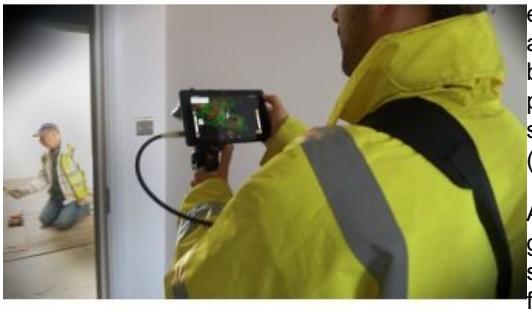
ACCESS ALL AREAS: GEOMATICS SYSTEMS FOR THE FUTURE

Rapid Site Surveys Using SLAM Technology



The difficulties of undertaking geospatial surveys, particularly in unstable buildings or underground environments, are well documented. However, the pressure to collect accurate, real-time data within strict timelines has certainly intensified in recent years. With increasingly tight deadlines coupled with strict budgets, conducting surveys of hard-to-access sites can be a real challenge for engineering and construction firms. This article explains how new innovations in building information modelling (BIM) are providing an answer with the aid of simultaneous localisation and mapping (SLAM) technology.

As engineering and construction firms grapple with issues such as skills shortages, robust safety regulations and fierce competition for contracts, traditional survey methods are increasingly coming under pressure to provide scan data that is accurate and turned around as quickly as possible. Added to this, many project managers cannot afford to solely rely on highly skilled operators to collect data if they would then need to spend multiple days processing it. Such lengthy process times often mean that operators run the risk of missing key information about the integrity of a structure.

Growing Demand for BIM

This need for greater operational efficiency is one of the reasons why demand for BIM technology is growing so rapidly. Site teams can now test and optimize processes at every point of an asset's lifecycle using a dynamic 'digital twin', enabling them to identify potential issues such as unstable ground, existing utilities or, occasionally, historic remains that could unexpectedly halt work and push up the costs. Whatever the nature of the project, firms can ensure that any changes to building plans are digitally communicated to stakeholders wherever they are in the world, in real time. Fuelling some of the latest innovations in BIM are developments in high-definition 3D laser scanning technology, which enables operatives to produce digital representations of a building or asset while reducing the need for anyone to access hard-to-reach and/or dangerous parts of the site.

SLAM-based mobile mapping solutions have the capablility of rapidly scanning buildings.

Advances in Mobile Scanning

Static scanning has certainly helped to improve the accuracy of site data, especially compared to manual tools like tape measures and total stations, yet it can be costly and time consuming compared to the recent technological innovations. Static surveys still require expert operators, and it takes hours – and often days – to process the data. Subsequently, without immediate access to information, decision-making is inevitably delayed and this could compromise the commercial viability of a project if deadlines are missed and costs escalate. To overcome this, project managers are increasingly deploying handheld mobile 3D laser scanning systems that empower anyone – not just surveyors – to scan a site in minutes and continually update a digital building model.

Mobile scanning is undoubtedly a great leap forward in terms of time savings and site accessibility. However, the fact that many devices

rely on GPS can make them less suitable for use in tunnels, caves, mines or potentially dangerous buildings. One alternative is SLAM technology, which delivers the same accurate results without the need for GPS. When this is coupled with the ease of transferring to BIM, data can be captured and assessed quickly and efficiently.


BIM model of the 13-storey apartment block.

How Scan Results are Used

One application for the implementation of SLAM-based mapping can be seen in a project undertaken by Danish survey specialist LIFA, which had been tasked with measuring the leasable floor area of a 13-storey apartment block that was under construction at the time. The site team needed a solution capable of rapidly scanning the building, and so turned their attention to SLAM-based mobile mapping solutions.

According to Danish law, all leased properties must undergo an official, interior, as-built survey for property tax reasons. Using traditional techniques, this process would have taken at least two days – but the entire survey was completed in just 30 minutes by walking with the GeoSLAM ZEB-REVO on site, plus another hour for data processing. After data for all 44 apartments and communal areas had been captured, the site team created a BIM model by importing the point cloud into third-party software. Having scanned almost 5,500 square metres, the measurements using a ZEB-REVO were accurate to within a few centimetres across the entire building. Moreover, the results were well within acceptable tolerances for the tax office. The BIM model was able to display the building and had enough detail and accuracy to meet the requirements of Danish law.

LIFA is now able to measure buildings up to ten times faster using mobile scanning devices. In just six months, a two-person team mapped over 16,000 rooms in approximately 400 municipal buildings. A task like this would once have taken years to finish, rendering it commercially unviable as the processed data would have been immediately outdated. However, LIFA can now obtain the results it needs in a relatively short period of time, and apply them accordingly. Furthermore, new advancements in real-time capability are allowing for simultaneous data collection and processing, paving the way for even shorter survey times.


BIM model created by importing the point cloud into third-party software.

BIM and SLAM: What Does the Future Hold?

All this seems light years ahead of the days when architects, surveyors and other stakeholders would manually update asset designs during the process. Instead, BIM technology enables project managers to carry out more work at the planning stage, identifying any potential issues before work begins on site. This is extremely important given that, according to industry research, a rework might amount to 12% of the total building cost. As well as speeding up construction projects, BIM also makes compliance more straightforward. For example, ISO certification can be easily shared with any stakeholder. Once the building work is complete, BIM continues to play an important role throughout the asset's lifecycle, even if it is eventually demolished.

Speed and ease of use make handheld mobile 3D laser scanning systems an attractive choice for firms looking to remain competitive. By embracing BIM, firms have significantly reduced materials waste, enabling them to offer better value for money, increase investor confidence and secure new contracts for large-scale capital projects. The fact that surveys can be completed so rapidly also means that project managers can do them more frequently, so architects, designers and facilities managers have the most up-to-date information both during the construction phase and throughout the asset's lifecycle. As a result, scan-to-BIM, using SLAM technology, is increasingly being deployed both on large-scale projects in the construction and engineering, mining and forestry sectors and on comparatively small housing developments.

Within tightly regulated industries such as engineering and construction, the need for more frequent surveys will only grow in the coming years, as contractors are expected to deliver detailed verification and progress monitoring reports. Rather than relying on professional surveyors only, it surely makes good business sense to equip others on the team with increasingly accessible geospatial devices so they can capture new data and update the BIM representations accordingly.


Walking with the GeoSLAM ZEB-REVO on site.