VR/AR Association White Paper

Energy Committee Whitepaper VR/AR To Address Staffing Challenges of the Energy Sector

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OBERON TECHNOLOGIES

Oberon Technologies is a leading provider of innovative interactive training solutions, leveraging virtual reality technologies coupled with state-of-the-art information delivery for environments where safety, security, or efficient cost of delivery is critical.

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Table of Contents

1 Introduction

Virtual and Augmented Reality (VR and AR) have the potential to revolutionize learning and training in the energy sector. They offer immersive experiences that enhance understanding of complex concepts, procedures, and equipment in a safe environment. These technologies are engaging and impactful throughout the employment cycle, from recruiting to reskilling and provide access to virtual training environments worldwide, reducing carbon footprints and promoting sustainability.

In 2021, the VR/AR Association Energy Committee released the first whitepaper in a series, titled "VR/AR in the Energy Sector," providing insights on VR and AR utilization in the industry. The goal was to offer insights to the VRARA Energy community, representing stakeholder organizations and technology suppliers, on how VR and AR solutions can be used to overcome critical business challenges facing our industry.

This whitepaper aims to guide energy organizations in leveraging VR/AR solutions to address challenges in staff acquisition, skill impartation, and talent retention. This document outlines key considerations in identifying use cases, specifications, functionalities, and hardware selection. Additionally, it addresses VR/AR solution deployment and change management.

These papers serve as reference documentation for both end users and VR /AR solution providers. They facilitate productive engagement by establishing a shared language and understanding of requirements.

2 Principal Considerations Before Getting Started

Deploying VR and AR solutions has led to significant improvements in various domains, including the Energy Sector, such as operational efficiencies, increased training effectiveness, and improved compliance with operational and safety standards. It is important to view VR/AR as a versatile tool with multiple use cases, such as plant tours, training, logistics optimization, supplier collaboration, and future planning. While usage may vary across industries, there are common factors for success for user organizations and solution providers.

2.1 For End User Stakeholders exploring VR/AR solutions, a holistic approach is crucial. Consider how the new technology fits within your existing processes and integrates with business systems. VR/AR can provide alternative and improved solutions for skills training, assessment, screening, recruitment, and marketing. Identify areas with the greatest burden or pain, which incur high costs, delays, productivity disruptions, or lack direct attention. Identify your organization's specific needs in the following areas:

- Key stakeholders: Identify the individuals within the organization who will be impacted by the change in tools and processes, and ensure their inclusion in the solution selection process (IT, HR, Operations, etc.)
- Most appropriate use cases: Determine the key pain points the organization aims to address with VR/AR solutions and identify the critical use cases that need improvement or implementation.
- Data metrics: Define the information that needs to be captured and shared, as well as the metrics required to monitor improvement and ensure project success.

- Content: Decide on the approach for VR/AR content development, whether it's buying pre-made content or developing it in-house, and establish priorities for content development.
- Hardware: Assess the available tools to meet the needs, considering the pros and cons of different options and determining the optimal time for procurement.
- Change Management: Develop strategies to drive adoption and effectively manage the change process to ensure maximum value from the VR/AR investment.

2.2 For VR/AR Solution Providers, it's essential to facilitate the selection and deployment process by finding the solution that best fits the needs of the user stakeholder organizations. Make it easy to identify, install and deploy your solutions by providing the following offerings:

- Solution architects: Employ experienced staff with a broad understanding of the business processes and tools commonly used in staffing and training applications. They can guide requirements gathering or help refine criteria.
- Flexible content creation: Experiences that can be easily configured or adapted to the unique needs of each organization, while also providing common elements used across the industry to help reduce costs.
- Hardware options: Provide guidance in selecting the appropriate features in VR/AR hardware, and ensure that experiences can be adapted across desktop, standalone and tethered headset devices.
- Integrations: Offer an open integration architecture, built-in integrations with common tools, and skilled system integrators with knowledge of VR/AR to provide guidance to your staff.
- Change management: Align the installation, configuration, and deployment of the solution with the user organization's internal team and change processes. Working in partnership is necessary to effectively adopt these new technologies.
- Delivery platform: Make the VR/AR content easily accessible, track usage effectively, and provide options for capturing user feedback online and offline.

The success of any VR/AR solution relies on alignment between the end user and the solution provider regarding the problem statements, solution objectives, and implementation plans. The above factors play a vital role in achieving this alignment and ensuring effectiveness of the VR/AR solutions.

