USE DIGITAL TWIN TO OPTIMIZE CONSTRUCTION PLANNING

Nexer Insight (Nexer Group), NCC, Microsoft and Scharc have just completed the first phase of a unique joint project on digital twins. This has taken place in connection with the construction of the new Sigfridsborgsskolan in Nacka municipality, Sweden. The purpose has primarily been to investigate how digital technology can make construction design safer, more sustainable and more efficient.

About two years ago, Nexer Insight was introduced to NCC by Microsoft. A meeting that resulted in a first joint and unique collaboration on safe and secure workplaces; one of NCC's most important focus areas. The project was based on cranes at construction sites – a high-risk area identified by NCC – and involved in addition to Nexer Insight (at that time Sigma), Microsoft, ARROW and Edins Byggkranar.

"In the crane project, part of the project Connected Construction Site, we tested new technology based on monitoring using cameras and advanced software that immediately warns the crane operator of any people on the ground. In the project, Microsoft provided the cloud-based technology platform that formed the link between us at Nexer Insight, NCC and the others involved, says Carl Tönseth", Regional Manager, Nexer Insight, niched in IoT (Internet of Things) and AI (Artificial Intelligence).

The successful collaboration around the Connected Construction Site has now resulted in another unique project; the construction of the new Sigfridsborgsskolan in Nacka municipality, designed by Scharc. The school is expected to be completed in the autumn of 2021, but already now the school staff has gotten to know the school virtually in a game that Scharc created in the game engine Unreal Engine. The game makes it possible to get around the entire building via streaming in the browser and get a sense of what classrooms and common areas look like.

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Sigfridsborgsskolan has a digital twin

Just before Covid started spreading, Sven Staiger, architect and founder of Scharc, had a meeting with his contact persons at NCC to initiate a test of his self-developed SmartHelmets, an IoT device that collects and reports data. These helmets connect the workplace to the BIM model (Building Information Model) – a virtual 3D model of reality in which all information from a building's life cycle is collected and organized. This provides the opportunity for close collaboration between the design phase and production through BuildingCloud, a platform built around the BIM model. Scharc has been involved in the construction of nine schools in Nacka municipality and now also Sigfridsborgsskolan. This made it an easy choice to perform the test in this particular building, as part of the testbed Connected Construction Site.

"We wanted to test how we could use our smart helmets to collect data from the construction site to improve the work environment and streamline the process on-site. We met several times and discussed what we wanted to achieve and whether we might make a project out of it. NCC liked the idea and at one of these meetings, Claes Henschel, Digitalization Project Manager at NCC, came up with the idea that it would be appropriate to connect our idea to the Connected Construction Site. Claes told about the things they have done together with Nexer and Microsoft when it comes to cranes and safe workplaces", says Sven Staiger.

The site manager for the construction project Sigfridsborgs-skolan, Niklas Hemmälin, also thought it was a good idea. The project was launched in October 2020 and Nexer Insight was involved to innovate together with NCC and Scharc. The goal was to be able to aggregate data from smart helmets and other sensor data at the construction site and transfer

these to a digital twin based on the BIM models of the school that Scharc created.

Digital twins

Digital twins are virtual copies of real objects, processes, places and human behaviors. The copies are based on real-time data and are designed to simulate, analyze and improve.

"By adding analyzes and AI to digital twins, you can track what has been, improve what is today and predict the future. You can make digital twins out of pretty much anything; trucks, supply chains, wind turbines and not least buildings", says Carl Tönseth, Nexer Insight.

The insights that come from the twins can help companies optimize processes and empower product development and improve customer experiences.

This is only the beginning

Using BIM models in the design and design phase is not unique in itself – construction and real estate companies like NCC have been doing this for quite some time. What is unique in this case is partly that a digital twin of the school has been created and partly that it has been used in the production phase.

"We have used the digital twin to visualize what steps are to be done in production and also to work with work environment issues. This can be, for example, real-time sensor data from zones where it can be dangerous to work due to hazardous microparticles in the air. We have also tried to track where the material is, as well as people we may need to get in touch with and who in the worst case has had an accident and need to be found quickly", says Claes Henschel, NCC.

Claes Henschel believes that this is just the beginning. NCC sees the potential to be able to do so much more. Among other things, predictions and simulations where the project members can test what happens if they do it in one way or another. It is more sustainable, safer and saves time and money to simulate.

This is unique

Simulations in the construction industry are nothing new. This has been done for a long time in the design and planning phase. What is unique about this test is that it was performed in the production phase and with digital technology. In the past, analog measuring tools, such as thermometers, have been installed and taken out on-site and read from time to time. Here it will be completely digital, in real-time and remotely. It is really only the imagination that sets the limits for what can be achieved with all data, especially with the help of advanced technical platforms and knowledge of AI and the Internet of Things.

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The hub – Azure Digital Twins

The technical hub of the digital twin project, linked to Sigfrids-borgsskolan, is Microsoft's platform Azure Digital Twins, a so-called IoT platform (Internet of Things). Nexer Insight has been specializing in IoT and digital twins since 2013 and has worked with Azure Digital Twins since the platform was launched in 2018. With Azure Digital Twins, you can easily model and create digital representations of connected environments using an open modeling language. The platform offers, among other things, a spatial intelligence graph that can track people, places and things.

"In the work with NCC and Nexer Insight, the focus has been on creating innovative and connected solutions to generate new opportunities and solutions in health, safety and sustainability. The close collaboration and close dialogue have made it possible for us to support the work with Microsoft technology to solve challenges and maximize the potential", says Therese Treutiger, responsible for innovation and partner operations at Microsoft Sweden.

Work together even more in the future

NCC sees that a natural next step is to integrate more parameters into the digital twin, including energy consumption and climate. And that more construction sites will then start working with digital twins.

"With more types of input data, I absolutely believe that we will see great positive effects of working with digital twins and that our customers also see the benefit of it; that it is something they are also beginning to embrace in the management phase.

But for there to be a good continuation in this and other projects in the future, it is important to collaborate with partners who can work agile with improvements based on the production staff's wishes. We have had that benefit in this project. The collaboration has worked very well with the partners we had", says Claes Henschel.
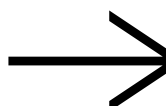
Scharc also views the collaboration very positively – together with customers and partners such as NCC and Nexer, they can do even better things.

"For us, it is important that the focus in the workflow is on the building. In this particular project, there have been 860 different people at the construction site. We want to work together even more in the future and ensure that the knowledge that is available to all these people benefits the building – in the digital twin – to be used by everyone involved. And Microsoft can support with the knowledge they have when it comes to Big Data and analytics. Nexer can contribute its experience from other projects where Azure Digital Twins has been used", says Sven Staiger.

Carl Tönseth at Nexer Insight believes that the digital ecosystems that work together and where each party can focus on developing and adding their expertise to the whole belong to the future.

"When the individual's knowledge is combined with other experts, who offer related services, the whole becomes so much larger than the sum of its parts. The result is a powerful digital twin, which creates clear value for the customer."

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