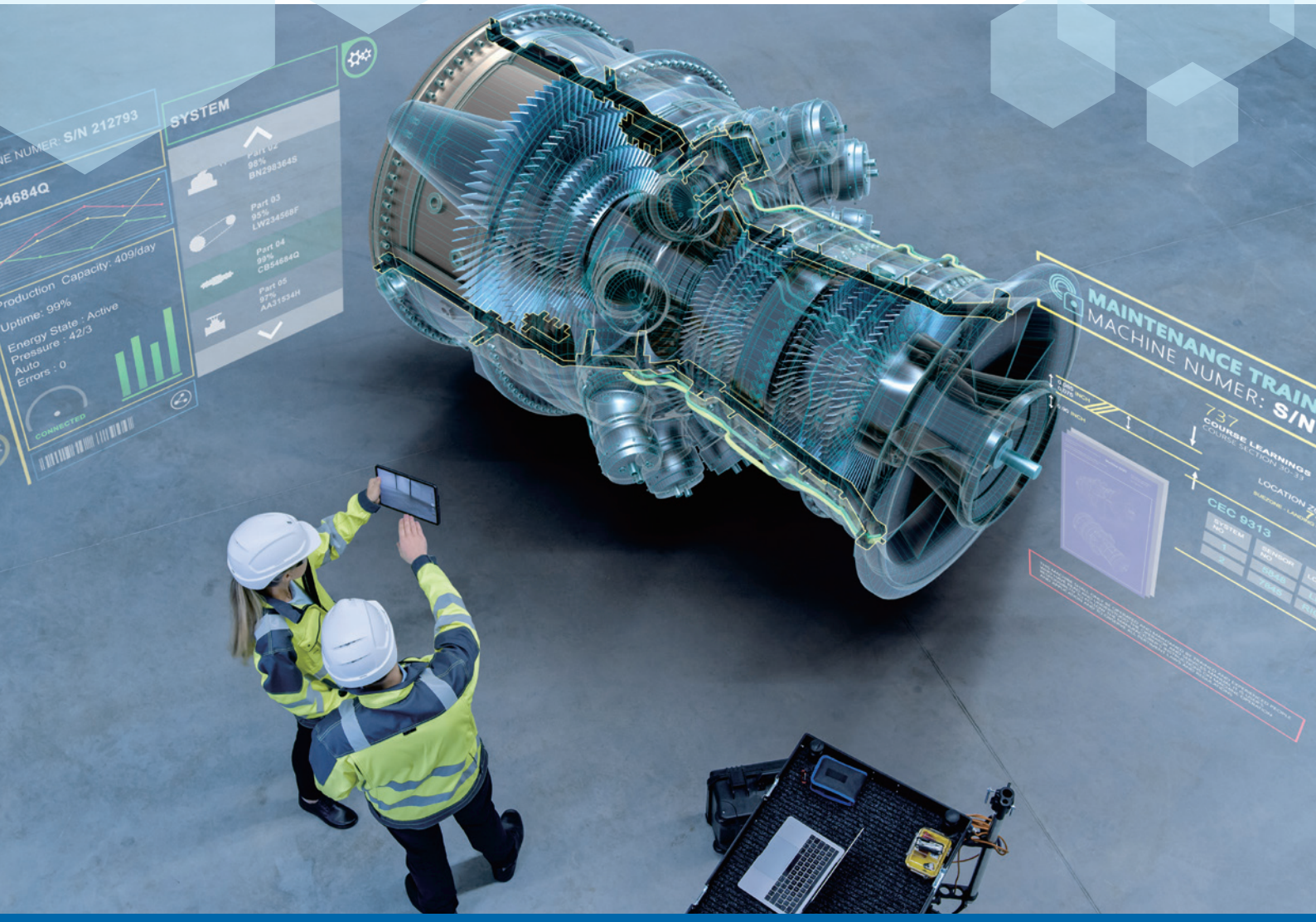
應用XR技術賦能產業邁向智能化及數據化

Enabling Industry Towards Smartification and Digitalization with XR Technologies



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Extended Reality Sheds Light on Smart Manufacturing, Healthcare, and Construction: A Review

Hudson CHEN, Brendon YU

1. Introduction

Extended Reality (XR) is an umbrella term that encompasses a range of immersive technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). These technologies are transforming various industries by providing interactive and immersive environments that enhance user experiences and operational efficiencies. XR offers unprecedented ways to visualise, simulate, and interact with digital information superimposed on the physical world, thus bridging the gap between the digital and physical realms. As we delve deeper into specific industries, it becomes evident how XR technologies are reshaping various sectors. In smart manufacturing, XR is being integrated into multiple facets of the production process, driving significant advancements in design, training, maintenance, and real-time data visualisation. In healthcare, XR is enhancing medical training, improving patient care, and aiding in complex surgeries through detailed visualisation and simulation. In the construction industry, XR is revolutionising project planning, design reviews, and on-site operations, leading to reduced errors, enhanced collaboration, and improved safety.

Hong Kong, a vibrant economic region, offers a compelling case study for the application and benefits of XR technologies. As a rapidly evolving technological and innovation hub, Hong Kong is well-positioned to lead in the adoption of XR technologies across various sectors thanks to its robust infrastructure, skilled workforce, and supportive government policies. The city's push towards smart city initiatives and digital transformation makes it an ideal environment for exploring the potential of XR in smart manufacturing, healthcare, and construction. This review aims to examine the current stage of XR in these three critical sectors, explore its practical applications, and provide insights into its future outlook. By understanding how XR technologies are being utilized today and their potential for future growth, industries can better leverage these tools to improve efficiency, reduce downtime, and enhance overall quality. To provide a comprehensive overview of this transformative technology, the following sections will delve into the specific applications and benefits of XR in smart manufacturing, healthcare, and construction. We will explore how XR is reshaping design and prototyping, revolutionising training and education, and enhancing maintenance and repair operations across these sectors.

2. XR in Smart Manufacturing: Current Stage and Future Outlook

To begin our detailed exploration, we will first focus on the significant impacts of XR in smart manufacturing. The manufacturing sector, often at the forefront of technological innovation, provides a fertile ground for exploring the transformative potential of XR. XR is revolutionising the landscape of smart manufacturing. These technologies provide immersive and interactive environments that enhance various aspects of the manufacturing process, from training and design to maintenance and real-time operations. At present, the integration of XR technologies into smart manufacturing is witnessing significant progress across several domains:

Design and Prototyping

In the realm of design and prototyping, AR and MR enable engineers and designers to visualise and interact with 3D models in real-time (Yang et al., 2022a). This capability facilitates better design decisions, rapid prototyping, and faster iterations from concept to production. By overlaying digital models onto physical objects, designers can identify potential issues early in the development process, reducing errors and saving time. Additionally, this technology allows for the integration of complex data sets into visual models, providing richer insights into design feasibility and functionality. As a result, companies can streamline their design processes, leading to cost savings and improved product quality. The ability to interact with virtual models in a physical context represents a significant advancement in design methodologies.

Moreover, MR allows for collaborative design sessions where team members can simultaneously interact with virtual prototypes, regardless of their physical location (Franze et al., 2022). This fosters a more cohesive and efficient design process, as real-time feedback can be incorporated seamlessly. Engineers and designers can make adjustments on the fly, ensuring that the final product meets all specifications and requirements. This collaborative approach also reduces the time required for design approvals and iterations. By leveraging MR, teams can bridge the gap between digital and physical realms, enhancing communication and understanding. The integration of MR into design workflows is transforming how companies approach product development.

Furthermore, the use of AR and MR in design and prototyping extends beyond traditional manufacturing applications. Industries such as automotive, aerospace, and healthcare are increasingly adopting these technologies to improve their design processes (Mourtzis et al., 2024). For example, automotive manufacturers can use AR to visualise new car models and make real-time adjustments to their designs. Similarly, aerospace engineers can leverage MR to simulate and evaluate the performance of aircraft components. In healthcare, medical device designers can utilise these technologies to create more effective and user-friendly products. The versatility and adaptability of AR and MR make them invaluable tools across various industries, driving innovation and efficiency.

Training and Education

Moving from design and prototyping, XR technologies, particularly AR and VR, are being extensively utilised for training purposes (Greci, 2022). They offer immersive training environments where workers can practice and refine their skills without the risks associated with real-world scenarios. This kind of training enhances learning outcomes, reduces costs, and minimises downtime. For instance, VR can simulate complex manufacturing processes, allowing trainees to gain hands-on experience in a controlled, virtual environment. Trainees can repeatedly practice procedures and techniques, building their confidence and competence. The immersive nature of VR ensures that learners are fully engaged, leading to better retention of information and skills.

In addition to VR, AR is also playing a crucial role in training and education within the manufacturing sector (Srivastava et al., 2023). AR can overlay digital instructions and annotations onto physical equipment, guiding trainees through various tasks and procedures. This hands-on approach helps learners understand the intricacies of machinery and processes, reducing the likelihood of errors. AR-based training modules can be customised to suit different learning paces and styles, ensuring that each trainee receives personalised instruction. Moreover, AR can provide instant feedback, allowing trainees to correct mistakes in real-time. This interactive and adaptive training method enhances the overall learning experience and prepares workers for real-world challenges.

Furthermore, XR technologies are not limited to technical training; they are also being used for soft skills development (de Giorgio et al., 2023). For example, VR can create simulated environments where employees can practice communication, teamwork, and leadership skills. These soft skills are essential for effective collaboration and problem-solving in the workplace. By experiencing realistic scenarios in a virtual setting, employees can improve their interpersonal skills and emotional intelligence. Additionally, XR can facilitate remote training, enabling companies to train employees across different locations simultaneously. This scalability and flexibility make XR an invaluable tool for comprehensive workforce development. As XR technologies continue to evolve, their impact on training and education will only grow, driving higher levels of proficiency and productivity.

Maintenance and Repair Operations

Transitioning from training and education to the operational side, XR technologies are transforming maintenance and repair operations by providing real-time visual instructions and guidance (Corts-Leal et al., 2022a). AR applications can overlay digital information directly onto physical equipment, helping technicians perform maintenance tasks more efficiently and accurately. For instance, AR can display step-by-step instructions, highlight relevant components, and provide real-time data on equipment status. This reduces the likelihood of errors, shortens repair times, and enhances overall equipment reliability. Technicians can access digital manuals, diagrams, and videos through AR interfaces, reducing the need for physical documentation. This streamlined approach to maintenance ensures that equipment is kept in optimal condition, minimising downtime and operational disruptions.

In addition to real-time guidance, XR technologies enable remote assistance for maintenance and repair operations (Corts-Leal et al., 2022b; Mourtzis et al., 2022). Using AR, experts can remotely view and diagnose equipment issues, guiding on-site technicians through the repair process. This remote support capability is particularly valuable in situations where specialised knowledge is required but not readily available on-site. It allows companies to leverage their global expertise without the need for travel, saving time and costs associated with bringing experts to the location. By using AR glasses or mobile devices, technicians can share their field of view with remote experts, who can then annotate the live video feed with instructions and suggestions. This collaborative approach enhances the effectiveness of maintenance operations and ensures that issues are resolved swiftly.

Furthermore, predictive maintenance is another area where XR is making significant contributions (Doolani et al., 2020; Mourtzis et al., 2020a; Siltanen & Heinonen, 2020). By integrating XR with Internet of Things (IoT) sensors and data analytics, companies can monitor equipment health in real-time and predict potential failures before they occur. This proactive approach to maintenance helps in planning interventions at the most opportune times, preventing unexpected breakdowns and extending the lifespan of equipment. XR can visualise data trends and alert technicians to anomalies that require attention. For example, AR can project temperature or vibration data onto machinery, allowing for immediate assessment of performance issues. This integration of XR and predictive analytics transforms maintenance from a reactive to a proactive strategy, enhancing operational efficiency and reducing costs.

Real-Time Data Visualisation and Monitoring

Another significant application of XR technologies in smart manufacturing involves real-time data visualisation and monitoring of manufacturing processes (Higinio de Jess & AHUETT GARZA, 2022). AR can project key performance metrics and operational data onto physical machinery, allowing operators to monitor system performance and make informed decisions quickly. This real-time insight helps in optimising operations and improving efficiency. For instance, by overlaying production statistics and machine health indicators directly onto equipment, operators can immediately identify and address issues. This reduces the need for constant manual checks and helps maintain a smooth and continuous production flow. The ability to visualise data in a contextualised manner enhances situational awareness and enables faster response times.

In addition to enhancing monitoring capabilities, XR technologies facilitate the integration of multiple data sources into a single, coherent view (Thomas, 2019). This holistic approach allows operators to see the big picture and understand how different variables interact within the manufacturing environment (Mourtzis et al., 2020b). For example, an AR dashboard can combine data from various sensors, including temperature, pressure, and production rates, providing a comprehensive overview of the entire production line. This integrated visualisation aids in identifying patterns and correlations that might not be apparent through traditional data analysis methods. By having access to all relevant information in one place, managers and operators can make more informed decisions, leading to improved productivity and resource utilisation.

Furthermore, the use of XR for real-time monitoring extends beyond the manufacturing floor (Bernstein et al., 2023; Gong et al., 2021). Remote monitoring capabilities allow managers to oversee operations from any location, ensuring continuous oversight and control. This is particularly advantageous for global enterprises with facilities spread across different regions. XR can provide virtual walkthroughs of production sites, enabling remote managers to inspect operations and ensure compliance with standards (Simes et al., 2018; Yang et al., 2022b). Additionally, real-time alerts can be sent to mobile devices, keeping managers informed about critical issues that require immediate attention. This level of connectivity and real-time visibility ensures that production processes are always under watchful eyes, reducing the risk of disruptions and enhancing overall operational resilience.

Future outlook of XR in Smart Manufacturing

The future of XR in smart manufacturing is poised for transformative advancements, driven by the integration of AI and machine learning. These technologies will enable more intelligent and adaptive XR systems, capable of providing real-time insights and predictive analytics. As hardware becomes more affordable and powerful, the adoption of XR will expand, making it accessible to a broader range of manufacturers. Enhanced connectivity through 5G and IoT will facilitate seamless data exchange, improving the responsiveness and accuracy of XR applications. Collaborative XR platforms will become the norm, enabling global teams to work together in virtual environments with unprecedented ease. Furthermore, advancements in haptic feedback and sensory integration will make XR interactions more immersive and realistic, enhancing training and operational efficiency. The focus on human-centric design will ensure that XR tools are intuitive and user-friendly, minimising the learning curve for workers. Data security measures will also evolve, addressing concerns and ensuring the safe deployment of XR technologies. Industries such as automotive, aerospace, and healthcare will continue to drive innovation in XR applications, setting new standards for design and manufacturing processes. Overall, the future of XR in smart manufacturing promises increased efficiency, reduced downtime, and enhanced product quality, solidifying its role as a cornerstone of Industry 4.0.

In conclusion, the current stage of XR in smart manufacturing demonstrates significant advancements and practical applications, particularly in design, training, maintenance, and real-time data visualisation. However, overcoming existing challenges such as high implementation costs, robust hardware and software infrastructure needs, and data security concerns is essential to fully realise the potential of XR (Casini, 2022). The future outlook for XR in smart manufacturing is promising, with increased adoption, AI integration, and human-centric design poised to drive further transformations. By leveraging XR technologies, smart manufacturing can achieve higher levels of efficiency, safety, and productivity, cementing its role in the future of industrial production.

3. XR in Healthcare: Current Stage and Future Outlook

With a clear understanding of XR's benefits in training and education, we now shift our focus to its applications in healthcare. XR technologies are revolutionising the healthcare industry. These technologies provide immersive and interactive environments that enhance various aspects of healthcare, from medical training and surgical planning to patient care and rehabilitation. The integration of XR into healthcare is witnessing significant progress across several domains:

Medical Training and Education

XR technologies are being extensively used for medical training purposes. They offer immersive simulations where medical students and professionals can practice procedures in a risk-free environment (Herur-Raman et al., 2021). For instance, VR can simulate complex surgical operations, allowing trainees to develop their skills without the consequences of real-world mistakes (Logeswaran et al., 2021; Mathew & Pillai, 1 C.E.). This hands-on experience is crucial for building confidence and competence in medical practitioners. These simulations can be customised to replicate rare or complex medical scenarios that practitioners might not frequently encounter in real life, ensuring a comprehensive training experience. By repeatedly practicing these scenarios, trainees can refine their techniques and improve their decision-making skills. XR also supports collaborative training, where multiple users can interact within the same virtual environment, enhancing teamwork and communication skills.

XR is transforming the way anatomy and physiology are taught (Barteit et al., 2021). By overlaying digital information onto physical models or directly onto the human body, these technologies provide an interactive and detailed understanding of human anatomy. Medical students can visualise internal structures in 3D, enhancing their spatial awareness and comprehension (Anisha, 2022). This interactive approach allows students to explore anatomical structures from different angles and see the relationships between various organs and systems. For example, AR can highlight blood flow through the cardiovascular system or demonstrate the movement of muscles during different activities. This level of detail helps in grasping complex concepts more effectively. Furthermore, AR can integrate real-time data, such as patient-specific imaging, into the learning process, providing a more personalised and relevant educational experience.

XR technologies facilitate remote learning, making medical education more accessible (Ali et al., 2023; Shahriar & Weber, 2022). Through VR, students and professionals can attend virtual lectures, participate in interactive case studies, and engage in practical training from anywhere in the world. This flexibility is particularly valuable for continuing medical education, where practitioners need to stay updated with the latest advancements. Remote learning through XR also supports real-time interaction and feedback, ensuring that learners remain engaged and can ask questions or clarify doubts immediately. This interactive element enhances the learning experience compared to traditional online courses. Additionally, XR can provide on-demand training modules tailored to individual needs. Medical professionals can access specific training sessions relevant to their specialities or areas of interest, ensuring they receive the most relevant and up-to-date information.

Surgical Planning and Assistance

XR technologies are revolutionising preoperative planning by allowing surgeons to visualise and interact with 3D models of patient anatomy before surgery (Vyas, 2022). These models can be created from patient-specific imaging data, providing a detailed and accurate representation of the surgical site (Shaikh et al., 2022). This enhanced visualisation helps surgeons plan the procedure more precisely, identifying potential challenges and determining the best approach. Surgeons can use AR to overlay these 3D models onto the patient's body during preoperative consultations, facilitating better communication with patients about the planned procedure. This visual aid helps patients understand the surgery, increasing their confidence and trust in the medical team. Furthermore, MR enables collaborative planning, where multiple surgeons can view and manipulate the same 3D model simultaneously, regardless of their location, ensuring cohesive and well-coordinated surgical plans.

During surgery, XR can provide real-time guidance by overlaying digital information onto the surgical field. This includes highlighting critical structures, displaying real-time imaging data, and providing step-by-step instructions (Arpaia et al., 2022). This augmented view enhances the surgeon's precision and reduces the risk of errors. For complex procedures, XR can integrate with robotic surgical systems, providing enhanced control and accuracy. Surgeons can visualise the precise movements of robotic instruments and make adjustments as needed (Latorre-Rojas et al., 2024). This combination of XR and robotic assistance leads to minimally invasive surgeries with better outcomes. Additionally, XR can assist in navigating through anatomical structures that are difficult to visualise with the naked eye, ensuring surgeons can avoid critical areas and perform the surgery more safely and efficiently.

XR technologies enable remote surgical assistance, allowing expert surgeons to provide guidance to on-site teams from anywhere in the world (Morimoto et al., 2022a). Through AR, a remote surgeon can view the surgical field in real time and provide instructions or annotations to guide the on-site team. This capability is particularly valuable in emergency situations or in locations where specialised expertise is not readily available. By leveraging global expertise, healthcare facilities can ensure that patients receive the best possible care, regardless of geographic constraints (Sadeghi et al., 2022; Sugimoto, 2021; Zhang et al., 2023). Remote assistance through XR also reduces the need for expert surgeons to travel, saving time and resources. This approach enhances the overall efficiency and effectiveness of surgical procedures, leading to better patient outcomes.

Patient Care and Rehabilitation

XR technologies are significantly enhancing patient care by providing immersive and interactive experiences that support both physical and mental health (Bulle-Smid et al., 2023). For example, VR is used in pain management, offering patients virtual environments that distract them from pain and anxiety during medical procedures or recovery (Govindarajan et al., 2023). This method has been particularly effective in burn treatment and physical therapy sessions, where traditional pain management techniques might fall short. Additionally, XR is used in cognitive therapy, where patients can engage in virtual environments designed to stimulate memory, attention, and other cognitive functions. This is particularly beneficial for patients with neurological conditions such as stroke or traumatic brain injury. The engaging and interactive nature of XR-based cognitive therapy can help improve patient motivation and adherence to rehabilitation programmes, ultimately leading to better recovery outcomes.

In physical rehabilitation, XR technologies are being used to create customised exercise programmes that patients can perform in a virtual environment (Gahelot et al., 2024; Valen, 2023). These programmes can be tailored to the specific needs and capabilities of each patient, ensuring that they are both effective and safe (Khan, 2023; Lorenz et al., 2024a). For example, patients recovering from orthopedic surgery can use VR to practice movements and exercises that are critical to their recovery, with the added benefit of real-time feedback and progress tracking. This personalised approach helps to maintain patient engagement and compliance with rehabilitation protocols, which is essential for optimal recovery. XR is also making strides in mental health care. VR environments are being used to treat conditions such as anxiety, PTSD, and phobias through exposure therapy. Patients can confront and manage their fears in a controlled and safe virtual setting, gradually reducing their symptoms. Moreover, VR has shown promise in alleviating symptoms of depression by providing immersive experiences that promote relaxation and emotional well-being. These therapeutic applications of XR offer new avenues for mental health treatment, making it more accessible and effective for a broader range of patients.

In addition to therapeutic applications, XR enhances patient education and engagement. By using AR to overlay information onto medical equipment or within healthcare facilities, patients can better understand their treatment plans, medication schedules, and post-operative care instructions (Kurata et al., 2023; Morimoto et al., 2022b). This visual and interactive approach to patient education can improve adherence to treatment regimens and overall health outcomes. For instance, patients can use AR apps to visualise how to properly administer medications or perform physical therapy exercises at home, reducing the likelihood of errors and enhancing self-care. Another area where XR is making a significant impact is in telemedicine. By incorporating AR and VR into telehealth consultations, healthcare providers can offer more comprehensive and interactive remote care. For example, a doctor can use AR to guide a patient through a physical examination or to explain complex medical conditions using 3D models. This enhanced interaction can improve the quality of remote consultations, making them more effective and satisfying for patients. Furthermore, XR can facilitate remote monitoring and management of chronic conditions, allowing healthcare providers to track patient progress and adjust treatment plans in real-time (Jones et al., 2024; Kurata et al., 2024).
The future of XR in healthcare is incredibly promising, with numerous advancements on the horizon. As XR technologies continue to evolve, they are expected to become even more integrated into routine medical practices. Enhanced hardware and software will provide more realistic and accurate simulations for medical training, leading to better-prepared healthcare professionals. The incorporation of AI will allow XR systems to deliver more personalised and adaptive training experiences, optimising learning outcomes. In surgical planning and assistance, XR will enable even more precise and minimally invasive procedures, reducing patient recovery times and improving outcomes. The convergence of XR with telemedicine will make high-quality healthcare accessible to remote and underserved populations, bridging the gap in healthcare disparities. XR applications inpatient rehabilitation will become more engaging and effective, leveraging gamification and real-time feedback to enhance patient adherence and recovery. Mental health treatments using XR will become more widespread, offering innovative solutions for conditions like PTSD, anxiety, and depression. Additionally, real-time data integration will allow XR to provide dynamic and context-aware information, further improving patient care and safety. Overall, the continuous advancements in XR technology will drive significant improvements in healthcare delivery, making it more efficient, effective, and patient-centred.

Future outlook of XR in Healthcare

Overall, the integration of XR technologies in healthcare is transforming the way medical professionals train, plan surgeries, and deliver patient care. These advancements are not only improving the efficiency and effectiveness of healthcare services but also enhancing patient experiences and outcomes(Cornejo et al., 2021; Eswaran & Khang, 2024; Pacione et al., 2016; Song et al., 2005). As XR technologies continue to evolve, their applications in healthcare are expected to expand further, paving the way for more innovative and personalized medical solutions. This ongoing development promises to address some of the most pressing challenges in healthcare, including the need for more accessible, efficient, and high-quality care, ultimately contributing to a healthier global population.

4. XR in construction: Current Stage and Future Outlook

Having discussed the transformative effects of XR on healthcare, we will now explore its impact on the construction industry. XR is revolutionizing smart manufacturing by providing immersive and interactive environments that enhance various aspects of the manufacturing process, from training and design to maintenance and real-time operations. Currently, XR technologies are making significant strides in several key areas:

Design and Planning

XR technologies, particularly AR and MR, are revolutionising the design and planning phases in construction (Alizadehsalehi et al., 2020a; Chi et al., 2022). By overlaying digital 3D models onto physical spaces, architects and engineers gain a better spatial understanding of their projects. This capability allows for real-time adjustments, improving design accuracy and reducing the risk of costly errors. Stakeholders can walk through virtual models, providing a more immersive and comprehensive view of the project before construction begins. This not only aids in making more informed decisions but also helps in identifying potential design issues early in the process. Collaboration is enhanced as team members, regardless of their location, can interact with the same digital model simultaneously(Muoz-La Rivera et al., 2024a). The ability to visualise complex structures in their intended environment streamlines workflows and enhances overall project planning. This approach leads to a more efficient and error-free planning phase.

One of the most significant advantages of XR in design and planning is the facilitation of collaborative efforts (Salinas et al., 2022a; Yabuki et al., 2023). Teams from various disciplines can interact with 3D models in a shared virtual space, regardless of their physical location. This interconnected approach ensures that everyone involved in the project can contribute insights and feedback, leading to a more cohesive design process. Additionally, clients can participate in virtual walkthroughs, providing feedback and making decisions quickly. This level of engagement helps ensure that the final design aligns closely with the client's vision and requirements. Real-time collaboration reduces the time needed for meetings and approvals, speeding up the overall project timeline. By bringing all stakeholders into a unified virtual environment, XR fosters better communication and understanding (Abhari et al., 2021). This collaborative approach ultimately results in a more efficient and harmonious design process.

Another critical benefit of XR in design and planning is the ability to detect potential issues early in the process (Li et al., 2022a; Muoz La Rivera et al., 2023a). By visualising the project in a detailed 3D model, architects and engineers can identify design flaws, spatial conflicts, and other problems before construction begins. This proactive approach reduces the likelihood of costly changes and delays during the construction phase. For example, clash detection in building information modeling (BIM) can be enhanced with XR, allowing for more precise identification of conflicts between different building systems. Addressing these issues early on saves time and resources, ensuring a smoother construction process (Han & Leite, 2022; Zoleykani et al., 2023a). Furthermore, XR tools can simulate various scenarios, such as structural loads and environmental impacts, helping teams to optimise designs for performance and sustainability. Early problem detection through XR not only improves project outcomes but also enhances safety and efficiency. This foresight ultimately contributes to the successful completion of construction projects.

Training and Safety

VR is being increasingly used to train construction workers in a safe and controlled environment. These simulations allow workers to practice complex tasks without the risks associated with real-world training (Bao et al., 2022a; Zoleykani et al., 2023b). For example, they can learn how to operate heavy machinery, handle hazardous materials, or perform high-risk procedures. This immersive training enhances skill levels and prepares workers for the challenges they will face on-site. Additionally, VR training can be customised to address specific scenarios and safety protocols, ensuring that workers are well-prepared for any situation (Liu et al., 2022a; Muoz-La Rivera et al., 2024b). This method not only improves safety but also boosts productivity by reducing the likelihood of on-site accidents. Workers can repeat simulations as needed, helping them to master tasks and build confidence. As a result, VR training is becoming an essential tool for improving safety and efficiency in construction.

AR is also playing a crucial role in training and safety by providing real-time guidance and support (Muoz La Rivera, 2023; Zhao et al., 2023). AR can overlay instructions, safety protocols, and other critical information directly onto the worker's field of view. This hands-on guidance helps workers perform tasks accurately and safely, reducing the risk of errors and accidents (Muoz La Rivera et al., 2023b; Proboste Martinez et al., 2024a). For example, AR can guide workers through complex assembly processes or highlight potential hazards on-site. This real-time assistance ensures that workers have immediate access to the information they need, enhancing both safety and productivity. Furthermore, AR can be used for on-the-job training, allowing workers to learn new skills while performing their duties. This approach minimises downtime and maximises the efficiency of the training process. By integrating AR into daily operations, construction companies can ensure that their workforce remains skilled and safe.

XR technologies are also being used to enhance overall safety on construction sites. For example, AR can be used to conduct virtual safety drills, allowing workers to practice emergency procedures in a controlled environment (Y. S. Lee et al., 2022a; Ojelade & Paige, 2020). This type of training helps ensure that workers know how to respond effectively in the event of an emergency. Additionally, AR can be used to monitor and enforce safety protocols on-site, such as ensuring that workers are wearing the appropriate protective gear. Real-time data from IoT sensors can be integrated with AR to provide live updates on site conditions, such as temperature, air quality, and structural integrity. This information helps site managers to identify and address potential safety hazards promptly (Kim et al., 2022; Rettinger & Rigoll, 2022). Furthermore, AR can be used to document safety inspections and incidents, providing a comprehensive record that can be reviewed and analyzed to improve future safety measures. These advancements in safety enhance overall site management and worker well-being.

Site Management

AR and MR technologies are transforming site management by providing real-time data and insights. Site managers can use AR to overlay construction plans directly onto the physical site, ensuring that each phase aligns with the overall project design. This real-time visualisation helps in identifying discrepancies and making necessary adjustments promptly (Proboste Martinez et al., 2024b; Seyman-Guray & Kismet, 2024). MR can integrate live data feeds from IoT sensors, allowing managers to monitor progress, track resources, and assess site conditions continuously (Salinas et al., 2022b). This capability enables better resource allocation and decision-making, ensuring that projects stay on schedule and within budget (Liu et al., 2022b). Remote experts can also provide guidance through AR, enhancing collaboration and problem-solving on-site. The integration of these technologies leads to more efficient and precise site management. Overall, AR and MR are essential tools for modernising construction site management (Zoleykani et al., 2023c).

Another advantage of XR in site management is the improvement of communication and coordination among teams (Muoz-La Rivera et al., 2024c). Traditional methods often involve multiple layers of communication, which can lead to misunderstandings and delays (Proboste Martinez et al., 2024c; Riedlinger et al., n.d.). With XR, all team members can access up-to-date visual information and instructions directly through their devices. This streamlined communication ensures that everyone is on the same page and reduces the need for lengthy meetings (Y. S. Lee et al., 2022b). AR can also facilitate remote site inspections and approvals, allowing experts to provide input without the need for physical presence. This remote capability is particularly beneficial for large or geographically dispersed projects. By improving communication and coordination, XR helps to eliminate bottlenecks and keeps the construction process running smoothly. This leads to higher productivity and better overall project outcomes.

XR technologies also play a significant role in enhancing predictive maintenance and resource management on construction sites. By integrating with IoT devices, XR can provide real-time data on equipment performance and site conditions. This information enables site managers to predict maintenance needs and prevent equipment failures, reducing downtime and maintenance costs (Bao et al., 2022b; K. Lee et al., 2023). Additionally, AR can be used to track the location and usage of materials and tools, ensuring that resources are utilised efficiently. This level of oversight helps to minimise waste and optimise resource allocation (Li et al., 2022b). Furthermore, XR can assist in planning and simulating different construction scenarios, allowing managers to test and refine strategies before implementation. This proactive approach to site management enhances operational efficiency and helps to ensure that projects are completed on time and within budget. The use of XR in predictive maintenance and resource management is a game-changer for the construction industry.

Quality Control and Inspection

XR technologies are significantly improving quality control and inspection processes in construction. Inspectors can use AR to overlay digital blueprints and specifications onto physical structures, allowing for more accurate and efficient inspections. This technology ensures that construction meets the required standards and specifications, reducing the likelihood of defects and rework (Proboste Martinez et al., 2024b; Seyman-Guray & Kismet, 2024). AR can also capture and document inspection results, providing visual evidence and detailed reports that can be shared with project stakeholders. Furthermore, AI-powered AR applications can automate the detection of discrepancies, such as misalignments or missing components, saving time and improving accuracy (Proboste Martinez et al., 2024c; Salinas et al., 2022b). The use of XR in inspections leads to higher quality standards and better project outcomes. By leveraging these technologies, construction companies can ensure that projects are completed to the highest standards. This approach ultimately results in increased client satisfaction and reduced costs associated with rework.

Another significant benefit of using XR for quality control is the ability to conduct remote inspections. With MR and AR, experts can inspect ongoing work from any location, providing real-time feedback and guidance to on-site teams (Alizadehsalehi et al., 2020b). This capability is particularly valuable in situations where travel is restricted or when projects are located in remote areas. Remote inspections reduce the need for on-site visits, saving time and travel costs while ensuring that quality standards are maintained. Additionally, AR can provide a historical record of inspections, capturing data and images at various stages of the construction process. This documentation is invaluable for verifying compliance with regulations and for future reference in case of disputes or warranty claims. Remote inspections facilitated by XR technologies enhance the efficiency and effectiveness of quality control processes. This leads to higher reliability and accountability in construction projects.

XR technologies also enable more comprehensive and detailed inspections by integrating various data sources (Lorenz et al., 2024b). For instance, drones equipped with cameras and sensors can capture high-resolution images and data from difficult-to-reach areas of a construction site. This data can be fed into AR applications, allowing inspectors to analyse and assess the condition of structures with greater precision. Additionally, thermal imaging and other sensor data can be overlaid on physical structures using AR, helping to identify issues such as insulation defects or moisture intrusion. By combining multiple data streams, XR provides a holistic view of construction quality, enabling more informed decision-making. This integration of advanced technologies ensures that potential issues are identified and addressed promptly, improving the overall quality of construction projects. The use of XR for comprehensive inspections represents a significant advancement in quality assurance in the construction industry.

Future outlook of XR in construction

The future of XR in construction looks promising, with significant advancements anticipated in the coming years. As XR technologies become more sophisticated and accessible, their integration into everyday construction practices will likely become standard. Enhanced hardware capabilities, such as lighter and more ergonomic AR glasses, will improve user experience and adoption rates. Additionally, the convergence of XR with AI and IoT will offer unprecedented levels of real-time data analysis and automation, further optimising construction processes. Cloud computing advancements will facilitate seamless collaboration across global teams, making remote project management and inspections more efficient. The advent of 5G technology will also play a crucial role, providing the necessary bandwidth and low latency for real-time XR applications on construction sites. Training programmes using XR will become more immersive and tailored, significantly improving worker safety and skill levels. Sustainability efforts will benefit as XR enables more precise planning and resource management, reducing waste and environmental impact. Regulatory bodies may start incorporating XR standards into building codes and safety regulations, ensuring broader adoption across the industry. Overall, the continuous evolution of XR technologies will drive innovation, efficiency, and safety in construction, setting new benchmarks for the industry.

In conclusion, XR technologies are transforming the way we design, plan, train, maintain, and manage operations in smart manufacturing and construction. By providing immersive and interactive environments, XR enhances productivity, accuracy, and safety, ultimately leading to better outcomes and greater efficiency. As these technologies continue to advance, their impact will only grow, shaping the future of these industries and driving new levels of innovation and success.

5. Conclusion

XR technologies are profoundly transforming industries like smart manufacturing, healthcare, and construction by providing immersive and interactive environments that enhance user experiences and operational efficiencies. In smart manufacturing, XR is revolutionising design and prototyping, training and education, maintenance and repair operations, and real-time data visualisation, leading to cost savings, improved product quality, and operational efficiency. The future outlook for XR in this sector is promising, with advancements in AI, machine learning, and connectivity expected to drive further innovations.

In healthcare, XR is enhancing medical training, surgical planning, patient care, and rehabilitation. It provides risk-free environments for practicing procedures, detailed anatomical visualisations, and personalised learning experiences. The adoption of XR in healthcare is poised to grow, with continuous advancements in technology making medical training more accessible and effective. The construction industry is also benefiting from XR technologies, which are revolutionising project planning, design reviews, and on-site operations. XR enables better visualisation, collaboration, and safety, reducing errors and improving project outcomes. The integration of XR into construction processes is expected to continue evolving, driving greater efficiency and innovation.

Hong Kong serves as a compelling case study for the application and benefits of XR technologies, showcasing the region's potential to lead in the adoption of XR across various sectors. With its robust infrastructure, skilled workforce, and supportive government policies, the Hong Kong is well-positioned to capitalise on the transformative potential of XR. This review underscores the significance of XR technologies in shaping the future of critical industries. By providing a comprehensive overview of XR applications and benefits, it highlights how industries can leverage these tools to improve efficiency, reduce downtime, and enhance overall quality. The review also emphasises the role of the Hong Kong as a hub for technological innovation and digital transformation, setting a benchmark for other regions to follow.

The future of the Hong Kong in the context of XR technologies is particularly promising. As the region continues to evolve into a technological and innovation hub, it is likely to see increased adoption and integration of XR across various sectors. Enhanced connectivity through 5G and IoT, coupled with advancements in AI and machine learning, will drive further innovations in XR applications. The Hong Kong's robust infrastructure, skilled workforce, and supportive government policies will play a crucial role in fostering this growth, positioning the region as a leader in the global XR landscape. This trajectory not only promises significant economic benefits but also sets the stage for the Hong Kong to become a model for other regions aiming to harness the potential of XR technologies.

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International Conference on Enabling Industry Towards Smartification and Digitalization with XR Technologies
應用延展實境（XR）技術賦能產業邁向智能化及數據化國際會議

延展實境（XR）是智能商業的關鍵賦能技術之一。XR 是虛擬實境（VR）、擴增實境（AR）及混合實境（MR）等與其相關範疇的總稱，XR 將現實和虛擬世界融合，從而創造出一個現實與虛擬物件共存、交互和交流的可視化實境。在執行工作或傳授知識前創造可視化場景，有助作出最佳決策，並吸納、保留和處理關鍵訊息。XR 趨勢正以模擬體驗的形式帶領業務發展。許多企業及人員均渴望認知這項新技術，了解它將如何改變我們的商業運作和生活。

生產力局於 2023 年 10 月 17 日舉辦的應用延展實境（XR）技術賦能產業邁向智能化及數據化國際會議，邀請了多位來自歐洲、日本、地及本地業界專家，分享相關技術及知識，同時介紹 XR 技術在製造、游戲、醫療與健康、零售、建築及其他產業之應用以及商機。

主題	講者
International Overview on XR Applications **國際工業 XR 應用概況**	**Mr. Matias Koski (何鴻宇先生)** Immersal (part of Hexagon) 行政總裁
Applying XR Technology in Business and Event Promotion **XR 技術於商業和活動宣傳之應用**	**Zaf Chow (周僖敏女士)** 香港 Artiface Labs 商務總監及 Animoca Brands 顧問
Enabling Industry Towards Smartification and Digitalization with XR Technologies **XR 技術賦能產業邁向智能化及數據化**	**Mr. Makoto Ito (伊藤誠先生)** 日本 RealWear 公司國家經理
How Mixed Reality is Opening a New Era for All Industries **在行業中使用 MR 技術解決方案**	**Mr. Othman Chiheb** 法國 Oriono 行政總裁 （微軟法國前混合實境專家）
XR Technology's Application in Vocational Education & Development Trends **XR 技術在教育培訓方面的應用**	**Mr. Vincent SU (蘇文濤先生)** 中國江西科駿實業有限公司副總裁
Overview on the Hardware and Software by Creating the XR Environment **創建 XR 環境的硬件和軟件概述**	**劉英健博士** 香港心理學協會會長

International Overview on XR Applications
國際工業 XR 應用概況

Matias Koski

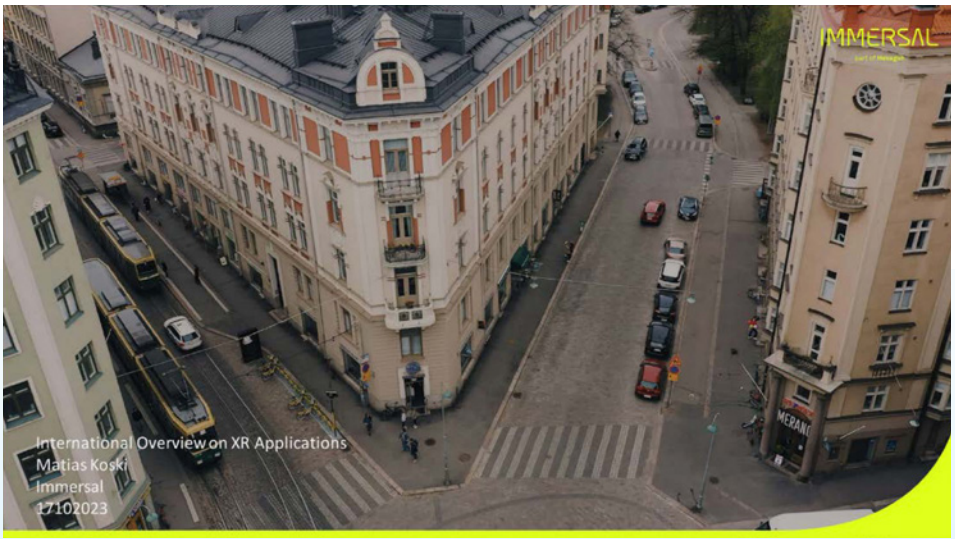
The presentation provided an overview of Immersal's visual positioning technology and its applications across various industries. Visual positioning uses pre-constructed spatial maps and computer vision to precisely locate devices within physical spaces. This allows anchoring of virtual content to real-world locations.

Spatial maps are created using mapping tools like the Leica BLK2GO scanner and BLK ARC/BLK2FLY autonomous systems. Immersal experts can assist with mapping projects. The technology supports localization on mobile devices and makes mapping large spaces more efficient.

Key applications discussed include utilities infrastructure management, manufacturing, construction, and training. In manufacturing, it aids digital twin implementations and navigation of large sites. Construction benefits from merging digital and physical building data. Training is enhanced with immersive virtual learning.

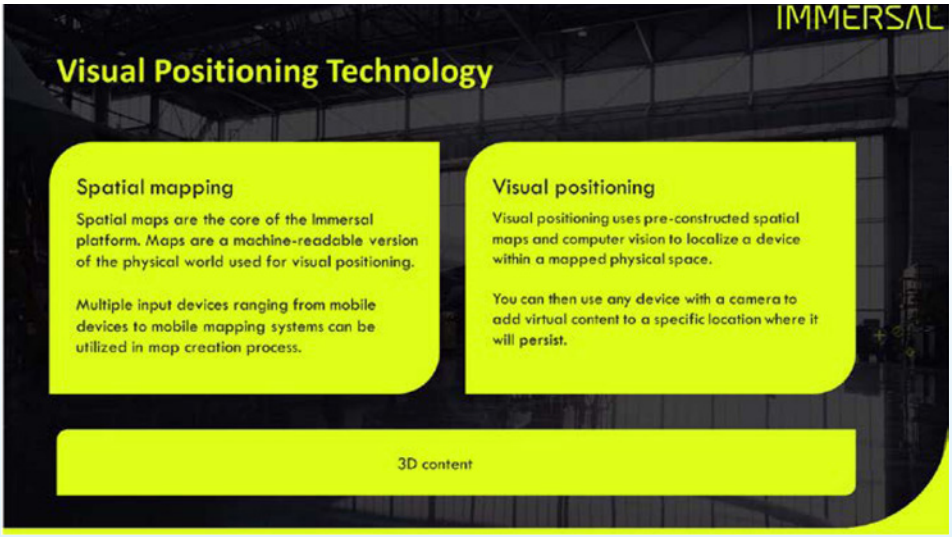
Other sectors covered were entertainment, sports, tourism and retail. At events, uses involve wayfinding, friend finding, premium services and traffic optimisation. Tourism applications included indoor navigation and enriched AR. Retail demonstrated personalised virtual shopping assistants.

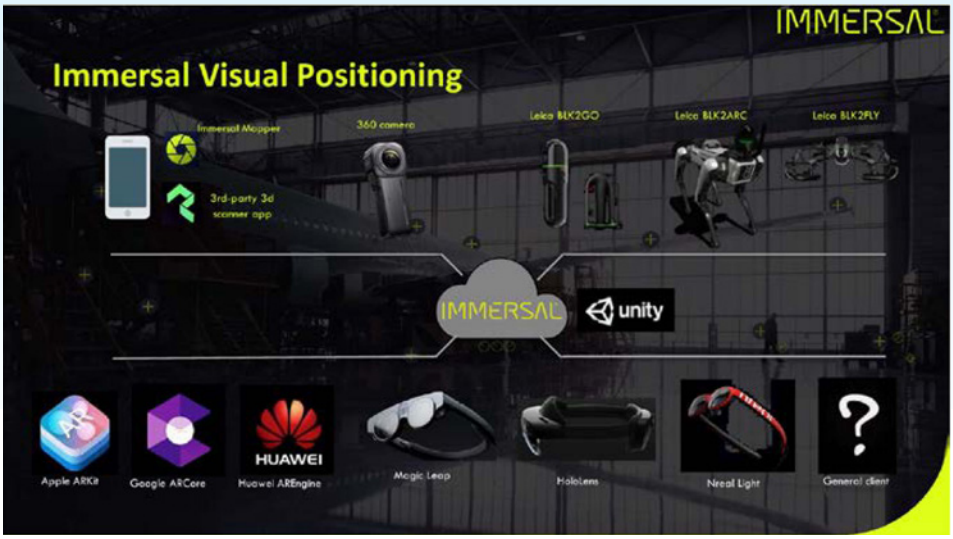
Benefits highlighted were improved visualisations, collaboration, decision-making across asset lifecycles. In summary, Immersal’s visual positioning digitally transforms processes by precisely correlating virtual and real elements through robust spatial mapping and localisation capabilities.

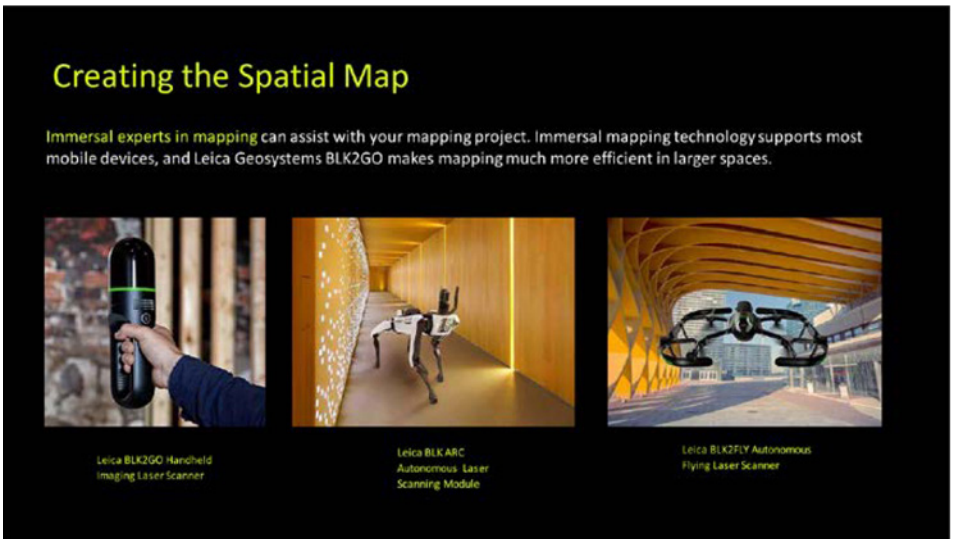


Hexagon in brief
INNOVATION
at scale
10-12% of revenues for R&D
~5,500 R&D employees
Thousands of active patents
Complementary emerging tech through acquisitions (200+ in 22 yrs)
RELEVANCY
that is vital
Serving manufacturing, infrastructure, construction, city services and more
Solutions that drive fewer inputs, less waste and less pollution from efficiency, productivity, quality and safety gains
STABILITY
that is proven
€500mn (2000) to €5bn (2022)
More than 23,000 employees across 55 countries
Increasing role in customers' businesses
SUSTAINABILITY
integral to our strategy
Committed to driving profitable business value that ensures economic growth, but not at the expense of the planet or people
2 | Corporate Presentation
HEXAGON

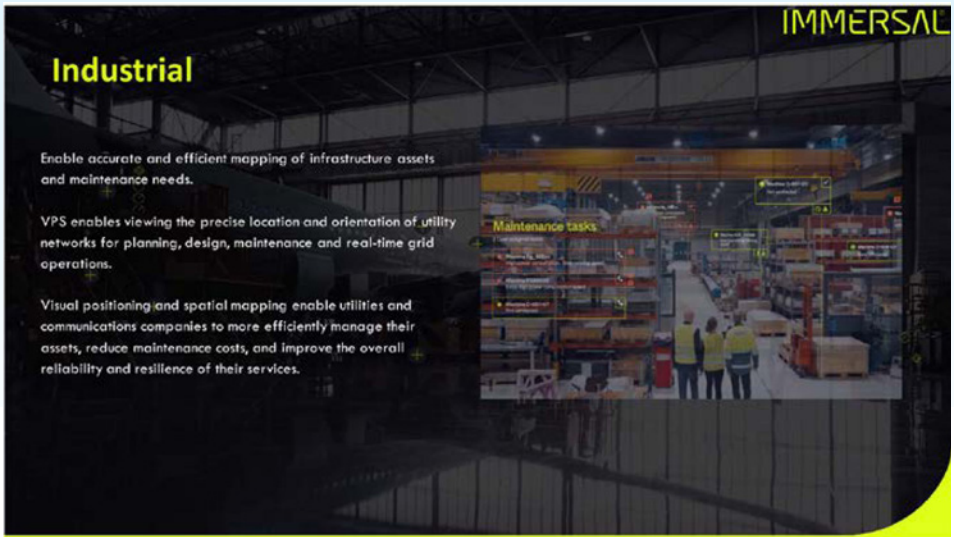
IMMERSAL
About Immersal
Immersal provides Spatial Mapping and Visual Positioning (VPS) platform
Founded in 2015 and headquartered in Helsinki, Finland
Part of Hexagon AB Geosystems division
trip VR
Microsoft
Cavernion
magic leap
ROVIO
FIFA
mawari
Goodmaps
Qualcomm
NOKIA
ERICSSON
Deutsche Telekom
Rakuten Mobile
verizon


IMMERSAL
Visual Positioning Technology
Spatial mapping
Spatial maps are the core of the Immersal platform. Maps are a machine-readable version of the physical world used for visual positioning.
Multiple input devices ranging from mobile devices to mobile mapping systems can be utilized in map creation process.
Visual positioning
Visual positioning uses pre-constructed spatial maps and computer vision to localize a device within a mapped physical space.
You can then use any device with a camera to add virtual content to a specific location where it will persist.
3D content


IMMERSAL
Immersal Visual Positioning
Immersal Mapper
360 camera
Leica BLK2GO
Leica BLK2ARC
Leica BLK2FLY
3rd-party 3d scanner app
IMMERSAL
unity
Apple ARKit
Google ARCore
HUAWEI
Huawei AREngine
Magic Leap
Hololens
Nreal Light
?
General client


Creating the Spatial Map
Immersal experts in mapping can assist with your mapping project. Immersal mapping technology supports most mobile devices, and Leica Geosystems BLK2GO makes mapping much more efficient in larger spaces.
Leica BLK2GO Handheld Imaging Laser Scanner
Leica BLK ARC Autonomous Laser Scanning Module
Leica BLK2FLY Autonomous Flying Laser Scanner

IMMERSAL
VPS Scenarios
Advertising and Marketing
Reimagine data-driven marketing
Aerospace and Satellite
Automotive
Consumer Packaged Goods
Solutions to transform manufacturing, optimize end-to-end supply chain, and drive more profitable brand engagements and transformative interactions with brand consumers
Education
Energy
Financial Services
Games
Government
Healthcare and Life Sciences
Industrial
Manufacturing
Optimize production and speed time-to-market
Media and Entertainment
Nonprofit
Power and Utilities
Retail
Semiconductor
Sports
Sustainability
Telecommunications
Travel and Hospitality


IMMERSAL
Industrial
Enable accurate and efficient mapping of infrastructure assets and maintenance needs.
VPS enables viewing the precise location and orientation of utility networks for planning, design, maintenance and real-time grid operations.
Visual positioning and spatial mapping enable utilities and communications companies to more efficiently manage their assets, reduce maintenance costs, and improve the overall reliability and resilience of their services.
Maintenance tasks

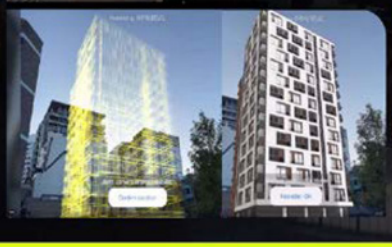
IMMERSAL
Urban planning
Visual positioning and spatial mapping enable real-estate development companies to more efficiently sell their properties and show how the environment will look alike in the future.

IMMERSAL
Urban planning
Bring your customers to the site and show how buildings will fit into the landscape.

Industrial – Building Design & Maintenance

Enhances construction, design and maintenance processes by merging digital building data with the physical environment.

Improves visualization, accuracy, collaboration, and decision-making throughout the entire building lifecycle, from design and construction to maintenance and facility management.



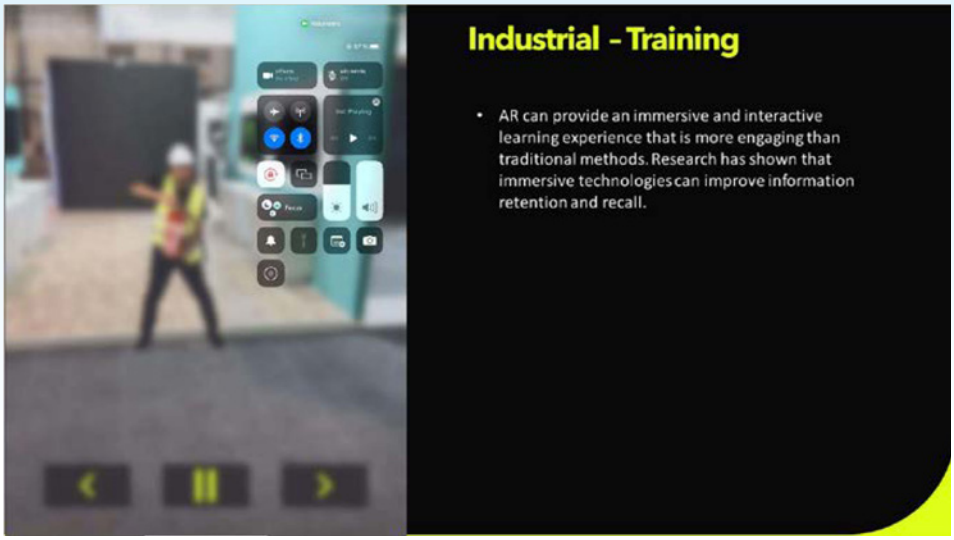
This technology helps bridge the gap between the digital design phase and the physical construction phase, leading to more efficient and effective construction projects.