3 Setting the Right Learning Objectives

VR and AR solutions can be used to address staffing challenges, particularly in training. However, it's important to achieve consensus among key stakeholders and recognize that VR and AR are part of a continuum when setting learning objectives. While VR is commonly used for new hire onboarding, task-based training, and skills assessment are commonly focused on VR training solutions, there are blurred lines with activities such as design collaboration, facilities inspection, field service, and safety/hazard awareness. All these activities can utilize the same virtual elements and environments designed for training.

Proper assessment of learning outcomes is critical to avoid using immersive technologies as a "solution in search of a problem." Learning objectives will vary depending on the type of training: The focus on performance evaluation and learning needs analysis cannot be neglected. Inadequately assessed learning outcomes are a major reason for the failure of any learning intervention. VR and AR can be significant investments, and without the proper foundation, these solutions can be costly, ineffective, and hinder the overall adoption of this technology in the organization. Careful and intentional design of content is essential to avoid overwhelming participants, gamifying undesired behaviors, and causing discomfort.

To establish the right learning objectives, it's crucial to honestly evaluate the following:

- *Do your instructional designers understand immersive technology and its appropriate use cases?*
- *Do your subject matter experts (SME's) understand immersive technology?*
- *Do you need to invest in your internal team or engage a third-party partner?*

Yet, instructional design for simulations and immersive scenarios differs significantly from creating solutions for 2D screen-based or instructor-led consumption. Game and marketing design are also quite different skill sets. Internal development teams or third-party partners should have a foundation in learning science.

Instructional designers responsible for defining learning objectives for virtual reality (VR) training should have a strong understanding of the following skills:

- Understanding of learning theories: How people learn and the factors that influence learning to create effective VR training experiences (e.g., attention rate, engagement rate, retention rate, the freedom to fail and learn through purposeful mistakes, human factors analysis, etc).
- Knowledge of the target audience: An understanding of the background and experience of the learners who will be participating in the VR training, including their needs, goals, and any potential challenges they may face.
- Ability to conduct needs assessments: Identifying the knowledge, skills, and abilities that learners need to acquire to be successful in their roles.
- Skill in writing "SMART" learning objectives: Writing Specific, Measurable, Achievable, Relevant and Time-bound learning objectives that align with the overall goals of the VR training program.
- Knowledge of instructional design principles: Best practices in instructional design, including the use of multimedia and interactive elements to engage learners and support learning.
- Experience with VR technology: Hands-on experience with VR technology and an understanding of its capabilities and limitations. Alternatively, they can work closely with an experienced partner who can provide guidance during the course development process.

When setting learning needs and objectives, it is important to establish a clear plan for assessing the effectiveness of new solutions. A recommended approach is to begin with VR Training scenarios/ experiences and subsequently layer in augmented reality for field service and remote support. During the planning phase for VR Training, it is a best practice to determine the desired training approach and tracking methods, as well as the specific areas of focus. It is imperative that instructional designers are part of the selection and development process to ensure a comprehensive and effective training program.

The "How's" of VR/AR Learning Objectives include:

- How will you prompt trainees to engage in the activity? Will you use questions, options, or other methods?
- How much time should be spent in each session?
- Should the training be team-based (multiplayer or role play) or focused on individual contributors?
- How will you score performance and report it to facilitate improvement?
- Will you conduct debriefing sessions and discussions with other students or an instructor?
- How will you assess the 'real world' impact on performance for those who have completed the virtual training?
- How will you track the data and evaluate the success of the training?

Note: Learning doesn't stop when the training scenario is over. Look for ways to reuse and vary the session in the future.

- Will your target audience be receptive to and able to access the necessary equipment?
- Will you need to train your instructors on how to effectively use VR/AR modules?
- It is important to be intentional in the development of simulations and outcomes for immersive training, considering that it can evoke strong emotional responses, and potentially trigger phobias and PTSD.

4 Type of Content to Develop

Content development should be very intentional, with particular attention to performance analysis and modern instructional design processes. While there is significant potential for this technology, adopters should be aware that poorly designed or poorly produced content can be especially ineffective. Production and deployment costs can be considerable. Failure to meet performance objectives for a given topic not only means that the original concern remains unaddressed but could also hinder the overall adoption of the technology within the enterprise. Employees can either become strong advocates or detractors, and a negative experience in VR can be more detrimental than a poorly planned eLearning course.

