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Tutorial Talk

Manufacturing and Supply Chain Optimization with Augmented Reality (AR) in Samsung Heavy Industry (SHI)

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***Abstract*—** The IT Convergence Team at SHI and researchers at KAIST teamed up to develop the SCM-AR solution which consists of the following four functions: 1) automatically analyzing the structure of the assembly topologies and determining the critical level of each part, 2) evaluating the delivery uncertainty level for each supplier–part pair based on past delivery history and part critical levels, 3) dynamically scheduling the assembly processes and prioritizing the urgent requests to suppliers, and 4) visualizing the assembly schedule with three-dimensional (3D) animation with an AR device so that field engineers and managers effectively understand the job sequence and schedule. The SCM-AR was deployed in 2016. A private LTE (4G) network infrastructure installed in the shipyard enabled the transfer of large volumes of data with the AR devices. The system allowed field engineers and managers to review which parts were

delivered and which were not, and they could easily learn the delivery status of the delayed part. Then, they could run optimal job scheduling for a given delivery and available part information. Moreover, the AR-based 3D visualization/animation helped them clearly understand the optimal job scheduling and sequence. Its academic contribution is also clear. First, this is one of the few actual cases dealing with assembly for a supply-chain problem. Although there are some successful cases in integrating the design process with manufacturing in the form of design-for-assembly (DFA) and manufacturing-for-assembly (MFA), not many practical cases have been reported for design, assembly, and supply chain integration. In our problem, the part design structure, assembly configuration, and supply chain are considered together. A matrix presentation of the part-assembly structure was developed to effectively quantify the complexity of the part structure and assembly process together. This matrix was then used to effectively evaluate the feasibility of the assembly sequences in the optimization models. Another academic contribution of this work is the convergence of advanced IT technology with the industrial engineering method. The AR device shows the assembly sequence in a proactive way and how the optimal solution is generated. It was found that the decision was effectively delivered to the field engineers and managers. This is one of the first industrial AR use cases.