A Powerful MR Solution Enhanced by Vision AI Technology

ArchiFiction Achieves Naked Eye Mixed Reality Using RealSense Depth Cameras

ArchiFiction

Established in Hangzhou, China in 2017, ArchiFiction has created a technology platform that powers mixed reality environments for work and play—without requiring people to put on headgear or other wearable devices.

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n'Space equipment with RealSense camera sensors

Challenge

Mixed reality (MR) technologies have the potential to revolutionize the way people interact with each other and with their surroundings. Unfortunately, traditional MR environments require users to wear bulky headgear to enable immersive experiences.

Solution

The ArchiFiction n'Space product is a projector-based virtual reality platform that delivers mixed reality experiences a headset or other wearable device. The RealSense™ Depth Camera D455 contributes to a stunning audio-visual n'Space experience. Where space is at a premium, Dexter Li, ArchiFiction Product Manager says "the advantage of the RealSense solution lies in its native ability to accommodate visible light and infrared sensors in one unit. This consolidation has substantially enhanced our data processing capabilities and made our development process more efficient."

Results

n'Space has brought naked-eye mixed reality solutions to many industries, including educational research, industrial manufacturing, and commercial entertainment. By superimposing digital data like images, videos, and 3D models onto the physical environment, its unique solutions improve how people perceive and interact with their surroundings.

Introduction

As the next evolution in social connection and the successor to the mobile internet, Mixed reality (MR) environments allow people to work, meet, game, and socialize together in 3D spaces. These systems can replace keyboards, mice, and flat-panel displays with new types of interfaces that immerse users in simulated, virtual worlds. Unfortunately, traditional MR environments require users to wear bulky headgear to enable these immersive experiences. ArchiFiction has revolutionized this expansive market with a "naked-eye" 3D spatial system that delivers a stunning audio-visual experience without requiring people to cover their faces with electronics.

Enabled by RealSense technology, the n'Space system achieves this social and spatial breakthrough via the integration of specialized hardware components, software applications, and AI algorithms. In addition, suspending the device above the physical space allows for the high-fidelity reproduction of the virtual world and a one-to-one, three-dimensional representation of real scenes.

Within this physical environment, the n'Space system uses two types of camera sensors from RealSense: the RGB visible light sensor and the infrared point cloud sensor. The RGB sensor is used to recognize human movements and postures, as well as to detect specific users. The infrared sensor measures the relative distances between important points on the human body and in space. Each n'Space system uses five RealSense cameras, ten sensors total.

Branded experience marketing allows retailers to present products in immersive settings.

An AI-Driven Machine Vision System

As a pioneer in the mixed reality arena, ArchiFiction caters to multiple markets and industries associated with 3D applications, including architectural modeling, industrial simulation, brand marketing, and metaverse-based on-site cultural tourism. The foundation of its unique 3D world is a human skeletal model and spatial human posture recognition algorithm, integrated with a sophisticated machine vision system. RealSense integrates five sets of visible-light and infrared point cloud sensor matrices, ensuring complete coverage and precise user positioning within the virtual space. The sensors are strategically positioned to precisely locate both the human body and eye positions. When more than one individual is engaged in the experience, the system leverages the target detection capabilities of RealSense to differentiate among them.

"The RealSense technical support team has consistently provided timely and effective responses, whether addressing hardware issues or supporting the development environment and tools. This level of support is a constant assurance to our R&D team."

-Dexter Li, Product Manager, ArchiFiction

The global shutter in the RealSense RGB sensor improves the correlation between visible light and depth data, resulting in better accuracy. Human posture and location data can be transmitted in real-time, enabling the n'Space system to render realistic visual images.

"As a hardware device for accessing the metaverse, our product stands out from artificial reality, virtual reality, and CAVE [Cave Automatic Virtual Environment]-type solutions," says Dexter Li, ArchiFiction's product manager. "Within this immersive environment, users feel like they are part of the scene, enabling interaction technology that is truly unique in the market."