4.1 Planning the Content

When planning your content, it is crucial to have a holistic vision of the overall training needs. VR/AR does not need to replace all aspects of training and onboarding, but it can significantly enhance efficiencies and reduce cost when integrated into the overall training course mix. There are tremendous opportunities for future scalability.

Your approach to VR/AR content development should include the following considerations:

- Consider all use cases and prioritize areas that have the greatest potential for impact and savings (e.g., onboarding Gen X staff, compliance training, hazardous environment screening for heights or confined spaces, specific learning objectives, etc.)
- Determine your approach to content development:
    - In-house development
    - External resources
    - Collaboration with community or standards bodies (e.g., EPRI, GTI Energy, UL, etc.)
    - Leverage knowledge from other VRARA committees (education, training, enterprise, etc.)
- Define data capture and metrics:
    - Determine what data you want to measure within VR/AR experiences, if any.
    - Establish methods for capturing and reporting that data.
    - Determine ownership of the data.
- Establish a distribution strategy:
    - Define who will have access to the course.
    - Develop a plan for managing distribution and tracking usage.
    - Determine changes and updates will be implemented.
- Identify and overcome barriers to adoption:
    - Consider change management aspects, such as identifying change agents and introducing the new process without threatening existing successful processes.
    - Define ways to integrate the new VR offerings with existing processes (what will be supplemented, what will be replaced)
    - Find a champion and conduct a proof of concept to demonstrate opportunities and track results.
    - Share results, ROI and success stories.
    - Expand into other areas based on priorities.

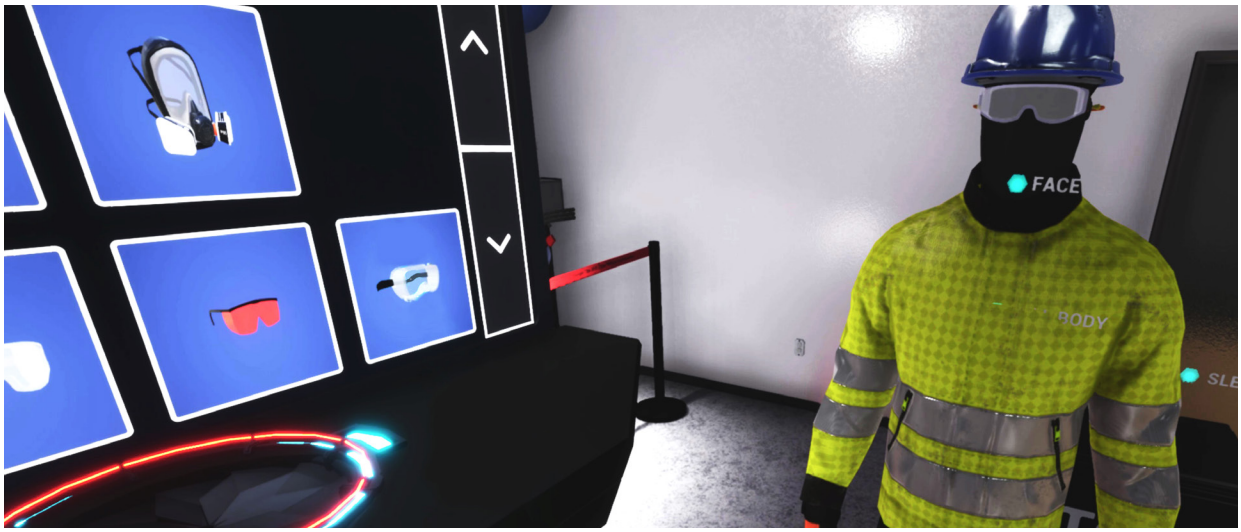
4.2 Classification of VR AR Use Cases for Training

There are nearly limitless uses for VR and AR content, and below are some of the common use cases from VRARA members, falling into four primary categories 1) Informational 2) Soft-skills training, 3) Technical skills training, and 4) Safety and compliance training.

4.2.1 Informational content such as virtual facility or site tours, gamification of roles, and interactive AR models, can effectively convey what prospective new hires can expect within a particular organization or job. It also showcases the company's investment in innovative technology, providing an incentive for individuals to engage with the organization.