Industrial – Building Design & Maintenance

Airflow simulation

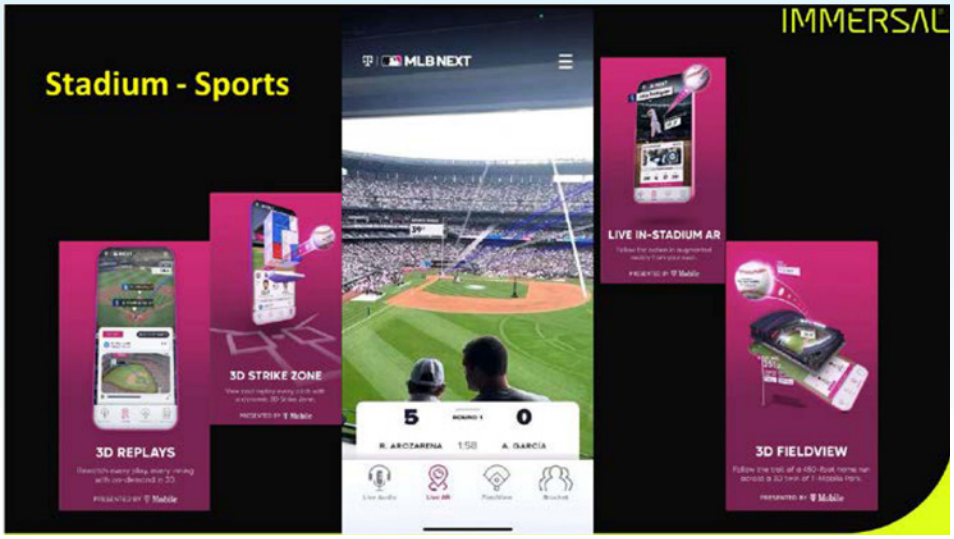
Industrial - Smart Manufacturing

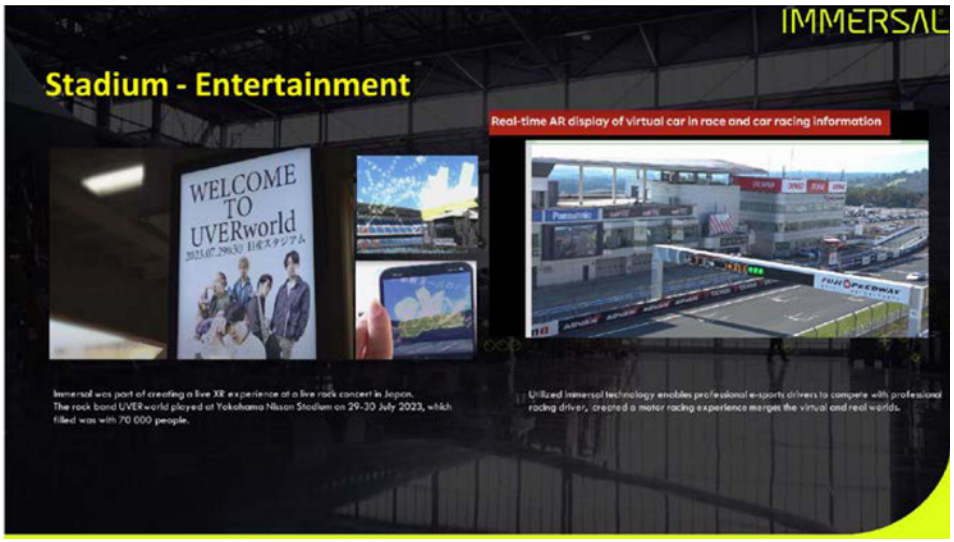
- Part of Digital twin and manufacture implmentations
- Identify Operational personal locations
- Auto display of machine inspection details
- Navigation of large industrial site
- Improve operational efficiency and productivities

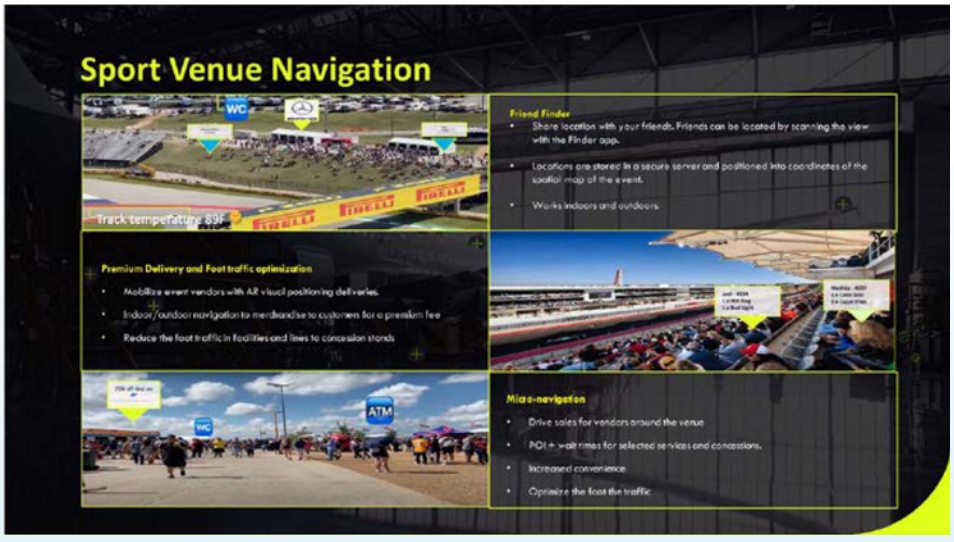

Industrial - Training
• AR can provide an immersive and interactive learning experience that is more engaging than traditional methods. Research has shown that immersive technologies can improve information retention and recall.

IMMERSAL
WHACK A MOLE
00
START

Turn Sport Venue into an audience interaction platform
Enriched Audience experience
• Visualization of game events and results.
• Easy access to statistic, player profiles, digital player cards.
• Immersive gaming and entertainment anywhere.
Navigations
• Way finding, enable easy navigation in large venue
• Optimise foot traffic
• Premium deliver for venue vendors
• Finding friends and social navigation in events
• Enhanced accessibility for people with disabilities
Enhanced retail
• Improve shopping experiences
• Enable additional offerings to venue vendors
• Product displays
• Efficiently guiding audience to specific vendors
Premium VIP offerings
• VIPs follow the event through smart glasses / smart devices.
• Content examples
• Player and game beyond the line of sight.
• Real time rankings, flags and times.
• View speed, gears, acceleration and engine rpm via telemetry


IMMERSAL
Stadium - Sports
MLB NEXT
LIVE IN-STADIUM AR
3D STRIKE ZONE
3D REPLAYS
3D FIELDVIEW


IMMERSAL
Stadium - Entertainment
Real-time AR display of virtual car in race and car racing information
WELCOME TO UVERworld
Immersal was part of creating a live XR experience at a live rock concert in Japan.
The rock band UVERworld played at Yokohama Nissan Stadium on 29-30 July 2023, which filled was with 70 000 people.
Utilized Immersal technology enables professional e-sports drivers to compete with professional racing driver, created a motor racing experience merges the virtual and real worlds.

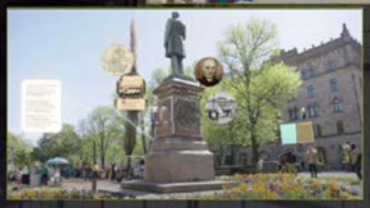

Sport Venue Navigation
Track temperature 89F
Friend Finder
Share location with your friends. Friends can be located by scanning the view with the Finder app.
Locations are stored in a secure server and positioned into coordinates of the spatial map of the event.
Works indoors and outdoors.
Premium Delivery and Foot traffic optimization
Mobilize event vendors with AR visual positioning deliveries.
Indoor/outdoor navigation to merchandise to customers for a premium fee
Reduce the foot traffic in facilities and lines to concession stands
Micro-navigation
Drive sales for vendors around the venue
POI+ wait times for selected services and concessions.
Increased convenience
Optimize the foot the traffic

IMMERSAL

Tourism

Way finding: VPS can be used to provide precise location information for indoor location such as museums, large tourism sites, where GPS signals may be weak or unavailable.

Enriched experience: VPS can be used to enhance AR experiences by providing accurate location and orientation information for virtual objects and characters.



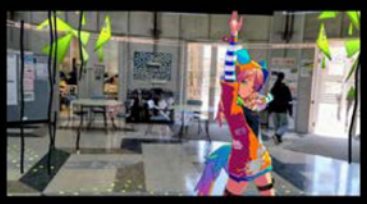
IMMERSAL

Retail – Experience: Store Avatar

Immersal platform can display volumetric video and 3D object content, enabling guests to have a personal virtual shopping assistants with natural interactions.

Applications:

- Feature famous people and partners in 3D "present" format.
- View 3D greetings and selection of your Personal Avatar.
- Featuring artists and stars relevant to Amazon brand, available in store locations.



Volumetric video example localized and viewed on iPad. Video is paused halfway to view details. Presenters are virtual.

IMMERSAL

Improved Accessibility

Help customers to navigate quickly and frustration-free in stores of any size or complexity with turn-by-turn directions via the use of our wayfinding app. Reduce interruptions to store staff working on store floor. Support the Americans with Disabilities Act by enabling voice navigation to visually impaired customers.

Applying XR Technology in Business and Event Promotion
XR 技術於商業和活動宣傳之應用

Zaf Chow

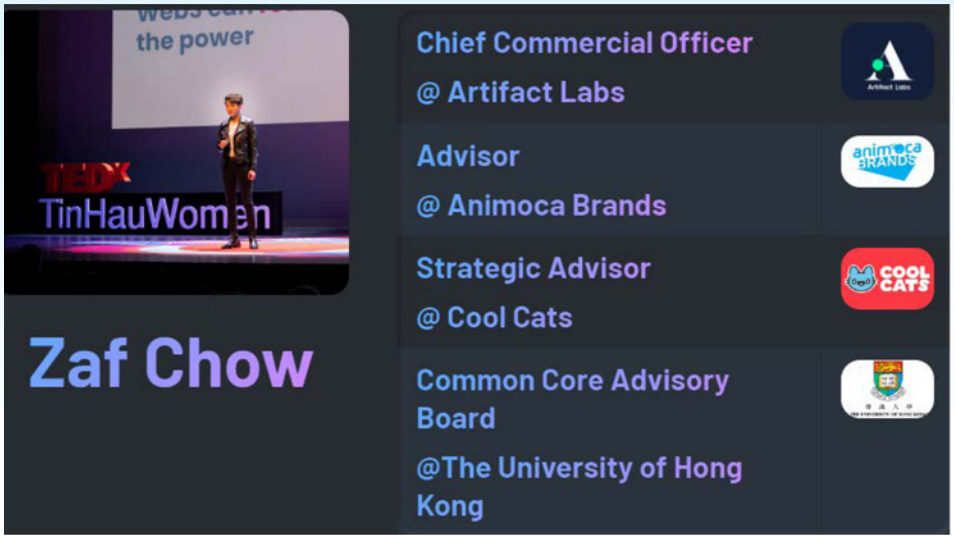
The presenter discussed how extended reality (XR) technologies, including virtual reality (VR), augmented reality (AR) and mixed reality (MR), can make content more engaging and interactive for users. By merging the digital and physical worlds, XR allows for immersive experiences that foster deeper engagement and memorable learning. Real-world simulations also facilitate hands-on skill development.

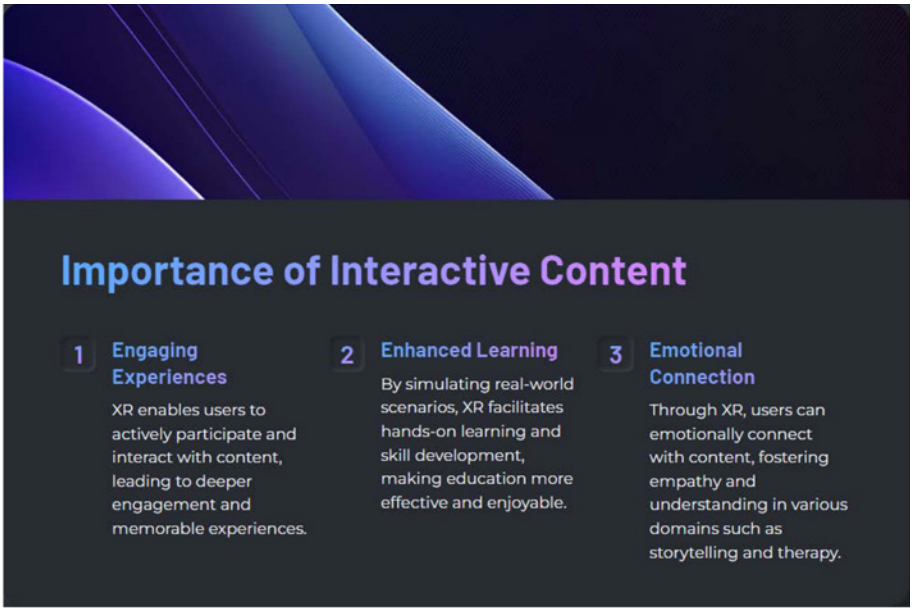
Several industries were highlighted as being transformed by XR, such as entertainment, education, healthcare, retail, event promotion and more. In education, XR enables realistic simulations for skill-building. In events, it can power virtual previews and maps to connect attendees. Museums are utilizing XR for interactive exhibits and immersive storytelling.

Benefits of XR include immersion, simulations, and customisation. It transports users and allows practice in virtual environments. Content can also be personalized to individual needs.

Future trends may see XR integrated with AI, IoT and web3 technologies. This could unlock new applications and smarter environments while embracing decentralisation. Web3 enhances XR through features like ownership, monetisation and interoperability of content.

While technical requirements, ethical issues, and accessibility challenges exist, XR is revolutionising interactions and experiences. As the technology advances, it will continue shaping industries and daily life by unlocking its incredible potential. Overall, the talk highlighted the transformative impact of XR across multiple sectors through immersive and engaging experiences.


the power
TEDx
TinHauWomen
Zaf Chow
Chief Commercial Officer
@ Artifact Labs
Advisor
@ Animoca Brands
Strategic Advisor
@ Cool Cats
Common Core Advisory Board
@The University of Hong Kong


Importance of Interactive Content
1 Engaging Experiences
XR enables users to actively participate and interact with content, leading to deeper engagement and memorable experiences.
2 Enhanced Learning
By simulating real-world scenarios, XR facilitates hands-on learning and skill development, making education more effective and enjoyable.
3 Emotional Connection
Through XR, users can emotionally connect with content, fostering empathy and understanding in various domains such as storytelling and therapy.

Applications of XR in Industries
Entertainment and Gaming
XR transforms entertainment and gaming experiences with immersive narratives, interactive gameplay, and virtual worlds.
Education and Training
XR revolutionizes education and training through realistic simulations, virtual field trips, and hands-on practice.
Healthcare and Medicine
XR is revolutionizing healthcare with applications in surgical planning, patient rehabilitation, mental health intervention, and medical training.

Applications of XR in Industries

Retail

XR enhances the retail experience by enabling virtual try-on of products, virtual showrooms, and personalized shopping experiences.

https://about.fb.com/news/2023/09/new-ray-ban-meta-smart-glasses/

Event Promotion

Event organizers can use XR to create **immersive event previews, interactive maps, and virtual event spaces** that enable attendees to connect with each other and the content in new and exciting ways.

Museum

XR can transform the way visitors interact with exhibits.

Virtual tours of historical sites, immersive storytelling experiences, and interactive exhibitions that bring artifacts to life.

Applications of XR in Industries

Architecture/ Design

XR allows architects to create immersive virtual walkthroughs of buildings, enabling clients to experience spaces before they are built.

Manufacturing

XR is used in manufacturing processes to provide virtual training, simulate assembly lines, and optimize production workflows.

Tourism

XR technologies offer virtual tours, interactive travel experiences, and augmented reality guides, enhancing the way people explore and learn about destinations.

Benefits of XR in Enhancing Experiences

1. **Immersion and Engagement**

   XR provides a sense of presence, transporting users to virtual realms and enhancing engagement through interactive elements.

2. **Real-world Simulations**

   XR enables realistic simulations, allowing users to practice skills, make informed decisions, and prepare for real-world scenarios.

3. **Personalization and Customization**

   With XR, content can be tailored to individual preferences, creating personalized experiences and catering to specific needs.

Future Trends and Potential Impact of XR

Advancements in XR Technology

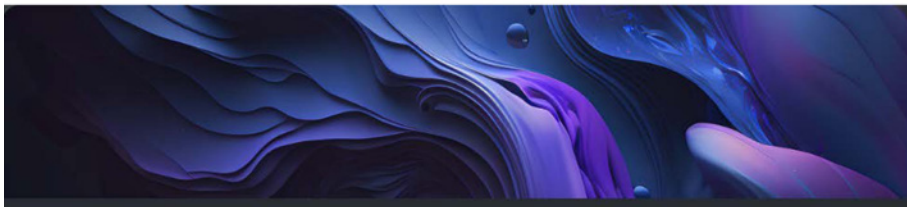
Ongoing developments in XR technology, including improvements in resolution, interactivity, and haptic feedback, will drive its widespread adoption.

Integration with AI and IoT

Integrating XR with artificial intelligence and the Internet of Things will unlock new possibilities, enhancing our daily lives and creating smarter environments.

Integration with Web3

Embracing blockchain technology and Web3 capabilities, XR will enable decentralization, creating new business models and empowering users.



Unpacking Web3

- Next evolution of the internet focused on decentralization and user control.
- Utilizes blockchain technology for transparency, security, and decentralization.
- Allows for peer-to-peer interactions, decentralized applications (dApps), and smart contracts.

Complementing Each Other:

- XR leverages Web3's decentralized nature for secure, peer-to-peer XR experiences.
- Web3 enhances XR by enabling ownership, monetization, and interoperability of XR content.
- Together, they create a more open, accessible, and user-centric ecosystem for immersive experiences.

Use Cases of XR and Web3 Integration

Virtual Art Marketplaces:

- Artists can tokenize their XR art, ensuring provenance and authenticity.
- Decentralized marketplaces facilitate direct sales and royalty payments to artists.

Immersive Social Experiences:

- XR-powered social platforms with decentralized identity and asset ownership.

Business and Event Promotion:

- Web3 facilitates secure ticketing, event sponsorship deals, and interactive event experiences.

Potential for Growth and Opportunities

- **New Monetization Models:**
  - XR creators can monetize content through tokenization and virtual asset sales.
  - Web3 enables new revenue streams like microtransactions, NFT sales, and decentralized ad platforms.
- **Democratizing Opportunities:**
  - Web3 democratizes access to XR technologies and content creation tools.
  - Empowers a global community of creators, artists, and developers to participate and benefit.
- **Collaboration and Interoperability:**
  - Integration of XR and Web3 promotes collaboration among diverse stakeholders.
  - Standardization efforts to enhance interoperability for seamless XR and Web3 experiences.

Challenges and Limitations of XR

1 **Technical Requirements**

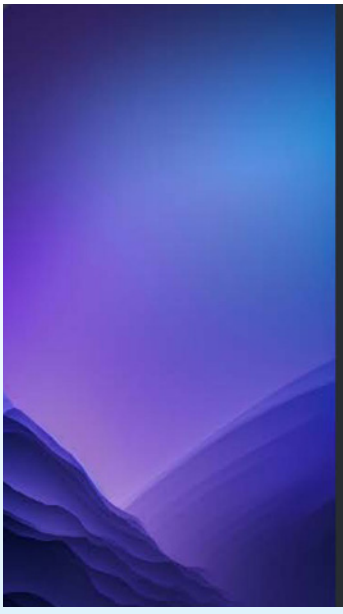
Advanced hardware and software demands, as well as network capabilities, can be challenging for widespread adoption.

2 **Ethical Considerations**

XR raises ethical concerns regarding privacy, data security, and the potential for addiction or psychological impact on users.

3 **Accessibility Issues**

Accessibility needs to be addressed to ensure XR experiences are inclusive and available to individuals with disabilities.



Conclusion

- XR is revolutionizing the way we interact with digital content, offering immersive and personalized experiences.
- As XR technology advances, it will continue to transform industries and impact our daily lives.
- Embrace the future of XR and unlock its incredible potential.

Enabling Industry Towards Smartification and Digitalization with XR technologies

Makoto Ito
Country Manager, Hong Kong, Macau, Taiwan and Japan, Regional Sales Director, North Asia
RealWear, Inc

RealWear, Inc. is revolutionising industrial operations with its ergonomic, hands-free, voice-controlled head-mounted computers that enhance worker productivity and safety. With a global reach spanning over 70,000 industrial clients, 200+ supported devices, and 6,500+ optimised apps, RealWear's solutions are deployed across 66+ countries, supported by 400+ resellers and 18 languages. The company addresses a vast market opportunity, targeting the 1.2 billion frontline workers to mitigate significant industrial downtime losses. RealWear's innovative full-stack Assisted Reality solution integrates cloud, hardware, and software, offering a seamless hands-free voice UX, powerful app ecosystem, and secure services. Its products, like the RealWear Navigator 500 and HMT-1Z1, are certified for safety and exceed traditional tablet and smart glass capabilities. RealWear's technology is adopted across various industries, showcasing its versatility and effectiveness in enhancing operational efficiency and safety.

"reality first, digital second approach"

RealWear has revolutionized the connected worker world. An ergonomically designed, hands-free, voice controlled, head mounted computer, ensures that workers can maintain full situational awareness, whilst connected, thus maximizing productivity and without compromising on safety.

Past (Pre-Covid)

- Significant OpEx budgeted on routine / adhoc repairs and maintenance
- On-site troubleshoot scenarios require extensive travel and usage of man-hours resulting in potential delayed hazard risk
- Communication is sluggish and decision-making is inconclusive

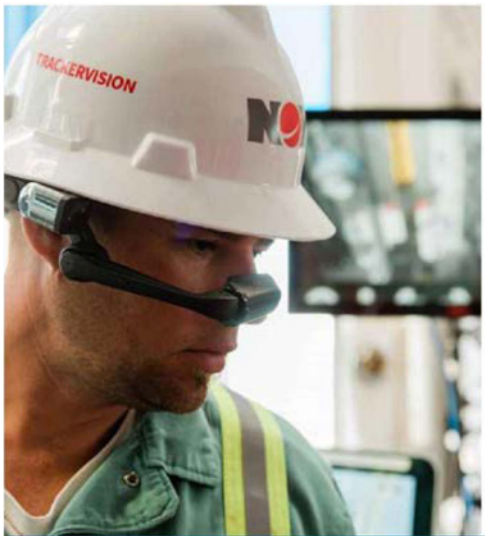
Present (2019 - 2023)

- Utilization of HMDs in the workspace have seen an increment in productivity and reliability
- Solution is quick to deploy and configure, achieving communication and immediate diagnosis of issues
- Assisted Reality HMD allows for safety practices in hazardous environments for frontline workers

Productivity

Electrical Inspection

Number of inspectors	4
Number of hours per day	10
Number of days per year	200
Average time per job (minutes)	40
Average jobs per day	15
Total jobs per year	12,000
With HMT-1	
Average time per job (minutes)	34
Average jobs per day	17.6
Total jobs per year	14,118
Productivity increase	**18%**



Downtime Avoidance

Offshore Oil Production

Number of oil rigs	22
Number of incidents/rig per year	12
Average production per hour	$ 138,000
Average length of downtime (hours)	4.5
Total cost of unplanned downtime	$ 163,944,000
HMT-1	
Average length of downtime reduction	29%
Revenue impact	**$ 47,543,760**

Future (Post-Covid)

- Improvement and design of hardware (Thermal Cameras, Borescope, etc) and software applications that achieve extensive functions in record time
- Digitalization and automation to optimize performance and enhance safety for global frontline workers

Our Product Inventory

RealWear Navigator 520

RealWear Navigator 500

ATEX	II 2G Ex ib IIC T4 Gb II 2D Ex ib IIC T135°C Db IP6X
IECEx	Ex ib IIC T4 Gb Ex ib IIC T135°C Db IP6X
NEC500	Class I, Division 1, Groups A,B,C,D T4 Class II & III, Division 1, Groups E,F,G T4

HMT-1Z1

Transcends tablets and smart glasses.

Better than a tablet
Just as powerful, but 100% hands-free.

Smarter than glass.
More processor, more run time, more camera, more rugged, more safety.

Confidential and Proprietary © 2021 RealWear

Full-Stack Assisted Reality Solution

Hardware

Revolutionary, Modular Hardware design

Software

Hands-free voice UX + Markup RealWear Apps and Utilities
Powerful App Ecosystem

Cloud

Secure suite of services and on-demand usage metrics

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realwear NAVIGATOR 500

Benefits of Assisted Reality

XR Spectrum

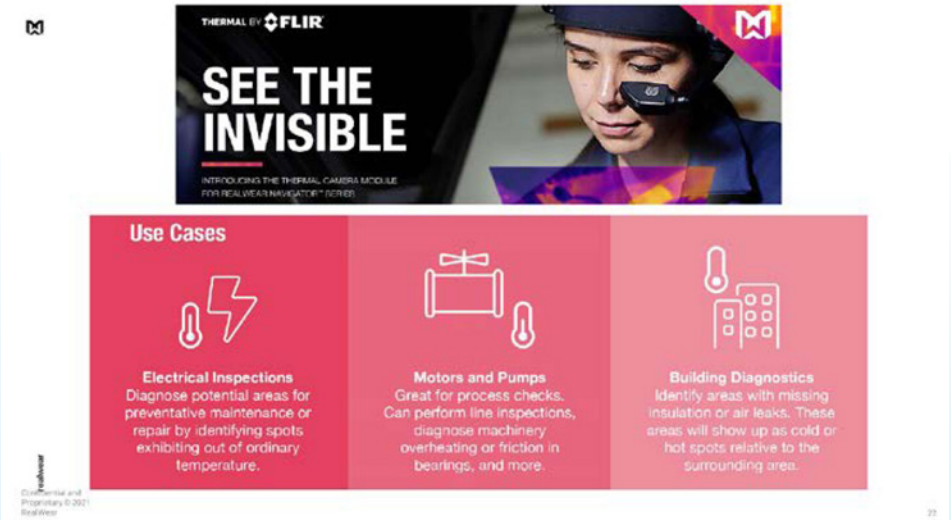
R	aR	AR	MR	VR
Reality	Assisted Reality	Augmented Reality	Mixed Reality	Virtual Reality

realwear

- **No immersive / Mixed Reality**
- **Hands-free**
- **Situational awareness**
- **EHS compliance**
- **Delivers only essential on-demand info in real time**
- **Industry 4.0 ready for frontline workers**

Power & Utilities
Oil, Gas & Chemical
Manufacturing
Construction & Mining
Transportation & Logistics
Key Industries
Automotive
Aviation
Food & Beverage
Retail
IT & Telecomm

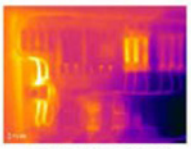
RealWear Thermal Camera Module
Introducing a brand-new superpower for the front line - Hands-free thermal vision
THERMAL BY FLIR


THERMAL BY FLIR
SEE THE INVISIBLE
Use Cases
Electrical Inspections
Diagnose potential areas for preventative maintenance or repair by identifying spots exhibiting out of ordinary temperature.
Motors and Pumps
Great for process checks. Can perform line inspections, diagnose machinery overheating or friction in bearings, and more.
Building Diagnostics
Identify areas with missing insulation or air leaks. These areas will show up as cold or hot spots relative to the surrounding area.

Thermal by FLIR

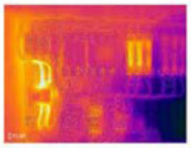
RealWear's Thermal Camera Module has been developed with Thermal by FLIR – from the world's leading manufacturer of infrared products. The Thermal Camera Module offers five modes including Teledyne FLIR's patented MSX®, which adds visible light details to thermal images for greater detail. Once you've got your image, you can take thermography to the next level with FLIR Thermal Studio Suite.

Visual Image Mode



Thermal Image Mode

Blend Image Modes (Low/High)



MSX® Enhanced Image Mode

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AI/AR Inspection by Head Mount Device

https://youtu.be/FT7v9N-rcPU?si=5nFDCBkD9whl71zM

AI/AR Inspection by Head Mount Device

https://youtu.be/QSeKsT3LRuo?si=ctpAw6kjLhJ3Xrmm

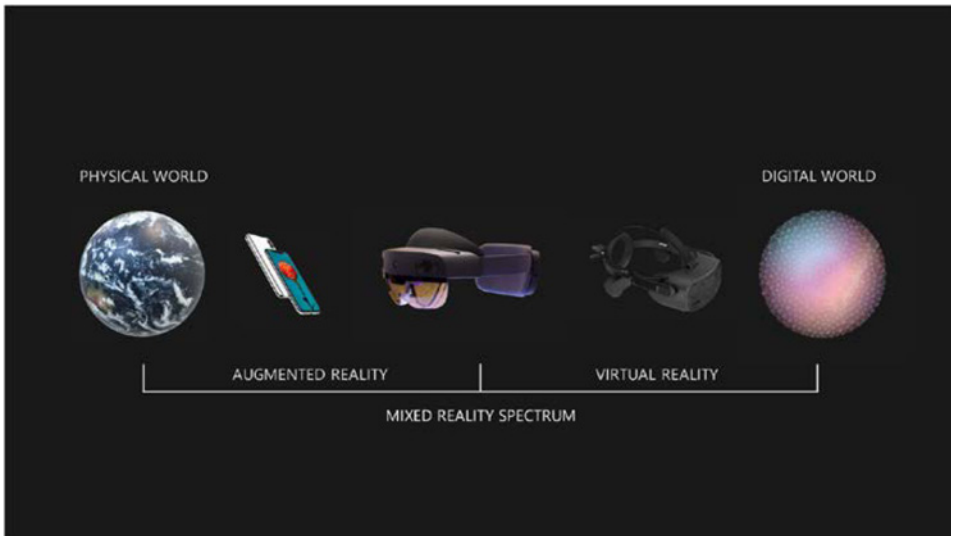
How mixed reality is opening a new era for all industries

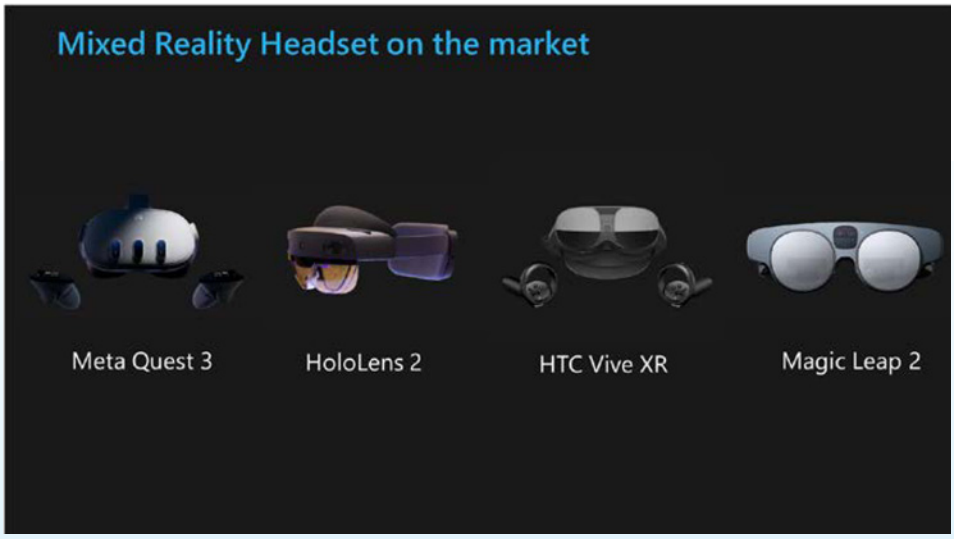
Othman Chiheb
Mixed Reality Expert

The presenter presented an insightful exploration into the transformative impact of mixed reality (MR) across various industries, with a particular focus on healthcare and business efficiency. Othman Chiheb, a Mixed Reality Expert with a decade of experience and former EMEA Mixed Reality Lead at Microsoft, the speaker underscores MR's potential to revolutionise traditional practices.

In the healthcare sector, MR is depicted as a game-changer, offering surgeons the ability to visualise complex 3D anatomical structures, thereby enhancing surgical planning and reducing complications. The speaker highlights the HoloMedicine Programme at NUHS and advanced surgical planning for procedures like liver transplants, demonstrating MR's practical applications in the operating room.

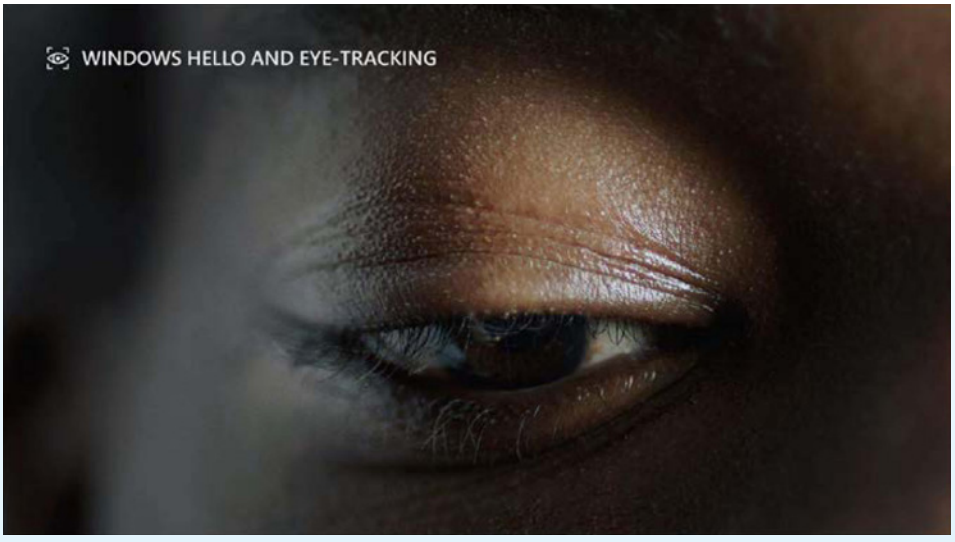
Immersive technologies landscape

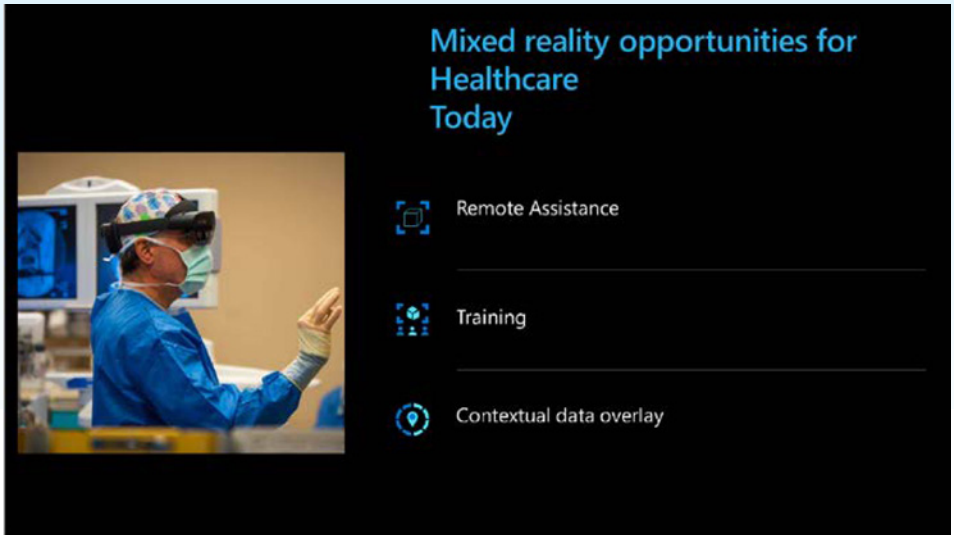

PHYSICAL WORLD
DIGITAL WORLD
AUGMENTED REALITY
VIRTUAL REALITY
MIXED REALITY SPECTRUM


Mixed Reality Headset on the market
Meta Quest 3
HoloLens 2
HTC Vive XR
Magic Leap 2

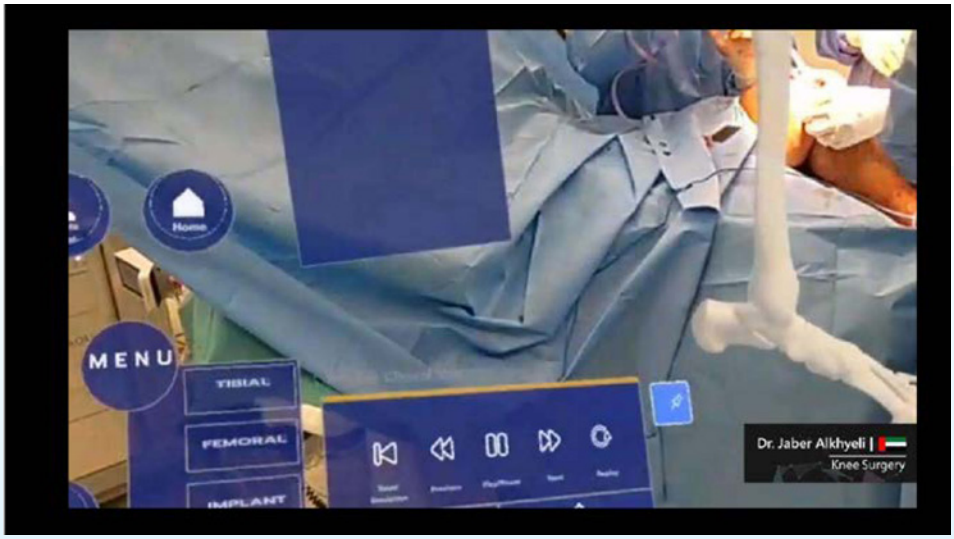
UNIVERSAL FIT

FULLY ARTICULATED HAND TRACKING


WINDOWS HELLO AND EYE-TRACKING


Mixed reality opportunities for Healthcare Today
Remote Assistance
Training
Contextual data overlay

Pr. Thomas Gregory
Dr. Peter Reilly
Dr. Rashed Al Shaeel
Dr. John Sledge
Lumbar Surgery


MENU
TIBIAL
FEMORAL
IMPLANT
Dr. Jaber Alkhyeli
Knee Surgery

Some key figures

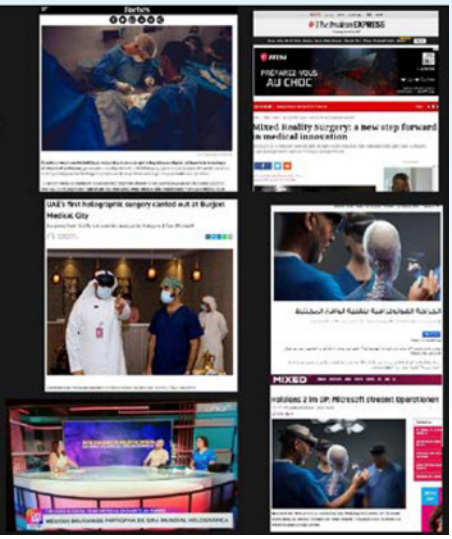
- Audience : Searcher, Doctors , Hospitals, Students

...

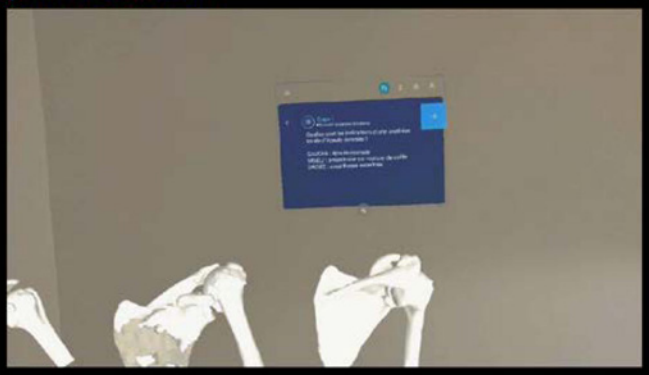
- 38 000 Unique visitors on the website
- 15 000 Live views from 130 countries
- 70+ speakers involved

Worldwide social impact :

- Reach : 100+ M
- 400+ pieces of earned coverage (TV, Radio, Article, newspaper...)
- Analysts from top firms like : Gartner, IDC, CCS Insights



Holographic education

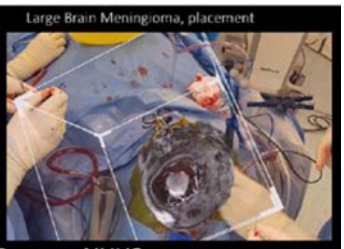


synergiz

Contextual data overlay

apoQlar

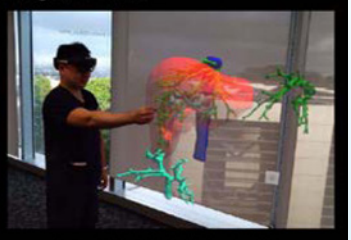
PET Scan superimposition



Large Brain Meningioma, placement

HoloMedicine® Program NUHS

Advanced Breast Cancer Op Planning

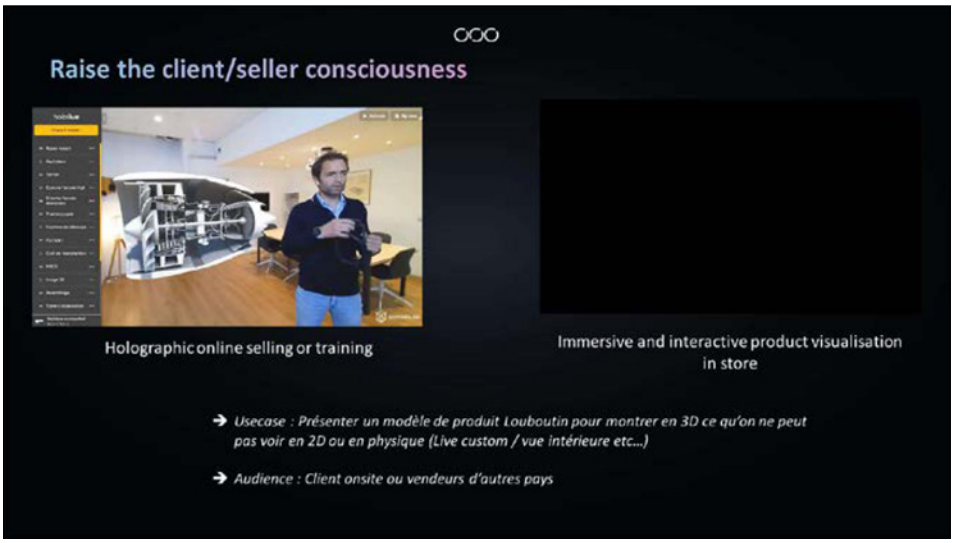


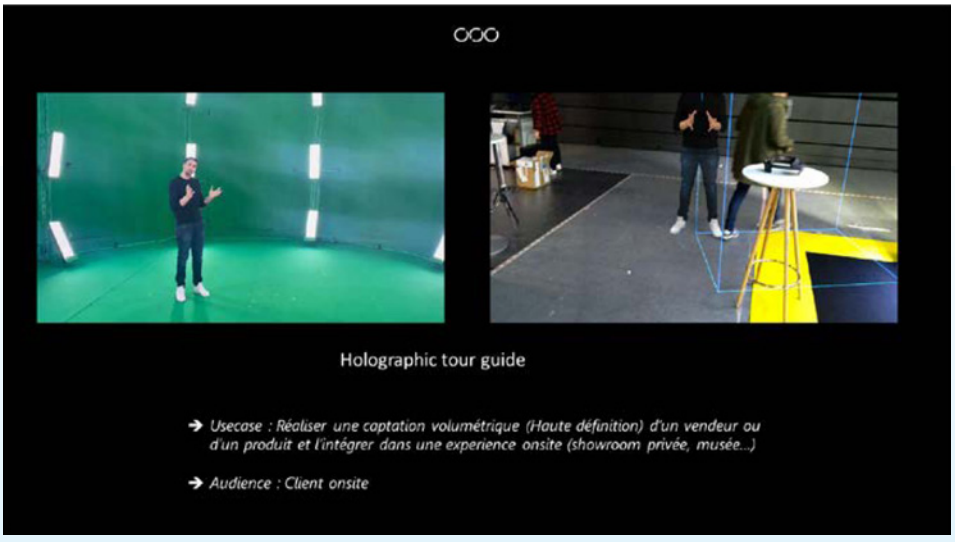
Liver Transplant Donor Op Planning

Dual-camera holographic assisted shoulder arthroscopy.

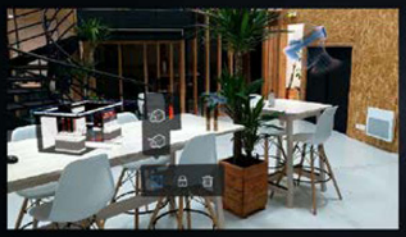
Mixed reality infused with AI
Navigation support
Teleoperation with robotics
Collaborative training

JoinXR
30 degrés.
Dr Jean-Florin
Ciornohac
RECORDED WITH

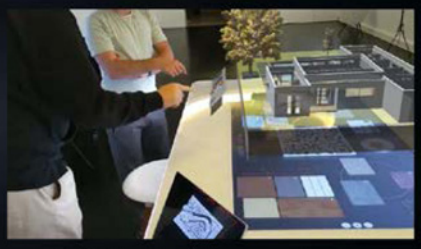

Raise the client/seller consciousness
Holographic online selling or training
Immersive and interactive product visualisation in store
→ Usecase : Présenter un modèle de produit Louboutin pour montrer en 3D ce qu'on ne peut pas voir en 2D ou en physique (Live custom / vue intérieure etc...)
→ Audience : Client onsite ou vendeurs d'autres pays


Holographic tour guide
→ Usecase : Réaliser une captation volumétrique (Haute définition) d'un vendeur ou d'un produit et l'intégrer dans une experience onsite (showroom privée, musée...)
→ Audience : Client onsite

Mixed reality to improve business efficiency and design review



Remote collaboration



Live design review / Showroom review

- *Usecase : Collaborer à distance sur le design d'une maquette 3D (Produit, Shopfloor, boutique...)*
- *Audience : Architecte / Designers / Décideurs / Responsable boutique*

How much does it cost ?

Remote Assist usecase :

Hardware: 8.2K€	Service: 1K€	Software: 800€/yr
-1 HoloLens 2 -Surface Pro -Routeur 4G	Hands-on training during ½ day	Remote Assist License

= 10 K€

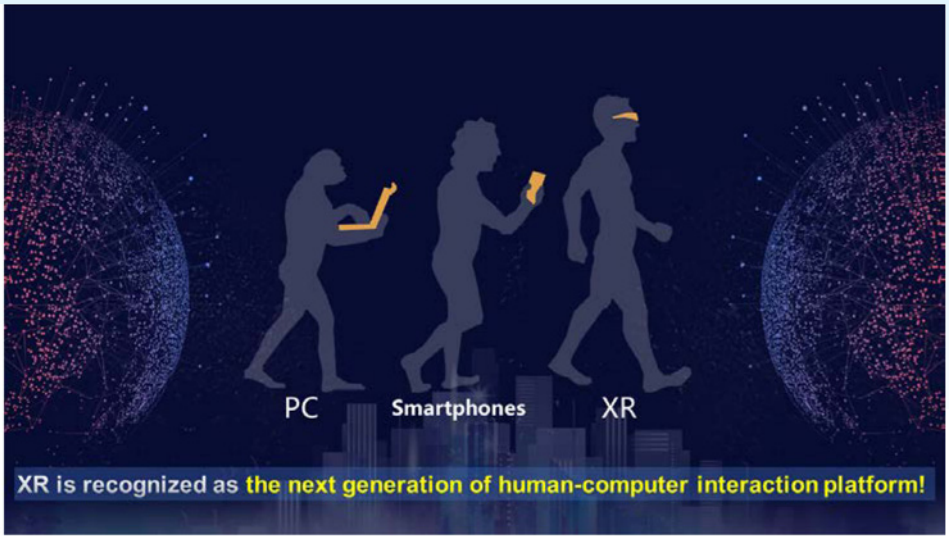
XR Technology's Application in Vocational Education & Development Trends

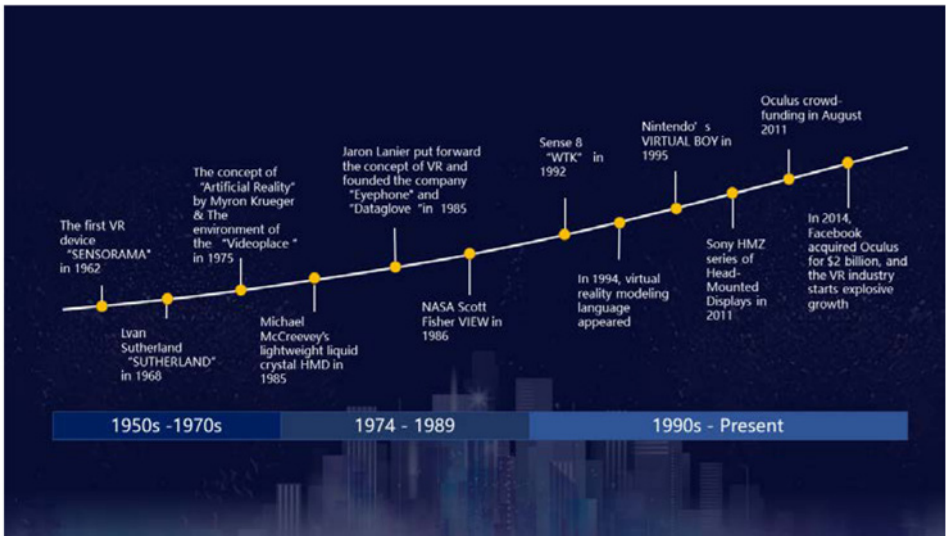
Vincent SU
Jiangxi KMAX Industrial Co., LTD

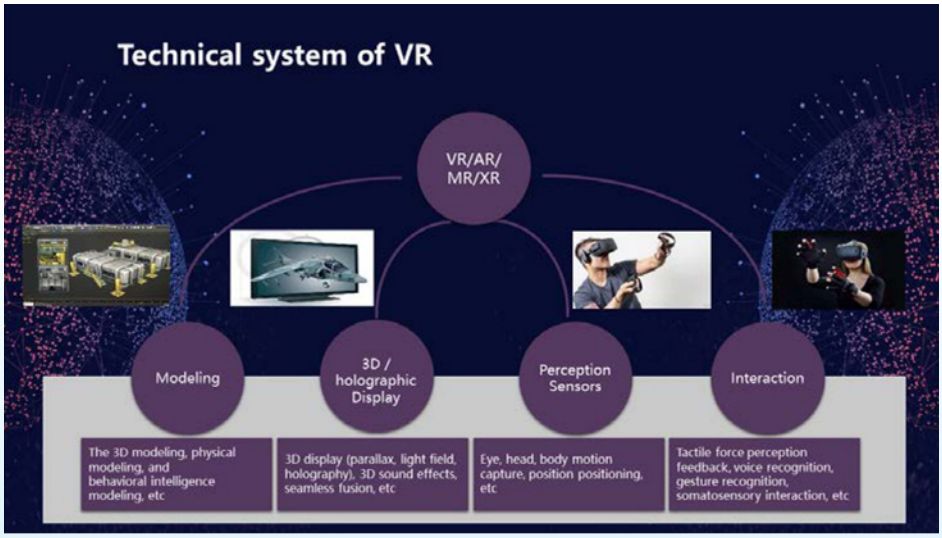
Vincent SU's comprehensive presentation from Jiangxi KMAX Industrial Co., LTD delves into the transformative application of Extended Reality (XR) technology in vocational education. He provides a historical trajectory of VR technology, from its early conceptualisation in the 1960s with devices like "SENSORAMA" to the significant advancements that led to modern VR devices and the integration of AI.

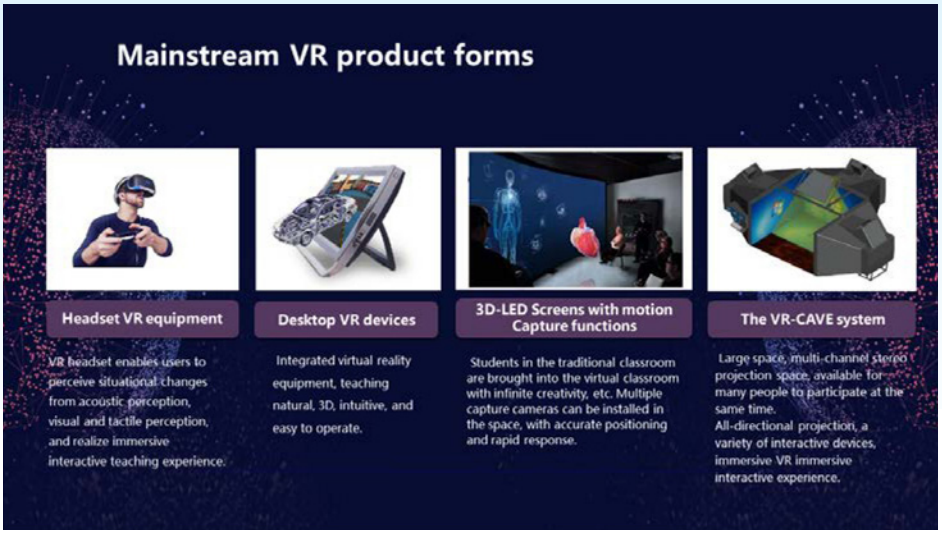
The integration of VR with AI is presented as a pivotal development for the future of vocational education. The combination of big data analytics and AI-driven personalization promises to enhance teaching modes, making education more accessible, efficient, and tailored to individual needs.