Dynamic tracking, posture recognition, location triggering, voice interaction, and peripheral control enable n'Space to deliver these interactive experiences. The device quickly scans the individual to capture relevant 3D data from the RealSense sensors. It determines the person's height and appropriate viewing angle, which may shift according to their orientation in the physical space. The positioning system also precisely tracks and captures the viewer's movements, allowing the projections and visual effects to change accordingly. The result is a deeply immersive experience where the 3D environment reacts to the viewer's every move.

Architectural scale awareness allows people to walk through virtual homes, buildings, and cityscapes.
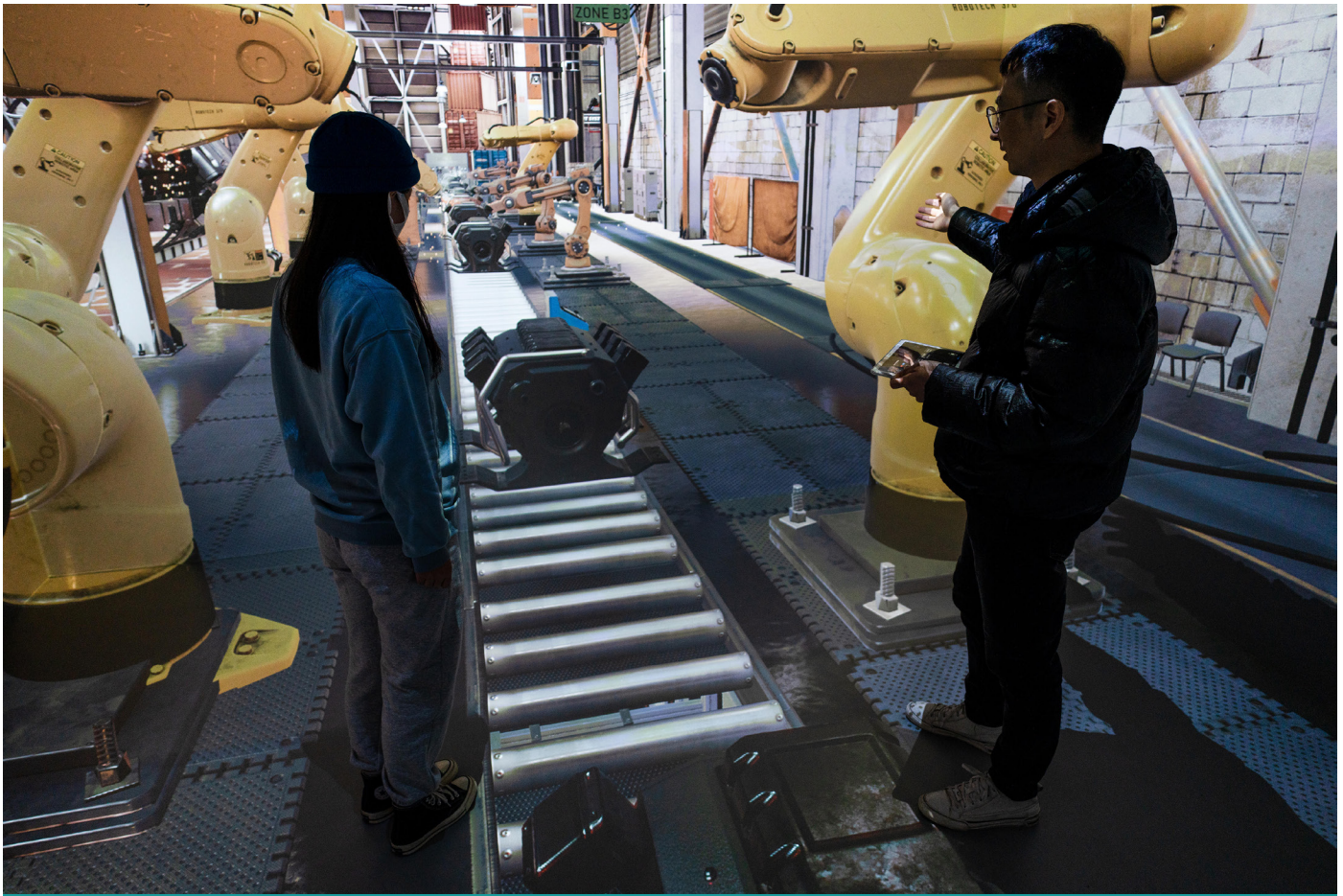
Digital twin factory simulations project participants into a virtual scene.

