Immersive Computing

Increasing engagement and productivity through immersive experiences

THE CHALLENGE

Virtual, augmented, and mixed reality use digital technology to simulate real-word conditions, thereby creating a sense of immersion. Virtual worlds are especially valuable where hands-on activities are unsafe, too expensive, or impractical—such as national security, training, and healthcare.

Immersive computing is being driven by advancements in processing power, optical display capabilities, sensor devices, motion tracking, and commercially available headsets. To increase user engagement and productivity, researchers must continue to integrate new display, input, and interaction techniques.

APPROACH

At Pacific Northwest National Laboratory (PNNL), we create novel immersive experiences that work with a variety of devices and platforms. We apply and develop emerging user-interface technologies to create more engaging experiences and seamless workflows.

We are developing multi-sensory interfaces that support collaboration, where users can immerse themselves in their data to explore, discover, and analyze. We are exploring ways to add technologies like voice assistants, facial recognition, and the Internet of Things.

PNNL simulations have let people walk around a three-dimensional molecule, see where a power plant should be safeguarded to protect against adversaries, and visualize computer science concepts to support educational achievement standards. We developed a travel-ready kit that contains all the equipment and software needed to run a virtual reality (VR) simulation without an Internet connection. This portable kit makes it easy to provide high-quality VR-based training or demonstrations anywhere.

As a multi-program national laboratory, we assemble customized teams of software developers, user experience designers, and subject matter experts from dozens of science and technology fields. Working with instructional designers, we conduct extensive user research to understand and document specific needs, so that users come away with the desired knowledge and understanding.
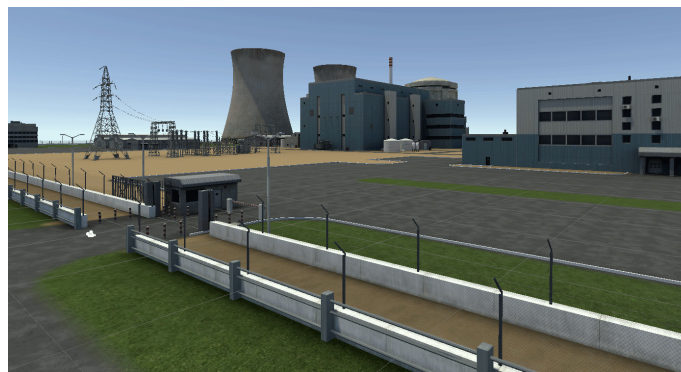
EXAMPLE PROJECTS

STEM Virtual Reality

Virtual reality has been shown to reinforce vital concepts and increase memory retention. To support K-12 educational curricula, PNNL is collaborating with teachers to develop VR applications in science, technology, engineering, and math (STEM). Initial topic areas include computer networking, data gathering and analysis, cybersecurity, and climate science.

Waste Tank Simulator

Aging underground tanks store hardened nuclear waste at the Hanford Site in Washington state. This VR application

helps train operators who use specialized equipment and cameras to examine the inside of the tanks. In a virtual environment, they can practice using robotic tools to look for damage, vacuum up sediment, and spot-weld flaws. The hands-on experience also helps stakeholders, such as legislative and community leaders, better understand the challenges of nuclear waste cleanup.

Active Shooter Preparedness Training

Teaching people how to respond to an active shooter is challenging. Videos and presentations may not be realistic enough. Live rehearsals in real buildings such as schools, hospitals, or businesses can be expensive and even traumatic for participants. PNNL is using immersive computing to deliver a safe, controlled, interactive experience. In a simulated environment, participants can practice strategies to run, hide, or fight as the scenario evolves. The application can evaluate the participants' responses and reinforce correct actions.

About PNNL

PNNL advances the frontiers of knowledge, taking on some of the world's greatest science and technology challenges. Distinctive strengths in chemistry, earth sciences, and data analytics are the heart of our science mission, laying a foundation for innovations that improve America's energy resiliency and enhance our national security. PNNL's computing research encompasses data and computational engineering, high–performance computing, applied mathematics, and semantic and human language technologies.

Contacts

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