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ADVANTAGES OF A DIGITAL TWIN - BIM 7D - FOR HIGH VOLTAGE SUBSTATION ENGINEERING USING OPTICAL SYMBOL RECOGNITION TECHNOLOGY

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Summary - The paper describes the new era in substation engineering of creating and using a "digital twin of substations". A digital twin - as a virtual model of a process or a product - connects the real world with the virtual world. This coupling of the virtual and real physical world allows the analysis of data, understanding of problems, monitoring and simulation of real-world conditions in order to proactively respond to changes, reduce downtime, improve operations, and develop new models. The digital twin technology covers the entire lifecycle of the process or product from the concept phase until the end of the lifecycle - until it retires. The idea and detailed definition of digital twins (with industry 4.0 and Building Information Modeling (BIM)) is described in the paper, as well as the advantages of using such digital twins in the context of substation design and engineering. The resulting possibilities of using a digital twin - an intelligent substation model - in substation engineering is shown.

Due to the increasing demand of electricity, including new renewable energy plants, the extending of grid infrastructure - and especially retrofitting of existing substations - will be necessary. In order to react quickly and reliably to events, as well as plan of extensions or retrofits, it is becoming more important to have exact documentation of existing substations in the form of a digital twin of the substation. The paper focuses - because of the aforementioned importance - on these retrofitting or extending of substation projects as an example. To meet the challenge of creating a digital twin out of an existing substation – the idea and starting point is the capturing an existing substation with laser scans. Thanks to the new innovative Optical Symbol Recognition (OSR) - which takes laser scanning data to provide an intelligent 3D substation model to create digital twins. This OSR idea and process - with the help of Artificial Intelligence (AI) in a mostly automatic process - is introduced in the paper.

The methodology of the OSR process - from capturing of already existing substations using laser scanning (LIDAR) to the creation of an intelligent substation model from point clouds (laser scan data) and a digital twin of the substation - is described in detail and presented. The paper also shows the new capability of getting an intelligent and absolutely up-to-date Building Information Modeling documentation of existing substations - by using the OSR technology.

Furthermore, the paper presents that this OSR method and the digital twin opens a new era for substation engineering to reduce costs, project times and improve the engineering, operation and maintenance of substations. The paper finally points out that an intelligent substation model is the perfect basis of visualizations and simulations of operation states during retrofitting, extensions (BIM 7D) and even current live operation in order to optimally support the substation engineering and substation operation teams.

Keywords: Substation Design – 3D – Building Information Model – BIM – Digital Twin – BIM 7D – 3Eot

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