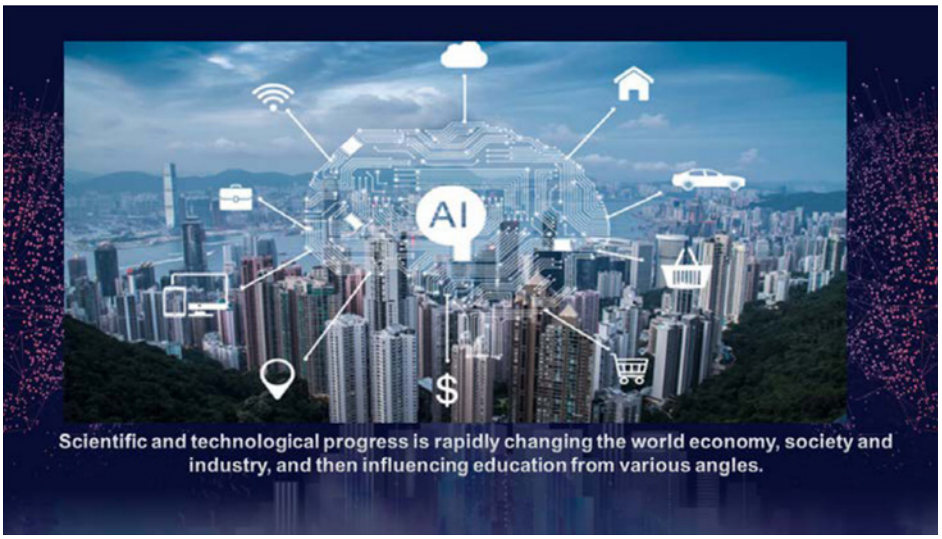
Vincent SU's presentation paints a future where XR technology is an integral part of vocational education, offering innovative solutions to traditional educational challenges and preparing students for the rapidly evolving digital economy.

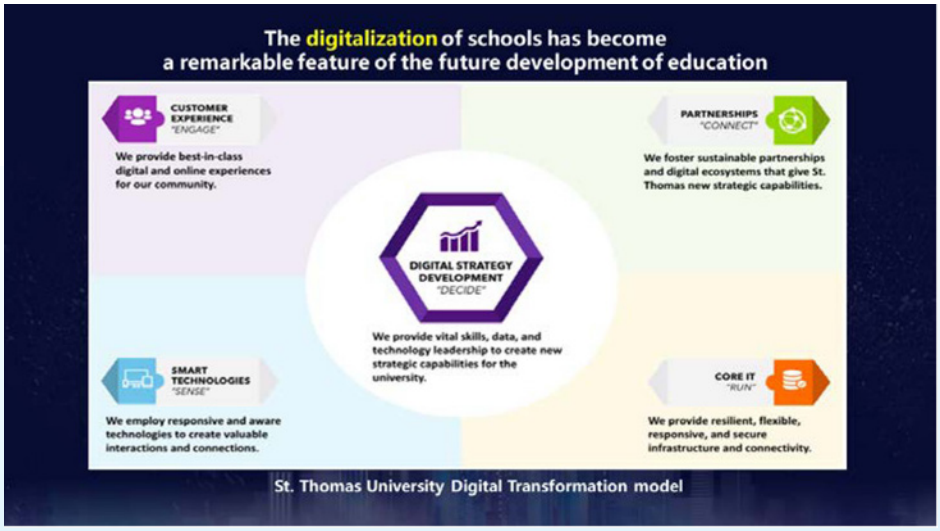

PC
Smartphones
XR
XR is recognized as the next generation of human-computer interaction platform!

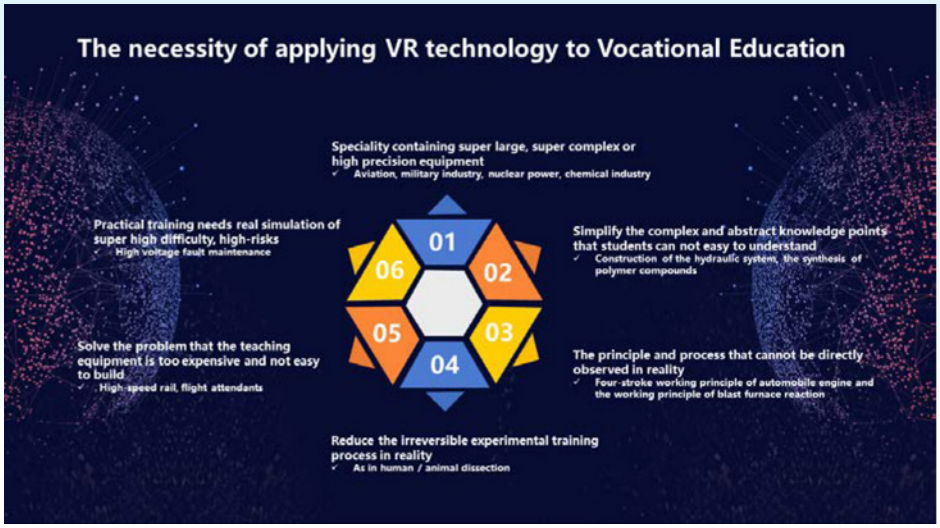

The first VR device "SENSORAMA" in 1962
Ivan Sutherland "SUTHERLAND" in 1968
The concept of "Artificial Reality" by Myron Krueger & The environment of the "Videoplace " in 1975
Michael McCreevey's lightweight liquid crystal HMD in 1985
Jaron Lanier put forward the concept of VR and founded the company "Eyephone" and "Dataglove "in 1985
NASA Scott Fisher VIEW in 1986
Sense 8 "WTK" in 1992
In 1994, virtual reality modeling language appeared
Nintendo' s VIRTUAL BOY in 1995
Sony HMZ series of Head-Mounted Displays in 2011
Oculus crowd-funding in August 2011
In 2014, Facebook acquired Oculus for $2 billion, and the VR industry starts explosive growth
1950s -1970s
1974 - 1989
1990s - Present


Technical system of VR
VR/AR/ MR/XR
Modeling
3D / holographic Display
Perception Sensors
Interaction
The 3D modeling, physical modeling, and behavioral intelligence modeling, etc
3D display (parallax, light field, holography), 3D sound effects, seamless fusion, etc
Eye, head, body motion capture, position positioning, etc
Tactile force perception feedback, voice recognition, gesture recognition, somatosensory interaction, etc

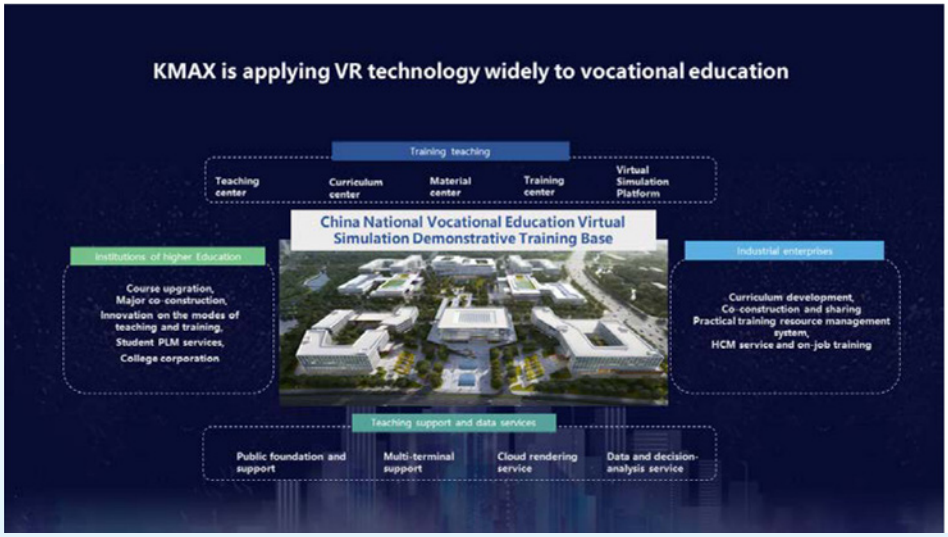

Mainstream VR product forms
Headset VR equipment
VR headset enables users to perceive situational changes from acoustic perception, visual and tactile perception, and realize immersive interactive teaching experience.
Desktop VR devices
Integrated virtual reality equipment, teaching natural, 3D, intuitive, and easy to operate.
3D-LED Screens with motion Capture functions
Students in the traditional classroom are brought into the virtual classroom with infinite creativity, etc. Multiple capture cameras can be installed in the space, with accurate positioning and rapid response.
The VR-CAVE system
Large space, multi-channel stereo projection space, available for many people to participate at the same time.
All-directional projection, a variety of interactive devices, immersive VR immersive interactive experience.


AI
$
Scientific and technological progress is rapidly changing the world economy, society and industry, and then influencing education from various angles.


The digitalization of schools has become a remarkable feature of the future development of education
CUSTOMER EXPERIENCE "ENGAGE"
We provide best-in-class digital and online experiences for our community.
PARTNERSHIPS "CONNECT"
We foster sustainable partnerships and digital ecosystems that give St. Thomas new strategic capabilities.
DIGITAL STRATEGY DEVELOPMENT "DECIDE"
We provide vital skills, data, and technology leadership to create new strategic capabilities for the university.
SMART TECHNOLOGIES "SENSE"
We employ responsive and aware technologies to create valuable interactions and connections.
CORE IT "RUN"
We provide resilient, flexible, responsive, and secure infrastructure and connectivity.
St. Thomas University Digital Transformation model


The necessity of applying VR technology to Vocational Education
Speciality containing super large, super complex or high precision equipment
Aviation, military industry, nuclear power, chemical industry
Practical training needs real simulation of super high difficulty, high-risks
High voltage fault maintenance
Simplify the complex and abstract knowledge points that students can not easy to understand
Construction of the hydraulic system, the synthesis of polymer compounds
01
02
03
04
05
06
Solve the problem that the teaching equipment is too expensive and not easy to build
High-speed rail, flight attendants
The principle and process that cannot be directly observed in reality
Four-stroke working principle of automobile engine and the working principle of blast furnace reaction
Reduce the irreversible experimental training process in reality
As in human / animal dissection

AIO XR
K1 XR
M1 XR
K2 XR
M2 XR
Medical and health categories
Civil architecture category
Electronic information categories
Agriculture, forestry, animal husbandry and fishing category
Automobile and intelligent manufacturing category
Transportation categories
Tourism categories
Red education


KMAX is applying VR technology widely to vocational education
Training teaching
Teaching center
Curriculum center
Material center
Training center
Virtual Simulation Platform
China National Vocational Education Virtual Simulation Demonstrative Training Base
Institutions of higher Education
Course upgration,
Major co-construction,
Innovation on the modes of teaching and training,
Student PLM services,
College corporation
Industrial enterprises
Curriculum development,
Co-construction and sharing
Practical training resource management system,
HCM service and on-job training
Teaching support and data services
Public foundation and support
Multi-terminal support
Cloud rendering service
Data and decision-analysis service

Overview on the hardware and software by creating the XR environment
創建 XR 環境的硬件和軟件概述

劉英健博士
香港心理學協會會長

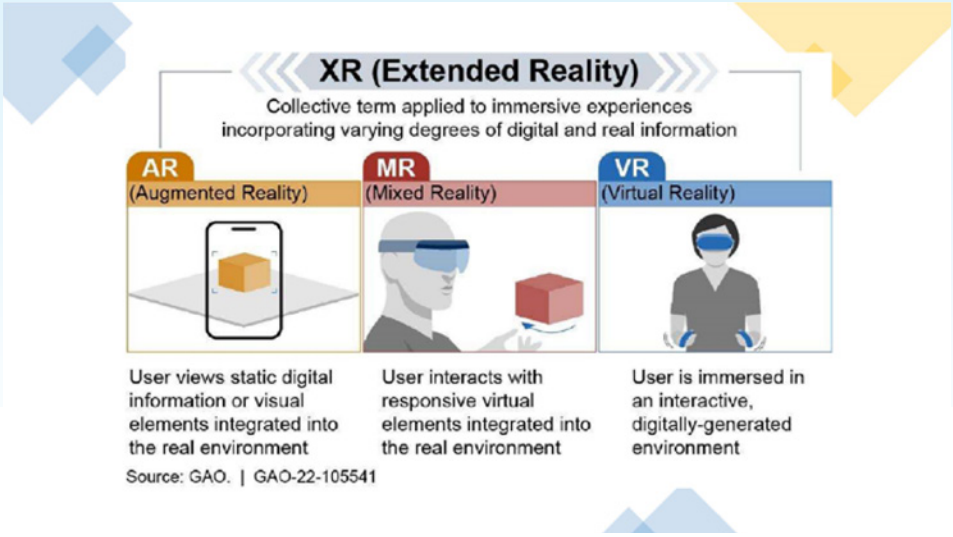
Dr Adrian Low provided an in-depth overview of the application of Extended Reality (XR) in creating therapeutic environments, focusing on VR therapy projects developed by his team since 2021. XR, integrating both Virtual Reality (VR) and Augmented Reality (AR), offers an immersive experience for various psychological treatments, including anxiety disorders, addiction, depression, and more.

The presentation outlines the operation flow of VR therapy, from selecting a therapist and scheduling appointments to connecting clients with virtual environments and recording data for AI analysis. It highlights the potential of XR in treating dementia through scientific interventions, emphasising the importance of testing and a scientific model.

The benefits of XR therapy are numerous, such as enhanced immersion, personalised interventions, and increased accessibility to mental health services. It also provides a safe and controlled environment for clients to practice coping strategies and offers a platform for therapist training and supervision.

However, the presentation also acknowledges the limitations of XR therapy, including the initial cost of technology, user comfort and safety concerns, technical limitations, ethical considerations, challenges in establishing therapeutic relationships, and the need for more research to support its efficacy.

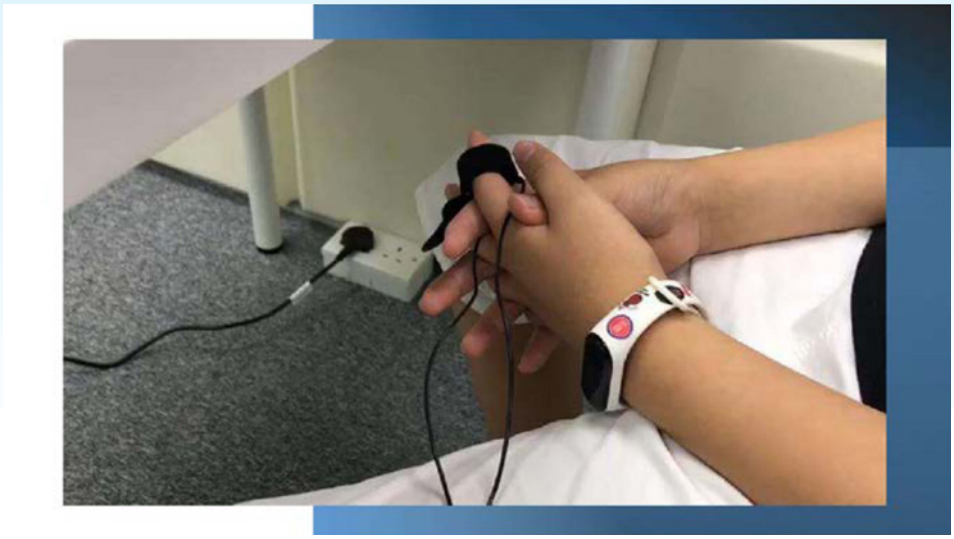
Dr Low concludes by inviting further inquiries into this groundbreaking approach to mental health treatment, hinting at the vast possibilities that XR technology brings to the field of psychotherapy.

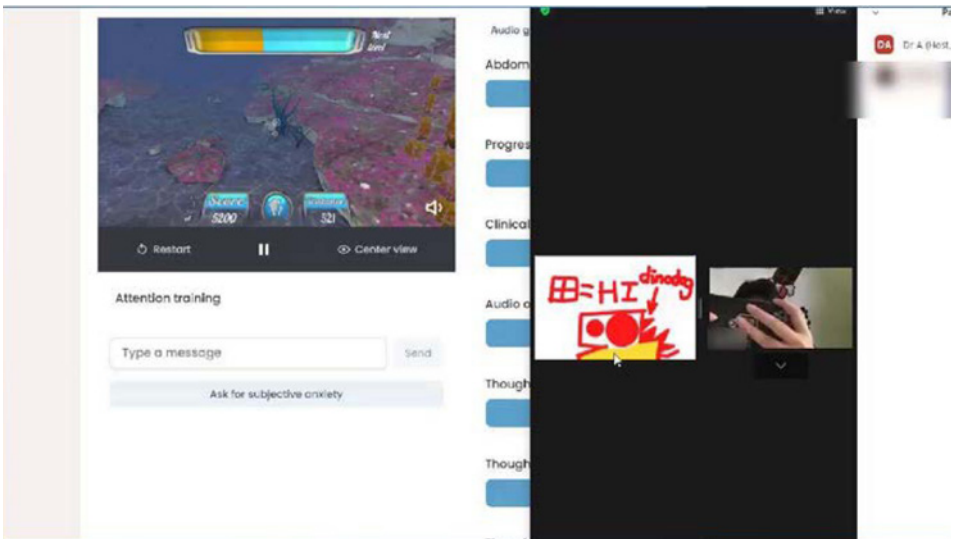


VR Therapy

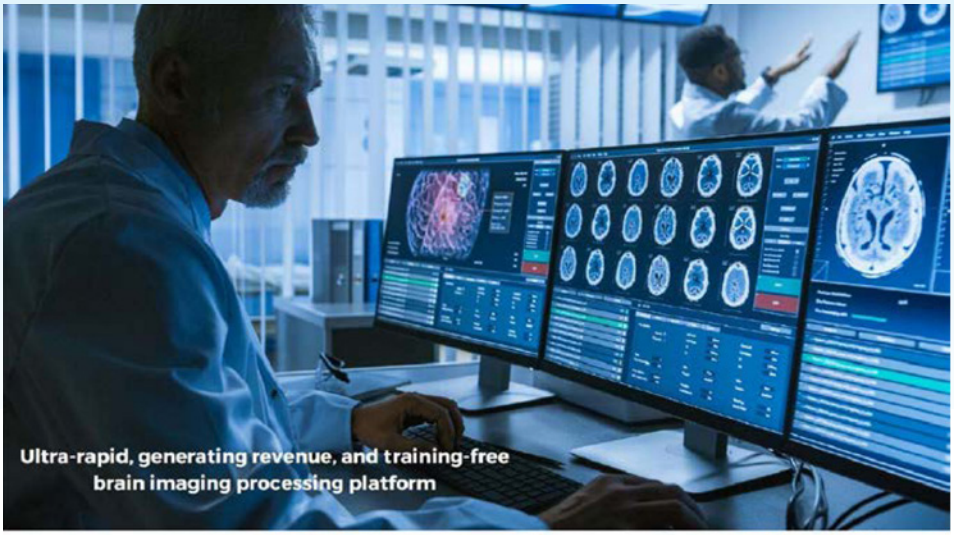
VR治療的應用十分廣泛，以焦慮症為例，利用電腦科技我們可以建構各種不同的場景，輸入所需的元素，按照患者的情況去訂定療程和進度，可以隨時進行治療及讓患者重複一些場景，確定和鞏固患者可以安然適應不同程度的焦慮反應，有着傳統療法所不能比擬的優點。隨着VR技術的發展，VR虛擬現實治療將會愈來愈受重視。

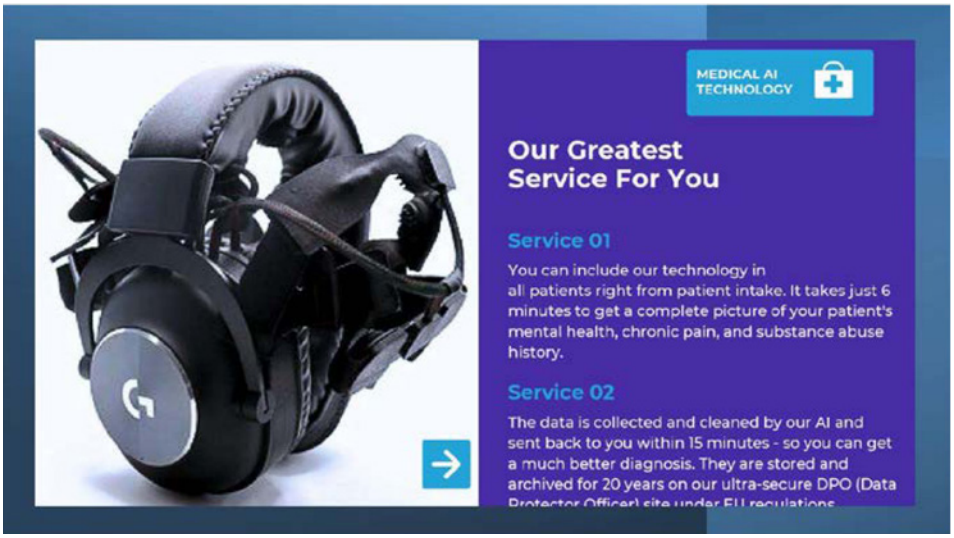
Scientific ?
Objective + Subjective!!!
Imagine the possibilities....

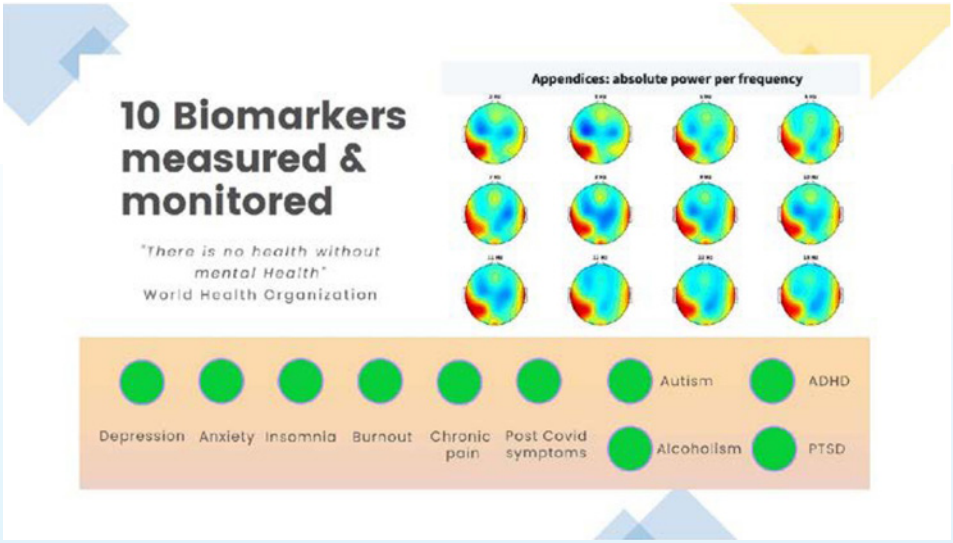



Restart
Center view
Attention training
Type a message
Send
Ask for subjective anxiety
Abdom
Progres
Clinical
Audio
Though
Though
Dr A (Hest,

Operation Flow
WORK OVERVIEW
1. Select the therapist
2. Receive client's appointment
3. Suitable place for scheduled treatment with VR glasses
4. Connect to virtual environment and real therapist
5. Record client's data and status for AI analysis


Ultra-rapid, generating revenue, and training-free
brain imaging processing platform


MEDICAL AI
TECHNOLOGY
Our Greatest
Service For You
Service 01
You can include our technology in
all patients right from patient intake. It takes just 6
minutes to get a complete picture of your patient's
mental health, chronic pain, and substance abuse
history.
Service 02
The data is collected and cleaned by our AI and
sent back to you within 15 minutes - so you can get
a much better diagnosis. They are stored and
archived for 20 years on our ultra-secure DPO (Data


10 Biomarkers
measured &
monitored
"There is no health without
mental Health"
World Health Organization
Appendices: absolute power per frequency
Depression
Anxiety
Insomnia
Burnout
Chronic
pain
Post Covid
symptoms
Autism
ADHD
Alcoholism
PTSD

The Problem

Doctors and individuals alike lack a common easy-to-use method to measure the impact actions have on the aging process.

Invasive
Existing measurements from blood panels are invasive and require professionals.

Incomplete
No devices on the market measure a suite of functional markers of aging.

Inaccessible
The future of medicine should empower individuals to monitor their aging health at home.

23

Our Solution

The world's leading functional age testing and monitoring platform: The AgeMeter Functional Age Test App

24

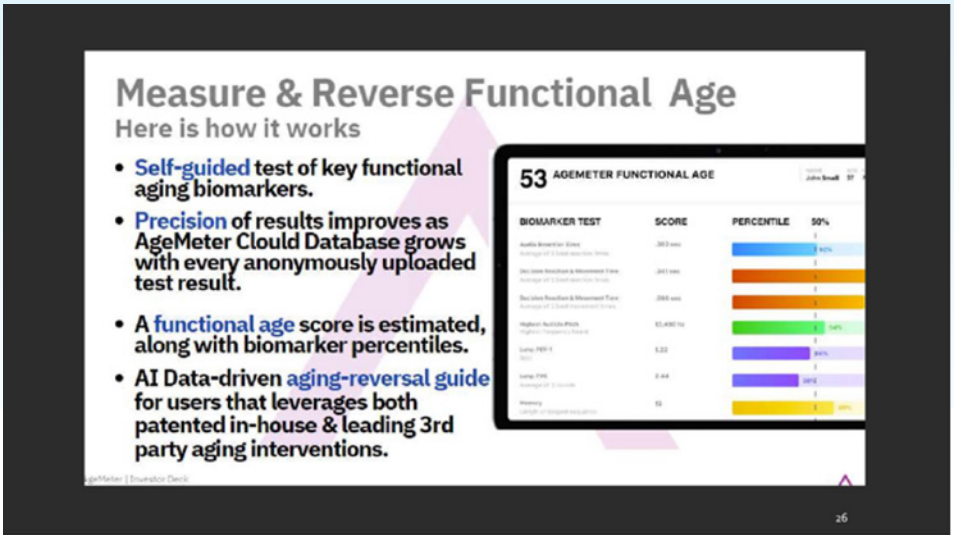
We measure valuable functional biomarkers that decline with age.

Auditory & visual reaction time, highest audible pitch, memory, lung capacity, muscle movement speed, coordination, arterial stiffness, HRV, visual accommodation, ...

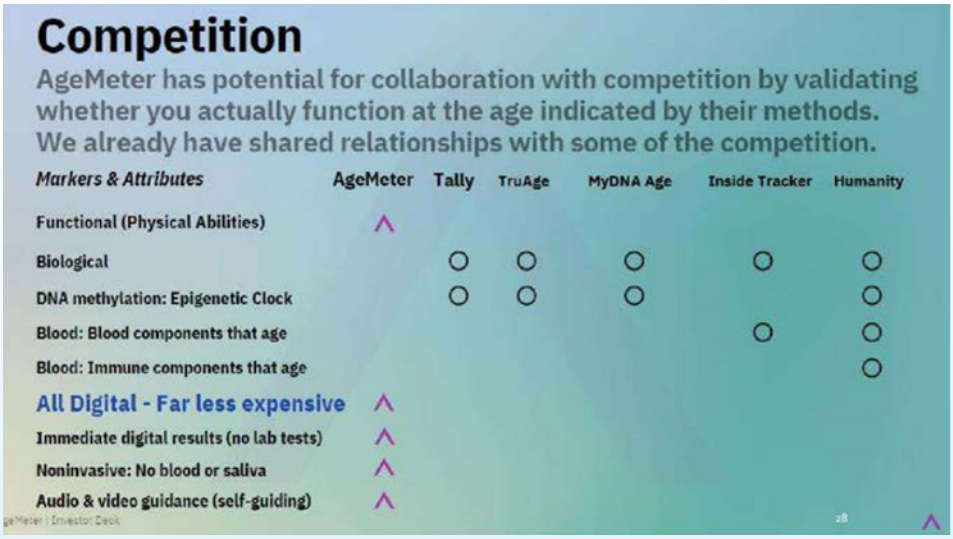
Rarely measured by physicians due to lack of methods and equipment to do so ... but now they can

Not a Medical Device, Does not require FDA approval

25


Measure & Reverse Functional Age
Here is how it works
• Self-guided test of key functional aging biomarkers.
• Precision of results improves as AgeMeter Clould Database grows with every anonymously uploaded test result.
• A functional age score is estimated, along with biomarker percentiles.
• AI Data-driven aging-reversal guide for users that leverages both patented in-house & leading 3rd party aging interventions.
53 AGEMETER FUNCTIONAL AGE
BIOMARKER TEST
SCORE
PERCENTILE
50%
26

Traction
Disney partner is now exclusive worldwide distributor of AgeMeters for B2B
There are AgeMeters on all continents except Antarctica
The distributorship can expand that current presence and prepare for new markets even beyond Antarctica
AgeMeter is being considered to test applicants for the $100,000,000 Aging Reversal XPRIZE
WIRED
"Quantified anti-aging"
iHeart RADIO
Frontiers of Anti-Aging podcast with Dr. Oliver Medvedik
LongevityTechnology
AgeMeter brings physical age measurement into the 21st century.
y!news
Small pilot study by Neurohacker used AgeMeter to measure its Qualia Life supplement 's effect on Healthy aging


Competition
AgeMeter has potential for collaboration with competition by validating whether you actually function at the age indicated by their methods. We already have shared relationships with some of the competition.
Markers & Attributes
AgeMeter
Tally
TruAge
MyDNA Age
Inside Tracker
Humanity
Functional (Physical Abilities)
Biological
DNA methylation: Epigenetic Clock
Blood: Blood components that age
Blood: Immune components that age
All Digital - Far less expensive
Immediate digital results (no lab tests)
Noninvasive: No blood or saliva
Audio & video guidance (self-guiding)
28

QUALIA LIFE - AGEMETER® PILOT STUDY

STUDY BACKGROUND

A small pilot study of Qualia Life—originally branded as Eternus—was conducted during the winter months of 2019-20. Functional testing was done using the AgeMeter® device and software. Prior to starting the initial tests, each participant was provided instructions on using the AgeMeter, and given practice sessions. After completing a baseline assessment, participants were supplied with Qualia Life and instructed to take eight capsules daily, between about 7-9 am with a glass of water for five days, followed by two days where no capsules would be taken. Qualia Life supplementation was taken following this dosing pattern throughout the study period. Participants returned to the Neurohacker Collective office to retake AgeMeter testing after 4 and 8 weeks of supplementation.

31

THE RESULTS

The results suggest that supplementation with Qualia Life may support cognitive and physiological functional performance in several areas that typically worsen with aging.

Some Important Changes in AgeMeter Test After 8 Weeks Were:

25% improvement in working memory* (p = 0.04; effect size = 0.4)

9% improvement in highest tone heard* (p = 0.01; effect size = 0.4)

13% improvement in speed of response to sounds* (p = 0.02; effect size = -0.85)

14% improvement in speed of acting on a decision* (p = 0.11; effect size = -0.53)

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Benefits of XR THERAPY:

- Enhanced Immersion: XR technology, which combines virtual reality (VR) and augmented reality (AR), can create highly immersive and realistic therapeutic environments. This immersion can help individuals feel more engaged and connected to the therapeutic experience, leading to a deeper level of exploration and understanding.
- Exposure Therapy: XR psychotherapy can be particularly effective in exposure therapy, where individuals are gradually exposed to anxiety-inducing situations in a controlled and safe environment. XR can simulate these situations with high fidelity, allowing therapists to guide clients through a variety of scenarios and help them confront and manage their fears or anxieties.
- Increased Accessibility: XR psychotherapy has the potential to increase accessibility to mental health services. It can overcome barriers such as geographical limitations, transportation issues, or physical disabilities by providing therapy in a virtual environment. This can make therapy more accessible and convenient for individuals who may have difficulty accessing traditional in-person sessions.

Seminar on XR Technologies Enabling Manufacturing Industry Smartification and Digitalization
應用 XR 技術賦能製造業邁向智能化與數據化研討

隨著新型工業化發展，製造業正準備引入智能化和數碼化的主要賦能技術 —擴增實境 (AR)、虛擬實境 (VR) 和混合實境 (MR) 等 XR 技術。這些新技術能夠有效改善生產流程 , 提升設備效率。例如 AR 能夠實現現場資產管理及遙距協作工作，VR 則可以用於虛擬培訓和跨地域協同產品設計等。 為了進一步探討如何利用 XR 技術賦能製造業數碼轉型，生產力局將於 12 月 6 日舉辦「應用 XR 技術賦能製造業邁向智能化及數據化研討會」，為「應用 XR 技術賦能產業邁向智能化及數據化」系列的活動。旨在向業界介紹涉及製造業領域的技術概念、方法、營運技巧及應用案例研究，同時闡述各項技術的優勢和局限性，以及最近之創新發展。

這次研討會邀請了相關領域專家學者進行深入分享，講述製造業應用延展實境技術的案例，當中包括供應鏈內之客戶、產品設計師和工程師透過 XR 技術實踐跨地區國界實時協作溝通和產品開發；以虛擬方式模擬工廠佈局及遙距指導安裝佈置新設備等。

主題	講者
XR 技術介紹及應用場景解析	**黎偉華先生** 香港生產力促進局首席顧問 **孫國山先生** 香港生產力促進局高級顧問
工業元宇宙 數字孿生 &XR 解決方案	**李姊鑫女士** 廣東瀚瀚孿生雲科技有限公司 創始人
Discovering NVIDIA Omniversa and Omniverse XR	**Dr Charles Cheung** NVIDIA AI Technology Center Deputy Director

XR 技術介紹及應用場景解析

黎偉華先生，孫國山先生
香港生產力促進局

孫國山先生介紹了 XR（擴展現實）技術及其在智能製造中的應用場景和未來展望。XR 是虛擬現實（VR）、增強現實（AR）和混合現實（MR）的統稱，通過電腦技術創造出立體仿真的 3D 空間，增強現實中增加虛擬元素，或結合虛擬與現實產生新的視覺化環境。

概述了 XR 的發展歷程，介紹了智能穿戴設備如 AR Hololens 眼鏡和 VR 設備如 HP ReverbG2。詳細分析了 AR 眼鏡的光學特點和市場主流 AR 眼鏡的參數對比，如 Google Glass 和 Hololens 2。XR 技術被廣泛應用於工程、醫療、教育、軍事、電子遊戲、市場營銷、零售、交通運輸、房地產、視頻直播和影音娛樂等領域。

特別強調了 XR 在智能製造中的關鍵作用，如產品設計、生產指導、工廠佈局審核、員工培訓和遠程技術協助。XR 技術通過 5G 網絡實現內容的雲端存儲和傳輸，促進了遠程辦公和工種作共享，解決了專業人才短缺問題，並使得同步虛擬工廠成為可能。

展望了 XR 技術賦能智能製造的未來，包括促進實現遠程辦公、工種共享和同步虛擬工廠，為製造業的智能化轉型提供了新的思路和工具。

- XR概述
- XR賦能智能製造的應用場景
- XR賦能智能製造的未來

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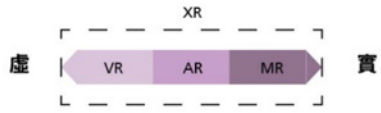
XR概述

XR（extended reality）延展實境是一個統稱，有虛擬實境（VR），混合實境（MR），擴增實境（AR）三種。

虛擬實境（VR），利用電腦技術創造出立體擬真的3D空間，使用者帶上VR裝置後，獲得逼真的立體感與空間感.

擴增實境（AR），現實中增加虛擬因素，虛擬元素會隨觀看者移動.

混合實境（MR），虛擬與現實結合產生全新的視覺化環境。虛擬與現實共同存在，並且可以隨時互動。如元宇宙，遊戲Pokemon Go.



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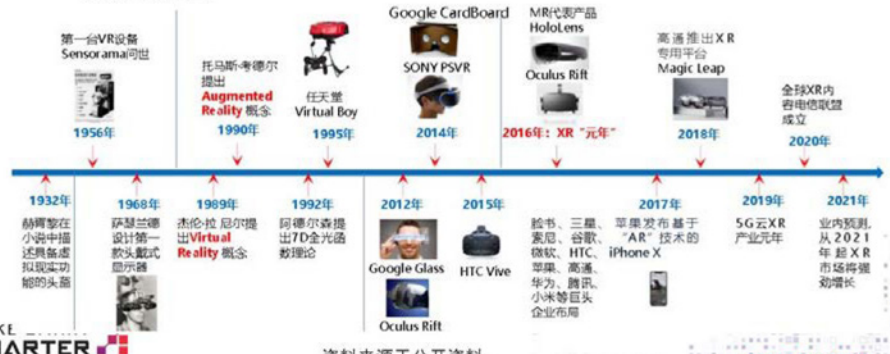
XR发展历程



资料来源于公开资料

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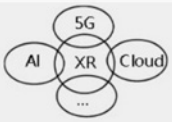
XR 未來發展動力

消費升級需求	**显示能力提升**：2K → 4K→8K，LCD → OLED **沉浸体验增强**：视觉沉浸 → 听觉沉浸 →触觉沉浸 →嗅觉、味觉等各种感知沉浸 ……	→ 消费者对舒适性、真实性、实用性和愉悦感的虚拟现实体验需求不断升级
产业升级需求	**数字化升级**：一维 → 二维→ 三维，信息的数字化建模 **智能化跃迁**：人机交互更加自然，提高生产效率 ……	→ 是经济新旧动能转换、经济结构转型升级的核心推动力量之一

技术融合



XR+AI：AI技术的发展让虚拟人物更加真实，VR技术构建虚拟世界，为人工智能提供大量数据进行学习

XR+5G：5G网络能使VR/AR设备通过无线方式获得高速、稳定的网络连接，告别现有设备的有线束缚

XR+Cloud：VR和云计算、云渲染结合，将云端的显示输出、声音输出通过编码压缩后传输到用户的终端设备中，实现VR业务的快速处理

资本集聚

2020年全球VR/AR产业融资并购规模总额为375亿元，较2019年增长了25%

中国是继美国的全球VR/AR第二大投资目的地

投资标的	细分领域	国家	投资轮次	融资额（百万美元）	主要投资者
Magic Leap	硬件	美国	D轮	$502	淡马锡、EBOI、阿里巴巴、富达投资、T. Rowe Price
Improbable	底层技术	英国	B轮	$502	Andreessen Horowitz、维港投资、软银
Niantic	游戏	美国	B轮	$200	星火投资、网易资本、Founders Fund
Lytro	硬件	美国	D轮	$60	Blue Pool Capital、Andreessen Horowitz、EDBI
Leap Motion	底层技术	美国	C轮	$50	Andreessen Horowitz、Founders Fund、摩根大通、SOSV
晶片	硬件	中国	B轮	$46	腾讯

保密文件僅用於生產力局培訓

XR 智能穿戴

AR Hololens眼鏡，Snap的Spectacle智慧眼鏡，聯想的ThinkReality A3，以及Vuzix的Next Gen Smart Glass，雷鳥創新MicroLED。

VR如HP ReverbG2，主要為遊戲類，教育培訓。

US1.5M in 1962

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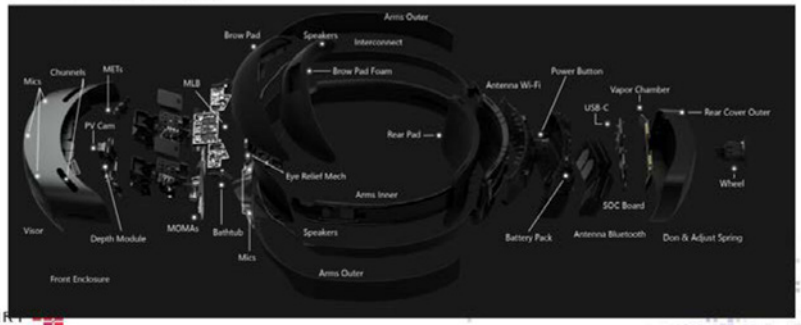
AR 眼鏡構成



MAKE SMART SMARTER

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保密文件僅用於生產力局培訓

AR 眼鏡不同光學特點

光學顯示方案	圖像源器件	厚度	FOV	透光度	量產難度	代表產品
棱鏡	LCOS	>10mm	~15度	50%	低	Google glass
自由曲面	LCOS, OLE	8mm	~30度	50%	適中	亮風台2代，Epson
Bird-bath	OLED	~8mm	30~50度	50%	適中	Nreal light, 聯想Mirage AR
光波導	LCOS, DLP	超薄	30~60度	80%以上	難	Magic Leap One, Hololens 2

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保密文件僅用於生產力局培訓

市場主流AR眼鏡參數對比

	Google Glass	Hololens 1	Magic Leap One	HiAR G200	Nreal Light	Hololens 2	Shadow creator JIMO
發佈時間	2014.4	2015.1	2018.8	2019.1	2019.1	2019.2	2020.3
FOV（度）	15	34	50	72	52	52	55
攝像頭像素(萬)	500	200		200	500	800	1300
單眼分辨率	640*360	1280*720	1280*960	1280*720	1920*1080	2048*1080	1920*1080
芯片	OMAP 4430	Intel Atom x5-Z8100p	NIVIDA Parke	高通驍龍820	高通驍龍855	高通驍龍850	高通驍龍845
儲存空間(G)	16	64	128	32/256	128	64	
重量(g)	50	579	316	80	88	566	120
價格	1500	3000	2295	約2641（RMB16998）	499	3500	約682（RMB4388）
光學顯示系統	微型反射投影	光波導	光波導	光波導	Birdbath	光波導	自由曲面

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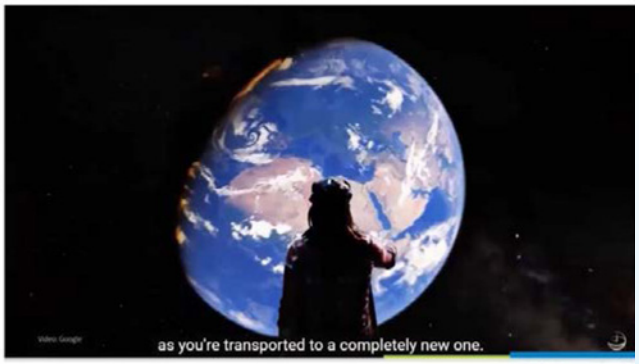
XR應用領域

工程
醫療
教育
軍事
電子遊戲
行銷與廣告
零售業
交通運輸
房地產
視頻直播
影音娛樂



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AR類型

SLAM即Simultaneous localization and mapping, 將虛擬3D建構與真實環境中的平面或地面。

用圖片觸發AR，通過識別圖像的特征後，引出AR效果包。如產品宣傳冊，APP掃描圖像，引出AR內容。

LBS，透過GPS，WIFI，藍牙等定位方式，推送AR內容，如車站內導航，觀光導覽，Pokemon GO尋寶。

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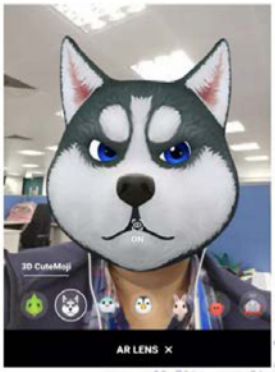
AR類型

物體辨識觸發AR，通過識別立體的物體的特征，引出AR內容。如汽車周圍，環繞虛擬運動。

臉部辨識觸發AR，透過臉部特征，引出AR內容，進行cosplay扮演



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5G+XR 成型原理

製作XR內容，將內容儲存於網絡雲端，通過SAAS方式，利用5G等技術傳送到XR的終端設備進行展示。

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XR智能製造應用

XR是製造業智能化轉型的關鍵技術之一。在工業智能製造領域應用更為廣泛

產品設計，藉助AR設備實現3D信息可視化，簡化溝通，與客戶易於互動，5G可以使得與全球任何地方工程師客戶進行互動交流。可以遠程辦公，減少了出差。

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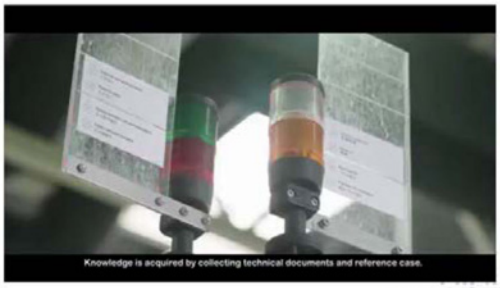
XR智能製造中應用

生產指導，AR/MR技術可以將生產流程，裝配步驟，產品工藝與品質信息，設備運行管理等有效信息展現給工人，從而提高操作效率和準確率。不同設備信息通過AR/MR進行傳送與共享，有利於運營策略，提升管理效率



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XR智能製造應用

利用XR技術對工廠佈局進行定義，審核，編輯，同步互動溝通佈局情況，即使無CAD的經驗也可以詳細的審閱佈局。2015年福特報道自從2003年利用VR進行人機工程研究，組裝線改進，輔助工具，工作站再設計等減少了組裝線傷亡率70%，

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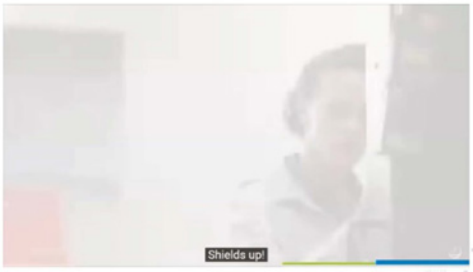
XR智能製造應用

利用XR技術進行遠程技術協助，遠程設備維修維護。

遠程專家指導藉助XR技術實現，將操作人員的第一視角與身處異地的專家共享，無障礙完成遠程指導。德國電信開發。「AR FieldAdvisor」的AR眼鏡應用，當維修人員在前線打算維修裝置時，可透過AR眼鏡，讓維修中心後台負責人可從電視屏幕實時視察維修現況，進行遙距協助，甚至遙距標記需要留意的位置，供前線人員參考。



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XR 智能製造應用

利用XR進行智能工廠設備的維修維護及保養，解決專業人才短缺問題。

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XR 促進遠程辦公

XR促使更多的遠程辦公，疫情的WFH在家辦公成為新常態。除辦公室工種外，更多的工種可以實現遠程辦公。減少辦公室的面積。

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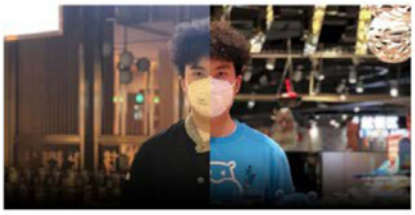
XR 促進工種共享

XR可以使得很多有技能的工人成為自由職業者在多間企業任職，幫助企業解決經營中的問題，解決企業的用人短缺及用人貴的問題。企業可以進行資源共享。



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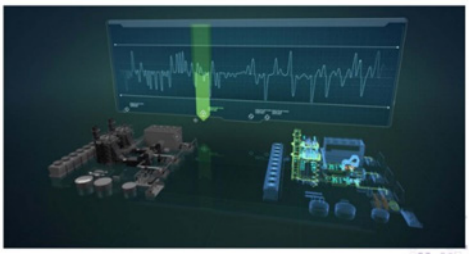
XR 同步虛擬工廠

XR 使得與現實同步的虛擬工廠成為現實，所有工廠數據均直觀可視化，非只有二維可視化。工廠在興建時同步建立虛擬工廠，實際工廠的生產數據在虛擬工廠直觀可見。



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工業元宇宙 數字孿生 & XR 解決方案

李姊鑫女士
廣東瀚瀚孿生雲科技有限公司創始人

李姊鑫女士展示了數字孿生和 XR 數智化解決方案，強調了由國家政策驅動，進行數字化轉型的重要性，並提出了數字孿生創新計劃。香港特區政府在數字經濟和智慧城市發展上投入巨大，工業元宇宙是新型工業化的全新探索，旨在通過數字孿生、數字原生和虛實融合技術構建數字化生態系統。

數字孿生技術預計有巨大的市場潛力，可廣泛應用於工廠規劃、虛擬投產、產品研發等多個製造場景。文檔介紹了數字孿生開發平臺 " 天鏡 HDP"，該平臺具備三維引擎、渲染引擎、物理碰撞引擎和數據中台等功能，支持快速配置和零代碼開發。

XR 技術在智能製造中扮演著重要角色，提出了一個全要素數字底座和影視級渲染的 XR+ 孿生工廠數智化管控平臺。該平臺可以適配多類型終端，提供豐富的行業模板，具有高開發效率和技術門檻低等特點。

工业元宇宙——新型工业化的全新探索

通过数字孪生、数字原生和虚实融合等技术手段，为工业领域构建起一个集生产、管理、销售等各个环节于一体的数字化生态系统。可以**实时监控生产线状态、预测设备故障、优化生产流程**等，促进产业数字化、网络化、智能化，推动新型工业化。

香港作为重要的国际金融中心、贸易中心，大力加强对数字技术的投入，迎接数字经济时代。2022年12月香港特区政府发布的《香港创新科技发展蓝图》提出加快香港数字经济和智慧城市发展步伐。今年在香港开幕的2023数字经济峰会上，香港特区行政长官李家超表示，财政预算案将拨款逾7亿港元加快数字经济发展。
香港《2023年施政报告》宣布一系列具体措施，支持新型工业化，包括成立“新型工业发展办公室”、成立港币100亿元“新型工业加速计划”。“新型工业化资助计划”资助在港设立的智能生产线，累计总数由2022年约30条增至2027年超过130条等。

工业元宇宙组成

工业元宇宙是由物理世界中工业企业全要素的数字孪生体为基本单元组成的平行世界，这些数字孪生体可以通过导入现实工业企业设计、研发、制造、仓储、销售等环节的实时运营数据，依托数字孪生模型启动智能化模拟运行模式，人们可以据此观察、预测、优化现实工业企业的经营发展状况。

数字孪生市场与应用概览

根据Grand View Research发布的数据，2021年，全球数字孪生市场规模为74.8亿美元，预计从2022年到2030年，年复合增长率将达到39.1%；另根据国外调研机构MarketsandMarkets的预测数据显示，到2023年数字孪生市场规模将达到157亿美元，到2025年将突破260亿美元。从这两份研究数据可以看出，数字孪生市场很大，而我国又是世界上工业门类最为齐全的国家，本身就有丰富的制造业应用场景和市场，数字孪生技术几乎可以延伸到制造业的每一个场景。

天镜HDP平台

全要素数字底座　影视级渲染　真孪生　实时动态孪生体　仿真引擎

数字孪生开发平台-天镜HDP

运用物理引擎技术、 3D加速渲染，拖拽UI与3D模型库，快速搭建虚拟应用场景。具有“多类型终端适配、丰富的行业模板、高开发效率、技术门槛要求低”等特点。

可面向工业制造、园区、能源、水务、交通运输、智慧城市等领域快速构建应用场景。为各行业提供**“低门槛、高效率、高质量”**的数字孪生创作平台。

天镜HDP-数据对接/统一开发API

- 模型类：物体三维属性、物体移动、物体材质、物体显隐等
- 效果类：昼夜与天气系统、粒子系统、人流车流、半透明处理等
- 交互类：模型标识点、物体定位、报警系统、巡检点、设备详情、楼层分层、爆开图、热力图、预警演练等

硬件产品矩阵

覆盖全场景的XR智能穿戴设备产品矩阵推进终端革命

H4000

5G智能单兵一体式头盔

C2000

5G智能工业一体式AR眼镜

C5000

国产一体式MR眼镜

AR 智能作业--搭建智慧作业平台

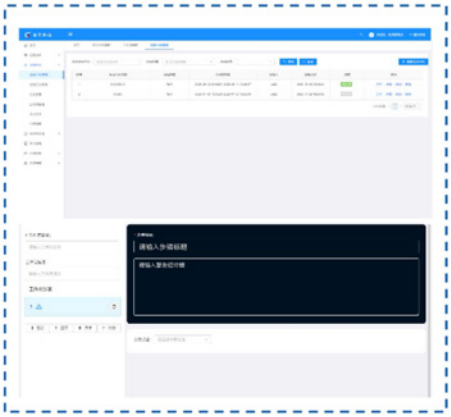
AR智能作业是以增强现实为底座，集成了AI语音/手势识别、音视频流媒体服务、数据中台等能力，为智能制造企业搭建以AI+AR为载体的**各种智能作业场景**，如：设备巡检场景、远程维修场景、远程售后场景、标准作业场景等等，最终打造**AR+AI智能**作业，助力企业数字化转型，迈向智能化。

面向场景

软件系统架构

产品功能特点介绍

工单管理平台



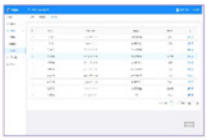
后台自定义工作流

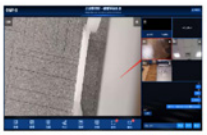
更多作业，自由定义

- 图形化界面工作流设计生成器，自定义工单巡检流程和内容，不局限于某种/某几种设备巡检，拓展使用性强。
- 巡检操作步骤确认交互包括：语音交互、手势交互，操作便捷、适用多种恶劣嘈杂环境。
- 任务完成情况的数据查看。
- 任务行动记录表单的数据查看&报告下载
- 任务分组一键指派。

工作流生成器　作业数据记录　一键部署下达任务

工单管理平台





01 **巡检记录**

巡检记录中可查看过去执行过巡检的人员，路线，开始时间以及执行状态，并可支持查看巡检过程中路线执行到哪一个点和照片记录，全程可进行可视化溯源。

02 **知识库管理**

图纸、巡检及操作规程等资料都可进行知识库建设，实现资源在线可视化查阅，即可用于远程培训、运维指导等，也可用于智能巡检过程中遇到的问题解决手段。

03 **巡检路线**

巡检路线可填路线名称、路线描述，一条路线可设置多个路线点，每个路线点可关联多个设备；
设备二维码用于眼镜端，扫一扫显示设备的参数。

04 **协作管理**

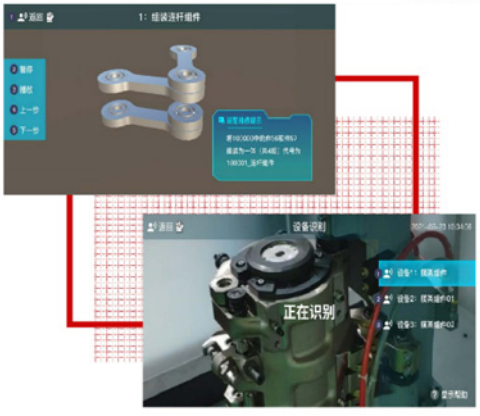
系统支持协作过程的全程记录，系统管理员可通过 WEB 后台查看协作记录及相关的视频画面，便于对协作过程进行回溯追踪。

作业辅助-模型和算法

3D模型展示

AI智能读数

- 支持查看维修指导动画模型，指导一线巡检/维修人员进行维修指引
- 可定制算法在巡检过程中识别设备、环境、设备仪器仪表读数等，简化巡检过程，自动填充设备信息。
- 支持在系统中绑定客户已有算法。



作业辅助-模型和算法

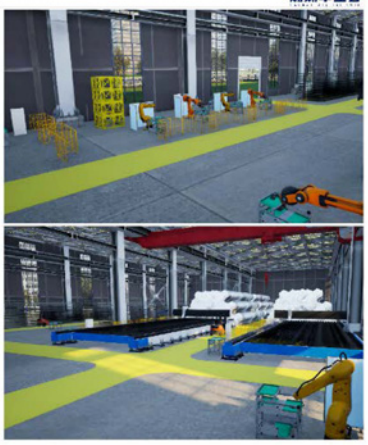
在巡检作业过程中个人无法解决，可通过呼叫专家，进行**远程协作**，为一线作业人员提供**解放双手**、**第一视角**的通讯服务，通过**实时/冻屏标注**等可视化手段，实现高效、精准的远程协作。

