.