4.2.2 Soft skills training can be challenging using traditional methods, as they often rely on 2D computer-based materials, or uncomfortable in-person role play interactions. However, with the ability to create fully immersive virtual reality experiences using lifelike avatars, you can more freely design challenging training scenarios that closely resemble real-world experiences in the field. VR's ability to evoke genuine emotional reactions dramatically enhances the retention of training information. In a matter of hours, you can recreate years of interactions in the field, better preparing employees for real-world scenarios.

4.2.3 Technical skill training may provide the most evident value of VR and AR training. It supports the development of practical skills that require hands-on training to install, operate, and service equipment, especially within challenging or hazardous environments. VR provides fully immersive virtual environments that simulate real scenarios, enabling trainees to engage with exact digital twins or replicas of facilities and equipment. This allows them to practice limitless variations of training scenarios, while ensuring safety. Augmented reality can provide learners with real-time information in the field, offering step-by-step instructions, technical guidance, or critical safety information.



4.2.4 Safety and Compliance training can be dramatically enhanced with VR and AR technology. Instructors can simulate realistic hazardous scenarios that allow learners to practice emergency procedures and learn how to handle dangerous situations in a safe and controlled environment. Furthermore, virtual environments help learners understand their responsibilities and how to comply with relevant environmental and safety regulations. Additionally, the potential for professional certification assessments can be explored in this context.

Overall, immersive technologies have the potential to revolutionize technical training in the energy sector by providing hands-on, immersive experiences that help learners understand complex concepts and procedures in a safe and controlled environment.

4.3 Types of Simulation Modules

There are three main types of simulation-based learning modules in virtual reality.

4.3.1 Lesson Simulation Module:

This type of simulation is used to teach students how to perform tasks or procedures that involve multiple steps. The simulation can be used to demonstrate a task and then allows students to practice it repeatedly until they master it. This type of learning module is best suited for teaching skills such as operating machinery or performing complex procedures that require multiple steps. The VR content is accompanied by visual and audio instructions to guide the student. During the learning simulation session, students receive corrections if their action is not correct. This module is effective for learning new tasks, but not designed for learning complex concepts or rules.

4.3.2 Test Simulation Module:

This type of simulation is used to test the student's knowledge based on the lesson modules they have already passed. Unlike lesson simulations, which provide audio and visual cues to guide students step-by-step through a scenario, test simulations do not include such features. Student can interact more freely with the virtual environment. At the end of the VR course, the student receives feedback on their results and performance.

4.3.3 Linear & Deviated Simulation Type Modules:

Linear simulation modules consist of a series of sequential steps that users must follow. They are used to teach complex concepts or rules.

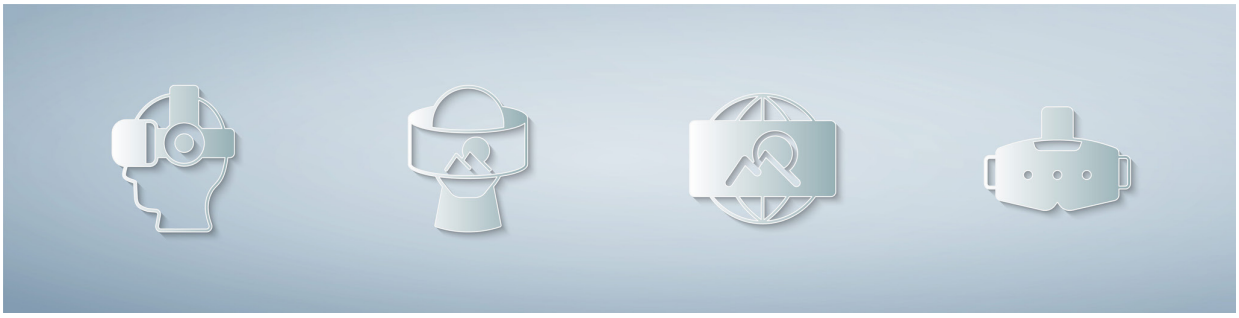
Deviated simulation modules are designed to randomize their initial states, allowing for testing of students' ability to follow given rules. These simulations are often used when teaching emergency response procedures, health and safety protocols, and other scenarios that require correct decision-making in potential real-world situations.