AI算法与算法平台产品

规划设计-工厂布局规划

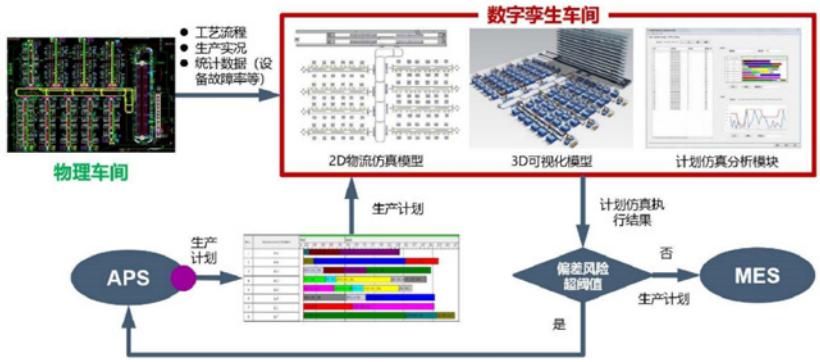
对物理车间进行三维建模，包括产线、立库、物流、电子看板、操作人员、中央控制室等，定义设备仿真交互属性，从而建立一个与实际环境1:1的虚拟工厂环境。在孪生工厂中，动画模拟从订单接受到产品交付的全套生产流程，并支持

- 人机交互和虚拟漫游；
- 全方位展示数字化、智能化技术的应用效果；



规划设计-生产仿真优化（与APS打通）

有了虚拟工厂模型，就可以提前对生产订单进行仿真，基于实时数据还原车间实时状态，基于历史数据提取车间关键特征值和运行规律，预演未来可能发生的情况，实现生产订单和计划的可行性评估等决策支持。



规划设计-物流仿真优化

在物流系统规划或调整升级阶段，通过物流仿真设计，一方面，直观呈现未来系统建设方案和效果，便于方案沟通和评审，统一企业思想；另一方面，综合考虑实际复杂因素，实现物流系统能力、资源配置、系统参数的定量评估和仿真优化；最终实现基于经验的规划向基于仿真的设计转变，大大缩短物流系统规划建设周期。

仓库布局优化

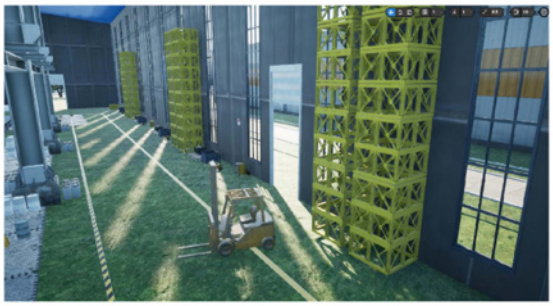
模拟不同的仓库布局方案，包括货物存放位置、货架排列等，以优化物流流程和进出货效率

库存管理

实时监测和管理库存水平，包括货物的进出库记录、库存量、库存位置等，提升管理水平

运力预测

预测物流需求和货物流量，帮助企业进行运力规划和调度，提高资源利用率



以山西某旧厂升级灯塔工厂为例（零部件初加工行业）：

客户背景：为旧厂房升级改造需求，原有的厂房车间是负责四种零件的初加工。厂房中间可以通行大型车辆。因为设备故障，生产节奏把握不准确，材料供应不及时等问题，导致了大量零件发生地堆现象，影响到大车的通行与调度，该企业期望提高生产效率和车辆调度效率，同时实现厂房的数字化可视化，智能化管理，将工厂升级为灯塔工厂。

解决方案：

- 利用天镜DT的拖拉拽布局能力，进行老厂房的重新设计。通过模拟不同的布局方案，选择最优的方案以满足生产需求
- 完成产线规划与重新设计后，使用天镜DT对整个车间进行数字孪生管理系统的部署。该系统与原有mes，erp打通，并包括机器设备运行状态、车辆调度状态、车间运作情况等三维可视化信息。

价值成效：

- 生产效率提升--重新设计的生产线布局使得零件的生产流程更加顺畅，减少了设备故障导致的生产节奏不准确等问题。产品的制造周期明显缩短
- 车辆调度效率优化--通过数字孪生管理系统对车辆调度状态进行实时监控和优化，大型车辆的通行效率得到提高。车辆调度更为灵活，减少了因零件堆积引起的调度困难。

生产制造-柔性制造之数控机床的数字孪生

决策大屏

通过实时数据采集和分析，提供准确的生产情况和性能指标，帮助管理人员做出基于数据的决策，以优化生产过程和资源分配。

中央刀具库管理

三维场景实时展示刀具使用信息，管理员通过三维界面即可掌握实时刀具使用情况，协助管理员管理和优化刀具的使用，如刀具槽的位置占用、刀具寿命、刀具维护管理等。

故障预测与预防维护

可以通过实时监测和分析现实世界中的设备和工艺数据，预测设备的故障和维护需求。这有助于提前预防和避免故障，减少生产中断和损失。

生产制造：以广东某行业龙头注塑机加工厂为例

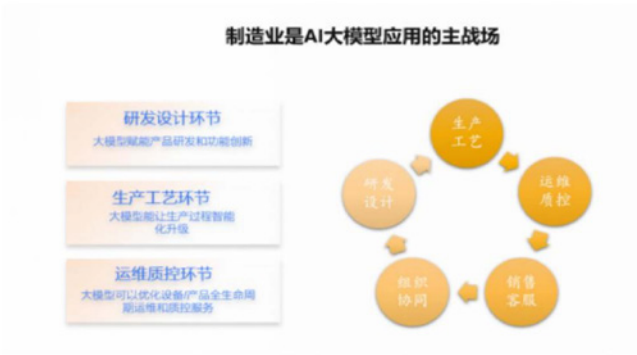
客户背景：某行业龙头注塑机企业，原有设备已经使用很多年，需要对原有数控机床升级改造，并融入智能化，可视化信息化管理平台，做到无人值守的黑灯工厂。该工厂目前还处于传统加工方式，依赖人工操作，费力还容易出现质量问题；加工工 艺自动化程度低，无法实现高效率 和高产能的需求。且物料管理不当 刀具数量庞大且种类繁多，手工管理难以满足需求。此外，由于缺乏 刀具，加工流程常常中断，机床操 作工需要花费大量时间来找刀具。

解决方案：客户在上fms系统的同时，为其升级为三维的数字孪生fms管理平台，不仅把fms系统融合并帮其打通原有erp等管理系统，并且实现智能化刀具管理，对设备的运行状态可视化，设备出现问题可以第一时间发现，并且通知到相关负责人。

价值成效：

- 生产效率提升
- 生产质量提升：原来打模经常因为工厂操作不规划导致差品高，通过管理平台，可以规划工作操作流程，出现操作问题，系统会提醒。

预测性：AI大模型是重塑全球制造业竞争格局的新起点



AI大模型正加速第三次“数实融合”浪潮全面到来，智能化是其主要特征。AI大模型将影响制造业发展格局，AI大模型将会融入制造业的研发设计、生产工艺、质量管理、运营控制、营销服务、组织协同和经营管理的方方面面。

预测性：以流程制造行业-工艺流程优化ai小模型为例

客户背景：该客户为国内造纸行业信息化龙头公司，深耕行业数十年，并且积累海量有效数据，通过ai训练，用于解决生产过程控制不精准等问题，并积累多个ai生产工艺优化小模型，该企业拥有大量传感器数据，但难以有效地分析和利用，无法充分发挥其在优化生产中的潜力。并且在AI调参方面，该企业面临挑战，缺乏可视化的工具来帮助工程师调整参数以优化生产。

解决方案：生产优化ai小模型需要各个传感器的参数，如震动，噪音，转数等，同时会有大量参数并且相互影响，在此基础上，通过在孪生平台虚拟生产线，与海量数据实时交互，可以所见即所得，只看孪生场景，就发现在复杂工艺流程下相互影响的因素。比如环境调高2度，有可能会提升其生产效率10%，

价值成效：客户用虚拟数据在孪生平台全程可视化大量运行， 最后用于调试他们ai的参数 ai的参数最后调试完之后 将ai优化工艺流程后的结果再放到我们平台上来跑 看具体的优化过程是怎么样 最后再得出结论把这些参数用于实际生产中机器设备的自动调节

运维管理-孪生工厂IOC

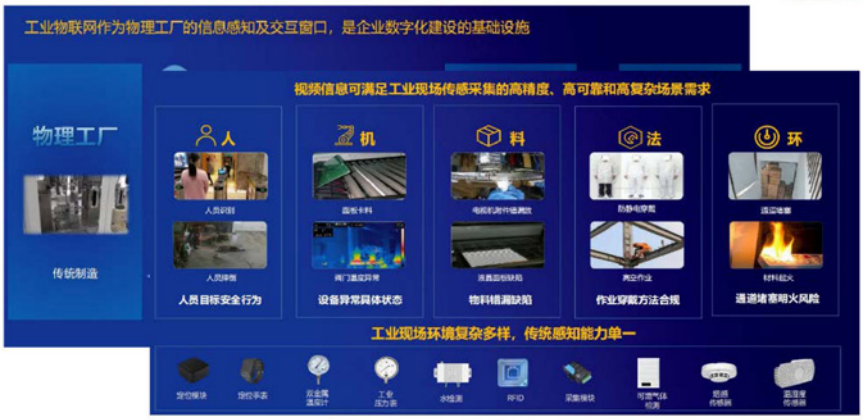
企业通过基础IT建设产生大量的业务数据，想要从存储于各种商业信息系统中的数据转换成有用的信息，BI报表能够帮助决策者做出更快、更好、更合理的决策，依托报表工具或BI可以在不同层面上帮助企业实现这个目标。并且通过BI系统进行挖掘数据，通过智能算法预测为企业提供可预见的业务趋势。提高了企业自身的前瞻性，才能更好地在市场立足。

运维管理-孪生工厂IOC

集成系统平台可对接企业的数字孪生或IOT在线监测系统、生产管理系统等，可在眼镜端实时显示各设备的指标数据、历史运行参数（如变压器实时温度或维修记录、运行监测数据、高压电机运行状态等信息）;可根据运行情况，对接第三方系统，做到实时报警、超前预警，提醒现场作业人员注意相关信息和周围安全状况，保证作业人员了解设备运行状态和安全信息。

运维管理-孪生工厂IOC

运维管理-孪生工厂IOC



成功案例—— AR石化定制项目

- 与某石油企业合作，共拓AR智能终端及远程巡检运维系统在石油石化领域的应用
- 通过AR智能终端与企业数字平台的结合，以AR可视化形式，有效辅助一线工作人员提升工作效率，以数字化手段，实现数字化安全生产

Discovering NVIDIA Omniverse and Omniverse XR

Dr Charles Cheung
Deputy Director | NVIDIA AI Technology Center

The speaker offered an extensive look into NVIDIA's Omniverse platform and its Extended Reality (XR) features. He highlights the transformative potential of the Industrial Metaverse across various scales, from individual products to entire planetary systems.

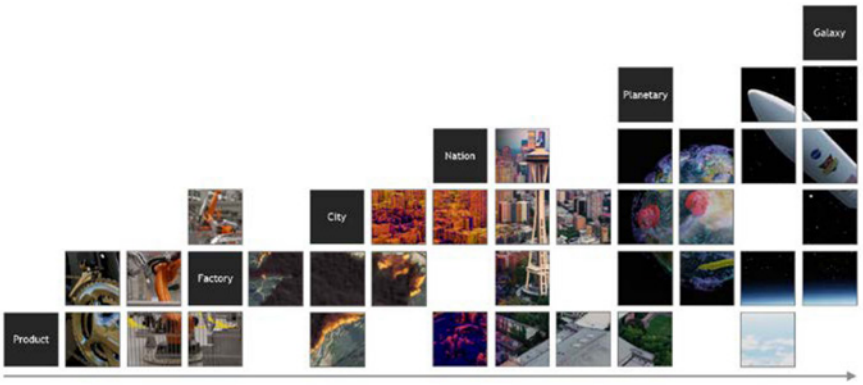
Industrial enterprises are accelerating their digitalization efforts, and NVIDIA Omniverse plays a key role in this transition by unifying the entire product lifecycle with OpenUSD. This platform streamlines processes from the initial concept and design phase, through manufacturing, and onto marketing and advertising.

The presentation identifies several challenges in current 3D workflows, such as siloed data, legacy infrastructure, incompatible tools, and disconnected teams. These issues can lead to increased costs, waste, slow decision-making, and reduced quality and output. To counter these, there is a demand for digital twins, unified digitalization, full fidelity XR, and generative AI.

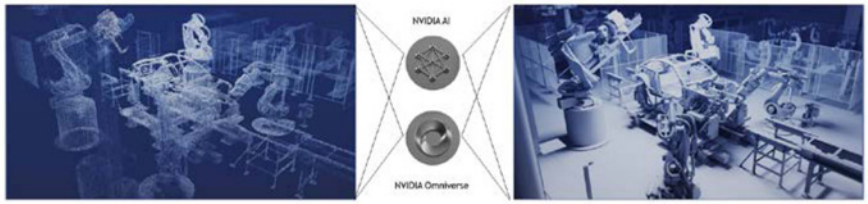
NVIDIA Omniverse is introduced as a platform that enables the development of industrial digitalization applications on OpenUSD, covering areas like robotics, scientific digital twins, autonomous vehicles, 3D design, AI avatars, and synthetic data generation. The platform includes foundational components and applications such as USD Composer, DRIVE Sim, Isaac Sim, Replicator, and USD-GDN Publisher, which operate on NVIDIA RTX-enabled systems.

Industrial Metaverse Opportunities Exist at Every Scale

Every Physical Process Will Be Software-Defined



Industrial Enterprises Are Racing to Digitalize

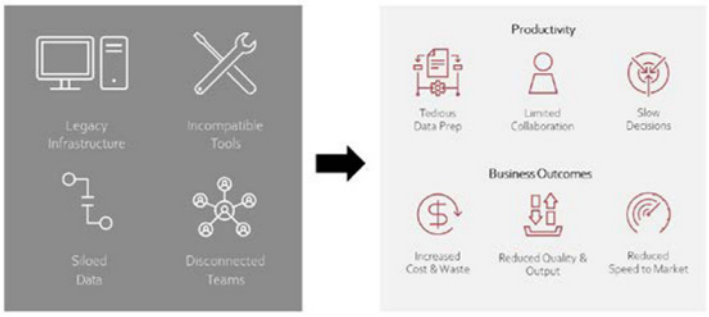


Omniverse Unifies the Entire Product Lifecycle With OpenUSD

From Concepting & Design, to Manufacturing, to Marketing & Advertising

Primary Challenges in 3D Workflows

Impacting Productivity & Business Outcomes

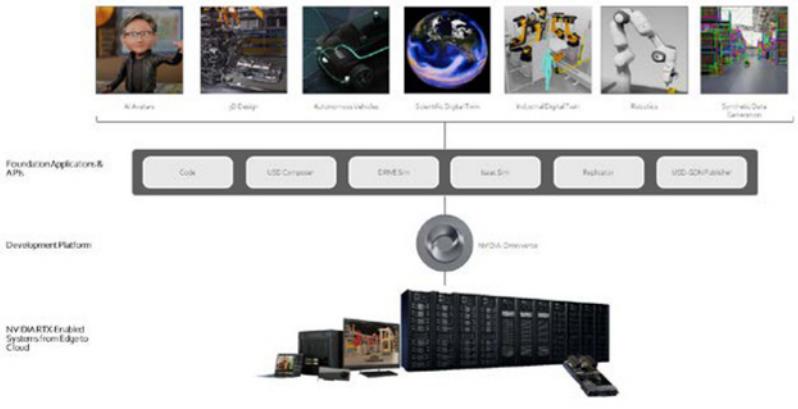


Primary Demands in 3D Workflows

Unified Digitalization | Digital Twins | Full Fidelity XR | Generative AI

NVIDIA Omniverse

Platform for Connecting and Developing Industrial Digitalization Applications on OpenUSD



Foundational Platform Components

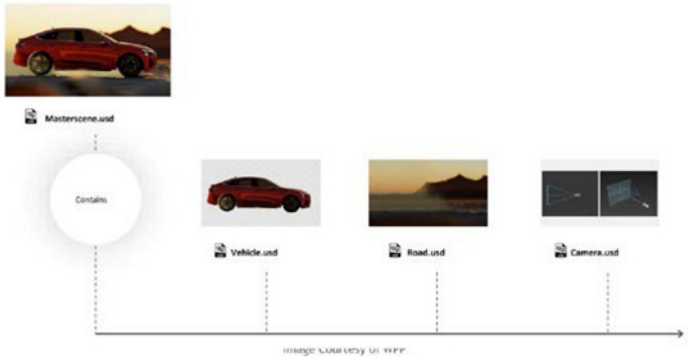
Universal Scene Description (OpenUSD)

More Than Just a File Format

Connects Tools, Data | Enables Collaborative, Non-Destructive Workflows | Connects Devices, Humans, AI Agents

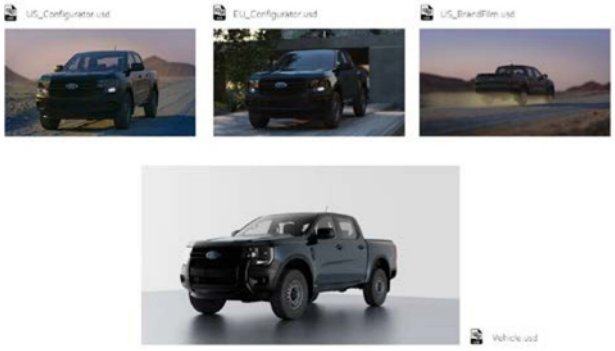
What Does this Mean for Content Creation?

Non-Destructive, Layer-Based Workflows; Protects Every Layer of Data



What Does this Mean in Content Deployment?

Single Source of Truth Asset That Can Be Distribution to Multiple End Points



Advanced Tools and Technologies

Foundational Platform Components

Omniverse Nucleus

Asset Database and Collaboration Engine

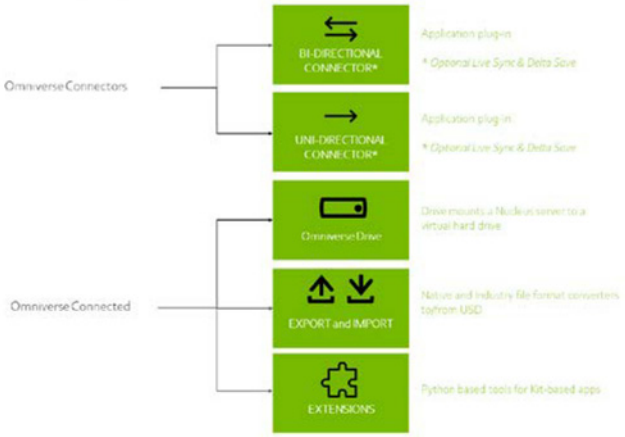
- Allows multiple software tools to talk to each other as well as live sync workflow
- Universal asset exchange – can house assets of any filetype
- Enables collaboration on large, ultra-complex scenes and passes only the change deltas
- Because only deltas are exchanged, extremely fast creation/replication is enabled
- No more hour-long or overnight uploading/downloading of entire scene files – everything is real-time and live
- Enables a single source of truth and eliminates messy, redundant file copies

Advanced Tools and Technologies

Foundational Platform Components

Connecting to Omniverse

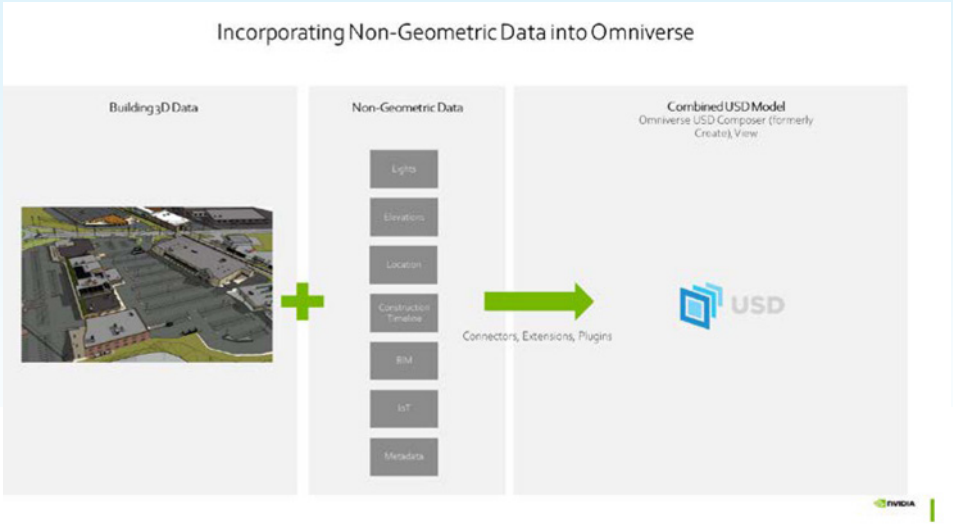
Multiple Ways to Interact – Some in Real-Time with Automated Material Conversion

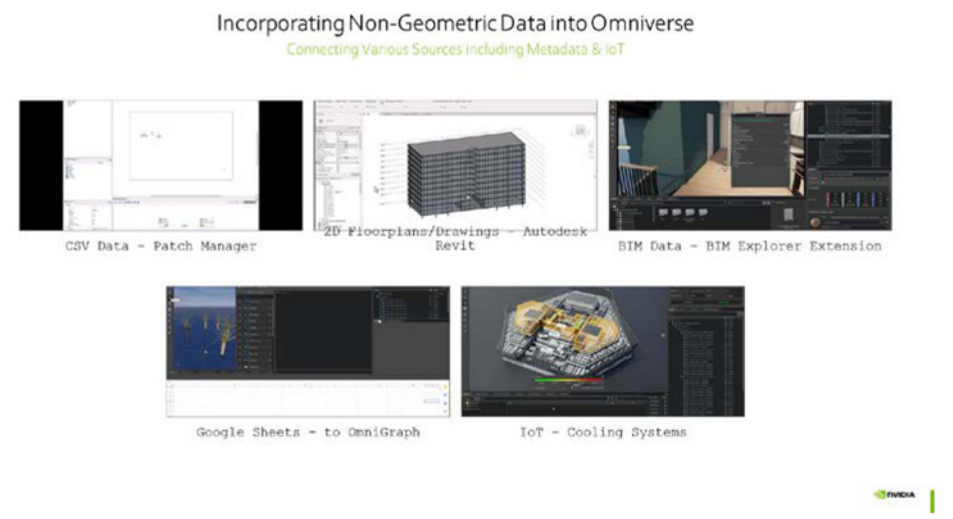


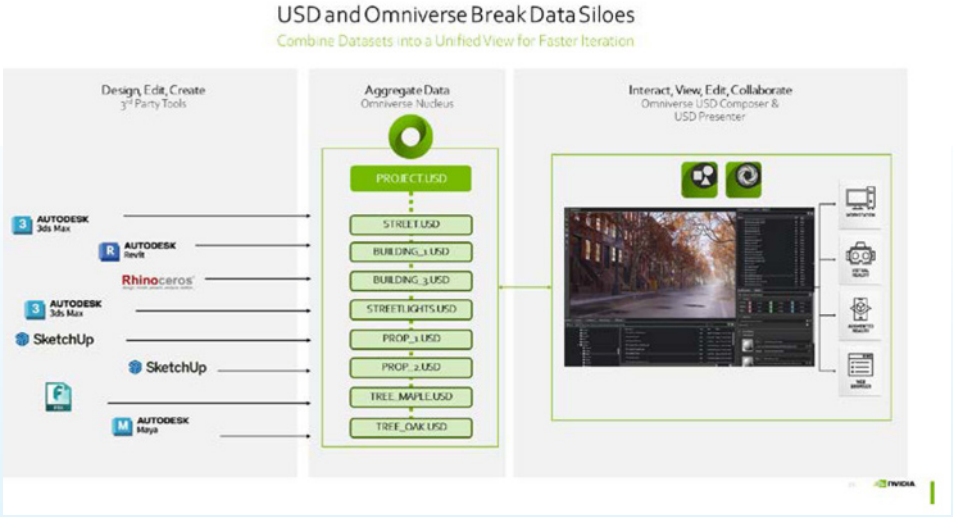
Connect to Omniverse With USD

Many Ways to Connect, Baseline is USD Ingest

BI-DIRECTIONAL NUCLEUS CONNECTION	Updates shared between 3rd party tools and Omniverse often a single export/import. Live sync available for some connectors.	ENTERPRISE SUPPORTED	AUTODESK 3ds Max, Bentley, AUTODESK Maya, ipolog, UNREAL
		BETA	Houdini, iClone, CESIUM
UNI-DIRECTIONAL NUCLEUS CONNECTION	Updates reflected from 3rd party tool to Omniverse but aren't shared back. Material conversion supported. Live sync available for some connectors.	ENTERPRISE SUPPORTED	Archicad, CityEngine, Pt, AUTODESK Revit, Rhinoceros, SketchUp, SIEMENS
		BETA	blender, creo, onshape, ParaView, Unity, VECTORWORKS
USD INTERCHANGE	Similar to uni-directional. Allows for USD or native import	BETA	AUTODESK Alias, CINEMA 4D, ZBRUSH, Ps, Ds, SIMSCALE
	Conversion to USD via direct import or third-party app.	EXPORT AND IMPORT	3MF, FBX, GLB, GLTF, OBJ, OpenVDB, PDBX, USD
		IMPORT	3D PDF, 3DS, 3DXML, ACIS, Alembic, CATIA V4, CATIA V5, Collada, DWF, DWG, Eg, IFC, IGES, Inventor, JT, LXO, MDL, NX, Parasolid, PRC, PROE, ShapeNet, Solid Edge, SOLIDWORKS, STL, STP, U3D, URDF, VDA-FS, VRML, X3D


Incorporating Non-Geometric Data into Omniverse
Building 3D Data
Non-Geometric Data
Lights
Elevations
Location
Construction Timeline
BIM
IoT
Metadata
Combined USD Model
Omniverse USD Composer (formerly Create), View
Connectors, Extensions, Plugins
USD


Incorporating Non-Geometric Data into Omniverse
Connecting Various Sources including Metadata & IoT
CSV Data - Patch Manager
2D Floorplans/Drawings - Autodesk Revit
BIM Data - BIM Explorer Extension
Google Sheets - to OmniGraph
IoT - Cooling Systems


USD and Omniverse Break Data Siloes
Combine Datasets into a Unified View for Faster Iteration
Design, Edit, Create
3rd Party Tools
Aggregate Data
Omniverse Nucleus
Interact, View, Edit, Collaborate
Omniverse USD Composer & USD Presenter
AUTODESK 3ds Max
AUTODESK Revit
Rhinoceros
AUTODESK 3ds Max
SketchUp
SketchUp
AUTODESK Maya
PROJECT.USD
STREET.USD
BUILDING_1.USD
BUILDING_3.USD
STREETLIGHTS.USD
PROP_1.USD
PROP_2.USD
TREE_MAPLE.USD
TREE_OAK.USD

Advanced Tools and Technologies

Foundational Platform Components

Omniverse Kit & Kit Extensions

Easily Build Advanced 3D Tools, Services, Applications

- Extensible platform, modular, flexible, open
- **Omniverse Kit** – SDK to build extensions, apps, microservices
- **Omniverse Extensions** - the building blocks of Omniverse Apps
- Provide over 300 extensions as source
- Majority written in Python
- Provide app templates to build-your-own

Advanced Tools and Technologies

Foundational Platform Components

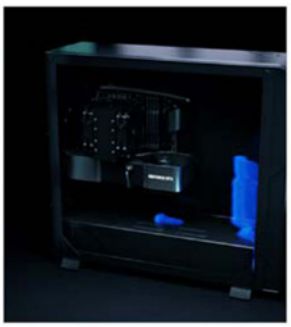
Bringing in Physics Data in Omniverse

NVIDIA PhysX

Rigid & Soft Body Dynamics, Destruction, Fluid & Fire

Import Physics Instance

Offline from External 3rd Party Application

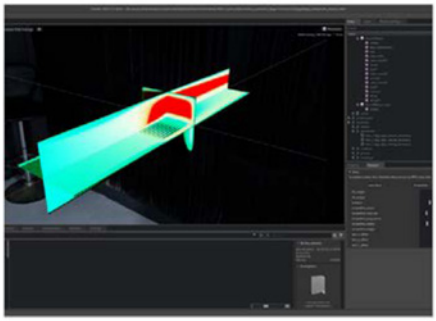


NVIDIA Modulus

Accelerated with Physics-ML Platform

NVIDIA Modulus

A Framework for Developing Physics-ML Models for Digital Twins



- Available as Omniverse Extension
- Train Physics-ML Models Using Governing Physics, Simulation, and Observed Data
- Multi-GPU Multi-Node Training
- 1,000-100,000X Speed Models – Ideal for Digital Twins

Advanced Tools and Technologies

Foundational Platform Components

NVIDIA Omniverse

Connect and Develop Connected 3D Pipelines and Applications based on OpenUSD

Connect Your Tools & Data with OpenUSD

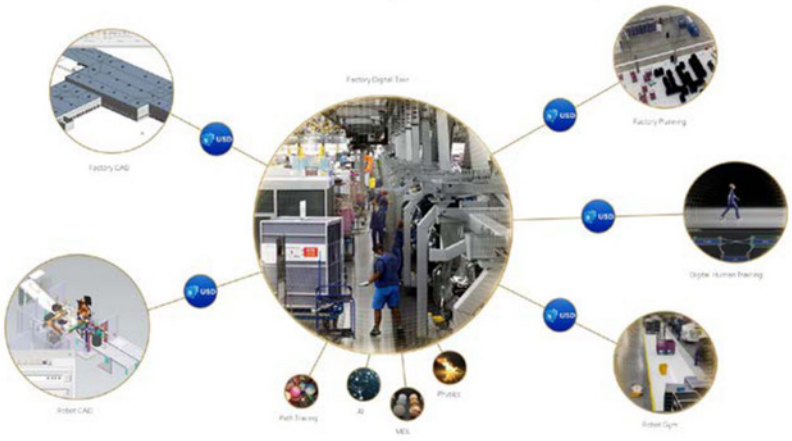
Build New, Interoperable Tools on OpenUSD

Connect Your Teams

NVIDIA

Omniverse Connects Artists' Favorite Tools via OpenUSD

Omniverse Connects Industrial 3D Tools & Data via OpenUSD



Connect Your Tools With OpenUSD and Omniverse

Real Time, Collaborative, Non-Destructive Workflows

Complex 3D Workflows with Legacy Software

Autodesk 3ds Max to Omniverse USD Composer (formerly Create)

Simple Full Fidelity Visualization Workflows

Rhino Grasshopper to Omniverse USD Composer (formerly Create)

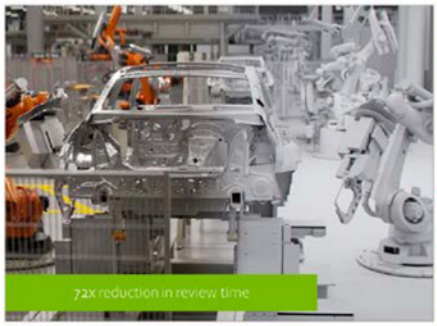
Connect Your Existing Tools, and Easily Build Custom Tools

WPP, World's Largest Ad Agency, Builds 3D Content Creation Pipeline with Omniverse Enterprise

Generative AI in 3D Workflows

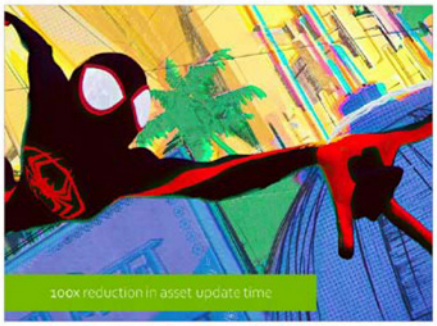
Omniverse Enterprise Lets You Connect Your 3D and Generative AI tools

Saving Time and Money With Omniverse & OpenUSD



Omniverse for OpenUSD Factory Data Workflows

BMW Group reduced design freeze times from 3 days to 1 hour by building a custom Omniverse OpenUSD application



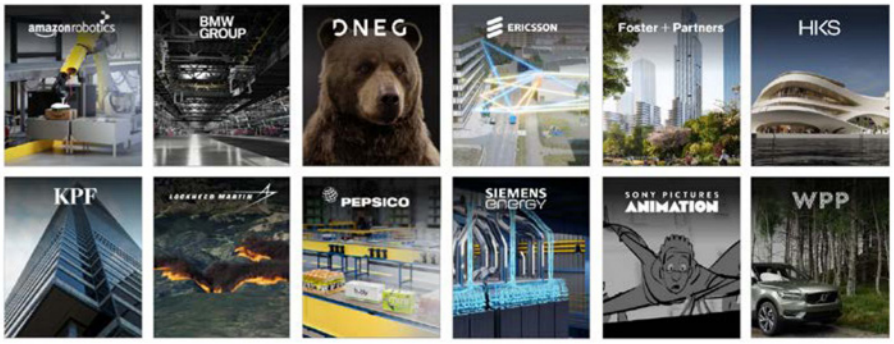
Omniverse for OpenUSD M&E Workflows

Sony Pictures Animation reduced asset update times in previz workflow from 5 days to 1 hour by building a custom Omniverse OpenUSD application

NVIDIA

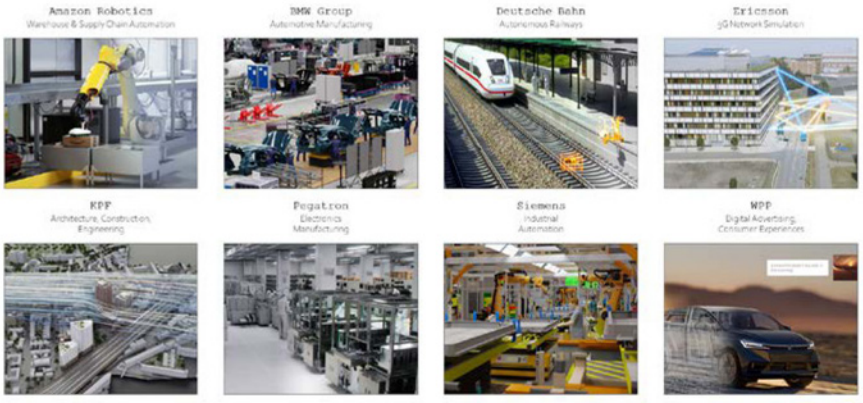
Omniverse Is Everywhere

Customers Across Every Industry Building Custom 3D Pipelines & Virtual Worlds

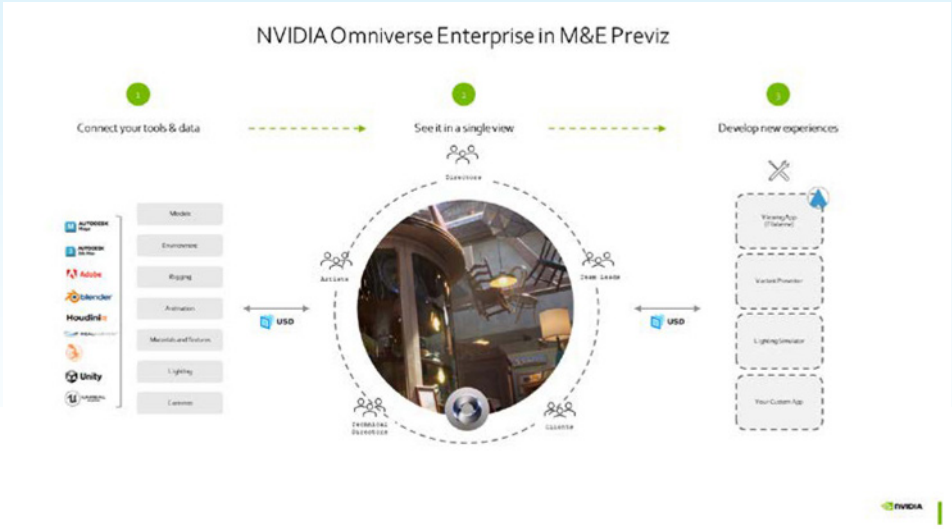


NVIDIA

Industries Racing to Digitalize With NVIDIA Omniverse



NVIDIA



Omniverse Enterprise in Media & Entertainment Previz

Sony Pictures Animation

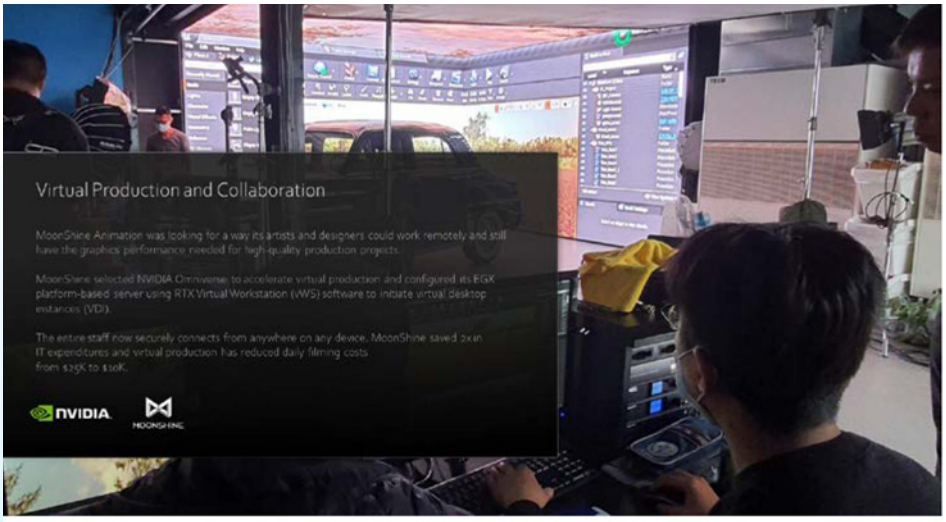
DNEG

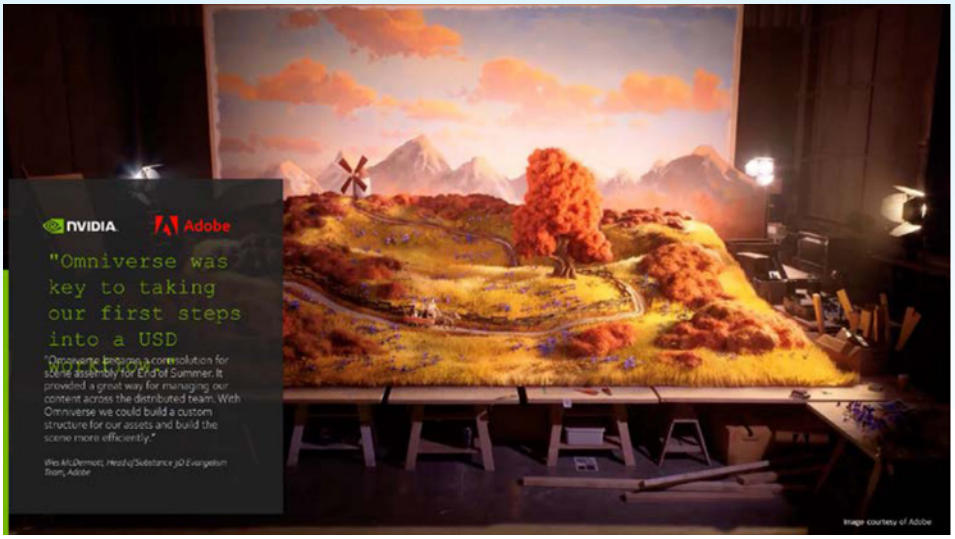
4X
More time for creative iterations
Sony Pictures Animation

Reduced Redundant Processes

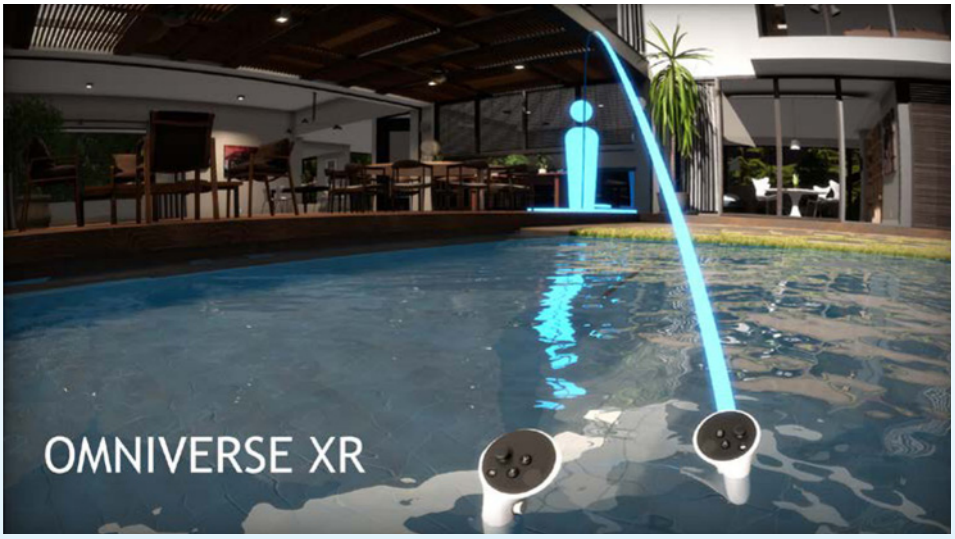
Increased Quality & Output

Accelerated Speed to Market




NVIDIA
Adobe
"Omniverse was key to taking our first steps into a USD
Image courtesy of Adobe

NVIDIA
SONY PICTURES ANIMATION
"Using the Omniverse extension library saved weeks in development


OMNIVERSE XR

Seminar on XR Technologies Enabling Computer Game Industry Smartification and Advancement
應用延展實境（XR）技術賦能游戲產業邁向智能化及數據化研討會

延展實境（XR）是智能商業的關鍵賦能技術之一。XR 是虛擬實境（VR）、擴展實境（AR）及混合實境（MR）等與其相關範疇的總稱，XR 將現實和虛擬世界融合並創造出一個現實與虛擬物件共存、交互和交流的可視化場景。在執行工作或傳授知識前先創造可視化場景，有助作出最佳決策，並吸納、保留和處理關鍵訊息。從趨勢可見，XR 正在以模擬體驗的形式帶領業務發展，許多企業及人員均渴望認識這項新技術和了解它將會如何改變我們的商業運作和生活。

生產力局 2024 年 1 月 12 日舉行「應用延展實境（XR）技術賦能游戲產業邁向智能化及數據化研討會」，邀請了兩位海外專家為參加者介紹 XR 在游戲產業的應用、操作技巧及分享實戰案例。

主題	講者
XR Technologies Enabling Computer Game Industry Smartification and Advancement	**A/Prof Edward Tay** Associate Professor United Nations (UNITAR)
・VR 裝置如何為協助游戲開發人員和容創作者開發游戲 **・如何運用 VR 技術增玩家的沉浸感和互動性** **・創建多人 XR 游戲的設計和開發考慮因素** **・如何利用數據改善玩家體驗以及數據於游戲開發中的重要性**	**周成怡** 亞太區產品暨行銷經理 宏達國際電子（HTC）

XR Technologies Enabling Computer Game Industry Smartification and Advancement

Edward Tay
Associate Professor, United Nations (UNITAR)

Associate Professor Edward Tay's presentation, titled "XR Technologies Enabling Computer Game Industry Smartification and Advancement," explores the transformative impact of Extended Reality (XR) on the gaming industry. The presentation begins by introducing Tay's extensive background in investment, innovation and technology, highlighting his roles as an ambassador and board member in various technological and esports organisations.

The core of the presentation delves into the evolution of immersive experiences, emphasising how XR technologies break down barriers, foster creativity and enable new narratives in gaming. Tay identifies key use cases for XR in the industry, such as business-to-business (B2B) experiences, the rise of the Metaverse, new game development opportunities, improved user experiences and hybrid/virtual events. Each use case showcases how XR can enhance engagement, collaboration and interaction within gaming environments.

Tay examines the role of gamification in XR gaming, discussing how it makes games more accessible and interactive. He highlights the significant marketing potential of XR, which allows brands to create emotional connections with consumers through immersive experiences. Additionally, XR technologies are shown to revolutionise employee engagement and customer interaction by providing innovative training methods and enhancing the purchasing decision process.

Top use cases for XR in the gaming industry today.

1. B2B Experiences and Education

The widespread adoption of XR gaming experiences has opened the door to a new B2B avenue for games companies.

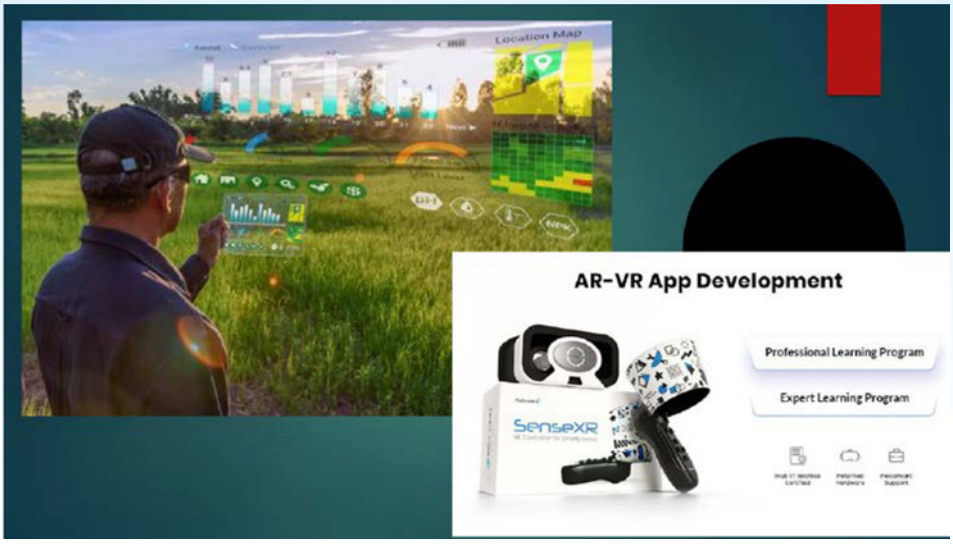
Brands across the world are rapidly investing in more methods to engage and educate their employees with immersive experiences.

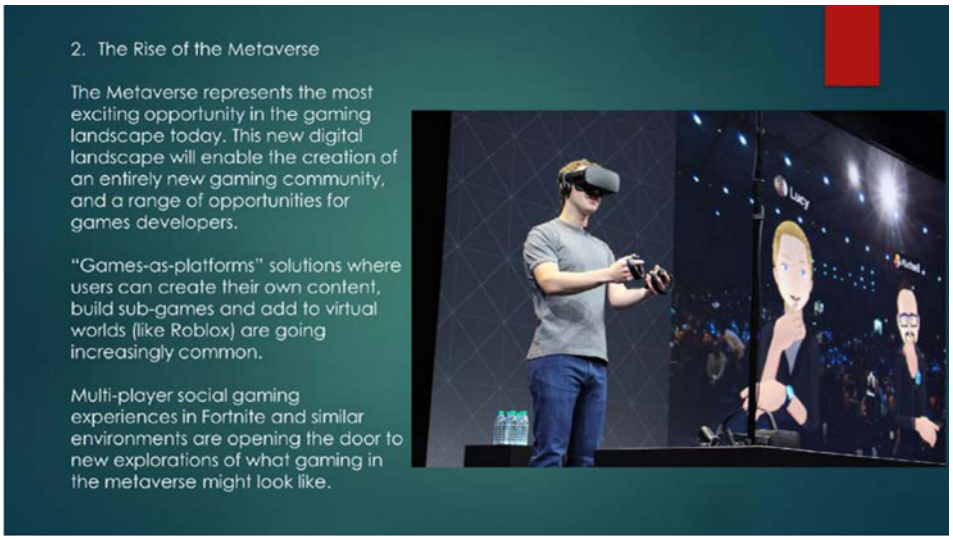
Gamification in the business landscape with the help of XR solutions can help to make hybrid and remote teams feel more connected to their colleagues.

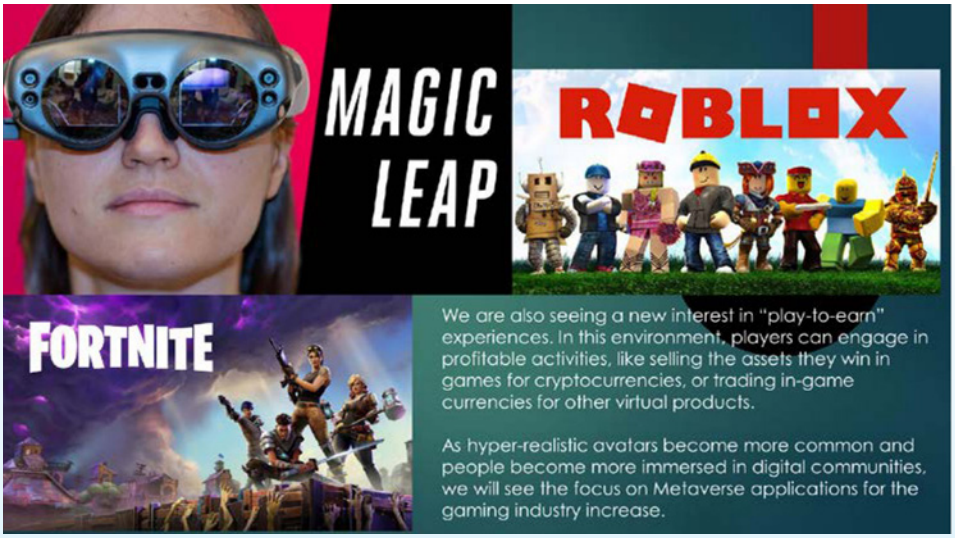
Escapee rooms, puzzle rooms, and other virtual "team building events" represent a new way for companies to align increasingly distributed staff members in a global landscape.

For gaming companies, the evolving B2B landscape offers an opportunity to engage and empower workforces with new types of all-inclusive fun.

Bringing teams closer together, these tools can pave the way for a memorable training experiences.


Location Map
AR-VR App Development
SenseXR
Professional Learning Program
Expert Learning Program


2. The Rise of the Metaverse
The Metaverse represents the most exciting opportunity in the gaming landscape today. This new digital landscape will enable the creation of an entirely new gaming community, and a range of opportunities for games developers.
"Games-as-platforms" solutions where users can create their own content, build sub-games and add to virtual worlds (like Roblox) are going increasingly common.
Multi-player social gaming experiences in Fortnite and similar environments are opening the door to new explorations of what gaming in the metaverse might look like.

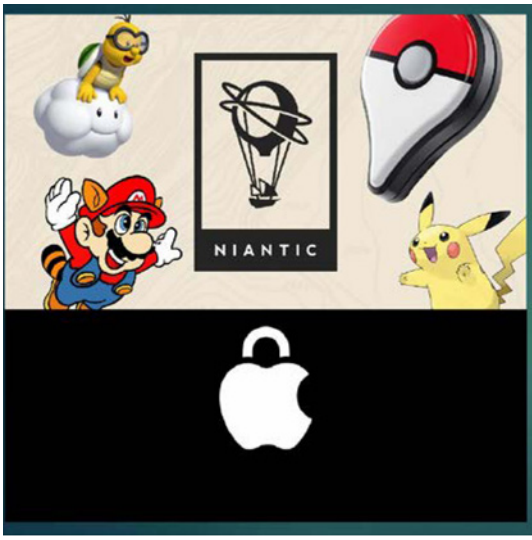

MAGIC LEAP
ROBLOX
FORTNITE
We are also seeing a new interest in "play-to-earn" experiences. In this environment, players can engage in profitable activities, like selling the assets they win in games for cryptocurrencies, or trading in-game currencies for other virtual products.
As hyper-realistic avatars become more common and people become more immersed in digital communities, we will see the focus on Metaverse applications for the gaming industry increase.

3. New Game Development Opportunities

XR solutions are powerful way for gaming companies to reach new customers and explore new avenues within their go-to-market strategy.

The right tools can also empower the creation of more amazing game experiences.

Collaborative apps within a VR environment can bring team members together to work on game landscapes in real-time.



Movie actors and professionals working on a game storyline can rehearse and speak their lines in a virtual environment, allowing for a deeper level of immersion.

Gaming professionals can even showcase their games to potential investors through virtual and mixed reality demonstrations.

As XR environments continue to evolve, there are countless apps, APIs, and SDKs produced by leading companies like Niantic and Apple which give gaming companies new ways to explore and create.

These environments ensure developers have a powerful landscape in place where they can design gaming assets and create experiences collaboratively.

4. Improved User Experience

The biggest challenges any game development startups might face in the development of a new asset, is making sure the user interface is as streamlined as possible.

People in the gaming world want to be able to interact seamlessly.

The XR gaming landscape opens the door to a new form of user experience, enabled by Natural User Interfaces (NUI).

AI technology can work together with sensors and other feedback tools to allow users to interact with games in a more organic way.

The natural user interface available from XR environments allows gaming companies to embed their users deeper into the first-person experience they're getting within a game.

Things like gesture and body tracking even allow for the creation of more practical gaming opportunities.

For instance, you can work out in XR without having to use controllers, or learn how to fly a plane while feeling as though you are sitting in a cockpit.

5. Hybrid and Virtual Events

As mentioned above, XR has already begun to emerge as a powerful tool for the gaming industry when it comes to sharing experiences with shareholders and investors.

In a world where in-person events are becoming less common, many gaming companies have begun building VR environments where people can see a 360-degree version of a game landscape up-close before purchasing the title.

Arcades and other XR-focused gaming companies are now appearing around the world to give people access to exclusive XR experiences.

New way to connect with their audience, and unlock new forms of revenue.