Photorealistic, three-dimensional images appear before them as they interact with virtual projections, immersing them in highly realistic environments for scenario simulations. This is ideal for everything from viewing real estate to training factory workers.

"Precise tracking of the user's eye position is essential for real-time perspective reconstruction in 3D scenes," Li explains. "The environment reacts to your shifting point of view, whether you squat, stand, rotate, or move in any direction."

Selecting an Intelligent Machine Vision Platform

Li is responsible for conducting technical research, selecting hardware and software technologies, planning product configurations, and formulating product strategies. He says their selection of a depth camera for this unique application was based on an exacting set of criteria including frame rate, resolution, and a field of view (FOV) that could effectively cover specific scene requirements. With respect to the hardware, ArchiFiction needed stable, industrial-caliber equipment that could operate reliably over extended periods. With respect to software, they insisted on exceptional debugging and development tools, along with excellent technical support to assist with application development.

These exacting requirements led them to RealSense Depth Camera D455.

"RealSense D455 features a consolidated design encompassing both visible light and infrared sensors, along with remarkably low power consumption," Li says. "Their sensors stood out not only for having the most powerful performance parameters, but also for their optimal balance in terms of product size, power consumption, and ease of development. RealSense is a capable and efficient system with a small form factor and robust development environment."

Using AI to Reconstruct Virtual Scenes

With their previous architecture, ArchiFiction needed two separate devices to accomplish what RealSense now achieves with one: an RGB camera to recognize movements and a laser sensor to achieve posture recognition and laser point cloud ranging. Together, these devices consumed twice the volume of the RealSense solution. Additionally, the team had to develop and refine custom matching algorithms to fuse visible light and infrared data. "The outcome did not meet our expectations," Li recalls. "The introduction of RealSense marked a significant breakthrough for our product."

There are quantitative advantages as well. The old RGB sensor had a resolution of only 352 x 288 @60Hz, and the point cloud density of the infrared sensor was approximately one-third the density of the RealSense Depth Camera D455. Additionally, lacking reliable development tools, it took the ArchiFiction team eight months to achieve synchronized output for posture recognition and positioning information. "The low frame rate of the previous sensors, significantly below that of RealSense, resulted in a stuttering experience, rendering it unsuitable for commercial use," Li notes.

Immersive home simulations allow people to experience a living space in 3D.

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Today, the RealSense RGB sensor reaches 640x480@60Hz, along with a substantial increase in point cloud density. "This enhancement has propelled our positioning and posture recognition accuracy to unprecedented levels," Li continues. "Practically speaking, the 3D reconstruction of virtual scenes is so seamless that users can hardly discern between the real and virtual environments. This transformation truly immerses users in the virtual experience, surpassing all our expectations."

Throughout the development and integration process, RealSense was quick to assist the team and help them surmount any technical hurdles. "The RealSense team offers outstanding technical support," Li confirms. "They are open to our feedback, and our issues are promptly addressed by their competent engineers. RealSense emerged as the globally optimal solution for our specific needs."

There have been business advantages to working with RealSense as well. "Customers are more likely to trust components that align with internationally recognized brands, so leveraging RealSense's industry influence and technical prowess helps establish foundational approval for our products, states Sheng Yang, a sales consultant at ArchiFiction. "Working with RealSense amplifies our visibility. It allows us to gain more exposure and introduces us to a broader customer base."

Technical components of the solution

- RealSense Depth Camera D455
- ArchiFiction n' Space

Learn More

- **ArchiFiction:**

http://www.archifiction-inc.com/

- **RealSense Technology:**

https://www.realsenseai.com