5 Hardware Equipment

It is essential to have a clear understanding of the terminology used to describe the features and functionalities of VR/AR hardware devices and the user experience. There are four basic deployment types that require clarification:

1. Headset (Head Mounted Device or HMD), with or without tethering to a computer.
2. Desktop
3. Mobile
4. Room Scale Projection

The selection and utilization of hardware devices significantly impact the features and functionalities of VR/AR applications. Therefore, it is crucial to consider the specific requirements of the use case and the features offered by available VR/AR hardware devices right from the outset of the development process. It also enables the development of applications that can be utilized across multiple platforms, accommodating variations in user hardware. For instance, the same virtual environment elements can be used for both standalone or tethered HMDs, while also being accessible as a computer-based training on desktop or mobile devices. These options enhance accessibility for all users.



5.1 Type of Headset systems

5.1.1 Wired systems (e.g., HTC Vive Pro) with or without wireless adapters

A tethered VR headset is connected to a separate computer or device, such as a desktop computer or a gaming console, providing enhanced GPU/CPU configurations for a powerful experience. It requires a wired or wireless connection to transmit VR content from the computer/devices to the headset. While more expensive and needing additional equipment, tethered headsets can support complex VR experiences.

To address safety concerns, wired systems require users to be mindful of the tethering wire. Measures like overhead cable management or wireless modules can be installed to mitigate risks. Tethered headsets usually include sensors that track the head movements and hand movements, enabling natural interaction with the virtual environment. The processing power of tethered systems allows for extensive data capture for tracking and assessment purposes. It also enables faster refresh rates and higher visual quality, resulting in a more realistic experience and reducing the likelihood of motion sickness.

5.1.2 Standalone systems (e.g., Pico Neo 3)

A standalone VR headset operates independently without relying on a separate computer or device. It has its own built-in processors, storage, and sensors, offering portability and convenience. They can be connected to controllers or other input devices. As these headsets have their own memory, this can become a limitation when dealing with large-sized applications. Standalone headsets are suitable for experiences with fewer interactions and lower graphical requirements.

One advantage of standalone headsets is their ease of transport and compact design. However, because they can be shipped anywhere, certain measures maybe needed to secure and control access to content. This can involve using them in a "kiosk mode." Uploading and updating content on standalone headsets typically involve additional steps.

5.1.3 Assisted and Augmented Reality Headsets

The market for AR headsets can be categorized into two main types: those that offer hands-free access to live video, QR scanning, and 2D content, and those that provide 3D content that overlays the user's field of view. The first type of headset is often compared to a modified cell phone in capability and is particularly useful for performance support and on-the-job training scenarios where access to digital work instructions or remote experts is valuable. These headsets enable users to receive real-time guidance and assistance while keeping their hands free to perform tasks. On the other hand, headsets that overlay 3D information onto the user's field of view are commonly utilized in design and manufacturing processes. These headsets enhance visualization and enable users to interact with virtual objects in a three-dimensional space, improving design accuracy and efficiency.

5.1.4 Mobile Device Management (MDM)

Standalone headset adopters typically utilize mobile device management (MDM) software, which effectively functions as a fleet management tool for tracking headsets, managing firmware status and assisting in content loading onto the devices. MDM is a software or service that helps organizations manage and secure mobile devices, including standalone VR headsets within their networks.

Some examples of how MDM can be employed:

- Enforcing device policies: MDM can enforce policies that regulate the use of standalone VR headsets, including password requirements, device access controls, and software updates.
- Monitoring device usage: MDM enables monitoring of standalone VR headsets, tracking which apps are being used and the amount of time spent in VR.
- Remotely wiping devices: If a standalone VR headset is lost or stolen, MDM can be used to remotely wipe the device to prevent unauthorized access to sensitive data.

Overall, the use of MDM for standalone VR headsets helps organizations ensure security, compliance, and optimal usage of these devices within the organization.

5.2 Mobile Devices (smart phones, tablets, AR glasses)

Smartphones and tablets are widely used for deploying VR/AR training experiences due to their effectiveness and familiarity. Mobile AR, known for features like facial filters and interactive maps, is popular among social media users. These devices are also prevalent in the enterprise, making them suitable for training purposes.

One advantage of mobile AR is the ability to provide remote trainees with access to "walkaround" 3D models of tools or environments within their current workspace. Additionally, some VR content can be accessed through mobile devices. These capabilities expand the reach of training content, without the need for dedicated VR headsets.

By leveraging smartphones and tablets, organizations can deliver immersive training experiences to a broader audience, promoting greater engagement and knowledge transfer.