AR and VR in Gaming

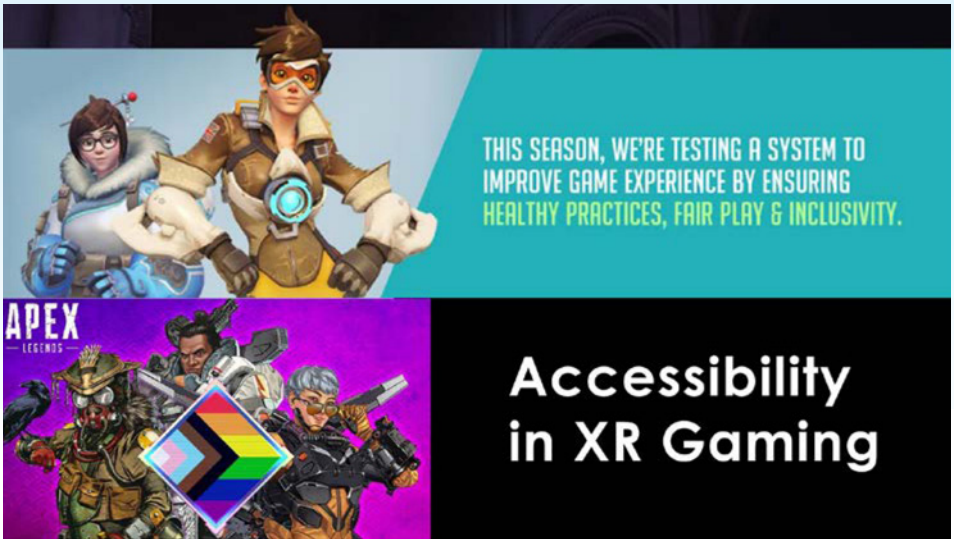
AR

- Enhance real world interactions.
- Seamlessly **blends the virtual and the real** environment.
- Impact gaming genres on global scale.
- Potential extends to sport & flight simulators.
- **Enhance reality** and fosters integration.

VR

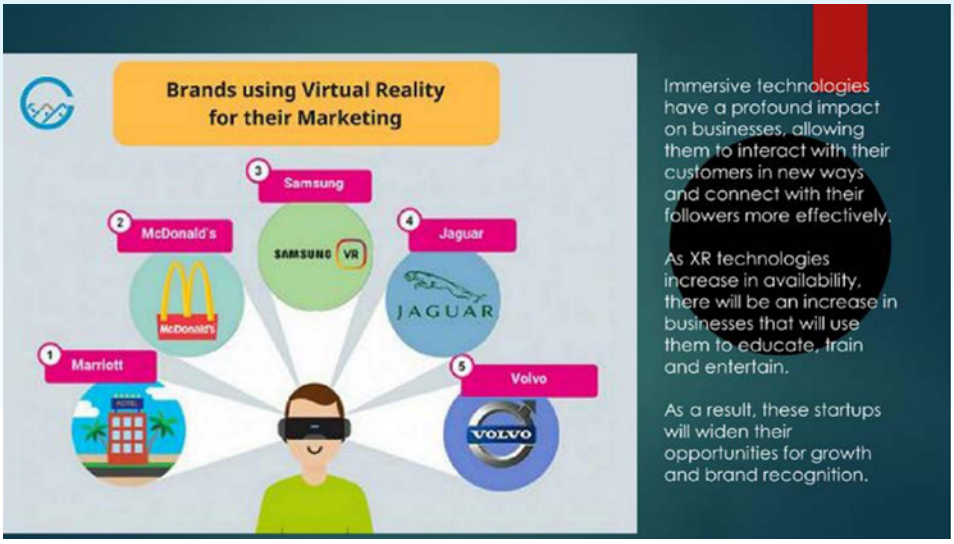
- Immerse users in fabricated environment.
- Envelope in worlds crafted by imagination and technology.
- Location based AR Games "Pokemon Go"
- **Bring history or science to life** in classroom.
- **Complete immersion** and transportive experiences.

Gamification and Roles in XR Gaming

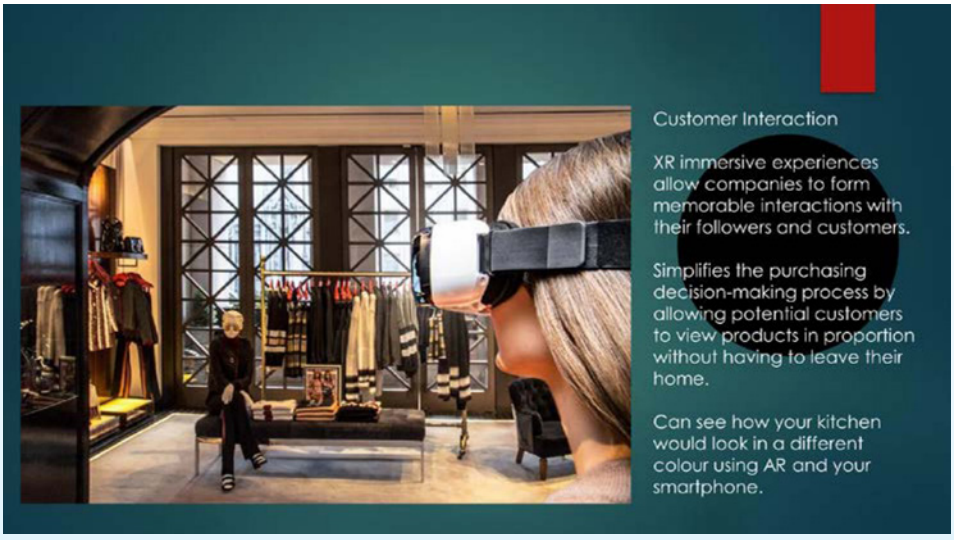

THIS SEASON, WE'RE TESTING A SYSTEM TO
IMPROVE GAME EXPERIENCE BY ENSURING
HEALTHY PRACTICES, FAIR PLAY & INCLUSIVITY.
APEX
LEGENDS
Accessibility
in XR Gaming

Interaction in
XR Gaming
SOCIAL
XR

Marketing
The ability to deliver experiences that create emotional connections and bring brands and their consumers closer is possibly XR's biggest potential for marketing.
New way of interacting with followers and customers.
The Future of
XR in Business


Brands using Virtual Reality for their Marketing
1 Marriott
2 McDonald's
3 Samsung
4 Jaguar
5 Volvo
SAMSUNG VR
JAGUAR
VOLVO
Immersive technologies have a profound impact on businesses, allowing them to interact with their customers in new ways and connect with their followers more effectively.
As XR technologies increase in availability, there will be an increase in businesses that will use them to educate, train and entertain.
As a result, these startups will widen their opportunities for growth and brand recognition.

Employee Engagement
XR technology offers training opportunities in any remote setting, saving time on travel.
Provides a safe environment to train in, especially in industries such as the armed forces, oil and gas businesses, or emergency services.
XR technologies can simulate these extreme environments without putting employees at risk.
Employees can work together on projects that they would normally need to be in the same room for.
VIVE
htc


Customer Interaction
XR immersive experiences allow companies to form memorable interactions with their followers and customers.
Simplifies the purchasing decision-making process by allowing potential customers to view products in proportion without having to leave their home.
Can see how your kitchen would look in a different colour using AR and your smartphone.

1. Generative Artificial Intelligence (AI) and Machine Learning:

Integral to XR experiences, enhancing realism, interactivity and personalization. From dynamic in-game environments to adaptive NPCs, the infusion of generative AI technologies is redefining the boundaries of virtual worlds.

In the realm of XR, this means dynamically creating environments, characters, and narratives that respond intelligently to user actions. The fusion of generative AI and XR opens up unprecedented possibilities for creating dynamic, ever-evolving virtual worlds that adapt to the player's choices and actions. Generative Artificial Intelligence is a driving force behind the next level of immersive and personalized experiences in AR/VR game development.

2. Metaverse XR Trend:

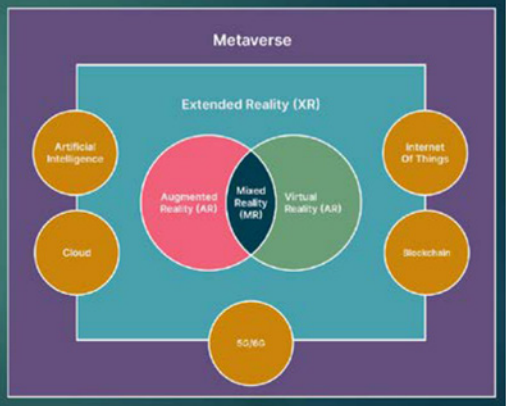
The concept of the Metaverse is a burgeoning reality.

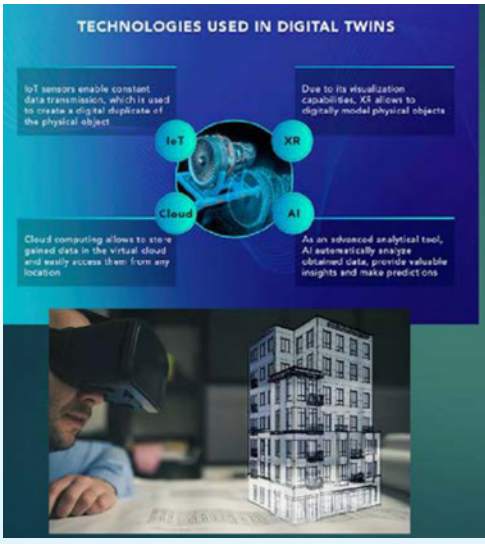
Metaverse XR trend is set to explode, creating interconnected virtual spaces where users can effortlessly navigate between different XR experiences, from gaming realms to social interactions.

3. Mixed-Reality XR Ecosystems:

XR ecosystems are evolving to become more interconnected and user-friendly.

Seamless transitions between AR and VR experiences, cross-platform compatibility, and collaborative XR environments are defining the future of XR ecosystems.





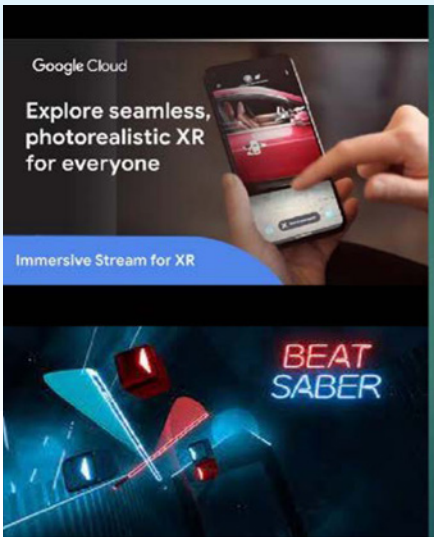
4. Digital Twins XR Trend:

Digital Twins are a fascinating technology that is making its way into the world of Extended Reality (XR).

Digital Twins replicate physical objects or systems in the digital realm. This trend has the potential to revolutionize a variety of industries, including architecture and urban planning.

By creating digital replicas of real-world objects, Digital Twins allow for more accurate simulations, better design decisions, and enhanced realism. With the use of XR technology, the possibilities are endless, and the applications are vast.

From simplifying product design to optimizing urban infrastructure, Digital Twins is a game-changer.



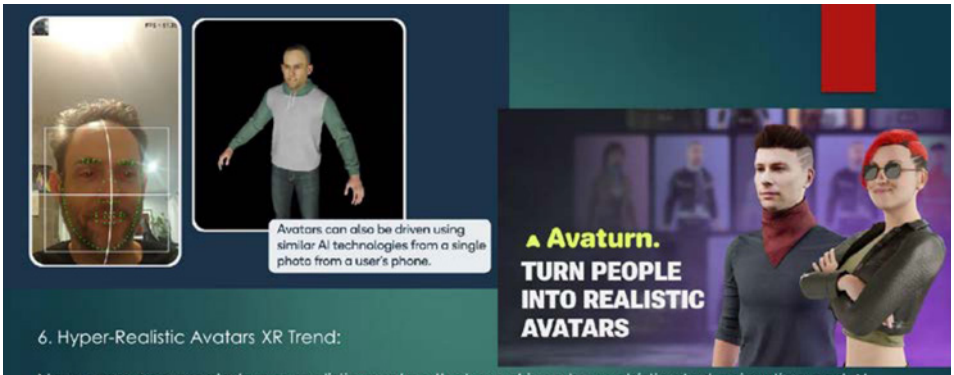
5. Photorealistic XR Trend:

Advancements in graphics and rendering technology have revolutionized the way we create and experience visual content.

From video games to movies and TV shows, the level of detail and realism that can be achieved is remarkable.

With the help of powerful hardware and software tools, artists and designers can create stunning visual effects, lifelike characters, and immersive environments that transport viewers to new worlds.

These advancements have opened up new possibilities for storytelling and entertainment, and continue to push the boundaries of what is possible in the world of digital media.



6. Hyper-Realistic Avatars XR Trend:

Now, users can create hyper-realistic avatars that are driven by sophisticated animation and AI.

These avatars enable users to express themselves in virtual spaces with unprecedented realism. With the ability to customize their avatars in such a detailed manner, users can truly make their virtual presence their own.

This kind of personalization can lead to a more immersive and engaging virtual experience.

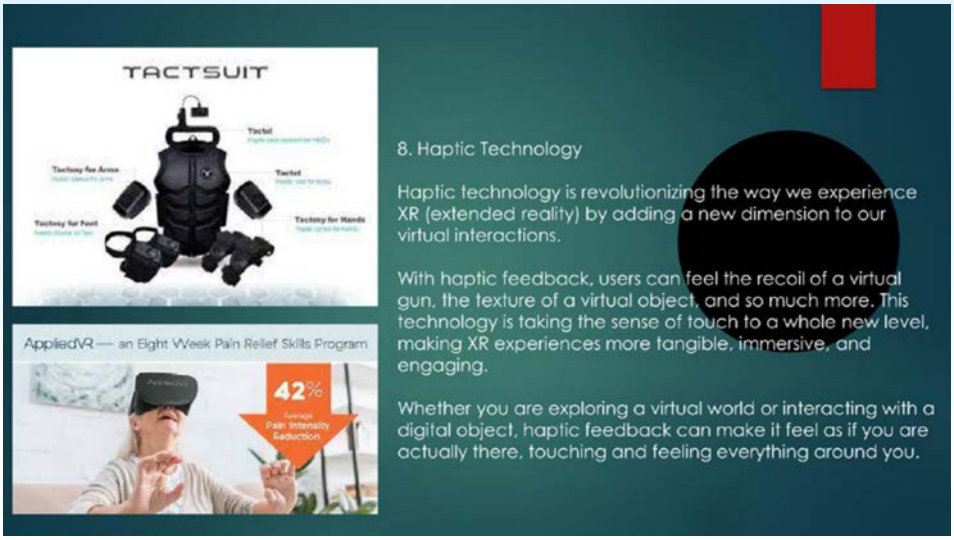
7. XR Immersive Training:

Immersive training using Extended Reality technologies is transforming the way we approach education and professional development.

Imagine being able to step into a virtual world where you can interact with realistic simulations of medical procedures or explore historical events firsthand.

XR immersive training offers an unparalleled level of hands-on experience that was once unimaginable, providing learners with a safe space to practice and develop their skills.

Whether you are a student, a professional, or a curious learner, XR immersive training is a game-changer that opens up exciting new possibilities for education and training.


TACTSUIT
Tactot
Tactot
Tactsleeve for Arms
Tactsleeve for Foot
Tactsleeve for Hands
AppliedVR — an Eight Week Pain Relief Skills Program
42%
Average
Pain Intensity
Reduction
8. Haptic Technology
Haptic technology is revolutionizing the way we experience XR (extended reality) by adding a new dimension to our virtual interactions.
With haptic feedback, users can feel the recoil of a virtual gun, the texture of a virtual object, and so much more. This technology is taking the sense of touch to a whole new level, making XR experiences more tangible, immersive, and engaging.
Whether you are exploring a virtual world or interacting with a digital object, haptic feedback can make it feel as if you are actually there, touching and feeling everything around you.

Beyond Boundaries: Unleashing Business Opportunities in XR and the Metaverse Frontier

Evelyn Chou
HTC ASIA PACIFIC PRODUCT MANAGER

The speaker delivered an in-depth exploration of the innovative solutions and opportunities presented by HTC in the realms of Extended Reality (XR) and the Metaverse. Highlighting HTC's global recognition with over 180 awards, the presentation underscores the company's commitment to excellence and innovation, particularly in the field of Mixed Reality (MR) solutions. HTC's offerings are elaborated upon across various categories, including hardware, software and services. Key hardware features include enterprise-grade functionalities, hygiene solutions and full-body tracking capabilities. The software suite encompasses VIVEPORT, VIVE Location-Based Software Suite and VIVE Business Store, supporting both consumer and enterprise content platforms. Emphasis is placed on secure data management, with ISO 27701 certification ensuring privacy and security.

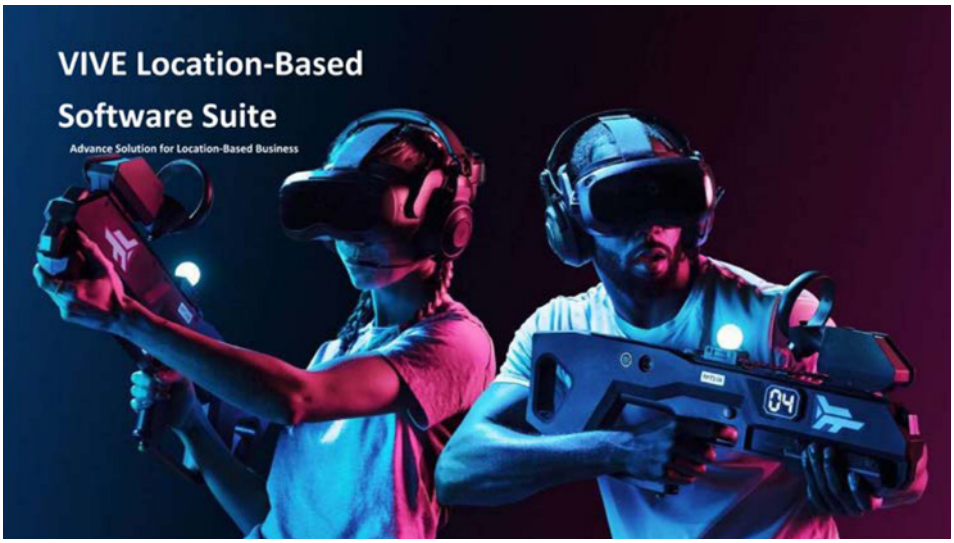
The speaker also discussed the advanced tracking accuracy and low latency of VIVE XR Elite Motion Capture and VIVE Ultimate Tracker. HTC's solutions are designed to provide a seamless and scalable experience, accommodating large-scale deployments of up to 300 head-mounted displays (HMDs).

At the core of HTC's strategy lies the VIVERSE platform, a comprehensive toolkit for the Metaverse creation and interaction. VIVERSE supports diverse applications, ranging from virtual work activities and client engagement to advertising, marketing and education. Key partnerships with entities like Chivas Regal, ELLE, and mobile operators in the Middle East are highlighted, showcasing the platform's broad appeal and applicability.

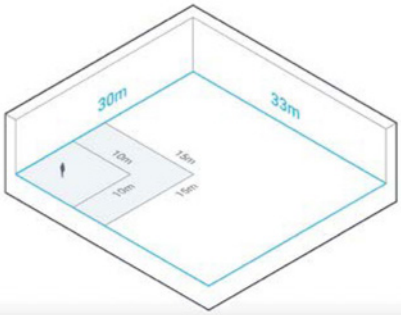
VIVE FOCUS 3
THE ALL-IN-ONE

VIVE XR ELITE
CES Best of CES 2023
CNN
WIRED
ZDNet
cnet
VentureBeat
Crast.net
ANDROID AUTHORITY
gamesradar+
tom's guide
TECH ADVISOR

Mobile AIO VR
Desktop PC VR
High Fidelity VR experiences powered by a powerful desktop computer
Immersive VR Glasses
Immersive and mobile VR experiences through an extremely compact and lightweight pair of glasses



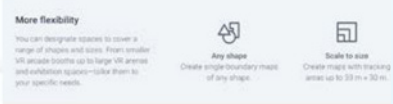
Choose from multiple modes



Location-Based Entertainment (LBE) Mode

Large-scale inside-out tracking

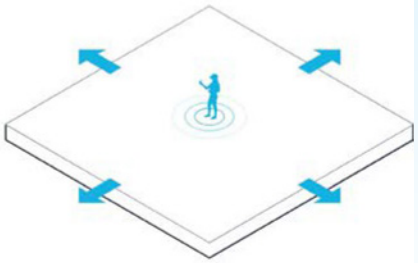
In LBE Mode, VIVE Focus 3 can scale up single-tracking areas up to 1000 m² (33 m × 30 m)—about the size of 4 adjacent tennis courts—while maintaining smooth, free-roaming, inside-out 6DoF tracking with sub-millimeter accuracy.

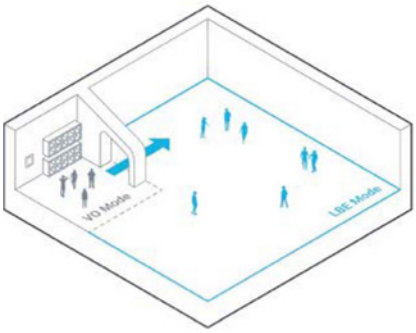


Visual Odometry (VO) Mode

Scale up user rotation

VO is the process of determining the position and orientation of a headset through headset-captured images while the headset is in use. VO Mode allows users to bypass the environment setup process so they can jump right into 6DoF experiences as soon as they put on their headsets. Quickly deploy LBE or VR-based training programs in different environments instantaneously.





LBE Hybrid Mode

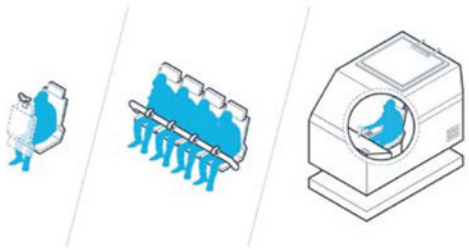
Easy onboarding

LBE Hybrid Mode allows for a seamless transition between VO Mode and LBE Mode for easy onboarding. By using VO Mode, users can start in VR while still in the prep area, where they can set everything up and get acclimated to the headset. Then after entering the designated play area, they can switch right into LBE Mode for the full experience. This smooth transition enables higher throughput for a greater return on investment.

Simulator VR Mode

3DoF to 6DoF simulation

Simulator VR Mode is a unique 6DoF VR solution for motion platform experiences such as cars, training simulators, and amusement park rides. A fixed VIVE Focus 3 controller or VIVE Wrist Tracker is used to convert a 3DoF environment into a 6DoF experience, providing more natural interactions that help prevent motion sickness. The capability to track in low-light environments makes Simulator VR Mode perfect for closed-cabin training simulators and movie theaters alike.



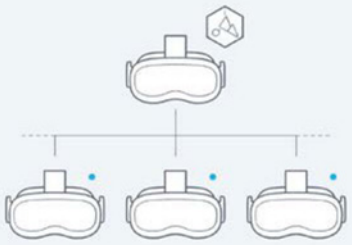
Co-location made easy

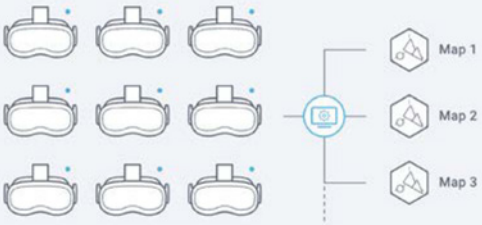
Map Sharing

Multiple users. One map.

Share a headset's room setup map with multiple headsets to achieve instant multiuser experiences where users can see and interact with each other in the same physical and virtual environment. Map Sharing not only eliminates the need to perform a room setup for each headset individually, but also saves time and resources—allowing for simple, quick, and scalable deployment.

With map sharing, all HMDs can have the same location reference points. However, to assign each HMD pose to the content side, a third-party backend service is required.





Group Management

Multiple maps. Multiple headsets.

With the Group Management feature, different maps can easily be assigned to a large number of headsets through intranet Wi-Fi connections.

Marker-based tracking

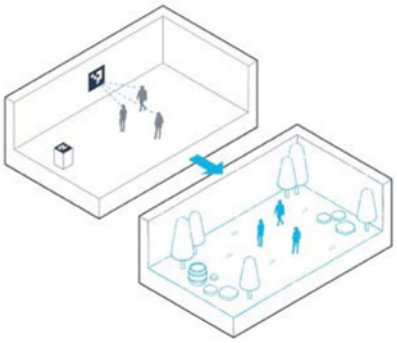
What are ArUco codes?

Similar to QR codes, ArUco codes are easily reproducible visual trackers that provide unique ID points and extra position information to VR headsets in real time. ArUco codes can provide additional tracking points to reduce positional drift, and they can act as unique markers to align virtual scenes and assets with real-world environments for more immersive experiences.

Marker-Based Location Sharing

Simple. Accurate. Instant.

With ArUco markers, VIVE Focus 3 headsets can instantly detect, provide and share real-time positional data in a shared space without extra input or additional setup procedures. Marker-based location sharing is ideal for eliminating the typical cumbersome setup processes involved with multiuser VR experiences—such as calibrating each headset from a specific starting point in the play area.



Services & customization

LBE Environment Setup Support

To make sure you get the most out of the VIVE Location-Based Software Suite, our dedicated support team will guide you step-by-step when building your maps. Just send us your 3D models and texture designs, and we'll provide a comprehensive tracking risk assessment as well as suggestions for how you can improve your environmental setup.

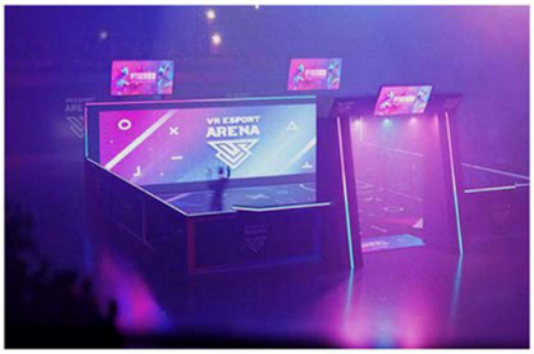
Customization

The VIVE Location-Based Software Suite can be customized and integrated according to the needs of your enterprise. We will work with you to make sure you get the most out of the available features and options.

Phenomena

"VIVE's LBE mode and untethered VIVE Focus 3 is the de-facto free roam solution to accommodate our arenas...We launched with it and the response from the industry has been outstanding. Additionally, VIVE's map sharing features for co-location has been instrumental in getting customers quickly into gameplay. Quicker throughput has been key to increasing ROI for operators."

Phenomena CEO, Awane Jones



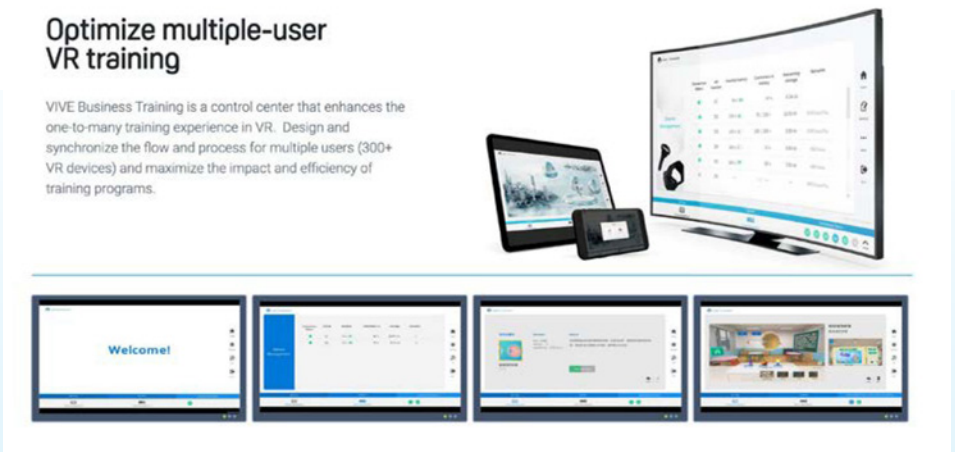
Zero Latency

"Upgrading to the Focus 3 has allowed us to stream PC-rendered content wirelessly, removing the need to manage bulky PC backpacks while improving the visual experience. With each headset provisioned and managed by one operating system, we have significantly reduced operational costs while removing complexity for both operators and players."

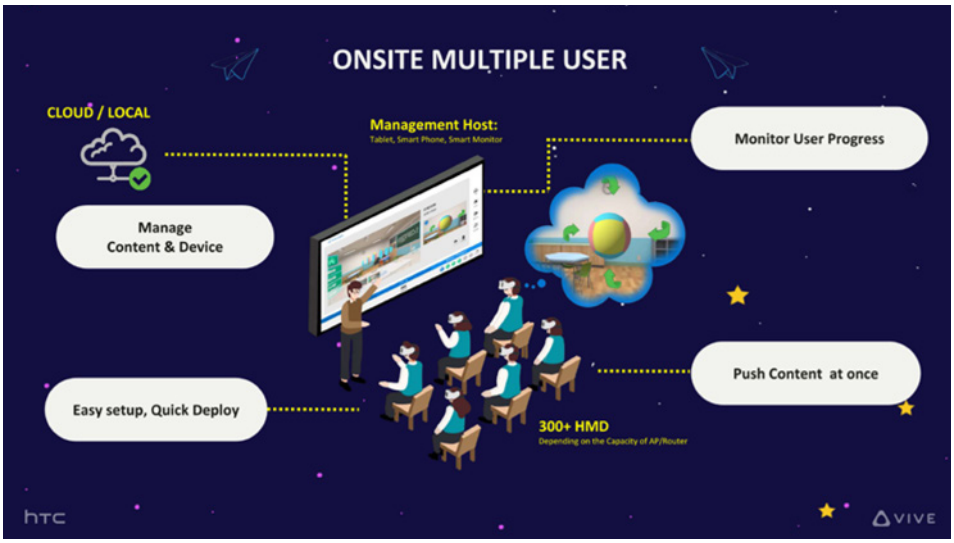
Zero Latency CTO, Scott Vandonkelaar

esa
PaleBlue
Norsk Romsenter
Norwegian Space Agency
HTC's Vive Focus 3 has a new, far-out mission: astronaut mental health

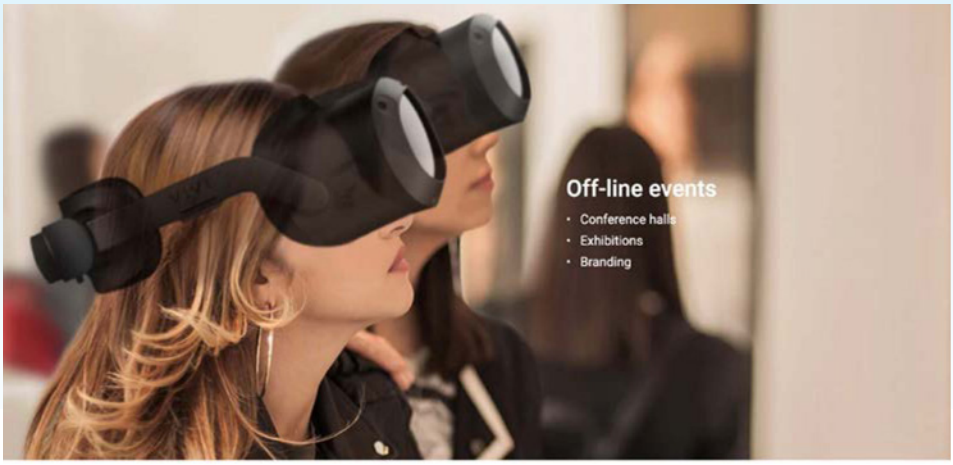
VIVE Business Training
Unleash the infinite power of VR.


Optimize multiple-user VR training
VIVE Business Training is a control center that enhances the one-to-many training experience in VR. Design and synchronize the flow and process for multiple users (300+ VR devices) and maximize the impact and efficiency of training programs.
Welcome!

1.
Simple setup
• Install the VIVE Business Training app on an Android device (smartphones, tablets, smart TVs). Then install the connecting software on VR headsets. Sync up the Android device and VR headsets via the same Wi-Fi network, and you're ready to go.
• Supports over 300 devices simultaneously.
2.
Monitor VR devices from one platform
• Monitor in real-time the connection status, power levels, and storage capacity of VR devices.
• Get status notifications and warnings about malfunctioning devices.
3.
Easily upload and push content
• Push content to multiple devices simultaneously.
• Upload, update and manage VR content from local and th cloud platform.
4.
Manage content interaction
• Simultaneously start and end training content running on multiple devices with just one click.
• Monitor content running in the trainees' headsets in real-time and in high-resolution.
• Customize the flow and speed of video playback and 3D model control with content integration developer tools.

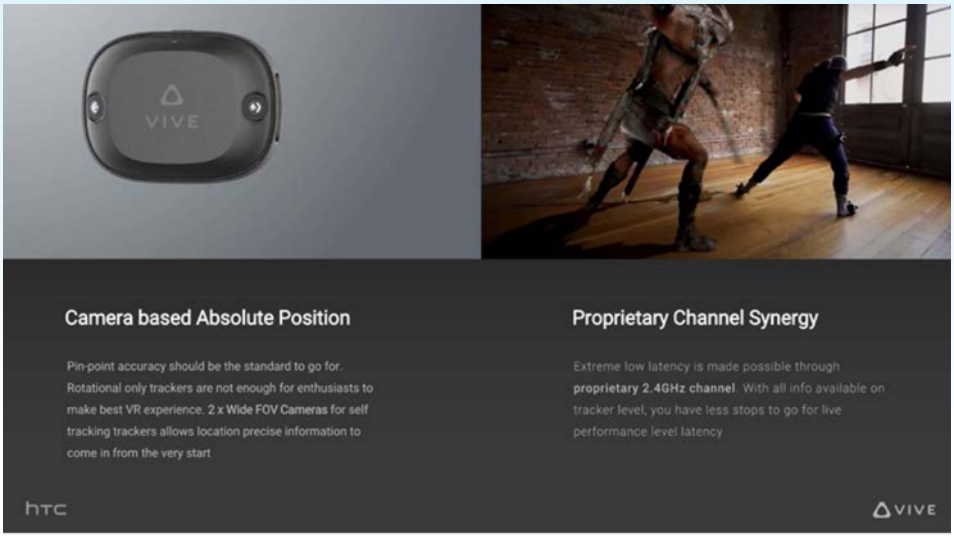

ONSITE MULTIPLE USER
CLOUD / LOCAL
Management Host:
Tablet, Smart Phone, Smart Monitor
Monitor User Progress
Manage
Content & Device
Push Content at once
Easy setup, Quick Deploy
300+ HMD
Depending on the Capacity of AP/Router
htc
VIVE

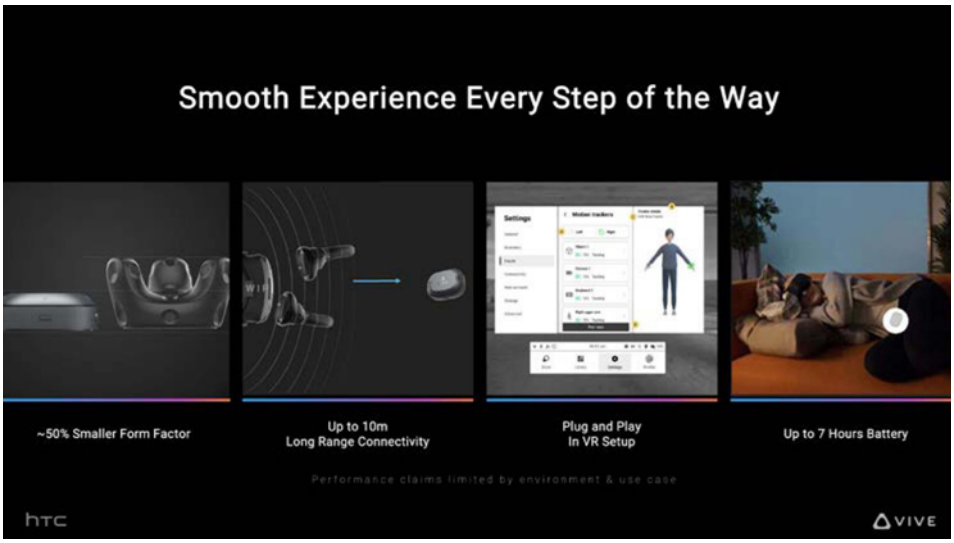
Education
• Arts and science courses
• Academic seminars
htc
VIVE

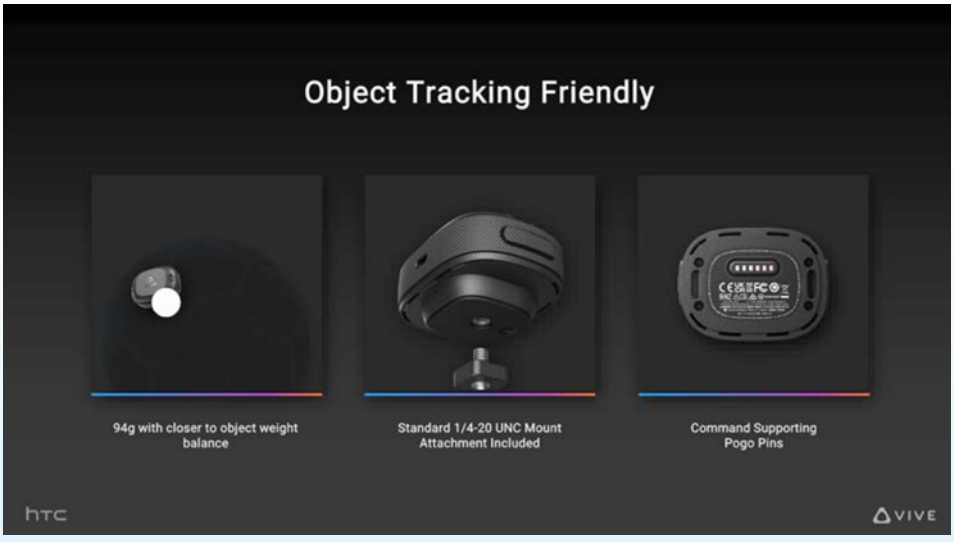


htc VIVE

htc VIVE

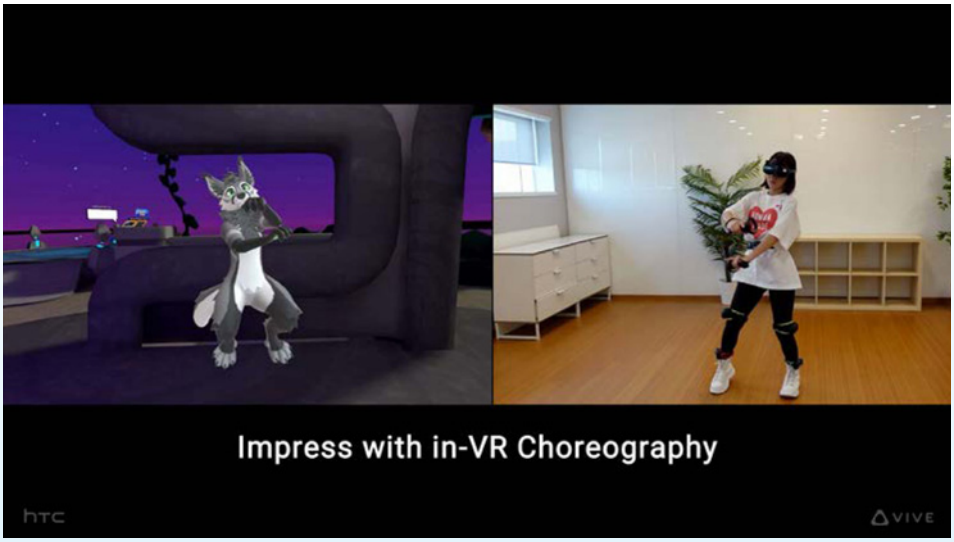

VIVE
Camera based Absolute Position
Pin-point accuracy should be the standard to go for. Rotational only trackers are not enough for enthusiasts to make best VR experience. 2 x Wide FOV Cameras for self tracking trackers allows location precise information to come in from the very start
Proprietary Channel Synergy
Extreme low latency is made possible through proprietary 2.4GHz channel. With all info available on tracker level, you have less stops to go for live performance level latency
htc
VIVE


Smooth Experience Every Step of the Way
~50% Smaller Form Factor
Up to 10m
Long Range Connectivity
Plug and Play
In VR Setup
Up to 7 Hours Battery
Performance claims limited by environment & use case
htc
VIVE


Object Tracking Friendly
94g with closer to object weight balance
Standard 1/4-20 UNC Mount Attachment Included
Command Supporting Pogo Pins
htc
VIVE

Multiple Devices. One Map
Up to 5 Simultaneous Tracking Per Wireless Dongle
htc
VIVE

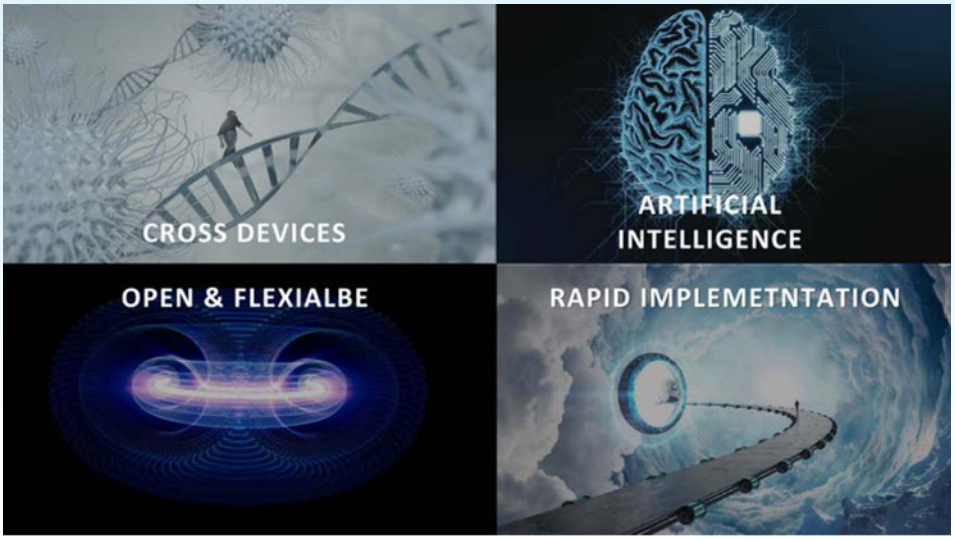
Simulation Training

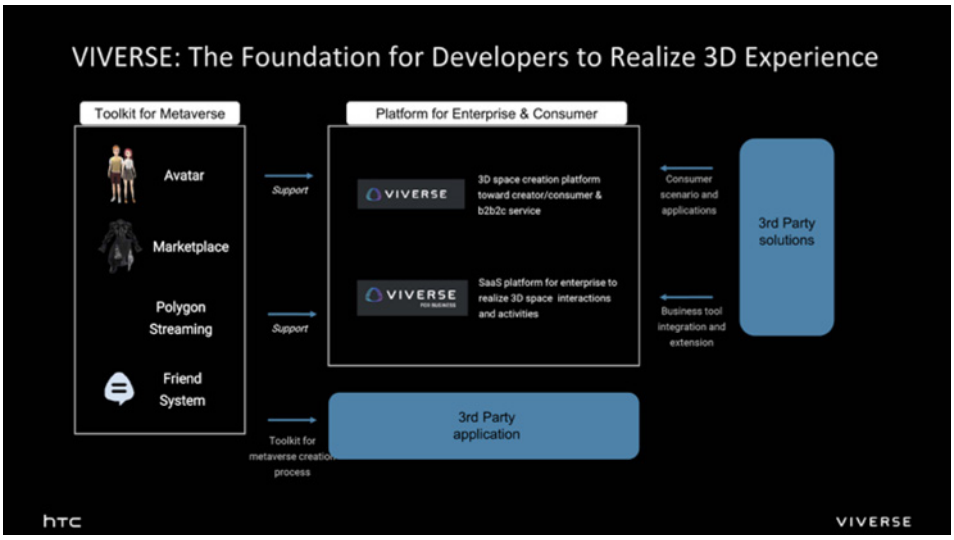

Impress with in-VR Choreography
htc
VIVE

VIVE XR Elite Motion Capture
VIVE Ultimate Tracker
VIVE
VIVE Full Face Tracker
htc
VIVE

Interact with audience and friends
with facial features
htc
VIVE

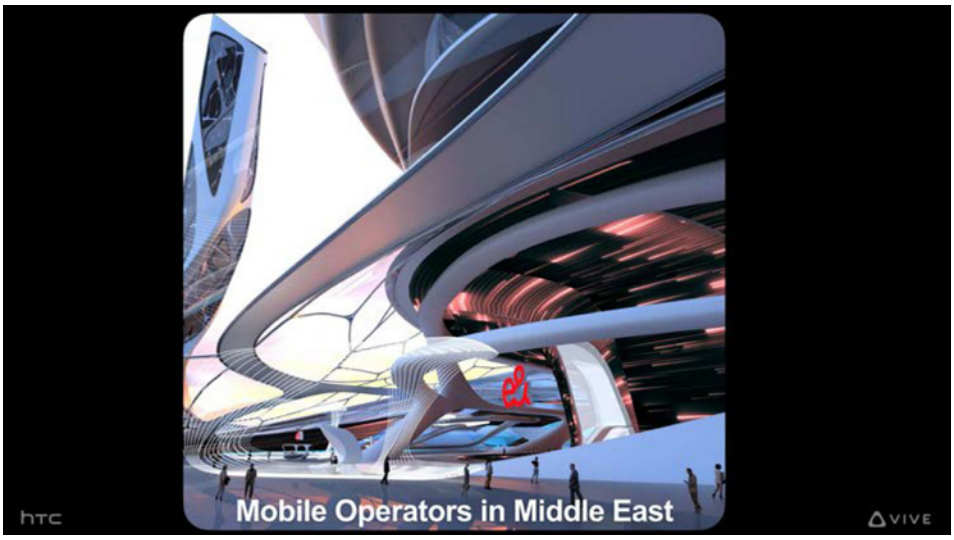
VIVERSE
Shape your business on the Metaverse


CROSS DEVICES
ARTIFICIAL INTELLIGENCE
OPEN & FLEXIALBE
RAPID IMPLEMETNTATION


VIVERSE: The Foundation for Developers to Realize 3D Experience
Toolkit for Metaverse
Avatar
Marketplace
Polygon Streaming
Friend System
Support
Support
Toolkit for metaverse creation process
Platform for Enterprise & Consumer
VIVERSE
3D space creation platform toward creator/consumer & b2b2c service
VIVERSE
SaaS platform for enterprise to realize 3D space interactions and activities
3rd Party application
Consumer scenario and applications
Business tool integration and extension
3rd Party solutions
htc
VIVERSE

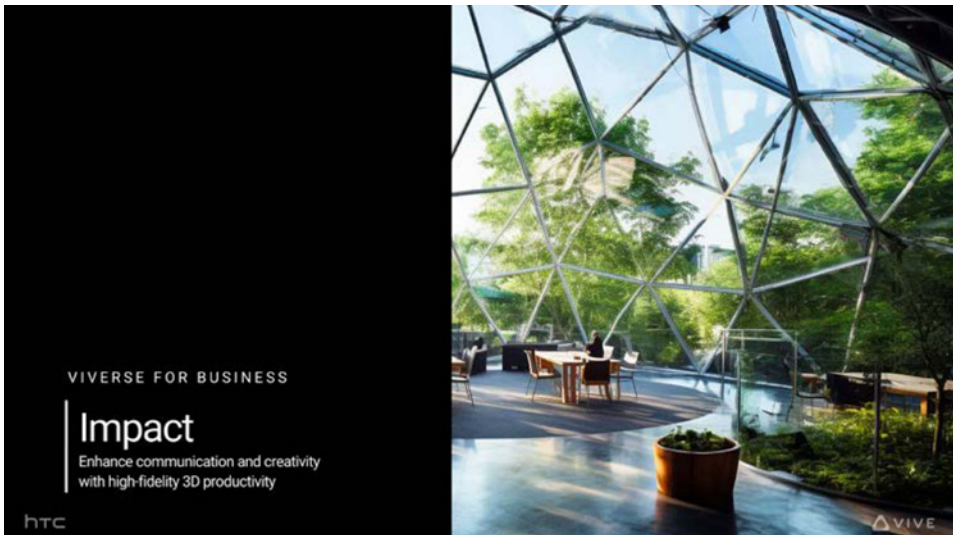
Top 5 to use the Digital Twin Campus
Virtual Work Activities
Client Engagement
Advertising & Marketing
Simulation Experience
Education & Training
Source: ntrc LearningHub
htc
VIVE

VIVERSE Partnerships
E& UNIVERSE
ZOMBIE CLUB
CHIVAS REGAL
ELLE
BIRDIE WING
htc
VIVE

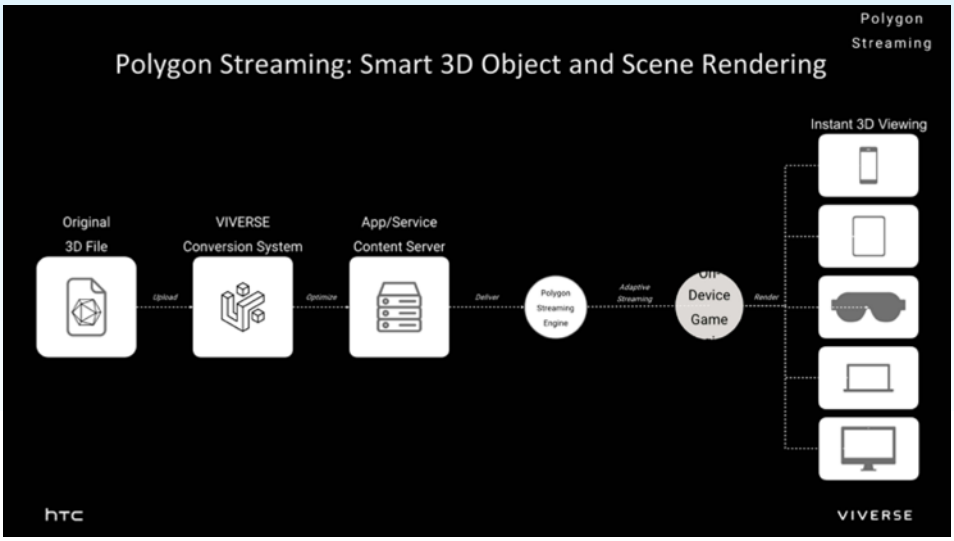

Mobile Operators in Middle East
htc
VIVE

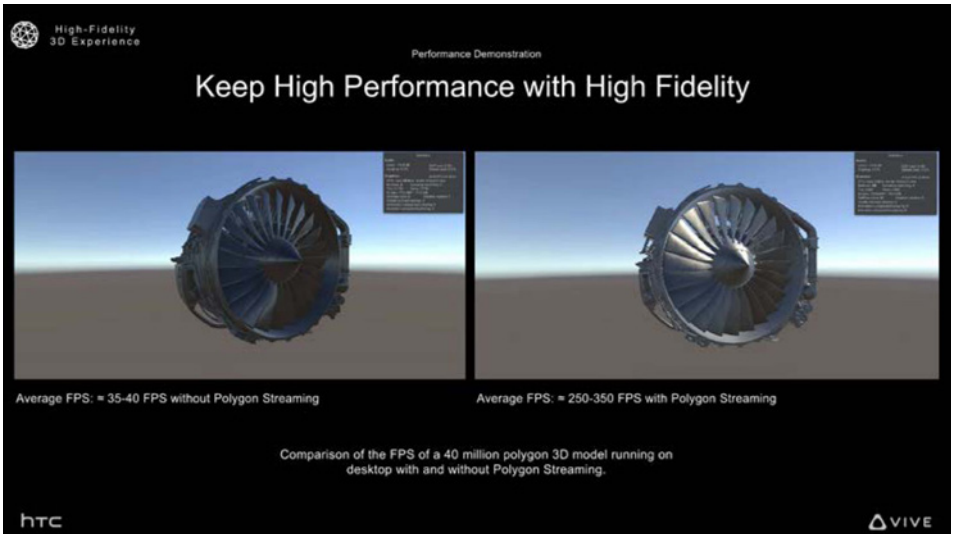
衛武營
國家藝術
文化中心
Kaohsiung Digital Twin City Building

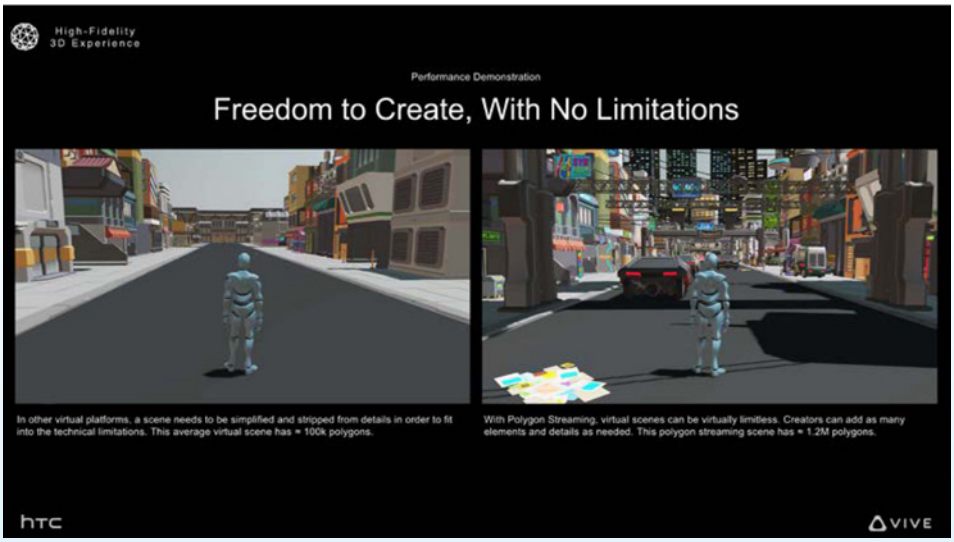
VIVERSE FOR BUSINESS
Modular
Quickly deploy design-ready modules
with flexibility and scalability
htc
VIVE


VIVERSE FOR BUSINESS
Impact
Enhance communication and creativity
with high-fidelity 3D productivity
htc
VIVE

VIVERSE
FOR BUSINESS
High Fidelity 3D Experience
Introducing Polygon Streaming. Display and share high-fidelity 3D
models of any size to any devices available only in VIVERSE
htc
VIVE


Polygon Streaming
Polygon Streaming: Smart 3D Object and Scene Rendering
Instant 3D Viewing
Original 3D File
VIVERSE Conversion System
App/Service Content Server
Upload
Optimize
Deliver
Polygon Streaming Engine
Adaptive Streaming
On-Device Game
Render
htc
VIVERSE

