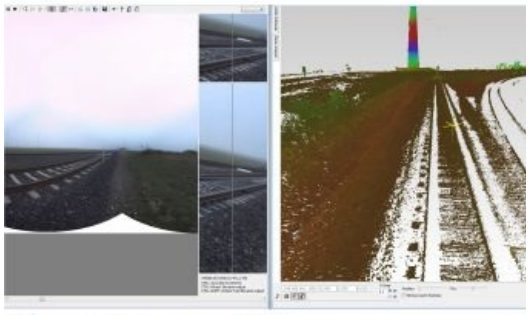
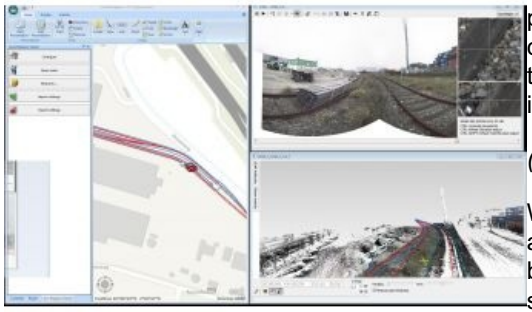
HOW WEARABLE REALITY CAPTURE IS SHAPING THE INDUSTRY

Laser Scanning on the Go





As the world's population keeps growing and changes in buildings and infrastructures become more rapid, there is an increasing need to document this growth and these changes. A revolutionary approach to geospatial documentation on a local, individual scale can help to meet this need. New systems enable users to walk around unhindered while logging reliable data about time, position and the world in 3D. Referred to as 'wearable reality capture systems', this new concept is shaping how measurement professionals come to understand the world around them. Read this article to find out more about the impact of wearable reality capture on the industry and its benefits for new applications.

(By Stuart Woods, Leica Geosystems)

Wearable reality capture systems are relatively new to the market and their applications are still being explored. Pioneers in the field are primarily working in four main areas: building information modelling (BIM) documentation; reality-based industrial training; safety and security; and disaster response documentation. Outside of these four main areas, wearable reality capture is also gaining popularity in traditional survey applications such as cadastral and as-built documentation, in particular for areas with obstructed GNSS access or challenging terrain. All applications require a fast and efficient connection to the changing environment, but also a reliable understanding in terms of both time and position.

Multi-level BIM

BIM is divided into multiple levels from 1D to 6D. Two levels can directly benefit from wearable reality capture systems. 4D is focused on adding a time or milestone scheduling to the typical 3D BIM design activities. 4D's scheduling aspect can be helped by providing a regular, fast and efficient connection to the chaotic construction site, enabling milestones and building changes to be easily documented and monitored. 6D, the phase after building construction is completed and operations are ongoing, is focused on the facilities management of a completed building. Here, reality capture offers the opportunity to pass on a complete as-built 3D and image-based dataset to the building's new owner. With a construction site changing almost hourly and considering that, typically, the only way to navigate a site is by foot, this makes BIM documentation an ideal situation for wearable reality capture systems.

Industrial Training

Reality-based industrial training is a requirement of the future. Today's buildings are more complex than ever before and many fire departments are now training in a gaming-based environment on a building before they are called out to an actual fire. Knowing which floor and/or around which corner the fire hose can reach will save lives in emergency situations. Oil refineries and chemical plants must be able to document any site changes in 3D and images for fast and efficient responses to emergencies. Gaming engines can now import reality capture data so the gap between as-built and gaming is shrinking.

Safety and Security

Safety and security is focused on the documentation of situations involving large crowds for emergency response or control, documenting large over-crowded housing camps, mapping of VIP routes for emergency or control, or border control. These are all situations where fast data capture is critical and primarily involve environments which are better approached from a pedestrian point of view.

Natural Disaster Response

When a natural disaster strikes, it is important to be able to manage any type of terrain and gain the information quickly. Typically, the only

way to access disaster areas is by walking. Documentation for disaster aid response can be captured quickly on foot, but there has been no option to do this in 3D until now. With reality capture sensor systems, faster response times translate into lives saved and damage minimised.

Combining Technologies

Lidar technology is fundamentally limited by certain physical properties, such as wet surfaces showing no returns or the inability to detect small changes in texture. In an urban environment, however, the visual aspects of objects are as important as their dimensions. In these complex areas, being able to calculate distances based on a difficult surface, such as a painted facade, can only occur through a combination with photogrammetry. In addition, using photogrammetry or image capture during post-processing helps in improving the position information. When no GNSS signals are available, as can happen in cities, wearable reality capture systems render the world in 3D from the Lidar profilers, cut up the 3D walking path into segments, compare the segments and then look for overlaps in those segments to estimate the movement from the last position. The Lidar system might not always be able to understand a change in elevation, but an anchor point can be included from the image data to help the system better understand its position and improve its accuracy. The best quality checks of a mass data collection can only come from a visual inspection of the images and dimensional checks through photogrammetry.

A Working Example

As part of this new generation of wearable reality capture systems, Leica Geosystems has created the Leica Pegasus:Backpack. Combining five cameras and a Lidar profiler within an ultra-light and ergonomic carbon fibre chassis, this mobile mapping solution creates a 3D view of virtually any location. The Dutch 3D survey firm Van Steenis Geodesie recently used the Leica Pegasus:Backpack in a terrestrial survey of a Rotterdam rail yard for pre-design measurements. The captured 3D imagery and point clouds will be used to design new rail tracks through reverse engineering, lay plans, ballast volumes and profiles, and quantity determination. Railways can present a particularly difficult environment for classical surveying methods due to low-hanging electrical lines and constricted spaces around train cars. With wearable reality capture systems, however, these environments can be thoroughly explored and documented. Van Steenis Geodesie director Klaas de Weerd, who led the survey, compared the use of the wearable reality capture system to traditional survey methods, finding an absolute positioning improvement of about 3 centimetres. The newer technology also allowed the entire survey to be completed in three hours with 360-degree visuals versus the traditional several days of capturing flat images. “Using wearable reality capture enabled us to realise many benefits over traditional surveying techniques,” said De Weerd. “Every spot in the rail yard was reachable. We didn’t have to implement extra safety measures either, since there was no need for us to enter high-risk areas; we could simply capture the data from a safe distance. Finally, we saw great time savings due to error-free data acquisition in a baseline survey that will allow us to accurately monitor any changes to the design in the future.”

Enabling Real-time Decisions

Capturing the world in 3D is important, but without knowing the position or the time of capture it is difficult to compare different locations or different datasets captured during a specific time period. To accurately measure the changes around us, it is vital to understand how measurements relate to time and position. However, it is no longer merely a question of accuracy. Now, the future is about capturing reality at the same speed as our world is changing and enabling the level of documentation needed to make real-time decisions.

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