5.3 Desktop deployments

Desktop deployments typically refer to modules that can be accessed and experienced via a standard laptop or desktop computer, in a similar way to smartphones and tablets. Offering a desktop version of the same experiences enables students to have a mixed learning environment, especially when equipment or physical constraints may restrict access to headsets or immersive environments. It is considered a best practice to be able to access a VR experience as a 2D desktop module for accessibility.

5.4 Room Scale Immersive Systems

In certain situations, it's beneficial to have multiple attendees physically interact together in an immersive environment instead of each attendee using an individual headset. This approach allows for important training conversations and design discussions, while maintaining visual contact among participants. By dedicating a space where multiple users can engage with impactful visualizations, several benefits arise.

One advantage is collaborative engagement. This allows for a collaborative and interactive experience between client, project teams, and trainees, moving beyond traditional methods such as drawings and sketches. Realistic design reviews are related, as conducting project design reviews in a room-scale immersive system brings the experience closer to reality. Participants can visualize and interact with 3D elements at scale, enabling to identify potential issues and make necessary adjustments in the design process. These approaches foster better communication, understanding and collaborative problem-solving.

5.5 Characteristics of VR/AR Hardware Devices

To select appropriate hardware devices for a VR/AR application it is important to understand key parameters and characteristics of these devices. Consider the following factors:

- Resolution per eye: The pixel count in each lens of the headset.
- Pixels per inch (PPI): measures the resolution or pixel density and image detail.

- Refresh rate: The time taken to redraw the on-screen image, measured in Hz (Hertz). The higher the rate, the smoother the motion that a screen can reproduce.
- Frame rate: Number of frames rendered per second. Ideally matching the refresh rate.
- Field of view (FOV): The extent of the observable environment in degrees.
- Brightness (nits): Luminance of the display in headsets.
- Spatial tracking / Degrees of Freedom (DoF): Movement capabilities in three-dimensional space.
- 3 Degrees of Freedom (3DoF): Tracks head orientation but not head translational motion.
- 6 Degrees of Freedom (6DoF): Tracks both rotational movement and translational movement.

Considering these factors ensures the selection of hardware that meets the specific requirements of the VR/AR application, providing optimal visual quality, immersive experience, and motion tracking capabilities.

5.6 Selection of VR AR Hardware for Application Development

Over the past few years, various brands of VR and AR hardware have emerged, offering progressive refinement in their functionalities and features. To successfully implement VR/AR applications, collaboration between solution providers and end users is crucial in selecting the right hardware devices. Consider the following key considerations for hardware selection:

- Understand your end user and connectivity needs to ensure compatibility with devices and connectivity options.
- Consult with IT on asset management and explore bundling options with existing hardware contracts.
- Plan for hardware obsolescence by establishing a strategy for managing it.
- Maintain a strong relationship with the corporate IT, network, firewall and security teams to ensure ongoing support and compatibility.
- Evaluate device compatibility, as standard corporate laptops may not support all simulations. Assess if standalone headsets can fulfil the required simulations and determine the investment feasibility.
- Anticipate technological advancements by considering more powerful standalone devices and exploring higher-level streaming options. Develop strategies for portability across multiple devices.

By considering these factors and preparing for future advancements, you can make informed decisions when selecting VR/AR hardware devices. This ensures compatibility, performance, and longevity for your applications.

6 Content Production and Distribution

When an organization is considering implementing a VR/AR training program, it is vital to concurrently evaluate the strategies for production, distribution, and deployment. Failure to address these aspects comprehensively can hinder scalability and limit the potential impact of your VR/AR training programs.

6.1 Internalize Capabilities

Depending on business needs and available in-house expertise, organizations may adopt an internal production and distribution pipeline for their VR/AR applications. This comprehensive strategy encompasses the creation, management, and distribution of VR/AR content within the organization. It allows them to have full control over 3D assets and their reuse, sustain development capabilities, integrate simulation and IoT data, and enjoy flexibility in platform administration. This approach provides complete ownership and control over VR/AR content, ensuring seamless asset integration, prioritized updates, bug fixes, and responsiveness as business demands change. It is particularly advantageous when leveraging assets created as part of standard business operations such as product design and manufacturing and may reduce cost for redevelopment of assets for different purposes.

6.2 Third-party partnership

By partnering with a reputable third-party platform or content creator, organizations can alleviate the burden on their IT teams while still accessing the necessary functionality to meet their needs. This collaboration ensures the availability of key capabilities for seamless integration, content management, and data analytics. Third-party providers should be able to address requirements such as Single-Sign On (SSO) integration for streamlined access, efficient content updates and version control, and comprehensive scoring and data collection. This allows organizations to focus on their core objectives, while relying on a trusted third-party to support their VR/AR initiatives.