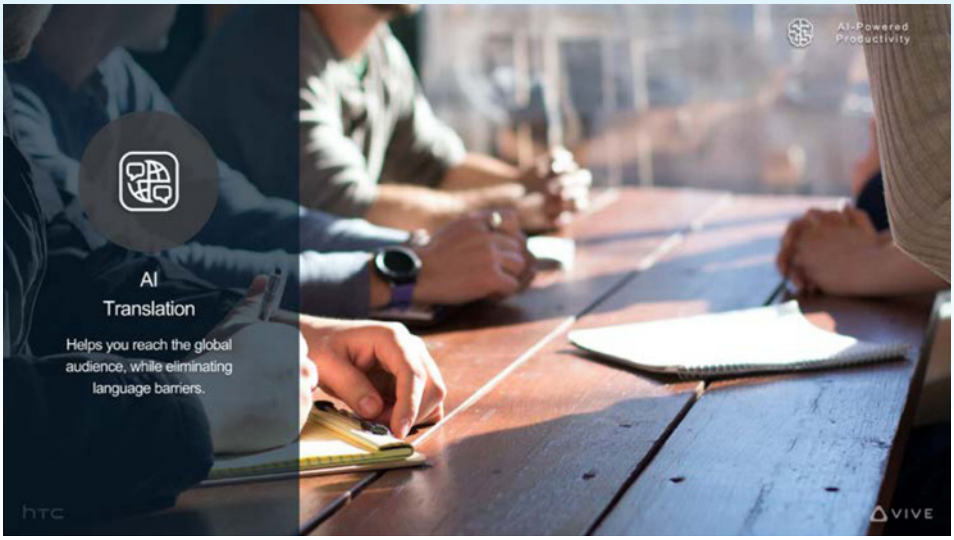

High-Fidelity 3D Experience
Performance Demonstration
Keep High Performance with High Fidelity
Average FPS: ≈ 35-40 FPS without Polygon Streaming
Average FPS: ≈ 250-350 FPS with Polygon Streaming
Comparison of the FPS of a 40 million polygon 3D model running on desktop with and without Polygon Streaming.
htc
VIVE

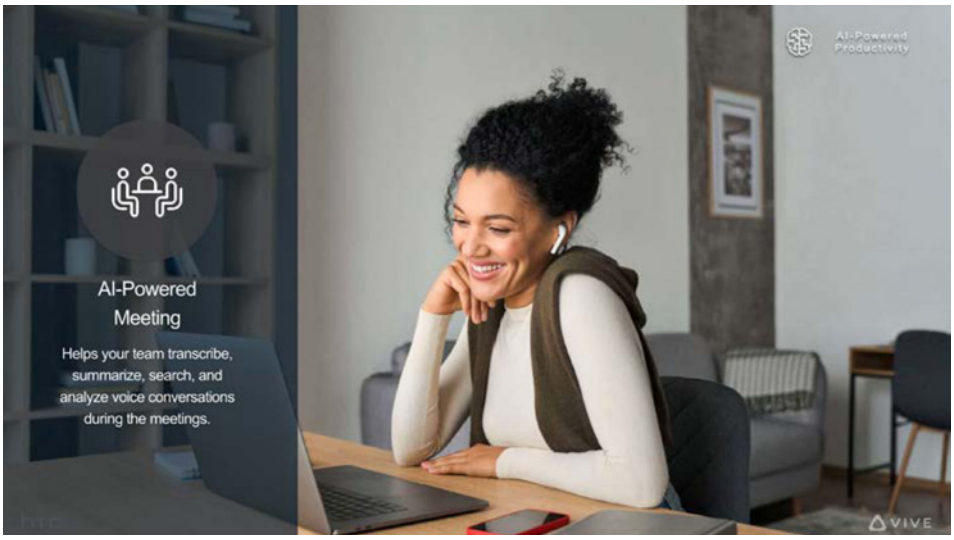

High-Fidelity 3D Experience
Performance Demonstration
Freedom to Create, With No Limitations
In other virtual platforms, a scene needs to be simplified and stripped from details in order to fit into the technical limitations. This average virtual scene has ≈ 100k polygons.
With Polygon Streaming, virtual scenes can be virtually limitless. Creators can add as many elements and details as needed. This polygon streaming scene has ≈ 1.2M polygons.
htc
VIVE

IMPACT
AUDITORIUM
AUDITORIUM
Conference & Presentation
• Present your documents and high fidelity 3D models in your virtual conference room for effective communication.
• Teams and Zoom support with your existing system and current workflow.
High Fidelity 3D Model
Multiple Display
Teams & Zoom Support
zoom
VIVE

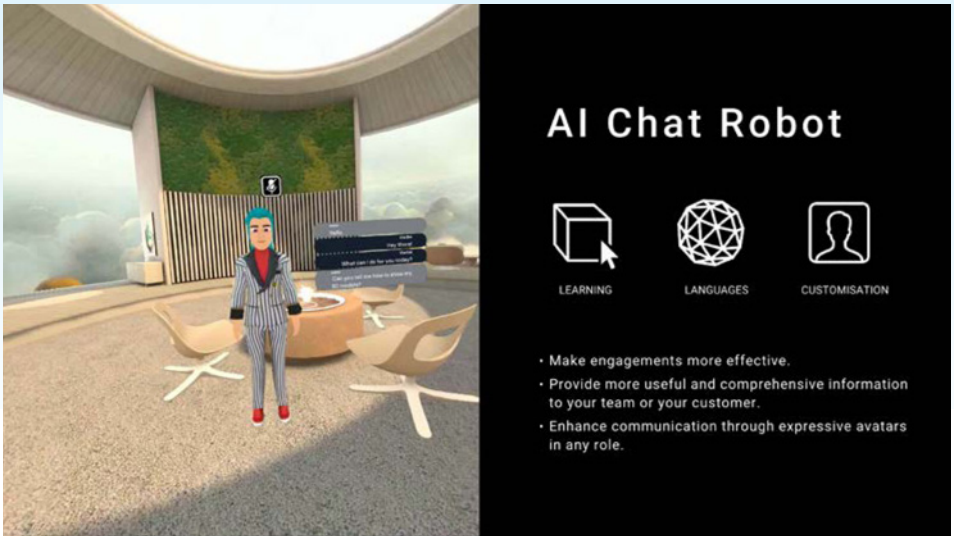
IMPACT
Design Review
• Make your engagements more vivid with 3D visualizations.
• Enhance your communication through expressive avatars.
• Collaborate and realtime feedback with your teams by whiteboard, stick notes and 3D annotation.
Whiteboard
Sticky Notes
Cloud Storage
htc
VIVE

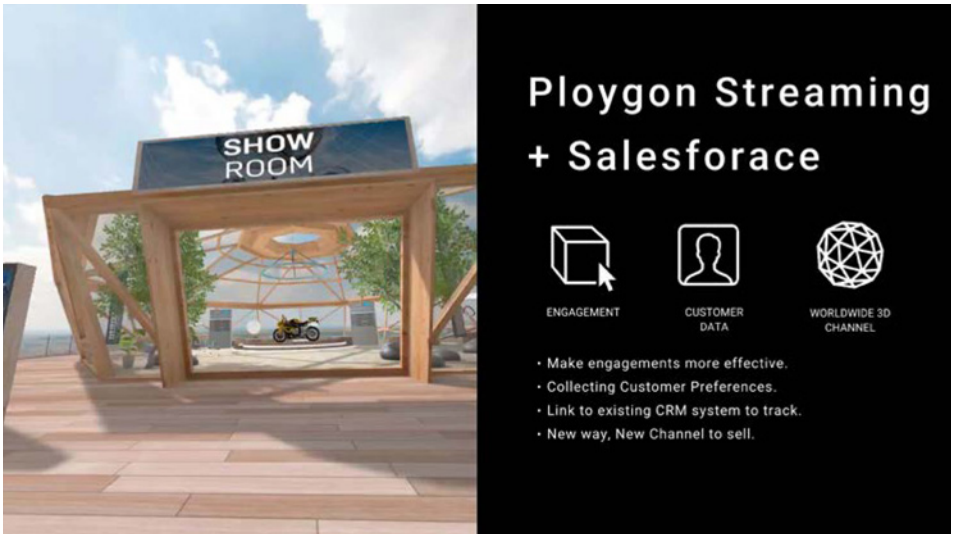
VIVERSE
FOR BUSINESS
AI-Powered Productivity
VIVERSE for Business has the powerful AI tools
needed
to integrate the power of AI into your workflow
htc
VIVE


AI-Powered Productivity
AI
Translation
Helps you reach the global audience, while eliminating language barriers.
htc
VIVE

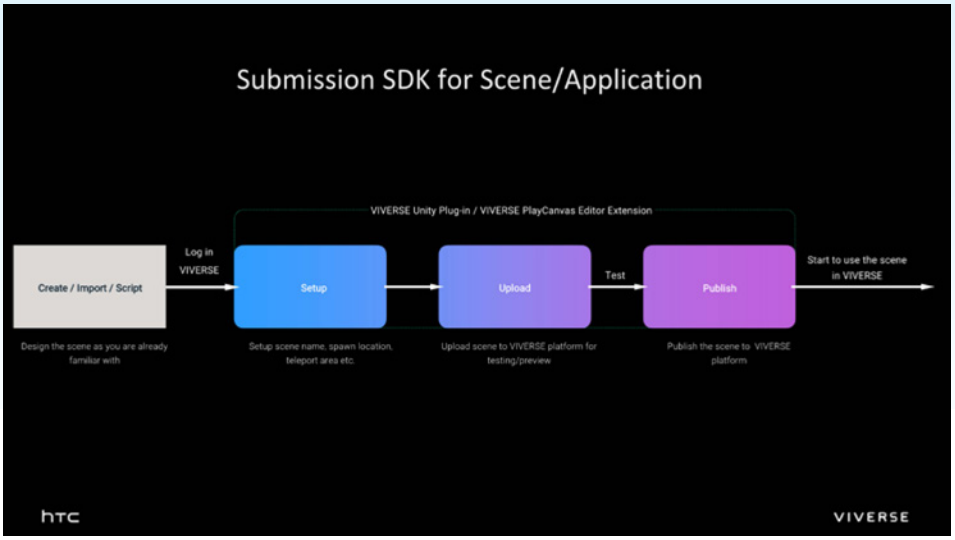

AI-Powered Productivity
AI-Powered
Meeting
Helps your team transcribe, summarize, search, and analyze voice conversations during the meetings.
htc
VIVE

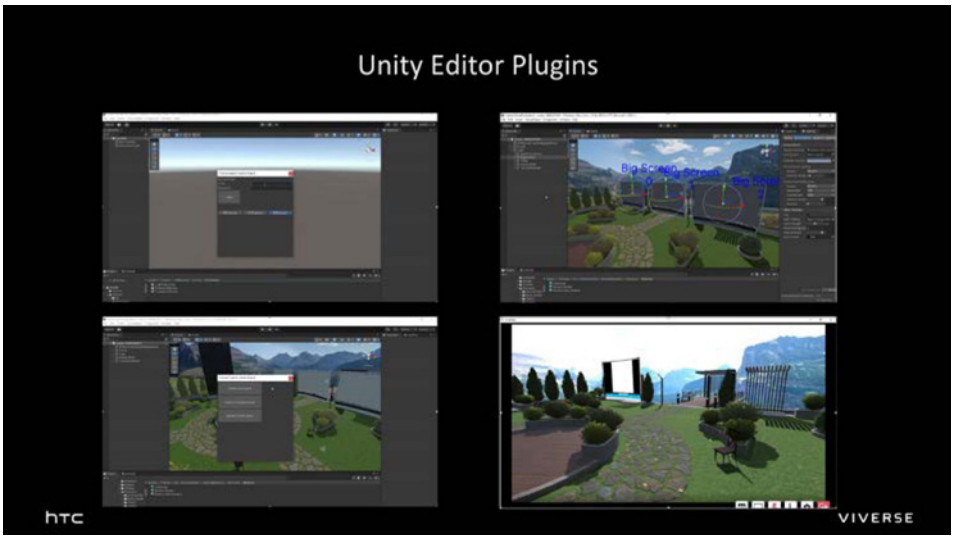
AI-Powered Productivity
AI
Assistant
Helps streamline tasks, manage schedules, facilitate communication, automate repetitive work, provide research and data insights.
htc
VIVE

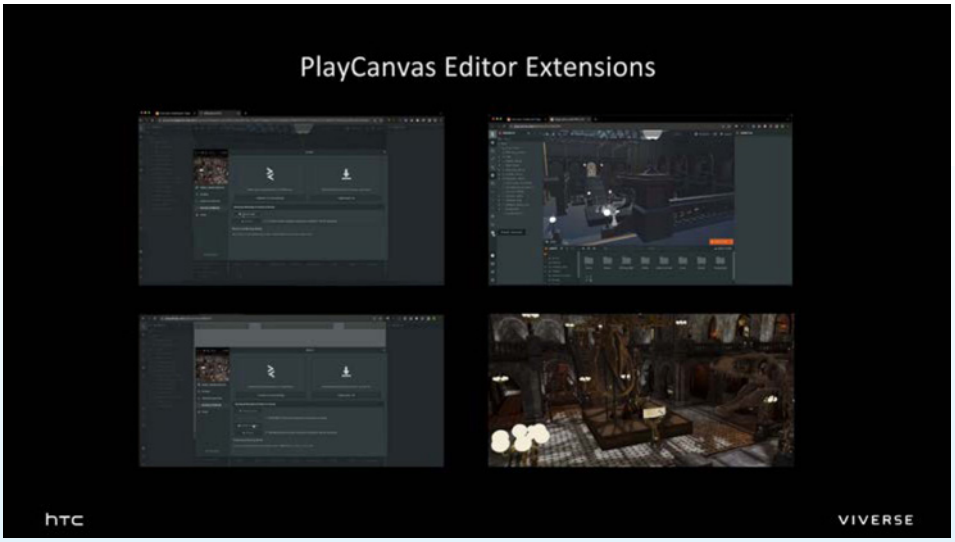

AI Chat Robot
LEARNING
LANGUAGES
CUSTOMISATION
• Make engagements more effective.
• Provide more useful and comprehensive information to your team or your customer.
• Enhance communication through expressive avatars in any role.


SHOW ROOM
Ploygon Streaming + Salesforace
ENGAGEMENT
CUSTOMER DATA
WORLDWIDE 3D CHANNEL
• Make engagements more effective.
• Collecting Customer Preferences.
• Link to existing CRM system to track.
• New way, New Channel to sell.

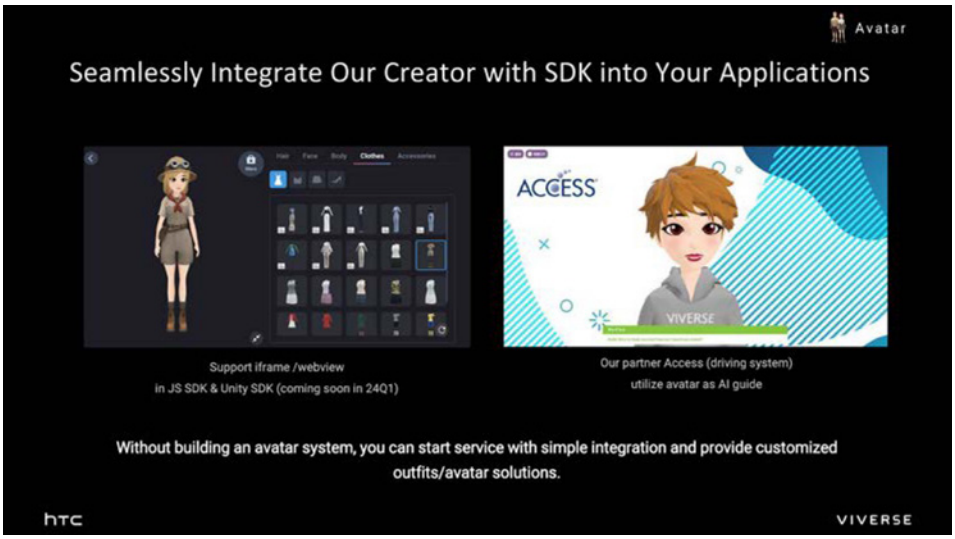
Web Management Console
• Account Tiering and Management
• Access Management
• Meeting/Event/Courses Management
• Cloud Storage
VIVERSE
Buildings & spaces
Buildings
Spaces
Members
Buildings
Persistent spaces
Roles & permissions
Plans
VIVERSE Dome (Large)
Members
115
Advanced Demo Space
Members
55
VIVERSE Dome APAC
Members
13

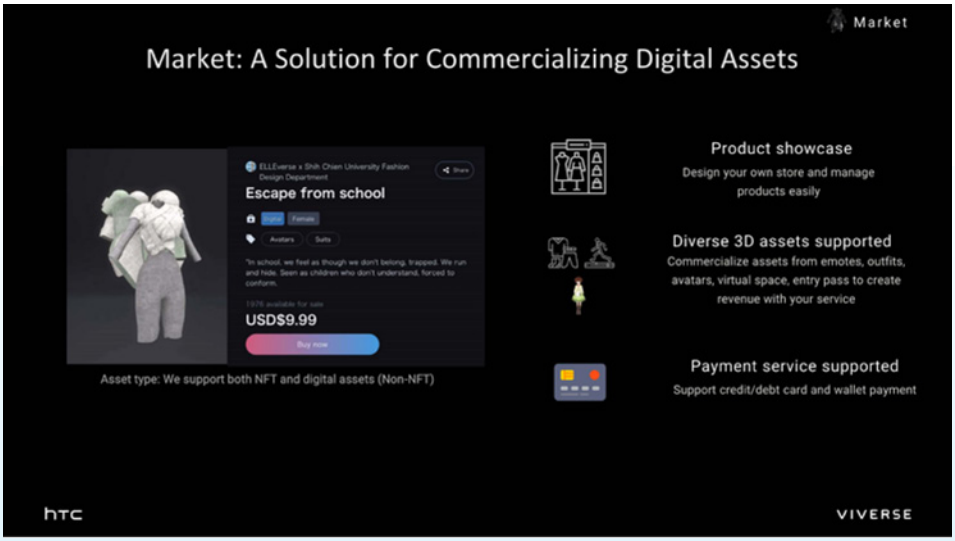

Submission SDK for Scene/Application
VIVERSE Unity Plug-in / VIVERSE PlayCanvas Editor Extension
Create / Import / Script
Log in VIVERSE
Setup
Upload
Test
Publish
Start to use the scene in VIVERSE
Design the scene as you are already familiar with
Setup scene name, spawn location, teleport area etc.
Upload scene to VIVERSE platform for testing/preview
Publish the scene to VIVERSE platform
htc
VIVERSE


Unity Editor Plugins
htc
VIVERSE


PlayCanvas Editor Extensions
htc
VIVERSE

Your Best Partner in 3D Experience Development
1
2
3
4
1 Avatar
One-stop avatar and character solution
2 Marketplace
digital asset commercialize solution
3 Polygon Streaming
3D object/scene smart rendering and storage
4 Friend System
interoperability social system
Building your own metaverse applications based on our core service and technologies
htc
VIVERSE


Avatar
Seamlessly Integrate Our Creator with SDK into Your Applications
ACCESS
VIVERSE
Support iframe /webview
in JS SDK & Unity SDK (coming soon in 24Q1)
Our partner Access (driving system)
utilize avatar as AI guide
Without building an avatar system, you can start service with simple integration and provide customized outfits/avatar solutions.
htc
VIVERSE


Market
Market: A Solution for Commercializing Digital Assets
Escape from school
USD$9.99
Asset type: We support both NFT and digital assets (Non-NFT)
Product showcase
Design your own store and manage products easily
Diverse 3D assets supported
Commercialize assets from emotes, outfits, avatars, virtual space, entry pass to create revenue with your service
Payment service supported
Support credit/debt card and wallet payment
htc
VIVERSE

Seminar on XR Technologies Enabling Retail Industry Smartification and Digitalization
應用延展實境（XR）技能賦能零售產業邁向智能化及數據化研討會

香港生產力促進局於 2024 年 2 月 23 日舉行「應用延展實境（XR）技術賦能零售產業邁向智能化及數據化研討會」，邀請了地世優科技及英國 Zappar 的代表介紹 XR 在零售產業的應用、操作技巧及分享實戰案例。
世優科技成立於 2015 年，在虛擬技術領域有近十年的經驗。公司主要針對虛擬化身創造及應用和元宇宙全景服務。企業科技廣泛應用於品牌營銷、電商直播／短視頻、影視等不同範疇。客戶包括央視、中國移動、華為、阿里巴巴等。近年來世優科技亦成為 2023 杭州亞運會開幕和閉幕擴增實境（AR）虛擬技術及閉幕式數字火炬手的技術支持服務商，提供數碼人動作捕捉、數碼人技術及 AR 特效應用等服務。

Zappa 則是來自英國的知名 AR 公司，成立於 2011 年，擅長利用移動載具結合自家 AR 軟體，並推出多樣化的創意，多年來為不同企業提供服務，包括 Legoland, Rovio Entertainment, Nestle, Puma 等等。

此次研討會，深入介紹零售產業最新的 XR 技術，並且通過實際案例分析，介紹相關投資、成本效益的優勢和局限性。

主題	講者
4U Technology company introduction & Digital Human & Virtual Studio	**黃先生** 世優（北京）科技有限公司副總裁
The Opportunities for XR in Retail	**Mr Max Dawes,** Chief Operation Officer, Zappar

4U Technology company introduction & Digital Human & Virtual Studio

黃先生
世優（北京）科技有限公司副總裁

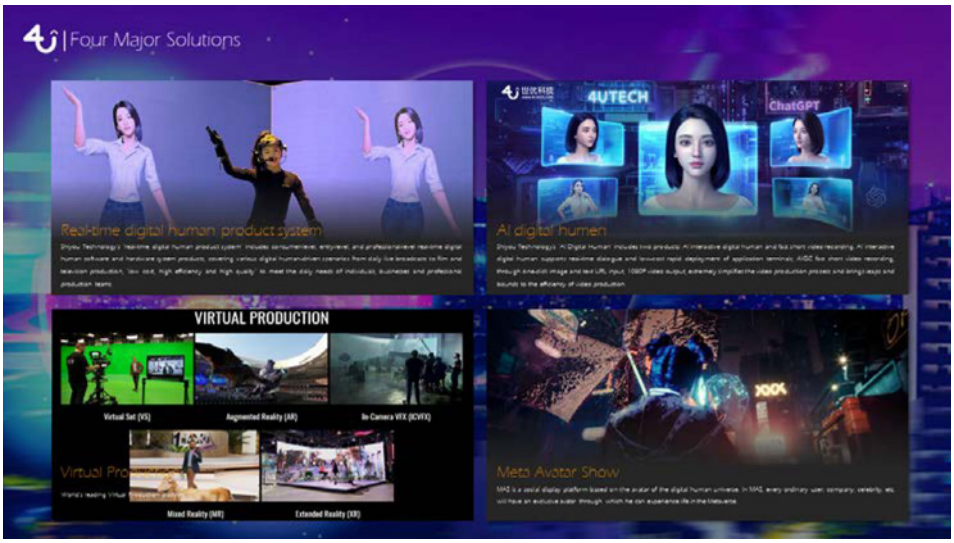
4U Tech is a company with extensive industry experience, serving a diverse clientele across multiple application scenarios. The speaker emphasises the company's commitment to driving innovation through its four major solutions:
Real-time Digital Human Product System: This system offers consumer-level, entry-level and professional-level solutions for digital human-driven scenarios, ranging from live broadcasts to film and television production. It aims to provide high-quality, efficient and cost-effective solutions to meet various user needs.

AI Digital Human: This includes artificial intelligence (AI) interactive digital humans and fast short video recording solutions. The AI interactive digital humans support real-time conversation and low-cost rapid deployment, while the artificial intelligence generated content (AIGC) fast short video recording simplifies the video production process significantly.

Virtual Production: This is recognised as a leading platform for virtual production, this solution leverages cutting-edge technology to enhance digital content creation.

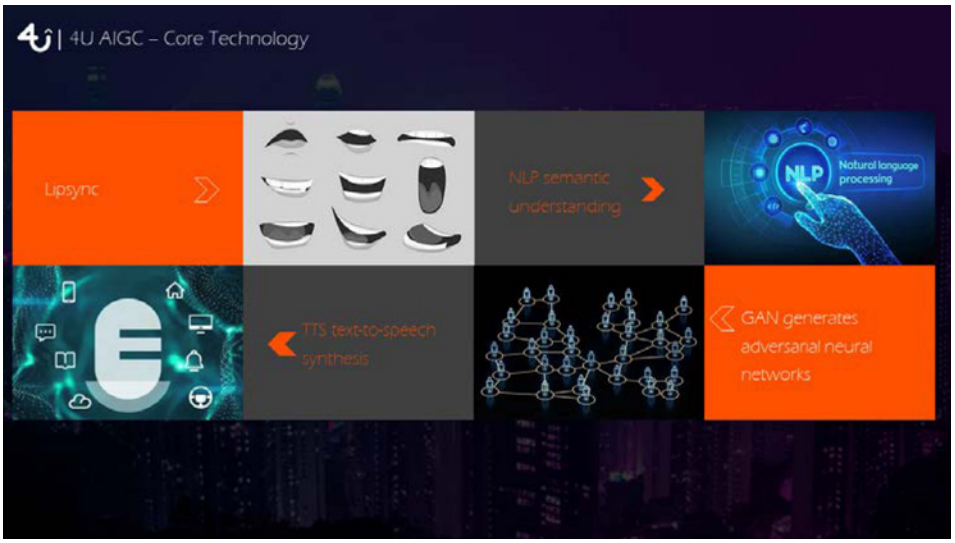
Meta Avatar Show (MAS): This is positioned as a social display platform within the digital human universe, MAS allows users, companies and celebrities to possess exclusive avatars, facilitating immersive experiences in the Metaverse.

Company Profile
1000+ digital human
1,000+ brand customers
10 main application scenarios
10 years industry experience

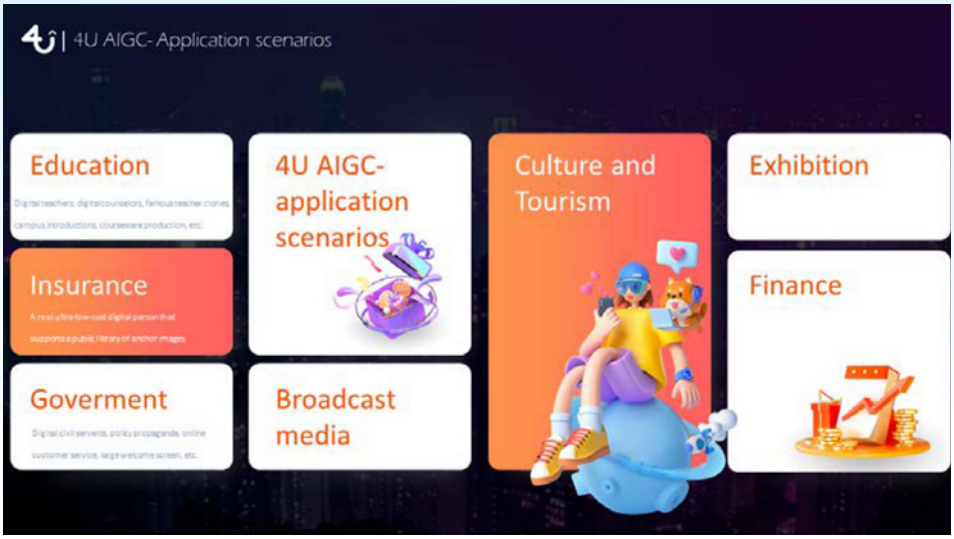

Four Major Solutions
Real-time digital human product system
4UTECH
ChatGPT
AI digital human
VIRTUAL PRODUCTION
Virtual Set (VS)
Augmented Reality (AR)
In-Camera VFX (ICVFX)
Mixed Reality (MR)
Extended Reality (XR)
Meta Avatar Show

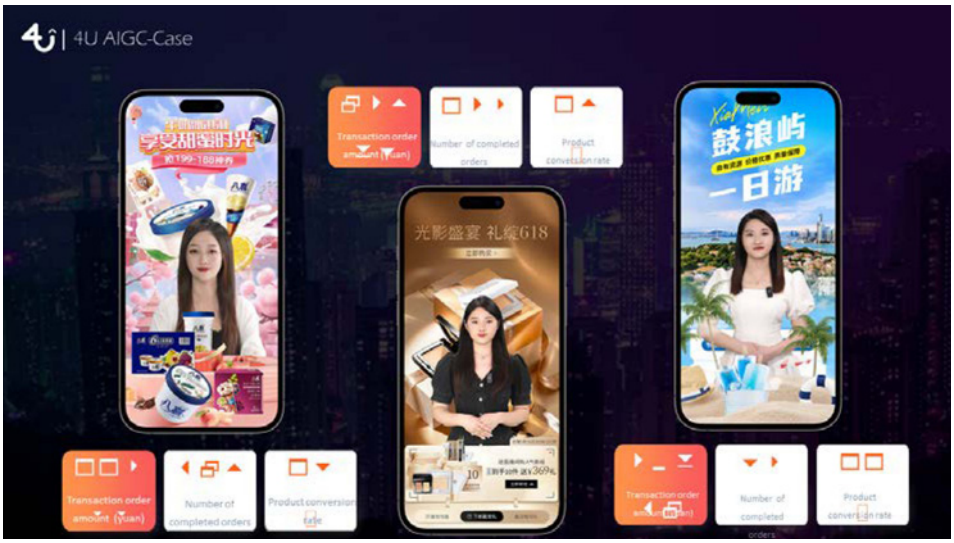
世优科技
DIGITAL HUMAN

Case Sharing


4U AIGC – Core Technology
Lipsync
NLP semantic understanding
NLP
Natural language processing
TTS text-to-speech synthesis
GAN generates adversarial neural networks

4U AIGC digital human live broadcast system
Subverting the production and operation methods of short videos and live broadcasts
1 Real person image reproduction
2 Real voice reproduction
3 Video generator


4U AIGC- Application scenarios
Education
Digital teachers, digital counselors, famous teacher clones, campus introductions, courseware production, etc.
Insurance
A real ultra-low-cost digital person that supports a public library of anchor images
Goverment
Digital civil servants, policy propaganda, online customer service, large welcome screen, etc.
4U AIGC- application scenarios
Broadcast media
Culture and Tourism
Exhibition
Finance

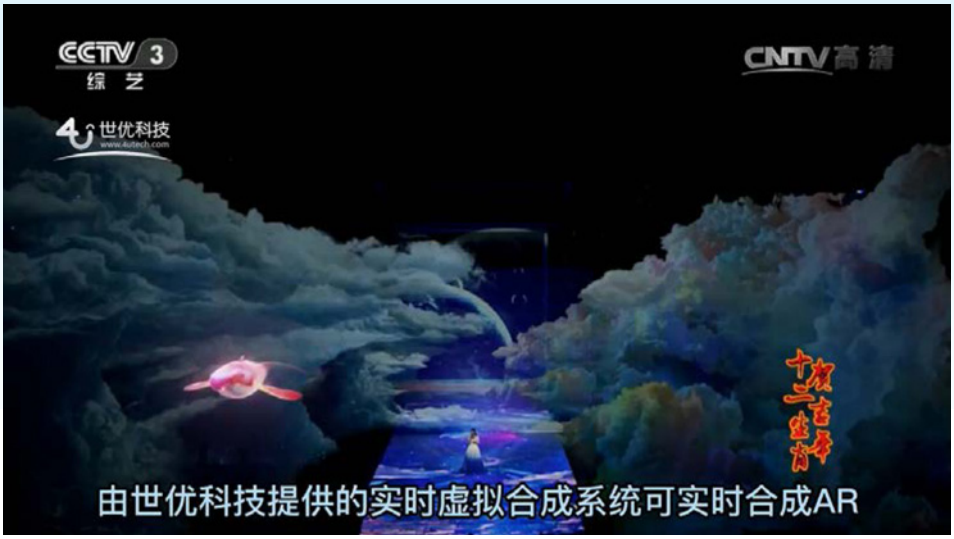

4U AIGC-Case
Transaction order amount (Yuan)
Number of completed orders
Product conversion rate
光影盛宴 礼绽618
鼓浪屿
一日游

4U AIGC-Case
服务行业
AI数字员工

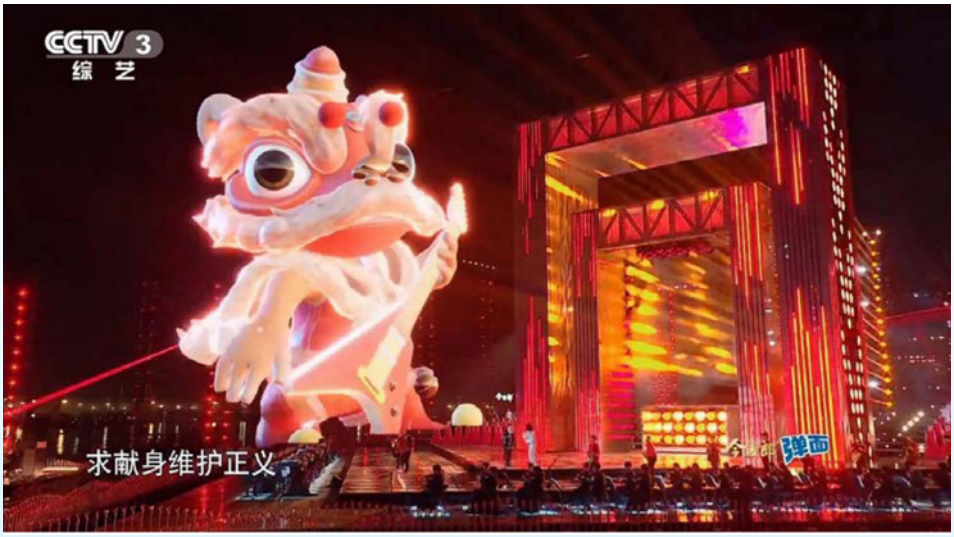
Offline retail scenario
智能全息舱
AI实时换脸
Virtual fitting with realtime AI face transplant

世优科技
VIRTUAL STUDIO

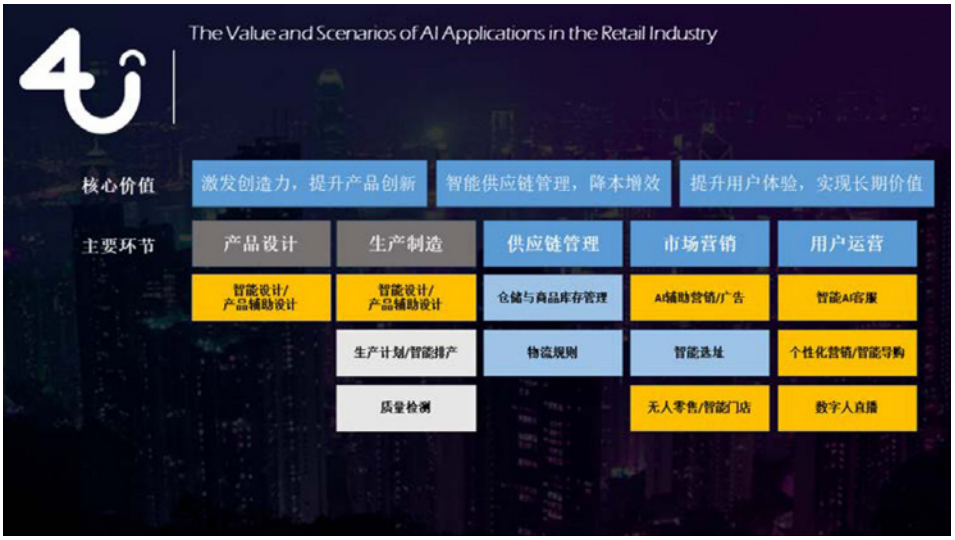
4U in Virtual Studio Industry
世优科技
www.4utech.com
PIXOTOPE
150+ Project Shooting Experience
60+ Unreal Graphic Engineers
20+ Studio HW/SW Engineers
10 years industry experience


CCTV 3
综 艺
CNTV高清
世优科技
由世优科技提供的实时虚拟合成系统可实时合成AR

世优科技
www.4utech.com
2021年央视春晚《牛起来》


CCTV 3
综 艺
求献身维护正义
弹幕

CCTV
亚残运会
开幕式AR

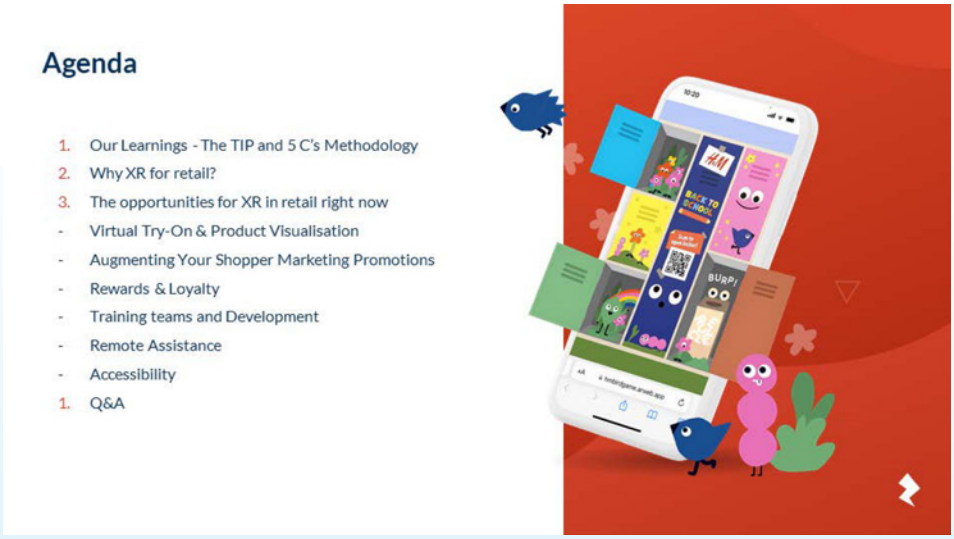

The Value and Scenarios of AI Applications in the Retail Industry
核心价值
激发创造力，提升产品创新
智能供应链管理，降本增效
提升用户体验，实现长期价值
主要环节
产品设计
生产制造
供应链管理
市场营销
用户运营
智能设计/产品辅助设计
智能设计/产品辅助设计
仓储与商品库存管理
AI辅助营销/广告
智能AI客服
生产计划/智能排产
物流规划
智能选址
个性化营销/智能导购
质量检测
无人零售/智能门店
数字人直播

Online retail scenario
零售行业线上数智化
售前阶段
售中阶段
售后阶段
AI营销/广告投放
AI导购+AI客服
数字人直播
智能服务+用户/会员运营
通过用户画像，进行定向投放，实现精准营销
通过搜索、对话等方式，为用户提供问答与商品推荐等服务，提升交易转化与用户体验
利用数字人直播为用户不间断进行商品讲解与推荐，降低直播运营成本
在原有客户服务基础上，利用AI进行情感分析来理解客户需求，提供个性化服务，以及围绕用户生命周期，自动化实现用户运营
AI选品+上架
商品营销物料生成
AI定价
虚拟试衣/3D展示
AI供应链+物流
围绕商品标签以及交易数据等进行选品模型训练，辅助进行选品决策
利用AIGC能力，针对商品图、短视频等进行营销以及广告投放物料生成，降低成本
基于历史销售数据，竞争策略等数据，实现实时定价及优化
创新购物场景，更全面展示商品全貌，提高交易转化率
优化物流和仓储管理流程，包括路线规划、运输方式选择，库存管理等，提升交易和履约效率

The Opportunities for XR in Retail

Mr. Max Dawes
Chief Operation Officer, Zappar

The speaker explored the significant potential of Extended Reality (XR) technologies in revolutionizing the retail industry. It outlines the various ways XR can enhance customer experiences, streamline operations, and provide innovative solutions for retailers.



A brief introduction to Zappar

zappar
CREATIVE STUDIO

The Creative Consultancy

Strategy
Creative
Design & Development
Production & QA
Ongoing management

zapworks

The Platform

No code
Low code
Developer SDKs
Data analytics
Training
Computer vision

zapbox

The Hardware

The affordable and scalable XR headset solution
Offering immersive smartphone powered VR/AR
Fully 6DoF at just $80.

zapvision

The Accessibility Solution

Enhancing QR to make product packaging accessible to everyone.

What we've learned so far...

Why retailers need to be considering XR..

95%
Increase in visual attention
(Neuro Insight)

70%
Uplift in memory encoding
(Neuro Insight)

45%
Higher attention than TV or online
(Neuro Insight)

64%
Of leading consumer brands are investing in immersive experiences
(Accenture)

250%
Increase in conversion rate in products using 3D models in AR compared to those not
(Shopify)

100M
Consumers shopping with AR online and in-stores
(Deloitte)

XR is now an expected part of the buyer journey

71% Say they would shop more often if they used AR

78% Say AR is a fun way to interact with brands

61% Say they prefer retailers with AR experiences

Meta AR/VR: New Dimensions of Connection 2021, Snap Consumer AR Global Report 2021

> *The conversion rates that we've seen have surprised us, as a result we're doubling-down on AR experiences to drive eCommerce*
>
> Robert Triefus EVP of Brand & Customer Engagement Gucci

94% Higher conversion rate after interacting with products that have AR experiences

> *As the technology evolves, it will revolutionize our lives and will become as significant of a technology shift as the web or mobile was to society, changing how we view and interact with the world around us*
>
> Allan Cook Digital Reality Business Leader Deloitte Digital

XR is making real impact within large organizations

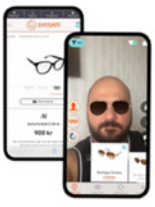
75% Business leaders plan to use XR or VR by 2024

42% Of marketers plan to increase their investment in AR/VR in 2023

94% Higher conversion rate after interacting with products that have AR experiences

Snap Consumer AR Global Report 2021, Hubspot Marketing Trends of 2022, Meta AR/VR: New Dimensions of Connection 2021

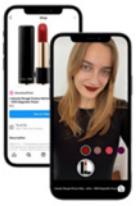
Opportunity 1: Virtual-Try On & Product Visualisation



Increased engagement

Increased time on site

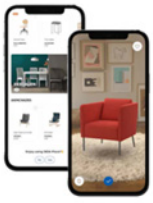
SYNSAM GROUP



Tripled website engagement

Doubled conversion

L'ORÉAL

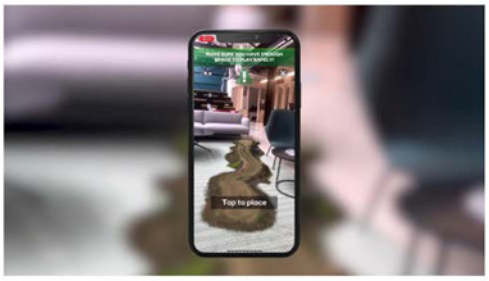


Reduced product returns by **20%**

Increased online sales by **35%**

IKEA

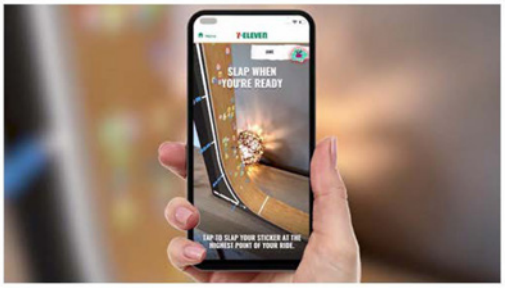
Opportunity 2: Augmenting your shopper marketing promotions



countdown CRAZE

- Over 1.4m visits to the app homepage
- Over 3.1m cards were scanned
- Face filters were viewed nearly 730,000 times
- The quiz was played nearly 407,000 times
- App rated #1 in education
- Transactions over the $30 threshold grew by 5% year on year
- App downloads were roughly equivalent to just over 1% of the NZ population

Opportunity 3: Rewards schemes, redemption and collectibles



7-ELEVEN

47% of consumers say immersive technologies make them feel connected with products. (Accenture)

96% Redemption Rate of Vouchers

average **dwell times** of over **2 minutes 30 seconds**

Opportunity 4: Revolutionise In-Store Experience

66% of consumers want physical stores to offer more AR experiences.

Chance to partner with brands and sponsors and create character driven narratives.

Build your digital real estate.

XR doesn't only impact customer journey when we speak about the 'opportunity for XR in retail'

Opportunity 5: How is XR used for Learning and Development?

AR is a highly effective **sub-set of micro learning** that can be the most effective due to **heightened engagement and memory recall.**

Microlearning experiences are typically delivered at the user's own time and location, on the devices they use most, (their mobile phones and tablets). Experiences tend to be completed in less than 10 minutes and can be easily integrated into a person's busy work schedule.

XR brings these experiences to life vs any other more flat media such as print or video:

- Meet and greets / employee onboarding
- Dangerous environment watch outs / health and safety
- Recreations of environments that would otherwise be expensive
- 3D visualisations of products / concepts or spaces
- Soft skills training / roleplay
- **Branching scenarios** that **enhance and re-energise existing learning actively rather than passively**

Trainee and Employee Development Examples

Unilever

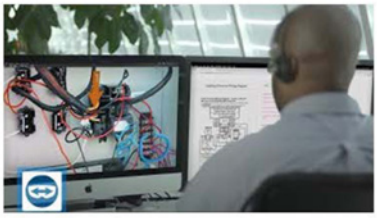
LOWE'S

A Training Experience built by Zappar

MOTOROLA

Scan this code with your mobile device camera or any QR code reader to try the augmented reality experience.

Opportunity 6: Remote Assistance



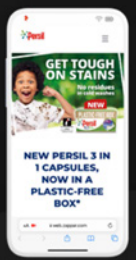
45% increase in first time fixed rates (Teamviewer)

Enhanced Customer Satisfaction

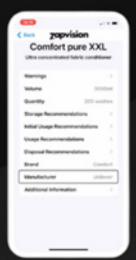
Cost & Sustainability Gains

Opportunity 7: Tackling accessibility on product packaging

Fully sighted users scan QR code from camera (c. 20mm) and get the Connected Pack experience as normal



15mm code



Partially signed users scan code from 5x the distance (c. 1.2m) using existing accessibility app (Microsoft Seeing AI + other leading apps for the market) or download one to be guided to relevant experience

If you have a QR code on pack why not make it accessible?

Our solution could not be easier to implement and scale.

One AQR code on product packaging.
Accessible to everyone, everywhere.

Summary

- You need to be thinking about your spatial strategy today
- Well executed XR campaigns drive taps, trips and transactions
- XR can also help drive more sustainable practice
- It extends beyond just the customer journey and can impact every area of the business function
- XR can drive societal impact and tackle accessibility

Seminar on XR Technologies Enabling Construction and Engineering Industries Smartification and Digitalization
應用 XR 技能賦能建造及工程界邁向智能化與數據化研討會

隨著香港特區政府大力推動新型工業化，建造業正準備引入智能化和數碼化的主要賦能技術——擴增實境 (AR)、虛擬實境 (VR) 和混合實境 (MR) 等 XR 技術。這些新技術能夠有效改善建造業前期規劃設計及實地檢測施工進度流程，提升人員效率及安全，例如運用 AR 實現參考圖紙指導施工現場操作，VR 則可以用於模擬危險場景的安全培訓等。

為了進一步探討如何利用 XR 技術使建造業數碼轉型，香港生產力局於 2024 年 3 月 8 日舉辦 「應用 XR 技術賦能建造業邁向智能化及數據化研討會」，為「應用 XR 技術賦能產業邁向智能化及數據化」系列的活動，旨在向業界介紹涉及 XR 技術在建造業領域的應用、技術概念、方法及案例研究，同時闡述技術的優勢和局限性，以及最新發展。

主題	講者
XR 技術應用在建造業土地測量 **・土地測量使用 XR 的優點** **・XR 整合解決方案** **・掌握 XR 的藝術：制定有效的整合工作流程**	**Ingo LAU** CEO of MICology
建造及工程界 VR/AR 相關的標準應用 **・BIM XR 及 Digital-twin XR 於行業內的作用及現狀** **・BIM XR 及 Digital-twin XR 於實際應用時的技術難處** **・實際應用技術難處的解決方法** **・推流 - 即 - 服務 - 雲端資源整合、網絡傳輸優化到終端裝置兼容** **・平台即服務 -BIM 及 Digital-twin XR 的應用案例** **・BIM XR 及 Digital-twin XR 結合推流 - 即 - 服務的效率優勢與數據安全優勢**	**鍾啟斌 先生** 平行雲科技有限公司 全球業務拓展經理

XR 技術應用在建造業土地測量

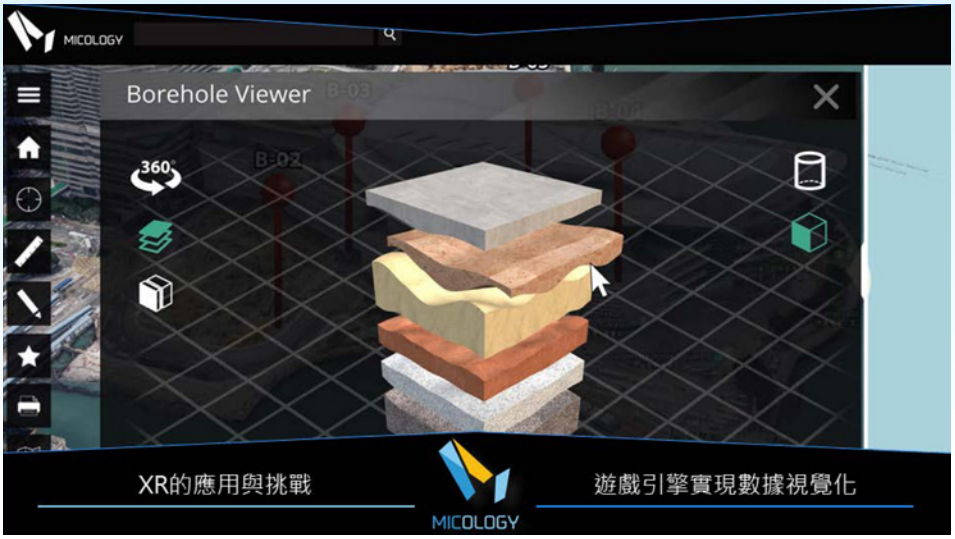
Ingo LAU
CEO of MICology

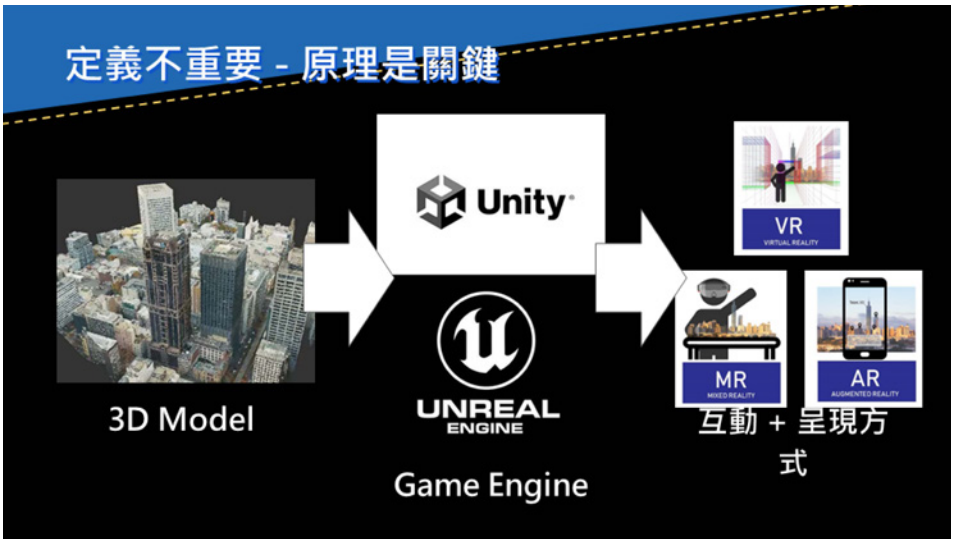
講者詳細探討了 XR 技術的基本概念，包括 VR、AR、MR 和 XR，並強調了這些技術如何通過 3D 模型和遊戲引擎實現數據視覺化，從而減少教學成本、降低判斷錯誤和加快溝通速度。特別指出，XR 技術能夠將複雜的 2D 資料轉化為更易解讀的 3D 形式，這對於提升決策速度和準確性有著顯著的作用。

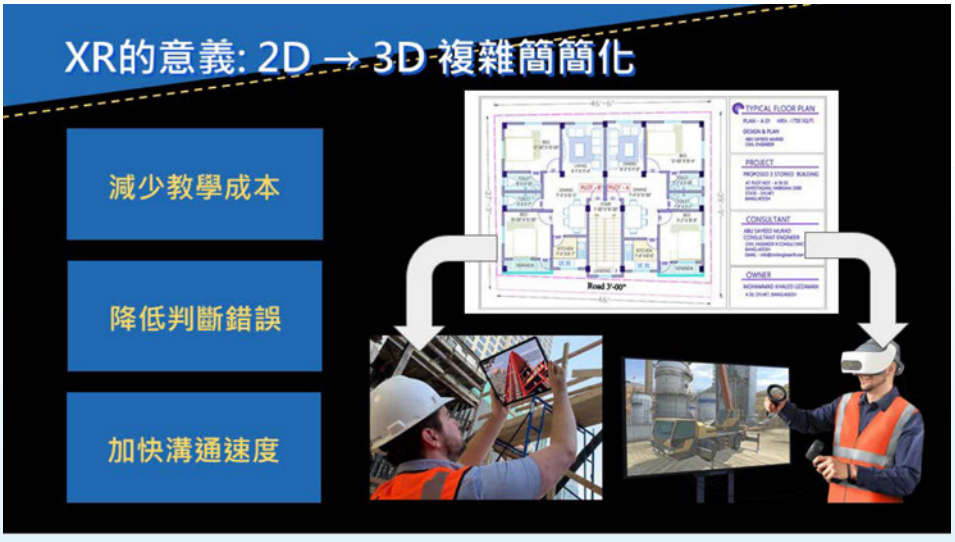
同時還展示了多個 XR 應用的實例，包括智能機場的 3D 數據整合、結合定位和 AR 技術的實時位置顯示、結合 IoT 和機械的同步數據，以及結合場地規劃的實時可視數據。這些應用例子展示了 XR 技術在提高工作效率和安全性方面的巨大潛力。

然而，XR 技術的推廣面臨多方數據整合、3D 處理複雜和遊戲專才缺乏等挑戰。需要大規模投資和有效的溝通策略來克服這些障礙，同時還需配置遊戲專才以支持技術落地。

最後介紹了 MICology 和平行雲科技有限公司的相關技術和解決方案，展示了如何通過雲端資源整合和網絡傳輸優化來實現高效的 3D XR Streaming-as-a-Service。這些技術解決方案旨在提升建造及工程界的生產力和數據化水平。


