To Development of the Physical asset Using GIS Data Help

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Abstract:

Digital twins, as a concept, are frequently tied to conversations focused on future technology in business and building infrastructure. However, the idea is actually as old as the first computers. In the virtual space, twin models represent real-world physical assets — which can be anything from product prototypes, a building's heating and cooling system, to something as large as city infrastructure. By testing simulated changes in the virtual world, twins help developers avoid costly real-world mistakes and can even anticipate the success of future scenarios on the digital twin model. All it takes is the right amount of data. Lots of it. On a building and city infrastructure level, this data often starts on the ground (or in the air) with a land surveyor. And, as stewards of GIS data, land surveyors and geospatial professionals are a crucial connection between what's real and what's twin.

Introduction:

One key component of a digital twin is to represent a physical asset, what is happening in the real world and to represent what is ongoing," says Benoit Fredericque, senior director of product management — reality and spatial modeling — at Bentley Systems. "And providing that information from the physical world for sure requires a lot of competencies – skillsets that are related to surveying and mapping.

Digital twins give architects, engineers, planners, and other building pros the detailed context that's needed to accurately plan ongoing and future projects. Land surveyors — using a mix of data collection, laser scanning, 3D modeling of assets and professional knowledge — help connect the dots, the point clouds, and other GIS data into highly detailed virtual models.

As Fredericque explains, "I think land surveyors and mappers can have a key role in terms of making digital twins a reality." How much of a role depends on the survey profession's willingness to adopt new technology.

Wherever there is a system, there can be a digital twin. "A very broad definition of it would be a computer-based model of some kind of physical system," explains mechanical engineer Robert Van Til, Ph.D., professor of lean studies and chair of the Industrial and Systems Engineering Department at Oakland University in Rochester, Michigan. "It's a relatively new term for a concept that's actually been around for a bit."

Data is a digital twin's genetic code. The better the data, the better a digital twin's ability to replicate the real-world conditions of an asset, its DNA.

"They are very valuable for use in a system because they allow you to do a lot of your work offline without interrupting your running system," says Van Til. "Or a lot of design work, pre-in place before you actually start buying physical components and putting them together, at which point, change becomes very expensive. It's very cheap in the digital domain if you put together a twin of the system you propose to buy to do design analysis and design changes and analyze behaviors and make changes early on."

Because a twin model is only as useful as its data, data-collection technology needed time to catch up to the concept. A major missing technology component being IoT (Internet of Things), which helps establish a constant connection between the digital twin and its real-world asset with contextual data, engineering

content, engineering information about the assets, as well as include information coming from real time sensors such as IoT.

"With the relatively recent introduction of the internet of things and cheap storage for data, it allowed the one missing element for these computer models to really truly reflect the behaviors of a physical system, to become a true digital twin," explains Van Til. "So that one piece was kind of the last piece to fall into place to make these models really reflective of a physical system."

Whether they are using Unmanned Aerial Vehicles, laser scanners, LiDAR, SLAM or another tool, surveying pros are the starting point of data collection that is transformed into a "living" virtual model of that place. Such a virtual model is referred to by some pros as "living" because it is changed and altered repeatedly, over time, to reflect changes in the physical asset it represents.

"Associating data with spatial understanding makes complicated information accessible to humans, because we can see what it means, and we can rapidly draw parallels and connect tangents and even orthogonal ideas that we wouldn't have pieced together otherwise," says Mothusi Pahl, chief commercial officer at B3Bar, a private equity firm focused on emerging tech companies. He is also COO of WORK Technologies.

"If I'm an engineer, an architect or a lawyer looking at a digital twin, I'm not just looking at survey lines that partition property and show topo features and buildings. I'm looking at geospatial objects that have shapes and contours and data overlays," Pahl explains. "Instead of seeing a line that simply says 'property,' you can click on that digital twin line and see info on the actual landowner, title report, etc."

He adds, "And the really solid digital twins incorporate with other tools so you can see zoning information or water infiltration rates in soil. How many offices are currently vacant in the building next door, or who owns the mineral rights, how much an easement sold for three years ago. The level of potential understanding is almost limitless."

What we can see with digital twins is also prompting questions around what we don't see.

How Do We Prepare for X Scenario?

Twin models are helping professionals manage, and even sell, everything from proposed construction projects to aging energy distribution lines, to skyscrapers. Plus, more professionals want to tie project or facility information together via the cloud, rather than having to locate data in various locales. They also want the mobility and other handy features that accompany cloud computing.

For example, even an old mixed-use building in New York City may have rather frequent footprint changes in its floors over time, due to tenants moving out and others renovating and moving in. Those building changes need to be integrated into a true to life virtual model of the building, for the benefit of those in operations and maintenance, as well as for emergency responders and others such as real estate pros. That digital twin might be a repeatedly updated model of the building that includes hyperlinks to equipment manuals, equipment warranties, reminders about maintenance, and other prompts aimed at staying on top of operations.

As technology advances and more effectively collects and organizes information to be used in digital twins, more opportunities are being created for land surveyors and geospatial professionals to use tech to provide better outcomes for clients. And a larger amount of correct data gathered means a nuanced look at a location or physical asset, enabling better planning for future operations. The perspective engenders system-wide planning as well as long-term planning.

"Survey assets can now be contextualized in a larger ecosystem," explains Jeremiah Karpowicz, editorial director at Diversified Communications, publisher of Commercial UAV News, SPAR 3D, and AEC Next News. "The data and information being captured by surveying and mapping professionals can be used to construct digital twins, although exactly what that looks like depends on the application and need."

Digital twins can take the maps and point clouds that have been the foundation of modern survey techniques to the next level. The growing interconnectedness of data is creating ever more tightly woven 3D models. Surveyors are now expected to not just record acreage or topography, but to create a virtual galaxy of points laden with meaning. These days, this is being done mostly in the AEC sector. Even so, not everyone knows how to deal with the model and how to get the most benefit from it. The technology is moving so fast that while its applications are known, industry is sometimes slower to catch up and use them.

Conclusion:

In short, there is a lot of unrealized potential. Surveying pros need to help nudge professionals in AEC and other sectors toward digital twins by knowing how they work themselves and being able to offer solutions that dovetail with those virtual models. They also need to explain to clients how the data and models can improve their decision-making, save money and save time. This technology allowed a company to complete what was a 20-month project in under 17 months. On top of that, construction sites are always changing, but Digital Twins can be utilized to ensure they're changing in the right way," Karpowicz says. "I can't tell you how often people reference the McKinsey report that details how construction projects take 20 percent longer to finish than scheduled and are up to 80 percent over budget. More construction stakeholders are realizing that digital twins will enable them to stay on schedule and under budget.

Reference:

References:

1. A. B. M. Moniruzzaman and S. A. Hossain, "Nosql database: New era of databases for big data analytics - classification, characteristics and comparison." International Journal of Database Theory and Application, vol. 06, no. 04, 2013.
2. D. Loshin, Big data analytics: from strategic planning to enterprise integration with tools, techniques, NoSQL, and graph. Elsevier, 2013.
3. Thuong Le-Tien, Vu Phung, "Routing and Tracking System for Mobile Vehicles in Large Area", The Dept. of Electrical Electronics Engineering, HCM University of Technology, Vietnam.
4. Beis, S. Papadopoulos, and Y. Kompatsiaris, "Benchmarking graph databases on the problem of community detection," in New Trends in Database and Information Systems II. Springer, 2015, pp. 3–14.
5. Thuong Le-Tien, Vu Phung, "Routing and Tracking System for Mobile Vehicles in Large Area", The Dept. of Electrical Electronics Engineering, HCM University of Technology, Vietnam.