The platform should also be capable of labelling, and providing detailed information or metadata about the content, including its country of origin or any restricted content. This is particularly important for organizations operating in regulated industries of global markets, as it ensures compliance with legal or regulatory requirements.

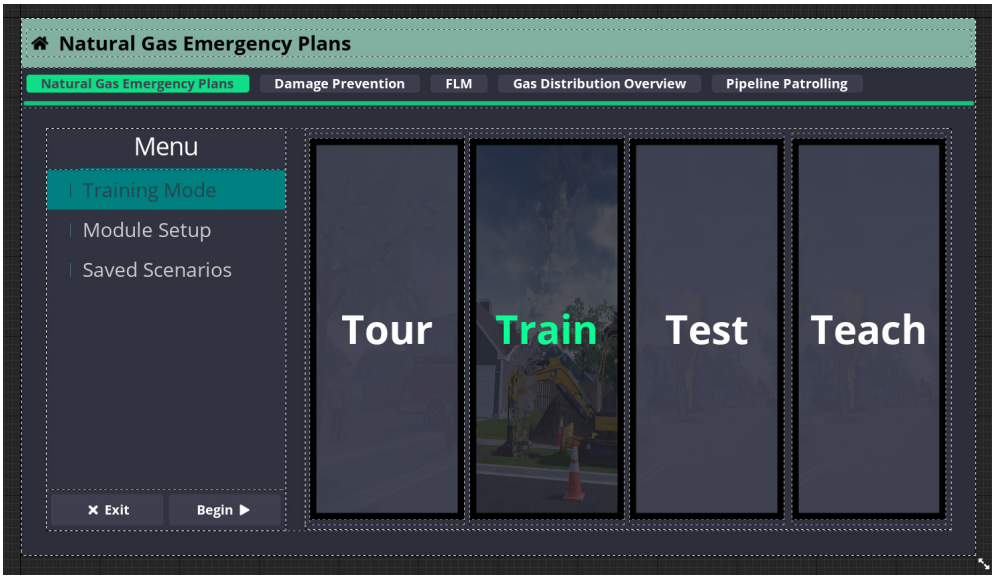
Security is of paramount importance when using a third-party, and to ensure data privacy and protection, their platform should offer single tenant server environments. This provides organizations with a dedicated server environment that enhances security measures and minimizes the risk of data breaches or unauthorized access.

7 Data and Scoring

VR/AR based training and other similar applications would typically involve testing the proficiency gained by the trainee through these applications. Therefore, it becomes important to monitor data pertaining to the performance of the trainee based on the trainee's response to various situations faced as part of the use of the applications.

To effectively track trainee programs, the following parameters should be monitored for each type of experience:

- Training: duration of time spent in training module
- Assessment: Score percentage or Pass/Fail for assessment
- Specific Steps: Details on session completion, including identification of missed steps.



As the role of data and its collection capabilities continue to advance, several additional considerations arise:

- xAPI Conformance: Ensuring compatibility with the Experience API (xAPI or tin can API) for effective data tracking.
- Interoperability: Integration with the broader learning and business ecosystem for seamless data exchange. with learning and business ecosystem
- Privacy and Retention: Adhering to privacy regulations and determining data retention policies.
- Machine Learning: Exploring the potential for leveraging machine learning techniques for data analysis, adaptive simulations, and insights.
- Aggregation and Anonymization: Properly aggregating and anonymizing data to protect trainee privacy.

As virtual simulation complexity advances, the definition of training modules may evolve. For instance, in an interactive virtual rig environment, the focus may be on students successfully performing job tasks as per their standard work instructions, with data collection including eye tracking, motion capture or other indicators of success.

8 Integrating into the Enterprise

8.1 Integration Support

Before finalizing decisions on content and hardware, it is important to engage in discussions with various teams, including Information Technology, Cybersecurity and Data Privacy, Legal and Supply Chain. These teams can be valued partners in this process and help address integration considerations. New technologies may pose challenges to existing infrastructure and processes, so early assessment of these is vital for successful scaled deployment.