MICOLOGY
Borehole Viewer
360°
XR的應用與挑戰
MICOLOGY
遊戲引擎實現數據視覺化


定義不重要 - 原理是關鍵
Unity
VR
MR
AR
3D Model
UNREAL ENGINE
Game Engine
互動 + 呈現方式


XR的意義: 2D → 3D 複雜簡簡化
減少教學成本
降低判斷錯誤
加快溝通速度

XR的意義: 2D → 3D 複雜簡簡化

$37+B
USD 浪費於會議上

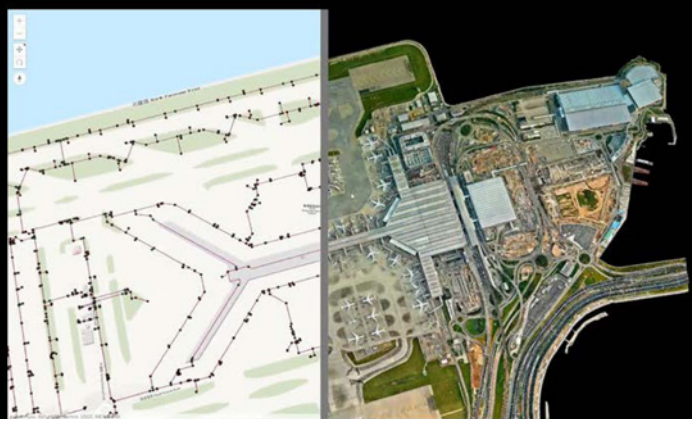
$8.8+B
USD 依靠可視化數據減少成本

48%
高層無法自行找到想要的數據

300%
增加決策速度

案例: SMART AIRPORT

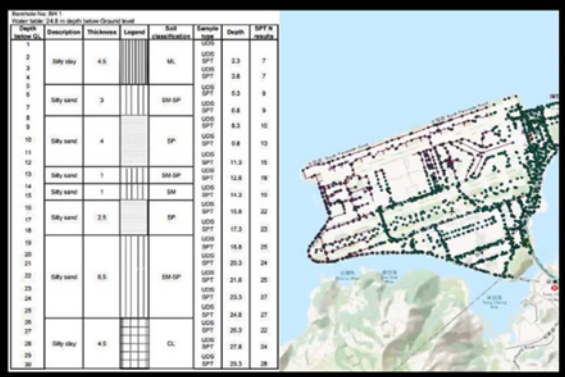
2D

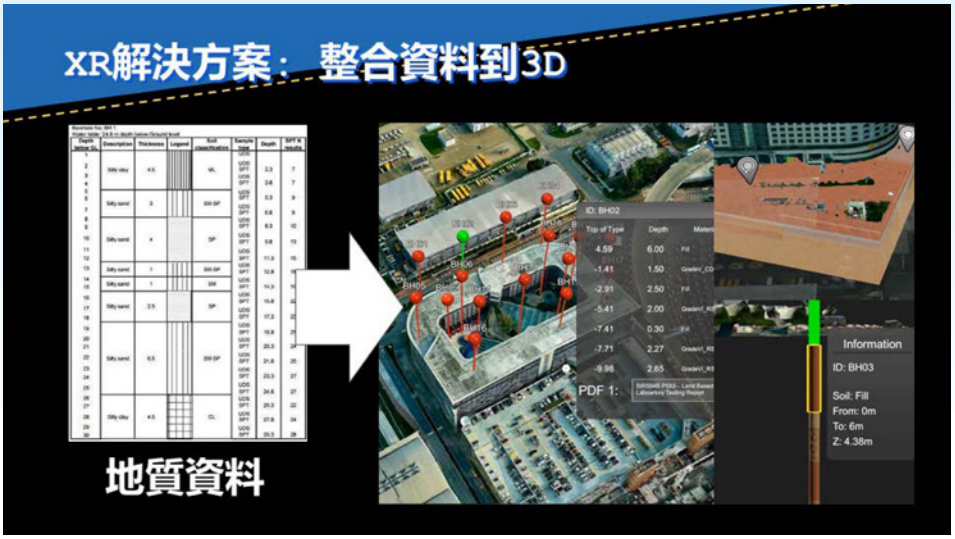


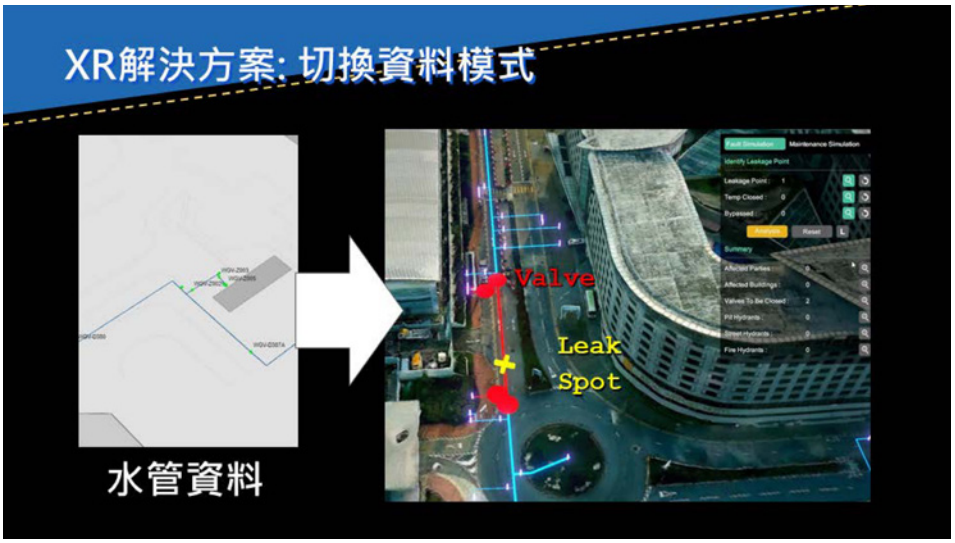
3D

痛點: 2D資料難以解讀

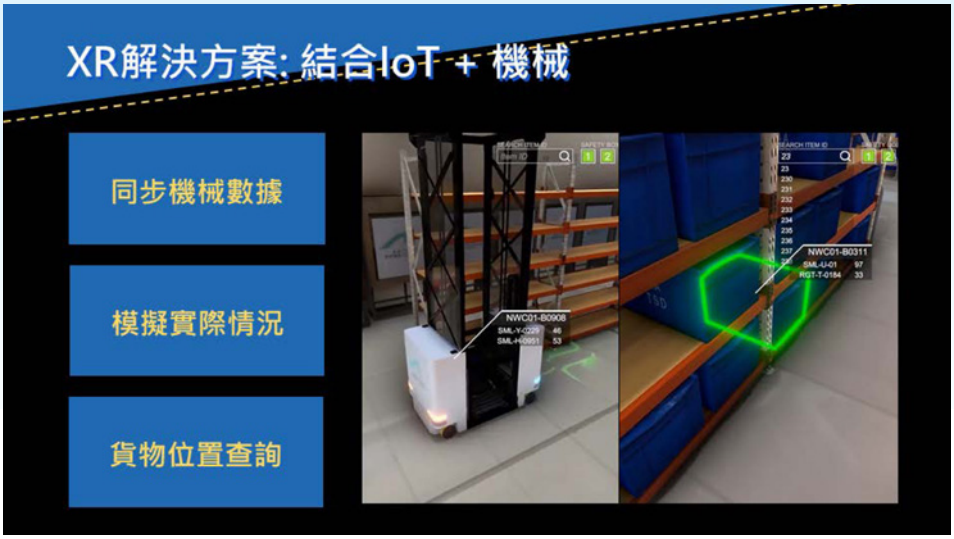
- 需要專家解讀
- 學習成本過高
- 資訊多不統一




XR解決方案： 整合資料到3D
地質資料
Information
ID: BH03
Soil: Fill
From: 0m
To: 6m
Z: 4.38m
PDF 1:


XR解決方案: 切換資料模式
水管資料
Valve
Leak
Spot

XR延伸應用: 結合定位+AR
實時位置顯示
看穿牆避風險
隨時遙距指導
工人位置
Sand
Clay
Concrete
手機AR看穿牆


XR解決方案: 結合IoT + 機械
同步機械數據
模擬實際情況
貨物位置查詢

XR解決方案: 結合場地規劃
實時可視數據
模擬實際情況
高速規劃位置
Mode
Construct
Occupied
47%
Item List
Crate : 2
Rack : 0
Container_Metal : 1
Plywoods_3lay: 2
Truck Container : 4
Shelves: 1
Cardboard : 0
PalletBox_Pastic : 4
PalletBox_Glass : 4
Plywood_Marine: 3
Plywood_Composite : 3

Mode
Construct
Occupied
42%
Item List
Crate : 0
Rack : 0
Container_Metal : 0
Plywoods_3lay: 2
Truck Container : 4
Shelves: 1
Cardboard : 0
PalletBox_Pastic : 4
Storage Simulation
Space Usage Optimization
Organize Loading Plan in Virtual World

XR面臨的挑戰

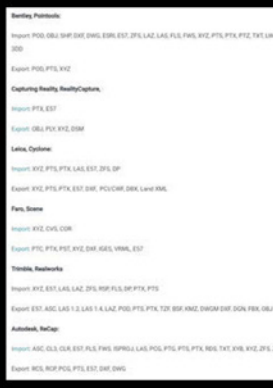
- 多方數據整合
- 3D處理複雜
- 遊戲專才缺乏

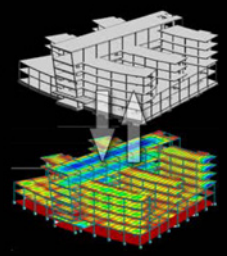
Unity

UNREAL ENGINE

3D處理複雜

- 文件種類眾多
- 導入轉換需時
- 需要專業人士





如何讓XR落地?

- 需大規模投資
- 減少溝通阻力
- 配置遊戲專才

建造及工程界 VR/AR 相關的標準應用

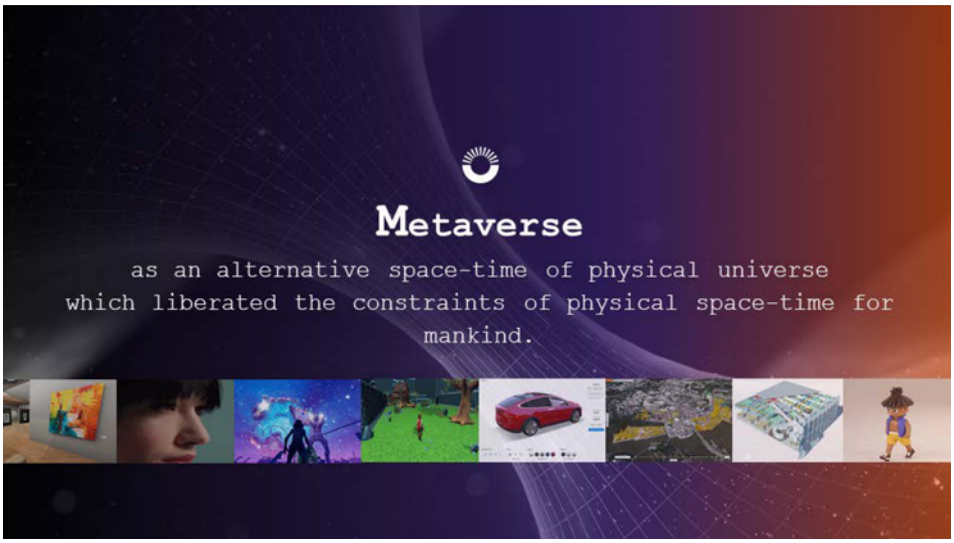
鍾啟斌 先生
平行雲科技有限公司 全球業務拓展經理

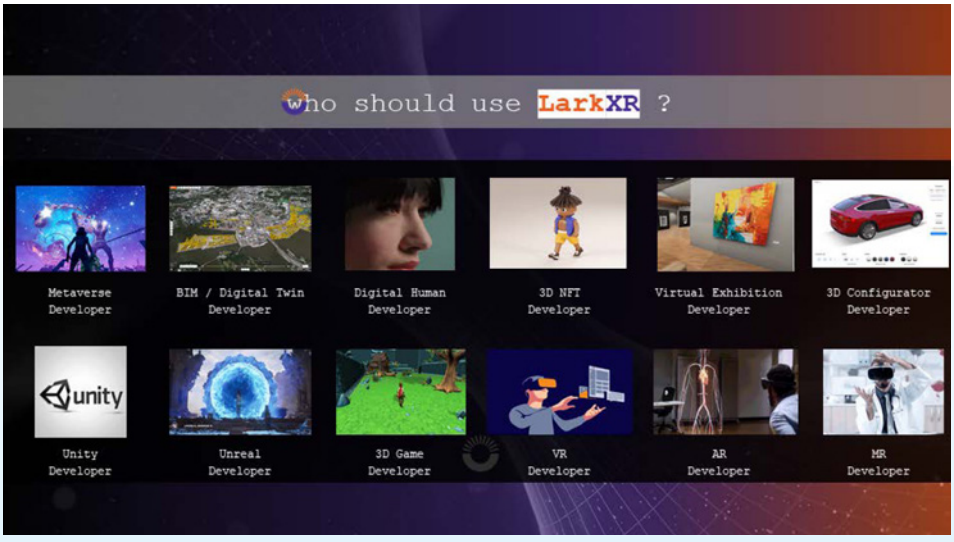
探討了 XR 技術在建造業土地測量中的應用。詳細闡述了 XR 技術的基本概念，包括 VR、AR、MR 和 XR，並強調這些技術如何通過 3D 模型和遊戲引擎實現數據視覺化，從而減少教學成本、降低判斷錯誤和加快溝通速度。XR 技術能夠將複雜的 2D 資料轉化為更易解讀的 3D 形式，顯著提升決策速度和準確性。

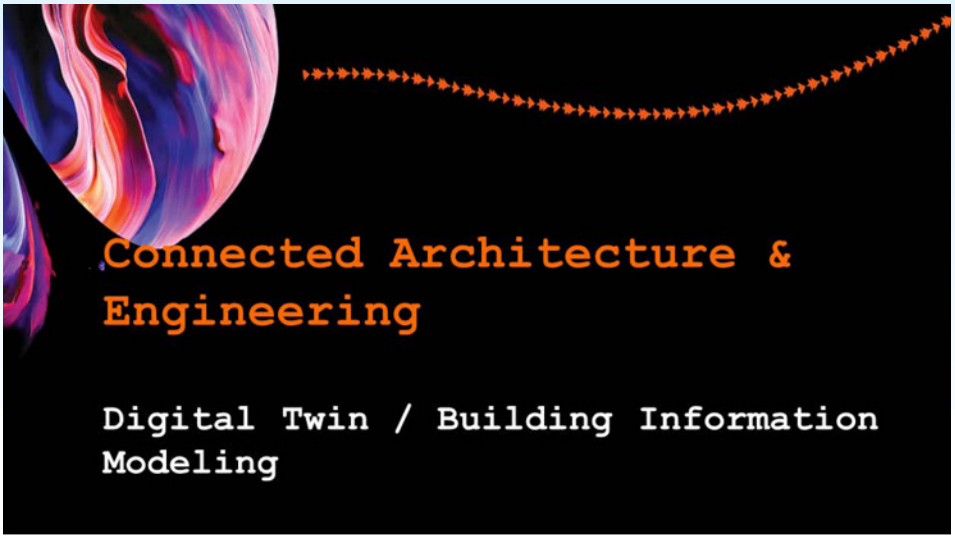
展示了多個 XR 應用實例，包括智能機場的 3D 數據整合、結合定位和 AR 技術的實時位置顯示、結合 IoT 和機械的同步數據，以及結合場地規劃的實時可視數據， XR 技術在提高工作效率和安全性方面的潛力。然而，XR 技術的推廣面臨多方數據整合、3D 處理複雜和遊戲專才缺乏等挑戰。需要大規模投資和有效的溝通策略來克服這些障礙，同時還需配置遊戲專才以支持技術落地。

此外，介紹了 Paraverse 公司及其 LarkXR 平台，該平台提供 3D XR Streaming-as-a-Service，通過優化網絡傳輸來實現高效的 3D XR 互動。強調了這些技術在建造及工程界的應用，包括數位雙胞胎和建築信息建模（BIM），這些技術能夠提供實時的可追踪反饋和沉浸式學習體驗。最後，強調了 XR 技術在提升各行業生產力和協作方面的重要性，並指出實現這一目標需要大量投資、技術人才和強有力的溝通策略。

PARAVERSE
TECHNOLOGY
借助 推流-即-服務
優化普及 BIMXR 與
Digital
TwinXR


Metaverse
as an alternative space-time of physical universe
which liberated the constraints of physical space-time for
mankind.


Who should use LarkXR ?
Metaverse Developer
BIM / Digital Twin Developer
Digital Human Developer
3D NFT Developer
Virtual Exhibition Developer
3D Configurator Developer
unity
Unity Developer
Unreal Developer
3D Game Developer
VR Developer
AR Developer
MR Developer


Connected Architecture &
Engineering
Digital Twin / Building Information
Modeling

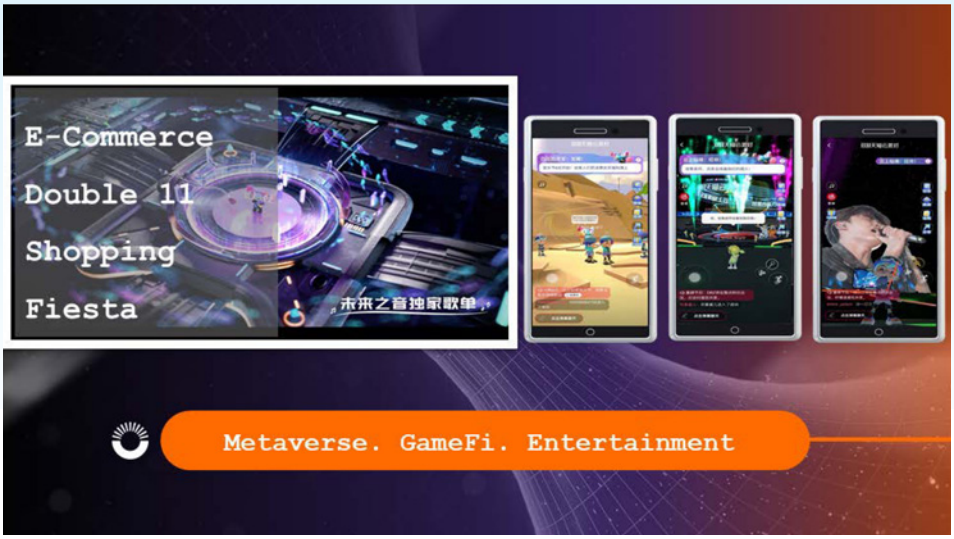
BIM Cloud Engine Platform
Digital Twin / BIM in Infrastructure
& Cities

Digital Twin Technology &
Operating System
Digital Twin / BIM in Infrastructure
& Cities

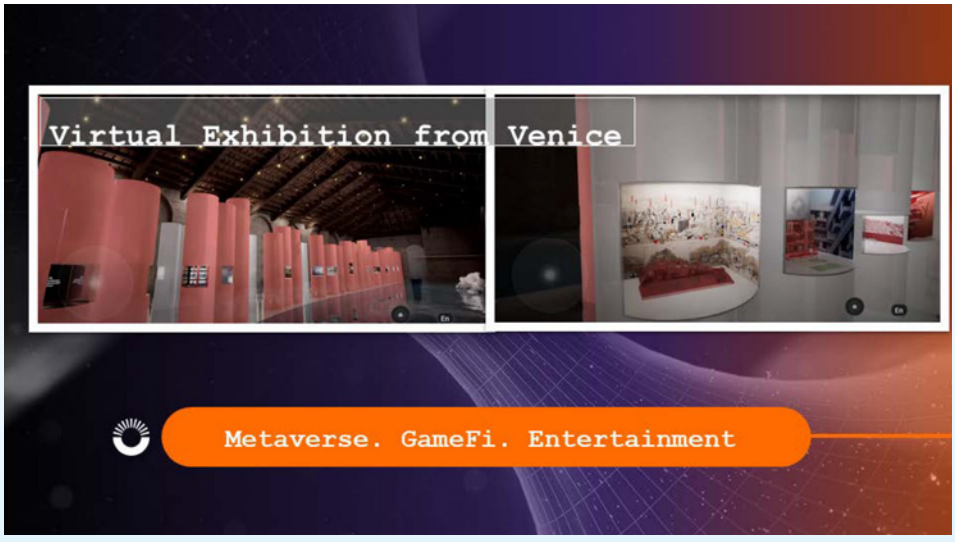
Integrated Live Surveillance
Digital Twin / BIM in Infrastructure & Cities

Connected Sports & Entertainment
Metaverse Events & Parties

Asian Game Metaverse
LOVE ASIA
Metaverse. GameFi. Entertainment


E-Commerce
Double 11
Shopping
Fiesta
未来之音独家歌单
Metaverse. GameFi. Entertainment

NetLand Pan-Entertainment
Virtual Space
Metaverse. GameFi. Entertainment


Virtual Exhibition from Venice
Metaverse. GameFi. Entertainment

Connected Education &
Training
Immersive learning in new dimensions

Immersive
Learning
5G + CloudXR
Educational Training and Simulation

LNG Ship
Operation
Educational Training and Simulation

Connected Digital Human &
Avatar
Lifelike Brilliance

Sign Language
Anchor
News & Media
Real-time Interactive Digital Human

Ultra-realistic
Digital Avatar
Customer
Services
Real-time Interactive Digital Human

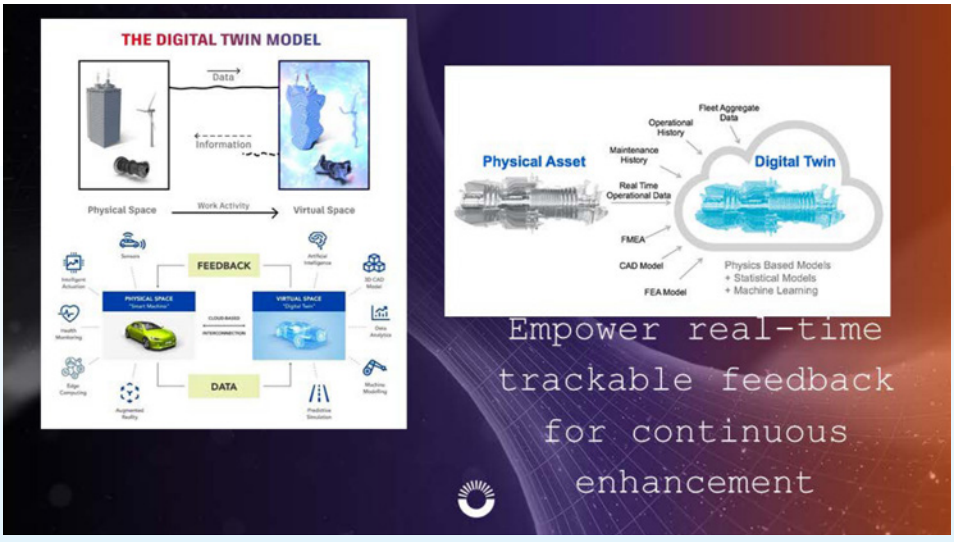
JUDY
首位数字员工
Ultra-realistic Digital Avatar
Digital Employees
Real-time Interactive Digital Human

建築工程數碼化
全面採用BIM圖則
「搬字過紙」職位
恐爆淘汰潮
業界求存須升呢
星島頭條
2024年2月29號 - 星島日報
為提高建造業的生產力，發展局在去年底公布《採用BIM模備和呈交建築圖則的路線圖》，諮詢期將於今日結束。
2018年，進一步要求顧問公司及承建商在預算3000萬元或以上的工務工程項目使用BIM。
目標於2026年起，由政府和法定機構開始逐步推展採用BIM製作和審批建築圖則，並在2029年達至全面強制性要求呈交有關模型和以該技術生成的建築圖則予部門審批。
可應用於項目整個生命周期，在設計階段就能進行碰撞檢測、成本估算、施工模擬等工作，減少現場施工過程中的問題和修改，提高工程效率、質量和安全度。
參考《路線圖》，BIM模型包含豐富的建築資產信息，有助設施管理人員規劃及保養建築設施，更可在樓宇系統和建築資產內嵌入物聯網設備和感測器，以收集即時數據。香港工程師學會專業認證小組成員梁志旋指，過去業界也會憂慮電腦性能不足以應付製作BIM的軟件，甚或要用指定軟件，但現時雲端及網上系統已廣泛應用，「基本文書電腦都足以應對，不需安裝軟件，登入網上系統也可以操作。」惟他續說，雲端或衍生私隱問題，如官方文件不能對外公開，要小心處理。

Building Information Modeling
建築信息模擬

BIM
is used for:
Hospitals
Offices
Resorts
Retail
Residential
Education
Data Centers
Infrastructure
Structural Analysis
Human Analysis
Solar Analysis
Clash Detection
Quantity Takeoff
4D Simulation
Logistics
Marketing
Facilities Management
Procurement
Virtual Reality
Mixed Reality
Augmented Reality
DESIGN
BUILD
OPERATE
BIM
Empower a full life-cycle management & collaboration

Digital Twin
數碼分身


THE DIGITAL TWIN MODEL
Data
Information
Physical Space
Work Activity
Virtual Space
FEEDBACK
DATA
Physical Asset
Digital Twin
Fleet Aggregate Data
Operational History
Maintenance History
Real Time Operational Data
FMEA
CAD Model
FEA Model
Physics Based Models
+ Statistical Models
+ Machine Learning
Empower real-time trackable feedback for continuous enhancement

Construction & Engineering

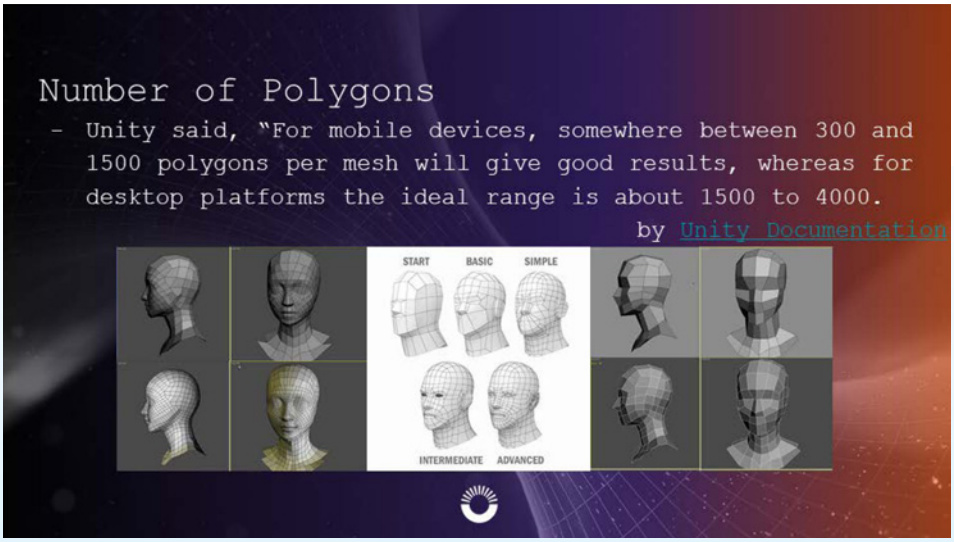
建築及工程

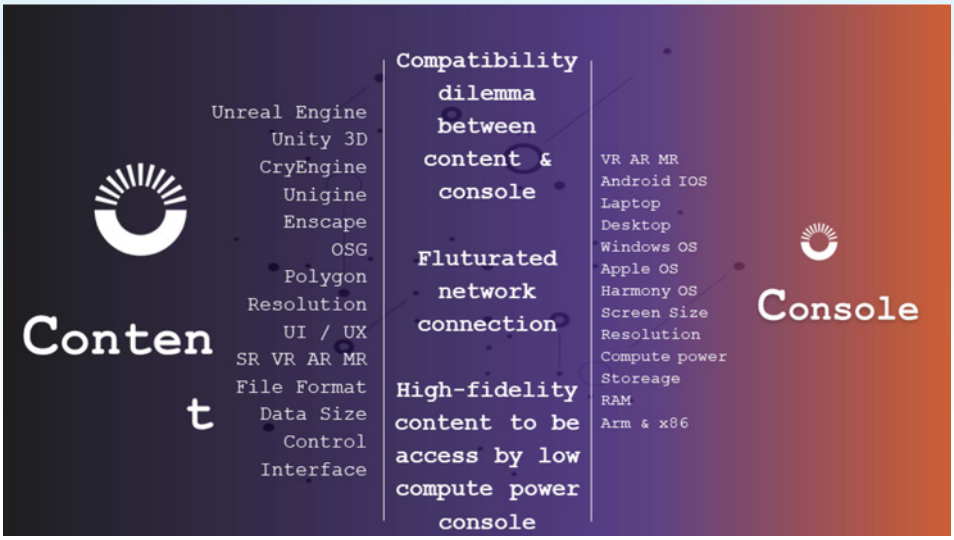
A gigantic collaboration activity
by groups of people from different perspectives
But head towards a same goal

(BIM + XR) x (Digital Twin + XR)
x Construction & Engineering

High-fidelity 3D model
>> Forms of XR interaction
>> Pragmatic Values

BLOCKERS!!!
為何難以普及應用


Number of Polygons
- Unity said, "For mobile devices, somewhere between 300 and 1500 polygons per mesh will give good results, whereas for desktop platforms the ideal range is about 1500 to 4000.
by Unity Documentation
START
BASIC
SIMPLE
INTERMEDIATE
ADVANCED


Content
Unreal Engine
Unity 3D
CryEngine
Unigine
Enscape
OSG
Polygon
Resolution
UI / UX
SR VR AR MR
File Format
Data Size
Control
Interface
Compatibility dilemma between content & console
Fluturated network connection
High-fidelity content to be access by low compute power console
VR AR MR
Android IOS
Laptop
Desktop
Windows OS
Apple OS
Harmony OS
Screen Size
Resolution
Compute power
Storeage
RAM
Arm & x86
Console

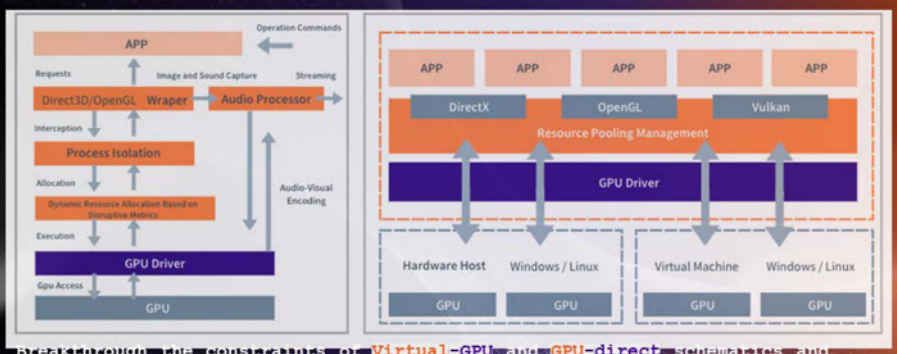
推流 3D XR Streaming-as-a-Service
就是重點Solution!

推流-即-服務
=
雲端資源整合 + 網絡傳輸優化 + 終端裝置兼容

GPU Server

圖像處理伺服器

GPU Computing Resource Pooling



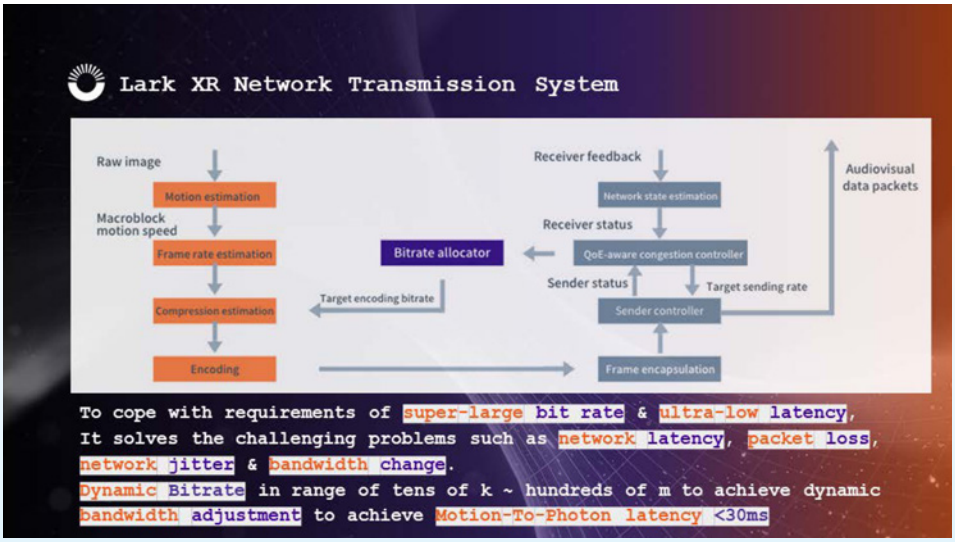
Breakthrough the constraints of Virtual-GPU and GPU-direct schematics and achieves real-time, dynamic, ultra-fine-grained GPU resources allocations. Architecting a unified GPU resource pool, promote flexiblity, efficiency & cost optimization.

Endpoint Device

終端裝置兼容適配

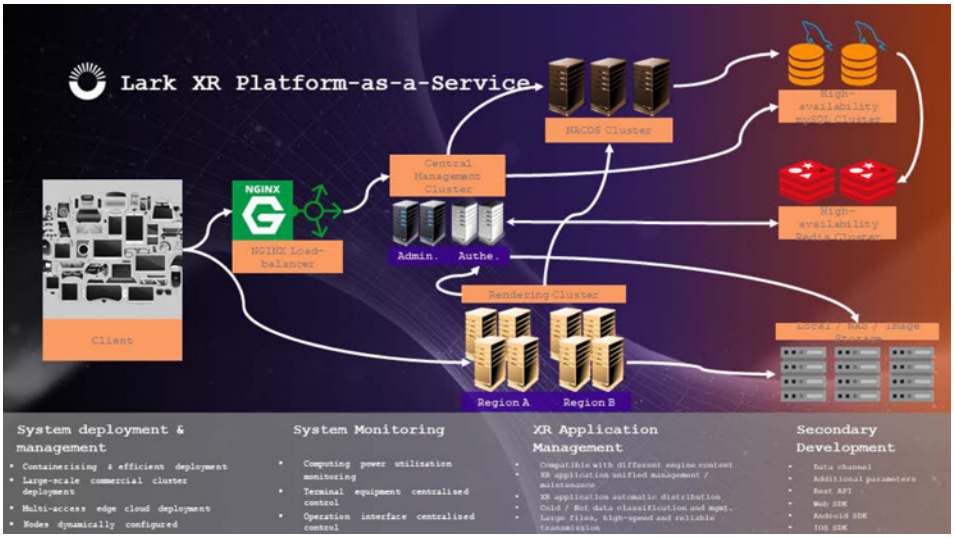
Lark XR Client Universal Access
Web Client
Native App
Quest
Pico
HTC
DPVR
Zspace
XVISIO
XReal
3rd Party Device & App
Web SDK
Andriod SDK
Unity SDK
Window SDK
iOS SDK
XR SDK
Process Audio & Visual codec decoding、Operation Command、Web RTC protocol、OpenXR proto
Open Protocol
Common Lib
Process Lark XR workflow
Based on the underlying Lark Runtime, the universal-terminal access archieves hosting and access of SR / VR / AR / MR on a single platform.

Network Transimission
網絡傳輸優化


Lark XR Network Transmission System
Raw image
Motion estimation
Macroblock motion speed
Frame rate estimation
Compression estimation
Encoding
Bitrate allocator
Target encoding bitrate
Receiver feedback
Network state estimation
Receiver status
QoE-aware congestion controller
Sender status
Target sending rate
Sender controller
Frame encapsulation
Audiovisual data packets
To cope with requirements of super-large bit rate & ultra-low latency,
It solves the challenging problems such as network latency, packet loss, network jitter & bandwidth change.
Dynamic Bitrate in range of tens of k ~ hundreds of m to achieve dynamic bandwidth adjustment to achieve Motion-To-Photon latency <30ms

LarkXR PaaS Architecture

LarkXR 的平台-即-服務 架構



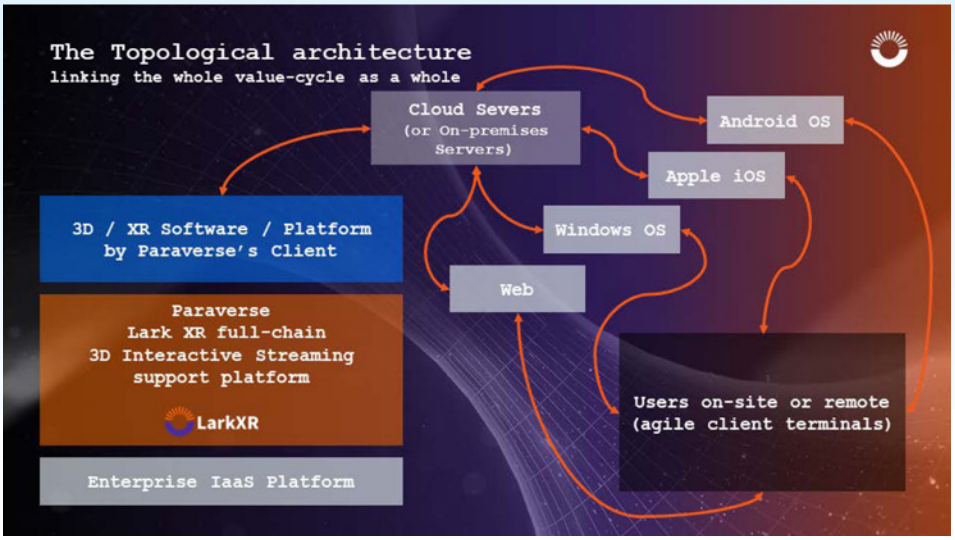
Application Reference

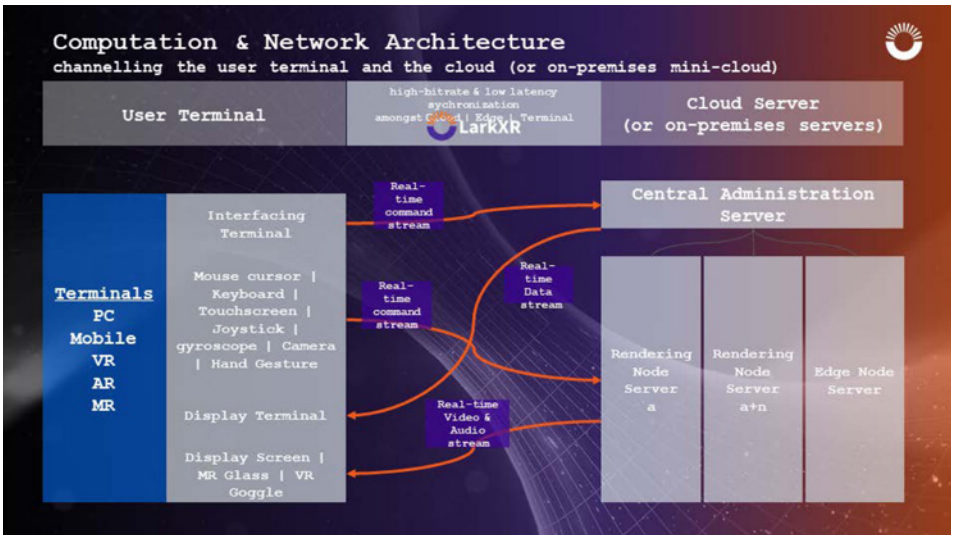
實際應用案例

OurEIM®

BN 博能股份

LarkXR
empowered
Application
s
Universal-
terminal Access
Multi-site
Access
朗迪锋
LONGTEK
To syncronize by
real fidelity data


The Topological architecture
linking the whole value-cycle as a whole
Cloud Severs
(or On-premises
Servers)
Android OS
Apple iOS
Windows OS
Web
3D / XR Software / Platform
by Paraverse's Client
Paraverse
Lark XR full-chain
3D Interactive Streaming
support platform
LarkXR
Enterprise IaaS Platform
Users on-site or remote
(agile client terminals)


Computation & Network Architecture
channelling the user terminal and the cloud (or on-premises mini-cloud)
User Terminal
high-bitrate & low latency
sychronization
LarkXR
Cloud Server
(or on-premises servers)
Terminals
PC
Mobile
VR
AR
MR
Interfacing
Terminal
Mouse cursor |
Keyboard |
Touchscreen |
Joystick |
gyroscope | Camera
| Hand Gesture
Display Terminal
Display Screen |
MR Glass | VR
Goggle
Real-
time
command
stream
Real-
time
command
stream
Real-
time
Data
stream
Real-time
Video &
Audio
stream
Central Administration
Server
Rendering
Node
Server
a
Rendering
Node
Server
a+n
Edge Node
Server

Data
Channel
It enables data interaction between the user front-end and cloud rendering-based 3D applications. This functionality is commonly used for secondary development to establish communication between the outer web page and applications, as well as between the client-side and the application.
Audio
Channel
By integrating the underlying audio and video driver layer, we can achieve data interaction of audio information between 3D applications. This integration can reduce the computational requirements on the client-side and help users overcome limitations in terminals and space-time constraints.
Video
Channel
By integrating the underlying audio and video driver layer, we can achieve data interaction of audio information between 3D applications. This integration can reduce the computational requirements on the client-side and help users overcome limitations in terminals and space-time constraints.
Collaboration
Mode
It allows for distributing GPU rendering to multiple users, achieving cost reduction and efficiency improvement. Multiple users can interactively observe the same application being operated by one person, enabling a scenario where one person operates, and multiple
simultaneously.
VR-synergy
Mode
For VR applications, two usage modes are provided: centralized and autonomous. In the centralized mode, users are assigned specific VR application operations. In the autonomous mode, users are granted the freedom to choose VR applications themselves.

Seminar on Applying XR Technologies to Empower Healthcare Industry Smartification and Digitalization
應用 XR 技能賦能醫療保健行業邁向智能化與數據化研討會

隨著科技不斷發展，醫療保健行業亦開始導入創新技術，以實現智能化和數據化轉型。為了進一步探討如何利用擴增實境（AR）、虛擬實境（VR）和混合實境（MR）等延展實境（XR）技術賦能醫療保健行業，生產力局將舉辦「應用 XR 技術賦能醫療保健行業邁向智能化與數據化研討會」，旨在向醫療保健行業界介紹 XR 技術在該領域的應用、技術概念、方法及案例研究。

香港生產力促進局於 2024 年 4 月 26 日舉辦「應用 XR 技術賦能建造業邁向智能化及數據化研討會」，此次研討會分享了這些新技術在醫療保健行業中的潛在優勢，例如運用 AR 實現手術導航和訓練、VR 用於病人治療和康復、MR 在醫學教育中的應用等

主題	講者
XR 技術在醫療康復的應用 **・虛擬實境 (VR) 精神治療系統** **・虛擬實境 (VR) 復康訓練系統**	**楊瀚博 先生** 豐睿科技創始人
擴增實境（AR）/ 虛擬實境（VR）技術在醫療保健行業中面對的機遇和挑戰 **・基於液態金屬的柔性傳感器的概念介紹** **・基於柔性傳感器制備的動捕手套在醫學 XR 領域的應用** **・基於柔性傳感器制備的可穿戴設備在醫學其他領域的應用**	**郭瀟聰 先生** 宇疊科技算法總監

XR 技術在醫療康復的應用

楊瀚博 先生
豐睿科技創始人

豐睿科技（Radiance Tech）的創始人楊瀚博先生介紹了公司的背景、業務範圍和願景，強調以人為本的經營理念和與人互動的重要性。豐睿科技專注於 VR 和 AR 內容創作平台設計，涵蓋了學習、醫療和訓練系統的開發。楊瀚博先生擁有數據分析與人工智能碩士學位，並在 2023 年獲得人工智能研究獎學金。他領導的團隊專門從事 VR/AR 在醫療和教育領域的應用。

重點介紹了 AI x VR 心理治療系統，該系統旨在通過 VR 技術創造沉浸式虛擬治療場景，幫助用戶面對和處理他們的壓力和焦慮，從而改善症狀。系統利用 AI 語音情緒識別技術，能夠準確地從用戶的聲音中識別出他們的情緒，進而提供更有效的治療方案。

還詳細描述了香港精神健康服務的現狀，指出精神科醫生數量不足，患者候診時間長。AI x VR 心理治療系統通過創新的方式解決了這些問題，提供了一種更經濟的有效治療方法，並能實時監測用戶在治療過程中的生理數據。

最後，介紹了 AI x VR 心理治療系統的應用範疇，包括抑鬱症、自閉症譜系障礙、社交焦慮症等。此外，公司還參加了香港創新科技署的公營機構試用計畫，為有需要的人士提供免費的 VR 心理治療服務。

AI x VR
Psychotherapy

VR
Rehibition
Training

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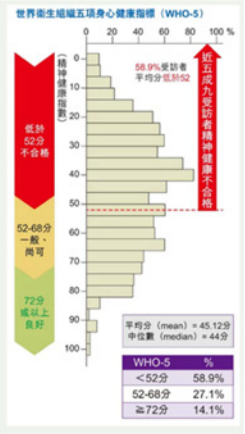
AI x VR 心理治療系統 – 背景



在香港，由食物及衛生局的香港精神健康調查2017 結果中，反映大概**七分之一**的人口有焦慮，抑鬱或其他情緒問題。

香港本地大學的研究團隊在2022年收集了3340名香港受訪者的資訊。結果顯示，16.6%名受訪者曾患抑鬱、焦慮及驚恐症等任何一種精神疾病，**每六位香港受訪者中就有一位受到精神疾病的困擾。**

傳統的心理治療費用高昂，候診時間長，只有少部分症狀已經十分嚴重的人群才會考慮接受系統性的治療，而更多只有輕微負面情緒的人只會選擇自己排解。

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什麼是AI x VR 心理治療系統？

一個幫助人們解決心理問題的**創新科技與傳統心理治療相融合的產品**，通過AI和VR技術創造沈浸式虛擬治療場景，**幫助用戶面對及學習處理他們的壓力或焦慮來源，從而改善症狀**。

其中針對有抑鬱症狀群體所設計的場景，研發訓練了一種簡單有效的，基於多特徵、多語言融合的語音情緒辨識演算法，名爲**AI語音情緒識別(SER)**，能夠實現準確地從用戶的聲音中識別出他們的情緒，並呈現每種情緒的占比，從而更方便分析用戶的情況。

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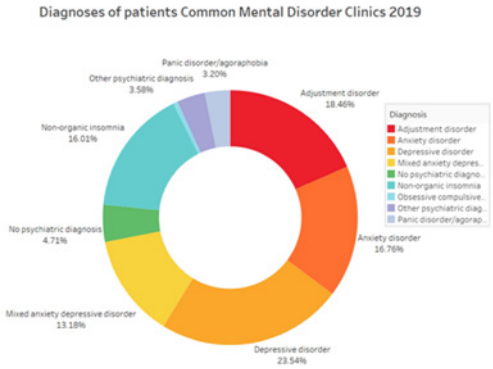

心理健康服務：
香港每 10 萬人中擁有 4.8 名公共部門精神科醫生，而類似高收入國家的數字為 8.59 名。

香港的精神科醫生不到400名，只有世界衛生組織建議的人口規模的一半。此外，患者看精神科醫師的等待時間超過2年，每次預約平均只持續6-8分鐘[5]。

Menth Health Service:
The number of public sector psychiatrists per 100,000 people was 4.8 for Hong Kong, vs 8.59 for similar high-income countries.

With less than 400 psychiatric doctors, Hong Kong had half the number recommended by the WHO for our population size. Furthermore, patients' wait time to see a psychiatrist is more than 2 years, and each appointment lasts on average only 6-8 minutes [5].

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AI x VR 心理治療系統解決的問題

AI x VR 心理治療系統的優勢

- 社工、輔導員能利用該系統為情況較輕微和中度的群體實施治療
- 舒緩當前社會的心理醫生的不足和輪候時間過長等問題
- 提供更創新、更有效和合符經濟效益的治療方法
- 能夠實時檢測用戶在治療過程中的心跳率、呼吸率、心率變異性(HRV)、和血壓

AI x VR 心理治療系統的應用範疇

- 抑鬱症
- 自閉症譜系障礙
- 希望舒緩壓力的普通人群
- 社交焦慮症
- 與分離相關的焦慮症

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AI x VR 心理治療系統 – 應用

VR心理治療系統 VR Psychotherapy System

公營機構試用計畫 Public Sector Trial Scheme (PSTS)

為實踐研發成果在社會層面上的可行性及跟進試用效果，我們已聯合**香港心理衛生會**及**基督教家庭服務中心**，參加有香港創新科技署推出的公營機構試用計畫，為符合使用條件的有需要人士提供**免費**的VR心理治療服務。

To test the feasibility of the research results at the community level and to follow up on the effectiveness of the trial, we will launch a public sector trial programme in collaboration with the Mental Health Association of Hong Kong and the Christian Family Service Centre to provide **free** VR psychotherapy services to individuals in need.

香港心理衛生會
The Mental Health Association of Hong Kong

預計計畫時長一年，每人將會獲得4-6節免費VR心理治療服務，將會有150-400名受精神健康問題困擾的人士受惠。

The programme is expected to last for one year and each person will receive **4-6 sessions** of free VR psychological therapy, will benefit **150-400** people suffering from mental health problems.

基督教家庭服務中心
Christian Family Service Centre

通過與大學得合作，我們也期望相關的心理輔導部門可以使用VR心理治療系統作為教育工具，提高學生對情緒病問題的認識以及學習相關的情緒控制技巧。

By cooperating with universities, we also expect that relevant psychological counseling departments can use the VR psychotherapy system as an educational tool to improve students' awareness of emotional disorders and learn related emotional control skills.

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HONG KONG SHUE YAN UNIVERSITY

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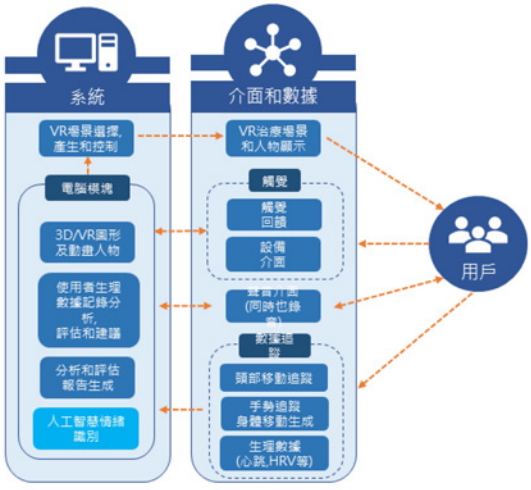
AI x VR 心理治療系統 – 系統結構



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AI – Speech Emotion Recognition 語音情緒識別(SER)

Communication is central to human society, and speech is one of the most important media. A single sentence might have multiple meanings based on different emotions. In this research, 7 speech emotions neutral, happy, angry, sad, fear, disgust and surprise will be investigated to recognized.

溝通是人類社會的核心，而言語是最重要的媒體之一。根據不同的情感，單一句子可能有多種含義。我們系統能識別6種言語情緒：快樂、憤怒、悲傷、厭惡、恐懼和中性

HAPPY | SADNESS | FEAR

DISGUST | ANGER | NEUTRAL

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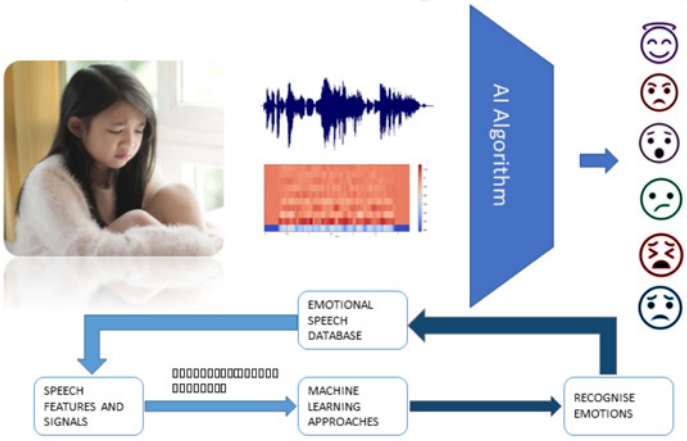
AI – Speech Emotion Recognition 語音情緒識別(SER)



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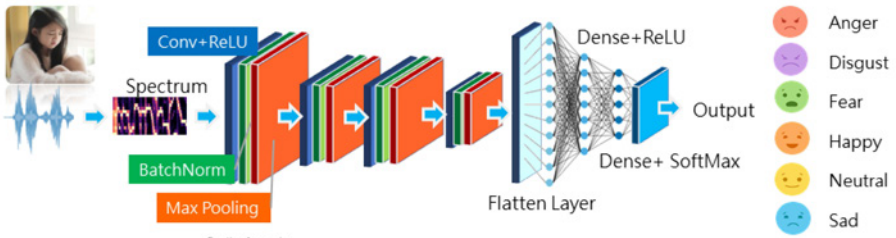
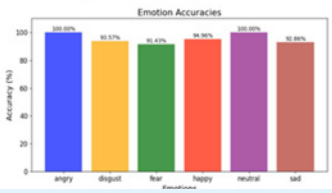
AI語音情緒識別

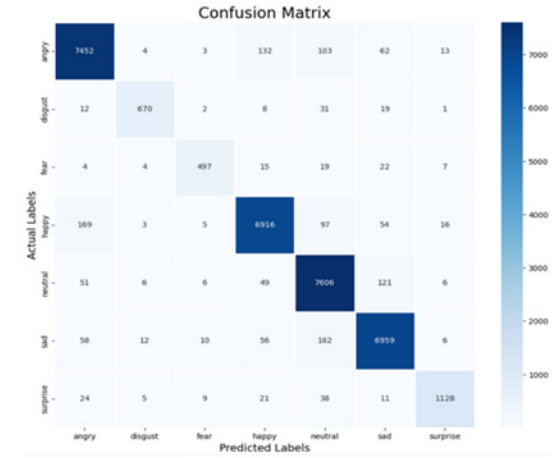
透過人工智能演算法，我們的AI x VR心理治療系統能夠辨識6種情緒：憤怒、厭惡、恐懼、快樂、中性和悲傷。





市面上的人工智慧演算法，準確率普遍在80%左右，而我們研發訓練的人工智慧演算法，廣東話情緒識別的準確率高達94%，普通話和英語情緒識別準確率高達95%

Models Prediction Performance



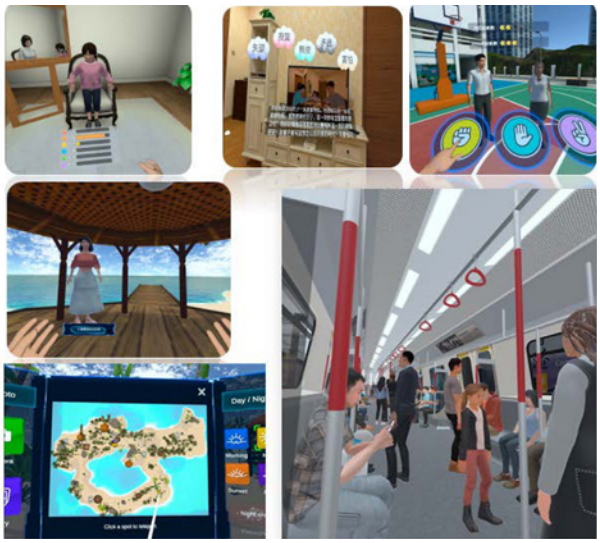
The accuracy of 7 emotions recognized are also evenly distributed and achieved about 95.5 % accuracy in average.

Emotions	Accuracy	Precision	Recall	F1-score
Angry	95.5%	95.9%	95.9%	95.9%
Disgust	95.5%	95.2%	90.2%	92.6%
Fear	95.5%	93.4%	87.5%	90.4%
Happy	95.5%	96.1%	95.3%	95.7%
Neutral	95.5%	94.4%	97.0%	95.7%
Sad	95.5%	96.0%	95.8%	95.9%
Surprise	95.5%	95.8%	91.3%	93.5%
Macro Average	95.5%	95.3%	93.3%	94.2%
Weighted Average	95.5%	95.6%	95.5%	95.5%

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

AI x VR 心理治療系統 –治療場景

AI ×VR Psychotherapy – scenarios



AI x VR 心理治療系統 – 內容

Overview of the VR Psychotherapy – Menu in Lobby Scene

一覽VR心理治療 – 大堂場景中的功能表

- 抑鬱症Depression
- 社交焦慮症Social Anxiety
- (與分離相關的)焦慮症 Anxiety related to Separation
- 自閉症 Autism
- 靜觀Mindfulness

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AI x VR 心理治療系統 – 治療場景

The Crying Child –Depressive Symptoms
哭泣小孩–抑鬱症狀

理論基礎Theory Base

1. 自我慈悲Self-Compassion / 慈悲聚焦療法 Compassion-focused Therapy
   - 促進和培養臨床人群的自我慈悲對提升他們的幸福感有所幫助
     Facilitating and cultivating self-compassion in clinical populations is helpful in improving their well-being
   - 對於覺得自己不值得同情或發現自我同情會刺激厭惡記憶的患者來說，直接鼓勵自我同情的感覺會很困難，而VR治療能夠改善這個情況
     Directly encouraging self-compassionate feelings can be difficult for some patients who feel they do not deserve compassion or find it stimulates aversive memories; using VR therapy could improve the situation
2. 此前的研究已經證明這種VR療法能夠令抑鬱症群體受益,減少他們的自我批評同時增加自我慈悲
   Previous research has proved that VR therapy can benefit the depression group, reducing their self-criticism while increasing self-compassion

Embodying Compassion: A Virtual Reality Paradigm for Overcoming Excessive Self-Criticism

Caroline J. Falconer[1], Mel Slater[2,3], Aitor Rovira[2], John A. King[1], Paul Gilbert[4], Angus Antley[2], Chris R. Brewin[1]*

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The Crying Child
哭泣小孩 – 為有抑鬱症狀的人群所設計的VR治療

玩家將在一系列指導的幫助下習慣虛擬環境和虛擬身體

The players will become accustomed to the virtual environment and their virtual bodies with the help of a series of guidance

玩家將被提供安慰句子，這些句子分別對應「慈悲的回應」中的三個基本階段（認可情緒，轉移注意力和啟動記憶）
The players will be provided with generic sentences that correspond to three essential stages for giving a compassionate response (validation, redirection of attention and memory activation)

他們將被指示盡可能記住這些句子
They will be instructed to memorize the sentences as best they can

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The Crying Child
哭泣小孩 – 為有抑鬱症狀的人群所設計的VR治療

玩家需要根據先前的練習用特定的安慰句子安撫哭泣的女孩
The players will give compassionate responses to the crying girl

隨著玩家完成「慈悲的回應」的三個階段，女孩將由最開始的掩面痛哭轉爲開心
The girl is first crying into her hands, but as the players finish the third stage of the compassionate response, she will stop crying and smile happily

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The Crying Child
哭泣小孩 – 為有抑鬱症狀的人群所設計的VR治療

玩家將化身爲剛剛哭泣的女孩，並在指導下熟悉女孩的身體

The players will be embodied in the body of the child and become accustomed to the child's body with the help of a series of guidance

玩家將從女孩的視角重新體驗一遍「慈悲的回應」
The players will reexperience their compassionate response from their new perspective as the girl

這一階段將重播他們最開始的成人化身，給予女孩慈悲回應時的聲音
There will be a real-time replay of their original adult avatar delivering compassion, which includes the replay of their own voice

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The Crying Child
哭泣小孩 – 為有抑鬱症狀的人群所設計的VR治療

AI(人工智能)語音情緒識別 AI Speech Emotion Recognition

- 一種簡單有效的基於多特徵、多語言融合的語音情緒辨識演算法已應用於針對憂鬱症患者設計的VR心理治療場景。具體來說，當玩家對哭泣的孩子做出富有同情心的回應時，所實現的模型可以準確地從玩家的聲音中識別出他們的情緒，然後呈現每種情緒的比例。
  A simple and effective speech emotion recognition algorithm based on multi-feature and multi-languages fusion has been applied in the VR psychotherapy scenario designed for depressive clients. Specifically, when the players giving compassionate response to the crying child, the implemented model can accurately recognize players' emotions from their voices and then present the proportion of each type of emotion.

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AI x VR 心理治療系統 – 治療場景

Rock, paper, scissor –Autistic Symptoms
包剪揼 –自閉症狀

理論基礎Theory Base

1. 相關的研究表明：
   i. 治療過程中可運用遊戲以提升自閉症兒童的社交能力
   ii. 自閉症患者存在檢測謊言方面的困難
   iii. 許多自閉症患者存在情緒調節障礙

Studies have stated that (a) games can be adopted in therapy sessions to enhance autistic children' s abilities in social interaction, (b) individuals with ASD have difficulties in detecting lie, and (c) many individuals with ASD struggle with emotion regulation impairments

2. 身體掃描Body Scanning

- 輸掉遊戲可能會引起玩家的負面情緒，而通過在遊戲中途設置身體掃描環節，玩家能夠學會調節情緒，知道如何讓自己平靜下來，並接受遊戲總有輸贏
  Losing a game can cause negative emotions in the players, and by having body scanning practice in the game, the players can learn to regulate emotions, know how to calm themselves and accept the fact that there will be winners and losers as long as there is a game.
- 經過數次身體掃描練習後，他們的認知能力可能會得到提高
  Their metacognitive skills may be improved after repeated trials of body scanning

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Rock, paper, scissor
包剪揼 – 為有自閉症狀的人群所設計的VR治療

玩家將處身於學校操場中，NPC會邀請玩家一齊玩包剪揼遊戲

The players will be in a playground and be invited by NPC Ben to play the rock, paper, scissor game

NPC將會為玩家介紹遊戲規則

NPC Anna will introduce the rule of the game to the players

玩家在理解遊戲規則並準備好後，需要點擊眼前的按鈕來開始遊戲

The players will click on the button to start playing once they' ve understood the game rule and are ready to play

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Rock, paper, scissor
包剪揼 – 為有自閉症狀的人群所設計的VR治療

NPC會喊出「包，剪，揼」，然後玩家需要選擇三個手勢中的一個

NPC Ben will call out "Rock, paper, scissor," and then the players need to choose one of the three hand signals

NPC會隨機出示三個手勢之一

NPC Anna will form one of the three hand signals as well

根據本輪的輸贏情況，兩個 NPC 會有不同的反應

Two NPCs' reactions depend on who is the winner of the present round

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Rock, paper, scissor
包剪揼 – 為有自閉症狀的人群所設計的VR治療

玩完四輪遊戲後，玩家將在一系列指導下進行身體掃描練習

After playing four rounds of the game, the players will have the body scanning practice with a series of guidance

身體掃描練習結束後，玩家將再進行兩輪遊戲

The players will have another two rounds of the game after body scanning

根據遊戲最終的輸贏情況，兩個 NPC 會有不同的反應

Two NPCs' reactions depend on who is the winner of the game

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Rock, paper, scissor
包剪揼 – 為有自閉症狀的人群所設計的VR治療

Rock, paper, scissor –Autistic Symptoms
包剪揼 –自閉症狀

We have designed "tricky rounds" to elicit varied emotions from children

我們在遊戲裡面設計了一些「欺騙局」以激起患有自閉症的小朋友的各種情緒

錯誤提示： NPC會告訴玩家她要出什麼，但她實際上不會出她所說的手勢

Wrong Hint: NPC Anna will tell the player what she is going to throw, but she will not actually throw the object she said

正確提示： NPC會告訴玩家她要出什麼，而她實際上會出她所說的手手勢

Correct Hint: NPC Anna will tell the player what she is going to throw, and she will actually throw the object she said

根據本輪欺騙局的輸贏情況，兩個 NPC 會有不同的反應，而這種反應與普通局稍有不同

Two NPCs' reactions depend on the winner of the present round; there is a slight difference between the response in the tricky round and the usual round of the game

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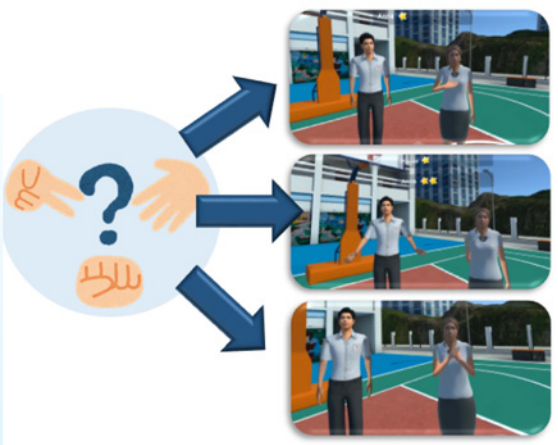
Rock, paper, scissor
包剪揼 – 為有自閉症狀的人群所設計的VR治療



如果NPC獲勝，那麼她會得到一張貼紙
NPC會鼓勵玩家再接再厲

If NPC Anna wins, then she will receive one sticker
NPC Anna will encourage the player

如果是平局，那麼玩家和NPC都會得到一張貼紙
NPC會邀請玩家再玩一輪

If both player and NPC Anna throw the same object, it' s a tie, then player and NPC Anna will each receive a sticker
NPC Ben will invite player to have one more round

如果玩家獲勝，則玩家會得到一張貼紙
NPC會拍手稱讚玩家

If the player wins, then the player receives one sticker
NPC Anna will clap her hands and praise the player

Radiance

AI x VR 心理治療系統 – 治療場景

MTR –Social Anxiety Symptoms
搭地鐵 –社交焦慮症狀

理論基礎Theory Base

1. 認知行為療法Cognitive Behavioral Therapy (CBT)
   - 幫助人們瞭解並改變導致恐懼反應的無負面自動想法，進而改變相對應的行為與反應
     Helping people learn to identify and then change the automatic negative thoughts that contribute to phobic reactions, resulting in changes in corresponding behaviors and reactions
2. 暴露療法Exposure Therapy
   - 在這種形式的治療中，心理學家創造了一個安全的環境，使人們被“暴露”在他們害怕和回避的事情之中
     In this form of therapy, psychologists create a safe environment in which to *expose* individuals to the things they fear and avoid.
3. 研究發現基於VR的CBT比起普通CBT在「真實情境暴露治療」方面更為有效
   Research has found VR-CBT to be more effective than normal CBT with in *vivo expos*

Radiance

MTR 搭地鐵 – 為有社交焦慮症狀的人群所設計的VR治療

玩家將在太子站聆聽VR心理學家Kaylee的一系列指導

The players will be in Taizi station and listen to a series of guidance from VR psychologist Kaylee

玩家準備好後需要點擊“開始練習”按鈕
The players need to click on the “start practicing” button when they are ready

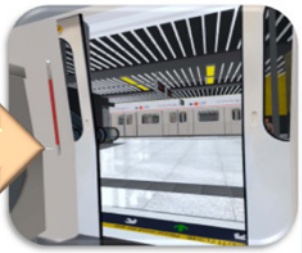
在聽完Kaylee的指示後，玩家將走向車門
After listening to Kaylee’s instructions, the players will walk

玩家站在門前等待地鐵到來

The players will stand before the door and wait for the train to arrive

Radiance

MTR 搭地鐵 – 為有社交焦慮症狀的人群所設計的VR治療



玩家走入地鐵

The players will walk into the train

玩家在地鐵車上站立直到到達目的車站

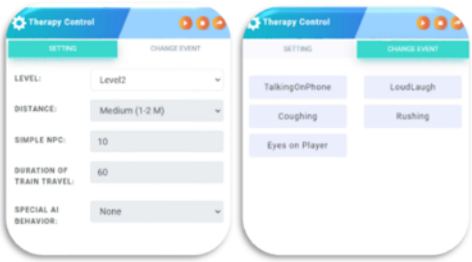
The players will stand on the train until they arrive at the destination station

抵達目的車站後，玩家下車

The players will get off the train once they’ ve arrived

Radiance

MTR搭地鐵 – 為有社交焦慮症狀的人群所設計的VR治療



The players/admin is able to customize the difficulty level; they are allowed to set (a) the number of ordinary passengers and special passengers, (b) the ethnicity of ordinary passengers, (c) the distance between the player and the passengers, (d)the speed of the train, and (e) the particular behavior of special passengers (including calling phone, laughing aloud, coughing constantly, making eye contact with the player, rushing by the players)

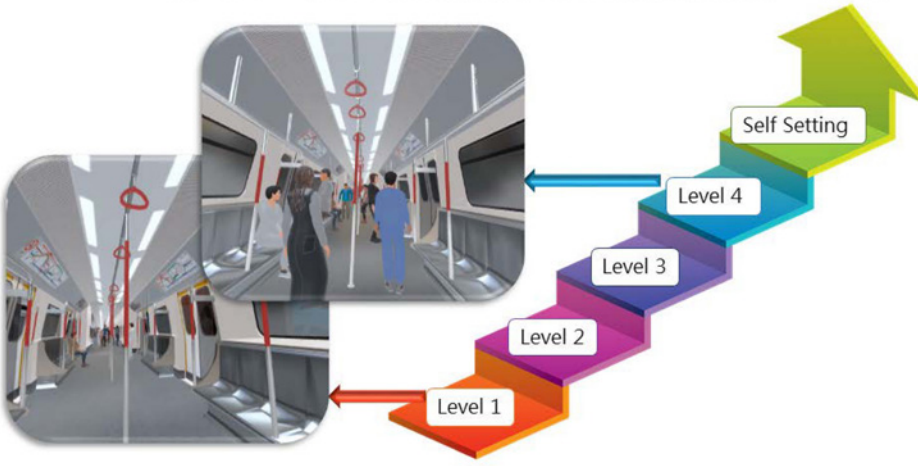
遊戲難度設置Difficulty Level Setting

- 玩家/管理員可以提前設置每次練習的難度，不同難度在下方的變量上會有所不同：
  I. 乘客人數
  II. 玩家與乘客之間的距離
  III. 玩家需要乘坐的車站數

  The player/admin can set the difficulty level in advance; the number of passengers, the distance between the player and passengers, and the number of stations that the player needs to take varied on the basis of the preset difficulty level
- 玩家/管理員也可以選擇自定義難度，自行設置下方變量：
  I. 列車行駛時長
  II. 普通乘客的種族
  III. 玩家與乘客之間的距離
  IV. 普通乘客及特殊乘客的人數
  V. 特殊乘客的特殊行為（打電話，大笑，不斷咳嗽，與玩家有眼神接觸，與玩家擦肩而過）

Radiance

MTR 搭地鐵 – 為有社交焦慮症狀的人群所設計的VR治療



Radiance

AI x VR 心理治療系統 – 治療場景

The Emigration Story – Anxiety Related to Separation
嫲嫲的故事 –（與分離相關的）焦慮症

理論基礎Theory Base

1. 敘事治療Narrative Therapy

- 通過讓玩家體驗移民故事，輔助玩家檢視自己在場景中出現的想法以及不同想法對他們的影響，進而啟發玩家重新建構新的關乎他們個人的生活故事，避免他們將問題內化的同時增強他們處理分離問題的信心
  By the means of allowing players to experience the immigrant story, it 's expected to assist players to examine their thoughts show up in the scene and the impact of these thoughts, resulting in inspiring players to reconstruct their personal life stories, avoid them from internalizing problems while enhancing their confidence in dealing with separation problems

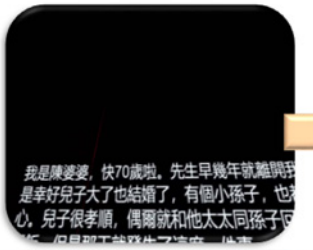
2. 情緒意識Emotion Awareness

- VR治療師幫助玩家識別並理解處在特定情境之中的感受
  VR therapist helps players identify and understand their emotions in specific situations

- 具體來說，場景中的VR心理治療師會不斷鼓勵玩家在情境中思考自己的想法，指引玩家關注自己的身體變化，同時讓玩家嘗試定義特定情境下出現的情緒。這樣的過程讓玩家越來越清楚自己對於分離的情緒，從而幫助玩家更快度過因分離而出現的難關
  Specifically, the VR therapist in the scene keeps encouraging players to think their thoughts when being in the situation; she asks them to focus on their physical change while letting them try to define certain emotions. Such a process makes players increasingly aware of their emotions towards separation, which helps them go through the difficulties of separation faster

Radiance

The Emigration Story – Anxiety Related to Separation
嫲嫲的故事 –（與分離相關的）焦慮症



玩家首先會聽到一位嫲嫲的自我介紹，讓他們意識到自己在遊戲中就是這位嫲嫲

The players will first listen to a short self-introduction in the voice of a granny, making them aware that they are going to be in the role of the granny

玩家將處身於客廳裡同兒子一家吃飯

The players will be in the living room

Radiance

The Emigration Story – Anxiety Related to Separation
嫲嫲的故事 –（與分離相關的）焦慮症

在與兒子對視後，兒子會告訴玩家他即將帶著妻女移民到加拿大
After having eye contact will the son, the son will tell the players that he is about to immigrate to Canada with his wife and daughter

玩家將聆聽嫲嫲和兒子之間的對話
The player will listen to the conversation between the son and the granny

對話結束後，玩家將處身於屋內
The players will be in the house after the conversation

VR心理治療師 Kaylee 將指引玩家，他們可以在這裡觀察自己對兒子即將移民一事的情緒和反應
VR therapist Kaylee will inform players this is where they can observe their emotions and reactions toward the fact that son is going to immigrate

Radiance

The Emigration Story – Anxiety Related to Separation
嫲嫲的故事 –（與分離相關的）焦慮症

玩家可以在屋內走動
The players can walk around the house

玩家可以按照指示點擊電視
The players can follow the instruction and click on the TV

電視裡會播放一家人一起吃飯的場景
The TV will play the scene of granny’ s family eating together

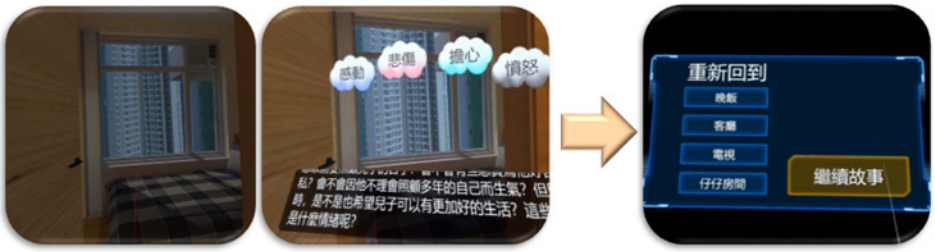
玩家將在VR心理治療師Kaylee的一系列指導下回憶自己的感受
The players will recall their feelings with a series of guidance from VR therapist Kaylee

玩家可以在屋內走動
The players can walk around the house

玩家可以按照指示點擊兒子的房門
The players can follow the instruction and click on the son’ s room door

Radiance

The Emigration Story – Anxiety Related to Separation
嫲嫲的故事 –（與分離相關的）焦慮症



玩家可以看到兒子的房間內部
The players can see the son’ s room

玩家將在VR心理治療師Kaylee的一系列指導下回憶自己的感受
The players will recall their feelings with a series of guidance from VR therapist Kaylee

玩家可以選擇重新體驗前四個場景或繼續故事
The player can choose to reexperience the previous four scenes or to experience the next scene

Radiance

AI x VR 心理治療系統 – 治療場景

The Island Beach – Relaxation
小島沙灘 – 放鬆

理論基礎Theory Base

- 沉浸式VR放鬆遊戲為玩家的身心放鬆提供了一個有效，便捷，可控，個性化，自助的方法
  The immersive virtual reality mental relaxation game provides an effective, convenient, controllable, personalized, self-service method for relaxing the mind and body
- 過往研究顯示：
  1. 玩放鬆性質的遊戲不僅可以減少玩家的攻擊性，還可以增加親社會行為；
  2. 玩放鬆性質遊戲的玩家在在玩後會表現出積極的情緒狀態，進而促進親社會行為；
  3. 相比於非沉浸式環境，沉浸式環境中心理放鬆的效果要更好

  Previous research has demonstrated that (a) playing relaxing video game not only decrease aggression but also increase prosocial behaviour, (b) People who played a relaxing video game showed an elevated positive mood state afterwards, which in turn facilitated helping behavior, and (c) compared to a non-immersive environment, the effect of psychological relaxation in an immersive environment is much better

Radiance

The Island Beach – VR Therapy Designed for Relaxation
小島沙灘 – 為放鬆而設計的VR治療

- 在這個場景中，玩家沒有具體的任務要完成：我們鼓勵玩家自由探索場景並獲得真實的體驗
  In this scenario, the players have no specific task to complete; we encourage players to explore the scene freely and get an authentic experience

- 在這個場景中，玩家可以：
  1. 隨意走動；
  2. 拾起地上的貝殼；
  3. 通過菜單拍照，更改背景音樂，以及更改沙灘中的時間，欣賞日出日落

  In this scenario, players are able to (a) walk around randomly, (b) pick up the shells on the beach, and (c) use the menu to take photos, change the time on the beach, enjoy the sunrise and sunset

Radiance

The Island Beach – VR Therapy Designed for Relaxation
小島沙灘 – 為放鬆而設計的VR治療

Radiance

AI x VR 心理治療系統 – 治療場景

The Mindfulness Beach – Mindfulness
靜觀沙灘 – 靜觀練習

<u>理論基礎Theory Base</u>

- 研究承認，利用沉浸式VR為基礎的靜觀可能會證實比傳統的靜觀對各種臨床幹預更加有效
  Research admitted that immersive virtual reality-enhanced mindfulness may prove especially effective for a wide range of clinical interventions where traditional mindfulness is currently proving valuable.
- 越來越多的證據表明，基於正念的幹預措施可以有效改善許多生物心理社會狀況，包括抑鬱、焦慮、壓力、失眠、成癮、精神病、疼痛、高血壓、體重控制、癌症相關症狀和親社會行為
  Accumulating evidence demonstrated that mindfulness-based interventions are effective for improving many biopsychosocial conditions, including depression, anxiety, stress, insomnia, addiction, psychosis, pain, hypertension, weight control, cancer-related symptoms and prosocial behaviors
- 利用沉浸式VR為基礎的靜觀被證明能夠令人更加放鬆，增加自我效能，減少走神並保留更多注意力資源
  According to the majority of the studies, VR-supported mindfulness guarantees increasing relaxation self-efficacy, reducing mind wandering, and preserving attention resources.

Radiance

The Mindfulness Beach – VR Therapy Designed for Mindfulness
靜觀沙灘 – 為靜觀而設計的VR治療

- 在這個場景中，玩家可以自由體驗三種不同時長及種類的靜觀，在沙灘上跟隨指導音頻進行練習
  In this scenario, players can freely experience three different durations and types of mindfulness and practice on the beach following the guidance audios
- 相比於傳統的靜觀，在靜觀沙灘中玩家可以：
  1. 沉浸於沙灘場景中；
  2. 隨時開關/更改背景音樂；
  3. 在靜觀練習結束後收穫個人的生物數據

  Compared with traditional mindfulness, players are able to (a) immerse themselves in the scene of the beach, (b) turn on/turn off/change the background music at any time, and (c) receive their biological data after the mindfulness practice.

Radiance

The Mindfulness Beach – VR Therapy Designed for Mindfulness
靜觀沙灘 – 為靜觀而設計的VR治療

The Mindfulness Beach –Mindfulness 正念沙灘 – 正念

三種正念練習The Three Mindfulness Practices

1. 正念呼吸Mindful Breathing
   - 訓練玩家直接、有意識地調節內部身體狀態；
     Breathing exercises train players to directly and consciously regulate internal bodily states;
   - 靜觀呼吸練習僅需幾個步驟，易於掌握，可在日常生活中隨時應用
     Having only a few steps to follow, the breathing exercise is easy to master and can be applied in daily life at any time

2. 感恩練習Gratitude Practicing
   - 鼓勵玩家回顧日常生活中值得感恩的美好事物和人；
     Gratitude practicing encourages players to reflect on the good things and people that are worthy of gratitude in their daily lives;
   - 感恩練習可以改善睡眠品質，促進心理和社交層面的健康，並訓練自我調節能力
     It improves sleep quality, boosts mental and social well-being, and trains self-regulation skills

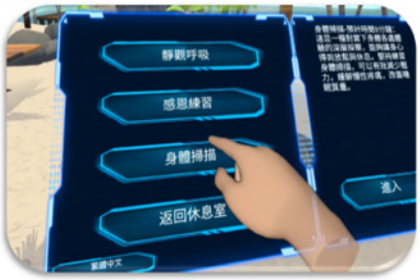
3. 身體掃描Body Scanning
   - 要求玩家先集中注意力於呼吸，然後再將意識轉移到身體的其他部位，從頭到腳或從腳到頭“掃描”自己的身體；
     Players are instructed to concentrate on their breathing before shifting their awareness to other body areas, "scanning" their bodies from head to feet or from feet to head;
   - 在此過程中，鼓勵玩家公開、不帶評判地觀察和接受他們所經歷的感覺，如果分心，則可以輕輕地將注意力帶回自己的身體；
     During this process, players are encouraged to observe and accept the sensations they experience openly and nonjudgmentally and gently bring attention back to their body if distracted

Radiance

The Mindfulness Beach – VR Therapy Designed for Mindfulness
靜觀沙灘 – 為靜觀而設計的VR治療

玩家可以開啓/關閉背景音樂
The players can turn on/off the background music

玩家可以更改背景音樂
The players can change the background music as they like



玩家可以調節背景音樂，環境音樂，以及語音導航的音量
The players can volume up/down the background music, ambient sounds, and voice navigation

玩家將在語音導航的指導下進行靜觀練習
The players will experience mindfulness with the guidance of voice navigation

Radiance

Radiance VR Psychotherapy System

Client's Profile 來訪者基本資料			
Surname in Chinese 姓（中文）	鮑	Surname in English 姓（英文）	BAU
Given names in Chinese 名（中文）	勃	Given names in English 名（英文）	Bob
ID 參加者編碼	2	Assisted Filler's Name 協助填寫者姓名	—
Gender 性別	Male 男	Assisted Filler's Relationship with Client 協助填寫者與來訪者關係	—
Age 年齡	18	Education 教育程度	Secondary or Matriculation 中學
Date of Birth 出生日期	2004-11-01	Working Status 工作狀況	Student 學生
Nationality 國籍	Chinese	Marital/Relationship Status 婚姻/關係狀況	Bachelor/Spinster 未婚
Religion 宗教信仰	No Religion 沒有宗教信仰	Phone Number 電話號碼	1234-5678
Involved Institution 所參加的機構名稱	Other 其他	Email 電子郵箱	BobBAU@gmail.com

Assessment Before Therapy 治療前評測結果*					
Date 填寫問卷日期	2021-06-07	Symptom 症狀	Difficulty making conversation and maintain close friendships, challenges with regulating emotions		
Status of Mental Health 個人精神情緒狀況	已確診精神疾病 精神疾病名稱：Autism Spectrum Disorder 確診年份： 2009	Previous Received Treatment 過往接受的治療	None		
Questionnaire 1 Result 問卷一結果	SDQ 社交行為表現問卷 (成人): 18，(總分 50，17 分或以上爲高)	DASS-21 Result 情緒自評量表結果	Anxiety 焦慮程度	4, Mild 輕度	
			Depression 抑鬱程度	3, Normal 正常	
Questionnaire 2 Result 問卷二結果	—		Stress 壓力程度	8, Mild 輕度	

Assessment After Therapy 治療后評測結果*					
Result of the Psychometric Scale Within One Week 一周內的問卷結果*					
Date 填寫問卷日期	2021-07-05	Symptom 症狀	Difficulty making conversation and maintain close friendships, challenges with regulating emotions		
Status of Mental Health 個人精神情緒狀況	已確診精神疾病 精神疾病名稱：Autism Spectrum Disorder 確診年份： 2009	GEQ Result 遊戲體驗量表結果	沉浸感	1.0	總分 4
			流暢感	1.0	總分 4
			能力	1.0	總分 4
			積極情緒	0.8	總分 4
			挑戰性	0.8	總分 4
			消極情緒	1.0	總分 4
			不安/加強感	1.0	總分 4
		SUS Result 系統易用性量表結果	67.5	D, Fail 不及格	
Questionnaire 1 Result 問卷一結果	SDQ 社交行為表現問卷 (成人): 15，(總分 50，17 分或以上爲高)	DASS-21 Result 情緒自評量表結果	Anxiety 焦慮程度	4, Mild 輕度	
			Depression 抑鬱程度	3, Normal 正常	
Questionnaire 2 Result 問卷二結果	—		Stress 壓力程度	7, Normal 正常	

Radiance

AI x VR 心理治療系統 – 後台管理

即時監測

場境中用戶所見所經歷的即時影像

場境控制

透過控制台根據用戶反應即時調整場境

病人生理資料監測

HRV、心跳率、呼吸率和血壓

自動化報告

自動生成和儲存用戶治療報告

Radiance

AI x VR 心理治療系統 – 競爭分析

解決痛點和創造價值 Resolve Problems and Create Values

我們的AI x VR心理治療系統提供了一種創新的治療和培訓工具

無藥無副作用

改善治療效果

縮短治療時間

目前在香港或亞洲市場幾乎沒有真正的VR療法，與西方大學在VR技術方面的試驗研究相比，我們的系統有以下優勢：

獲取語音情感識別資料

AI輔導員根據用戶反應提供回饋和建議

實時檢測用戶數據，同步用戶所見畫面，控制場景事件

獲取更多資料類型，例如心率、血壓、HRV（顯示患者精神壓力水準）

用手控制和互動場景，戴上智慧手錶。無需佩戴/固定額外的感測器

自動生成和儲存用戶治療報告

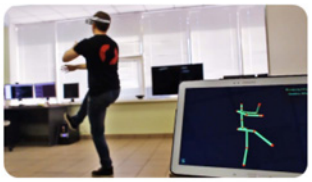
VR 康復訓練系統 VR Rehabilitation Training System

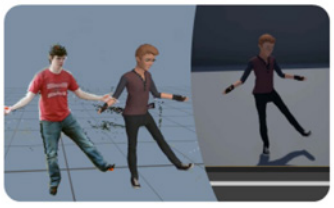
在運用VR心理治療架構下，我們在開發VR康復訓練系統。

我們的系統集成了VR視覺化和全身運動跟蹤技術。它是身臨其境的，反應靈敏，便於用戶的身體運動。該技術適用于老年人康復，身體訓練教育等。

Using the VR similar therapy Architecture, we are also developing a VR Rehabilitation Training System.

VR visualization and full-body motion tracking. It is immersive and responsive which facilitates user’ s body movement.





Radiance

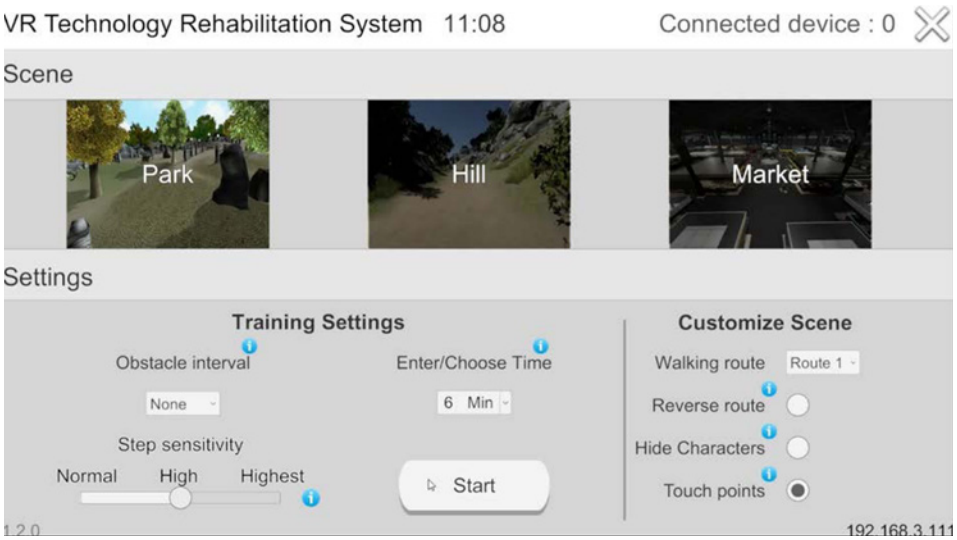
VR康復訓練場景

公園場景 Park

香港效野行山 Hong Kong Countryside Tours

香港街市場場景 Hong Kong Market Scene

場景交互點 Interacting point



Radiance

VR康復訓練與評估
VR Rehabilitation Training and Assessment

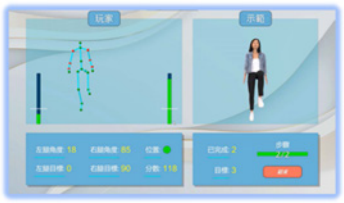
1. 開始訓練之前，在系統鍵入使用者資料，並選擇訓練時長，場景
Enter the user data in the system before training, select training duration and preferred scene.

2. 開始訓練，場景中的動畫根據使用者的活動而變化，用戶可以在訓練中獲得積分，樂趣十足，
Start training. The animation in the scenes changes according to the user's activity. Users may earn points during the training, full of fun.

3. 訓練結果匯總並生成excel格式檔
Training results summarized and generated in excel format.

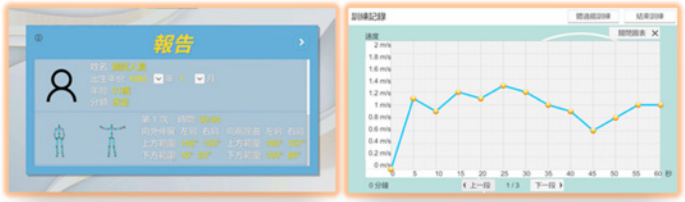
Radiance

VR 康復訓練系統
VR Rehabilitation Training System



1. 訓練開始之前可以錄入用戶的個人資料。訓練開始後，跟隨畫面中的人物做動作，軟體便可以測量出相關的訓練資料。

Input users' personal data (i.e. name, age) before the training starts. The software measures the training data (e.g. angle of shoulder movement) by following the movements of the characters on the screen.



2. 訓練報告：訓練結束之後可以即時取得訓練資料，包括訓練前後的資料比對。

Training report: instant access to training data after training, including pre- and post-training data comparisons.

Radiance

AI x VR 心理治療系統 – 後台管理

VR治療控制監測 VR Therapy Control and Monitoring

即時監測場境中病人所見所經歷的即時影像
Real time Streaming, see what patient is seeing and what is happening in VR scene

場境控制
透過控制台根據病人反應 調整場境
Control the event and flow of the scene

病人生理資料監測
心跳率，HRV壓力指數，Patient's data from biofeedback sensor

自動化報告

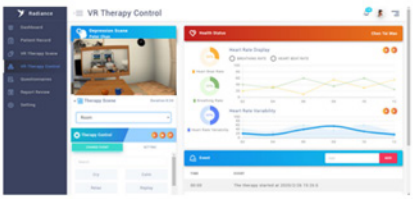
自動生成和儲存病人治療報告
Automated reports generation and storage

Radiance

AI x VR 心理治療系統 – 後台管理

系統管理面板 VR Therapy Admin Portal

概要 Dashboard



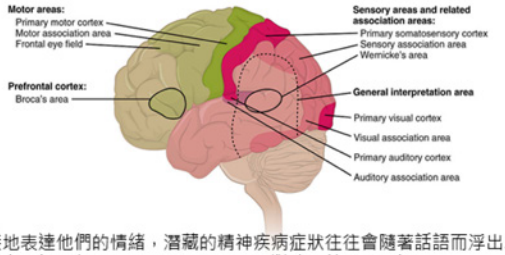
治療場境控制和監測
Scene setting control and monitoring

網頁版的即時視頻和音訊串流，無需安裝
Web-based real streaming of video and audio, no installation required

選擇合適治療場境 Therapy Scenarios Selection

AI（人工智慧）語音情緒識別
Speech Emotion Recognition
語音轉情感
Voice To Emotions

說話這一動作涉及上百塊肌肉的共同參與，有著龐大的大腦區域和體感網絡的支持。
Speaking involved over 100 muscles and supported by a large network of brain region and somatosensory.

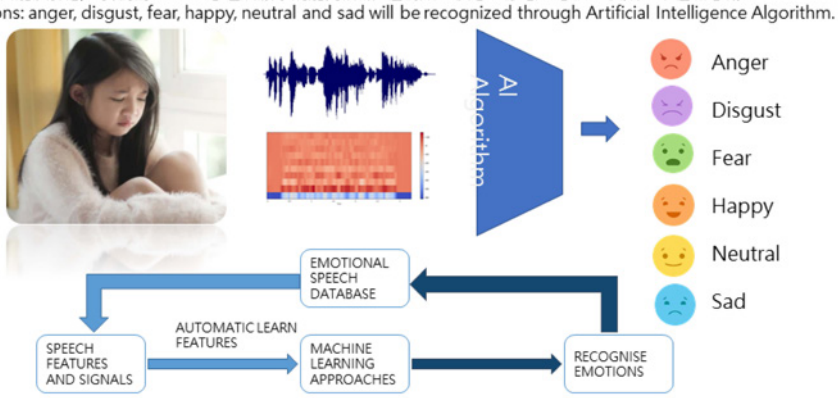


因爲人們的言語能夠更爲直接地表達他們的情緒，潛藏的精神疾病症狀往往會隨著話語而浮出水面（具體而言，抑鬱症患者說話時音調較低，語言單調，聲音較小，更加容易出現猶豫，結巴和低語）
Speech express emotions directly and symptoms are often difficult to hide (i.e depressed person tend to have lower pitch, monotonous speech, low sound intensity, more hesitation, stuttering and whispering)

Radiance

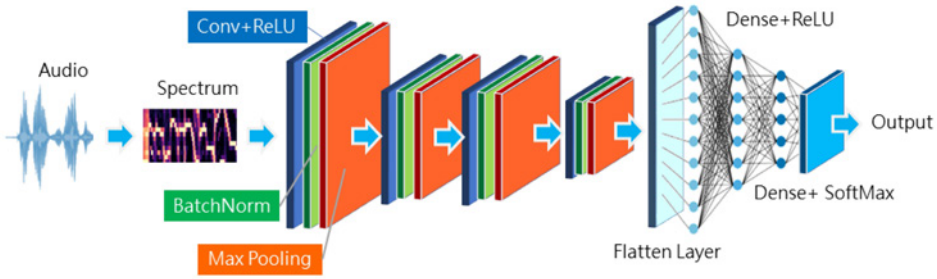
AI x VR 心理治療系統 – AI語音情緒識別
AI（人工智能）語音情緒識別- Speech Emotion Recognition

透過人工智能演算法，我們的AI x VR心理治療系統能夠辨識6種情緒：憤怒、厭惡、恐懼、快樂、中性和悲傷。
6 emotions: anger, disgust, fear, happy, neutral and sad will be recognized through Artificial Intelligence Algorithm.



Radiance

AI x VR 心理治療系統 – AI語音情緒識別
情緒識別(SER) AI模型架構

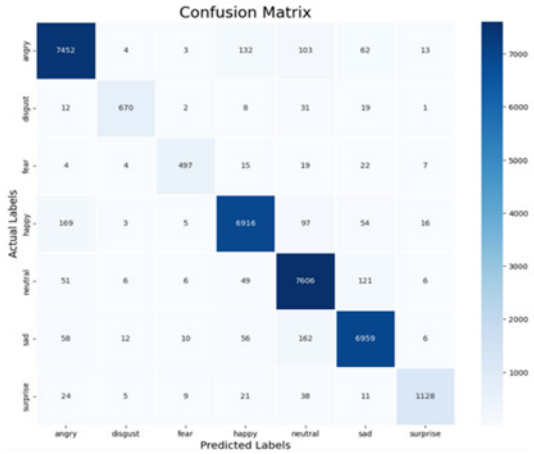


4 Convolution Layers: The layers have 256, 128, 128 and 64 filters respectively. The Convolution Layers, interspersed with activation functions, ReLU to form a ConvNet

Max Pooling, Batch Normalization & Dropout are used
Dense: Fully connected operations on the input,
1st layer : 32 units + ReLU
2nd layer: 7 units + SoftMax

Radiance

語音情緒識別 模型性能預測
SER Models Prediction Performance



在模型中，7種情緒——憤怒、厭惡、恐懼、快樂、中性、悲傷和驚喜識別的準確率也分佈均勻，平均準確率達95.5%左右。

The accuracy of 7 emotions: anger, disgust, fear, happy, neutral, sad and surprise recognized are also evenly distributed and achieved about 95.5 % accuracy in average.

Emotions	Accuracy	Precision	Recall	F1-score
Angry	95.5%	95.9%	95.9%	95.9%
Disgust	95.5%	95.2%	90.2%	92.6%
Fear	95.5%	93.4%	87.5%	90.4%
Happy	95.5%	96.1%	95.3%	95.7%
Neutral	95.5%	94.4%	97.0%	95.7%
Sad	95.5%	96.0%	95.8%	95.9%
Surprise	95.5%	95.8%	91.3%	93.5%
Macro Average	95.5%	95.3%	93.3%	94.2%
Weighted Average	95.5%	95.6%	95.5%	95.5%

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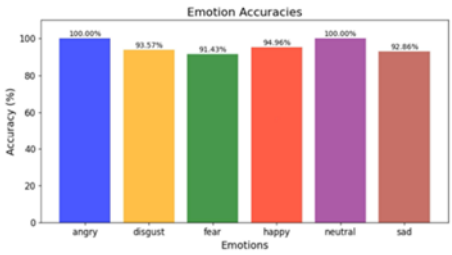
語音情緒識別 模型性能預測
SER Models Prediction Performance

廣東話情緒識別的準確率高達94%，普通話和英語情緒識別準確率高達95%。

The accuracy rate achieve up to 94% in Cantonese and 95% in Mandarin and English.




```
Total speech files processed: 828
Total speech files successfully recognized: 780
Overall accuracy: 94.20%

Accuracy by emotion:
Emotion | Accuracy   | Processed  | Recognized
-------------------------------------------------
happy   | 94.96    % | 139        | 132
sad     | 92.86    % | 140        | 130
angry   | 100.00   % | 120        | 120
disgust | 93.57    % | 140        | 131
fear    | 91.43    % | 140        | 128
neutral | 100.00   % | 139        | 139
```

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What is AI x VR Psychotherapy System?

- This is a product that **integrates virtual technology and traditional psychotherapy** to help solve common mental health problems by offering a wide range of immersive therapy scenarios, the system help clients **face and learn to deal with their sources of stress or anxiety, thereby reducing their symptoms**.
- Specifically, we have trained and developed a simple and effective **AI Speech Emotion Recognition Algorithm**, which is built based on multi-feature and multi-language fusion. The model has been proven to have 95% accuracy and is utilized in our system. It can accurately identify six types of emotions in the user's voice, showing the proportion of each emotion, making it easier for the admin to analyze the user's situation.

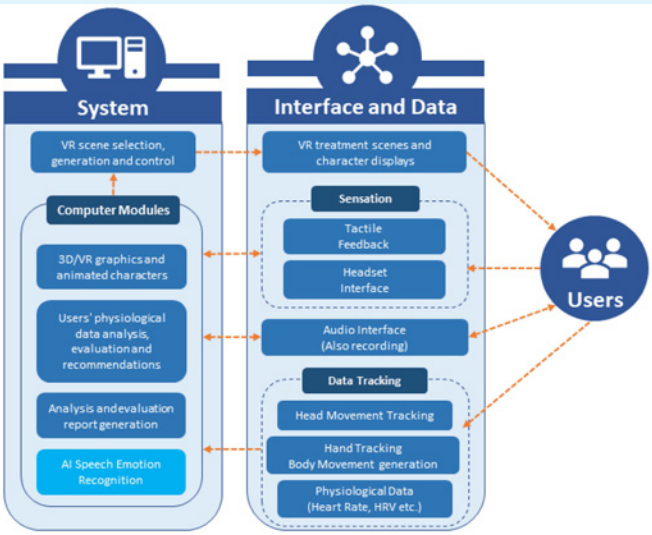
Advantages of AI x VR Psychotherapy System

- Psychological institutions and social workers could offer professional therapy to individuals with mild to moderate symptoms of mental illness
- Reduce costs and lighten the issue of lacking professional mental health support
- Provide a more innovative, effective, and cost-effective treatment
- Able to detect clients' heart rate variability (HRV), heart rate, respiratory rate, and blood pressure in real-time during treatment

Application scope of AI x VR psychotherapy system

- Depression
- Autism Spectrum Disorders
- General people who want to relieve stress
- Social Anxiety Disorder
- Anxiety Related to Separation

AI x VR Psychotherapy System – System Structure



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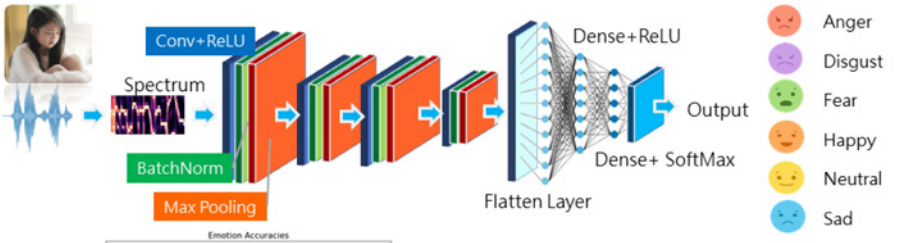
AI Speech Emotion Recognition

Through the AI Speech Emotion Recognition Algorithm, our AI × VR psychotherapy system can accurately identify six types of emotions in the user's voice



The accuracy of AI algorithms on the market is generally around 80%. However, what we developed and trained has a high accuracy of **94%** in Cantonese emotion recognition and **95%** in Mandarin and English emotion recognition.

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AI x VR Psychotherapy System – Backstage Management

Admin Control Panel

Real Time Streaming

See what patient is seeing and what is happening in VR scene

Scene Control

Control the event and flow of the scene

Monitor Physiological Data

Including heart rate, blood pressure, respiratory rate, and HRV

Automated Report

Automatically generate and store clients' treatment reports

擴增實境（AR）/ 虛擬實境（VR）技術在醫療保健行業中面對的機遇和挑戰

郭瀟聰 先生
宇叠科技 算法總監

講者詳細介紹了上海宇疊智能科技有限公司在新材料技術研發及應用方面的創新和成就，特別是液態金屬油墨在柔性傳感器領域的革命性突破。公司通過自主研發的液態金屬合金，生產出可拉伸且具高彈性、柔韌性和導電性的柔性傳感器，處於全球技術領先地位。

液態金屬複合彈性體材料與其他可拉伸導電材料相比，具有更高的導電性和彈性性能，並且抗疲勞性能優異，理論上可無限次拉伸。這一技術的商業化應用，使得公司在國內外市場上佔據了重要地位。

展示了柔性傳感器的多種應用場景，包括動作捕捉、旅遊與遊戲交互設備、運動康復及醫療領域。例如，在虛擬主播和影視動畫等領域，柔性傳感器可用于高精度的動作捕捉；在運動康復中，傳感器可檢測運動姿態和肌肉數據，應用於護膝、護肘、腕帶等產品。

此外，柔性傳感器在汽車和機器人領域也有廣泛應用，如自動駕駛方向盤觸摸檢測、智能座艙乘客信息檢測以及協助機器人示教與遙遠操作。還展示了其在醫療實驗室培訓和手術模擬培訓中的應用，強調產品的輕薄、穿戴舒適、交互靈敏、數據精確和實時同步性。

最後，提到公司在材料、工藝、算法、通信、電學和結構等方面已申請 20 項專利，未來兩年內預計專利數量將達百項。公司積極響應國家和地方政策，參與多項數字經濟和健康中國相關計劃，致力於推動新材料技術在各行業的深度應用與融合發展。

液态金属油墨 ——

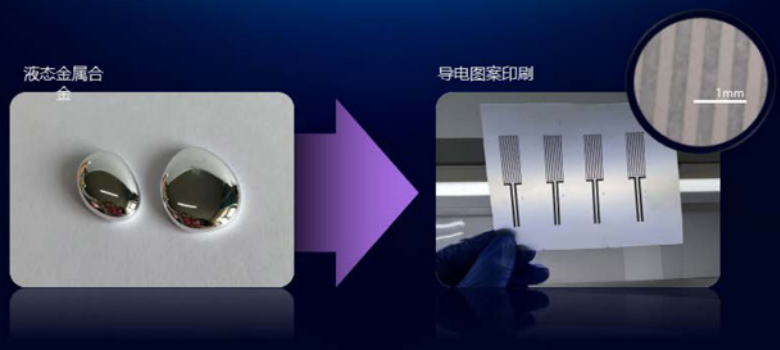
柔性传感器的革命性突破

上海宇叠智能科技有限公司——新材料技术研发、应用商

Shanghai Udexreal Intelligence Technology Co., Ltd.

UDEXREAL

新材料：液态金属油墨



柔性可拉伸传感器

公司以自主研发的新材料液态金属为基础，从而生产出可拉伸柔性传感器的技术处于全球第一梯队。目前全球范围内对于该技术的研究仍处于实验室阶段，尚无第二家公司将该技术商业化。公司更是国内当前唯一一家在该领域深耕的企业

特性

高弹性　柔韧性　导电性

优点

抗疲劳　抗挤压　可量产

可拉伸导电材料性能对比

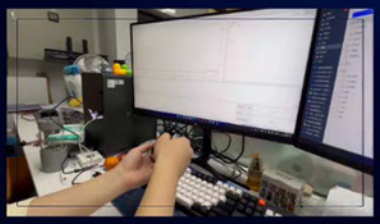
	导电性	弹性性能	疲劳性能
液态金属复合弹性体材料 Udexreal®UM21	约10^5 S/m	约1000%	理论上可无限次数拉伸
可拉伸碳纳米材料 DUPONT™INTEXAR™PE761	约10^4 S/m	约110%	约10次循环拉伸即失效
可拉伸金属纳米材料 DUPONT™INTEXAR™PE874	约10^5 S/m	约110%	约100次循环拉伸即失效
可拉伸导电聚合物材料 HeraeusClevios™ - PEDOT:PSS	约10^3 S/m	约100%	约100次循环拉伸即失效

柔性传感器技术对比

	检测方向	技术基础	相关企业	优缺点
柔性薄膜传感器	压力	导电纳米材料	能斯达、柔宇科技、 MC10、Flexpoint	生产工艺较为复杂，成本较高；无法水洗；无法折叠拉伸；存在疲劳度
纤维传感器	压力	尼龙纤维 +传感器	棉捷科技 Nextiles	生产工艺极其复杂，需要特殊机器，成本很高；只能微弱拉伸；存在疲劳度
宇叠柔性传感器	拉伸+压力	液态金属+ 高分子材料	宇叠科技	生产工艺较为简单；可量产；成本可控；可水洗；可折叠拉伸；理论上无限疲劳度

柔性传感器展示

形变传感器



压力传感器

形变传感器应用场景—动作捕捉
虚拟主播
B站有23万名虚拟主播开播，
年增长率190%。
影视动画
专业动捕手套市场1.8亿元。
虚拟仿真培训
超万家虚拟仿真公司。
产品形态：手套、服装
UDEXREAL
141

形变传感器应用场景—旅游、游戏交互设备
C端用户
全球VR头显C端用户3500万台
73%为游戏玩家。
线下体验店
国内线下体验店5000多家。
产品形态：动捕手套VR版
UDEXREAL
142

VR游戏交互
产品轻薄
穿戴舒适
交互灵敏
携带便捷
数据精准
时实同步
Pimax
Light
Comfort
Sensitive
Interactive
Precise
Convenient

形变传感器应用场景—运动康复
运动市场
职业运动：国内注册运动员120万，
优秀运动员17937人。
休闲跑步：Keep跑步用户月活743万，占市场50%。
休闲骑行：自行车爱好人群960万，
野途APP日活19.7万。
医疗市场
康复检测：国内康复医院810家，增长率10%，
市场规模1800亿元。
康复训练：国内肌肉骨骼患者3.2 亿人，
康复医师3.57：人群10万。
产品形态：护膝、护肘、腕带
产品性能：检测运动姿态、检测肌肉数据
UDEXREAL
144

护膝产品展示
产品轻薄
穿戴舒适
交互灵敏
携带便捷
数据精准
时实同步
Light
Comfort
Sensitive
Interactive
Precise
Convenient

医疗实验室培训
产品轻薄
穿戴舒适
交互灵敏
携带便捷
数据精准
时实同步
Light
Comfort
Sensitive
Interactive
Precise
Convenient
UDEXREAL

手术模拟培训
产品轻薄
·
穿戴舒适
·
交互灵敏
·
携带便捷
·
数据精准
·
时实同步
欢迎体验强生Attune膝关节置换模拟器
确认
Light
·
Comfort
·
Sensitive
·
Interactive
·
Precise
·
Convenient

医疗操作记录
缝合
手术

压力传感器应用场景—触摸、压力检测
➢汽车领域
方向盘：自动驾驶方向盘触摸检测，
市场需求2000万个/年。
智能座舱：检测车辆乘客信息，
全球市场规模2200亿元。
➢机器人领域
示教、遥操作：国内协作机器人市场
规模26.79亿元。
电子皮肤：人形机器人，
市场尚未打开。
产品形态：柔性传感器
UDEXREAL
149

Control System
System
Performance
Daily Target