In addition to selecting VR/AR headsets, there are other factors to evaluate and integrate into existing IT asset strategies. VR/AR equipment is costly, and new headsets are released regularly; therefore, asset tracking and obsolescence strategies should be evaluated. Collaborate with procurement and sourcing teams to identify bundling opportunities and best leverage existing vendor relationships.

Evaluate the corporate laptop and desktop catalog to identify machines with suitable GPU capabilities for tethered or desktop use. It is important to distinguish between GPU requirements for VR/AR versus other use cases like engineering or data science. Users may find that high powered GPUs for data applications do not drive headsets effectively due to trade off in video capabilities while "gaming" machines may face difficulty with loading the standard corporate image operating system. Ensure help desk teams are well-versed in setup and troubleshooting steps for all hardware involved.

Some VR headsets or platforms may require access outside the corporate firewall to gaming applications that are typically blocked. Efforts may be needed to address and whitelist these locations for access. Additionally, evaluate security aspects such as SSO enablement, Multi-Factor Authentication, traffic management, and access rules, to ensure compatibility with selected hardware and software.

8.2 Content Licensing and Intellectual Property

The terms and conditions of the licensing model for third-party content can impact how that content is deployed in the enterprise. It is critically important to have clear understanding of ownership of the IP for any bespoke VR/AR experiences that are created. Consideration of the deliverables including source code and models should be clearly stipulated. Proper contractual language can ensure content licensing protects both the end user and the solution providers interests.

9 Physical Considerations for a Virtual World

When organizations adopt VR/AR training, the excitement of immersive technologies may result in unintentionally overlooking important aspects of the physical training environment. While the focus is often on the technology itself, the success relies on other factors. The atmosphere and safety of a training space, and audience readiness play key roles in achieving the desired outcomes. In this section, we elaborate on some considerations to ensure a comprehensive approach to VR/AR training.

9.1 Training Space

When developing VR/AR training, you should visualize the spaces and locations where it will be used. Alongside connectivity requirements, such as strong wireless internet of 5G, you should also consider:

- Will users be seated or moving in the training space?
- Are multiplayer capabilities planned, and will players be co-located or joining from different locations?
- If movement is involved, how many players can safely be in the space?
- Will motion capture be utilized?
- Ensure comfortable environmental conditions, including ventilation and cooling.
- Be mindful of room lighting for AR or Mixed Reality experiences, as bright rooms can cause issues. Glass walls, windows or mirrors can cause tracking issues under certain circumstances.
- Consider wall protection or padding, to prevent users from accidentally colliding with walls.
- Use a carpet or flooring "warning track" that shows the extent of the virtual play space.
- Stock hygiene options for equipment such as UV sterilization or other sanitation methods.
- Ensure accessible charging units for multiple headsets and controllers.

9.2 Audience Preparation

The opportunity to use VR/AR can be both exciting and intimidating, so it is important to prepare users accordingly. Some individuals may feel apprehensive due to a negative initial experience, while others may approach it with enthusiasm, expecting a game-like encounter. Consider conducting a pre-training briefing that covers the following points:

- Inquire about users' familiarity with the technology.
- Explain the functionality of the headset and controllers.
- Provide an overview of the virtual environment and objectives; and inquire about any specific fears or concerns, such as heights or other environmental features.
- Assess if any experiences may be potentially traumatic or trigger phobias. For instance, if the simulation involves explosions, fire, or loud noises, be aware of the risk of triggering post-traumatic stress disorder (PTSD). Similarly, if the simulation includes heights, high-speed movements, or unpredictable motions, take steps to prepare users for these elements.
- Assure users that they can stop the experience at any time and that their comfort and safety are a priority.

Regularly monitor users, particularly if the experience involves physical movement. If you need to relocate a user, communicate clearly, informing them before touching their hand or moving them.

10 Conclusion

Virtual and augmented reality (VR/AR) have the potential to revolutionize learning and training in the energy sector. These immersive technologies offer hands-on experiences that enhance understanding of complex concepts, procedures, and equipment within a safe and controlled environment. For instance, VR and AR enable learners to practice problem-solving and decision-making skills without risking harm. Moreover, VR and AR facilitate remote training, expanding access to high-quality education and professional development opportunities. Integrating VR and AR in the energy sector hold promise for improving learning outcomes and optimizing training programs.

This paper offers valuable insights and considerations to help organizations evaluate and select suitable equipment, content, and providers. By considering these factors, organizations can make informed decisions that align with their training objectives and maximize the benefits of VR and AR technologies.

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