Phygital workspace as a Digital Twin for design & planning of smart factories

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Phygital workspace as a Digital Twin for design & planning of future factories

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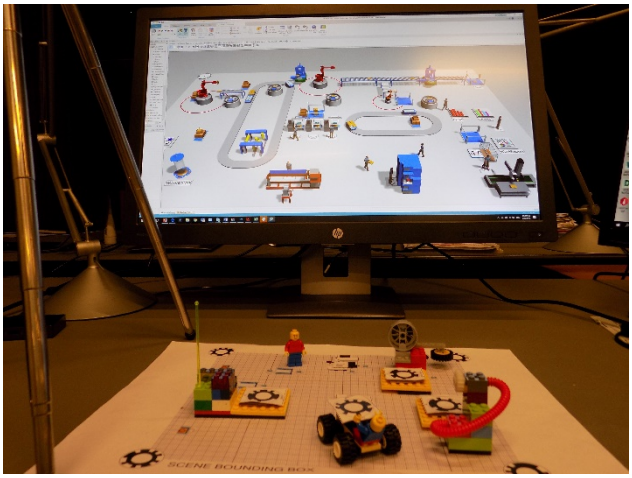

Figure 1: System setup of simulation and physical objects as a digital twin

We present a *phygital* workspace where the digital and the physical world combine or intersect with each other to form a digital twin in the design phase of a system. The method combines the usefulness of dynamic discrete event simulations seamlessly connected with physical objects placed on a table to enable collaborative design. Physical objects are used as a representation of machines and equipment in the simulation. The users can manipulate the tangible-objects placed on the table to evaluate different what-if scenarios. All the changes made on the table to the physical objects are communicated to the virtual simulation for layout optimization with the users' perspective. The user gets an immersive experience by using a tangible object to move around in the simulated space. The whole experience makes the simulation more user-collaborative for group discussions and forming a physical intersection of the first-phase digital twin.

1. Introduction

The design process (as well as optimization) of new-production system require several stakeholders to get involved starting from the design process. In doing so, virtual discrete simulations are an integral part for making productivity forecasting and estimations. Several developments have been made over the past decades to make the virtual simulations generate maximum information to produce effective design. The developments in new form of mixed reality have opened many new ways of interacting with the simulation.

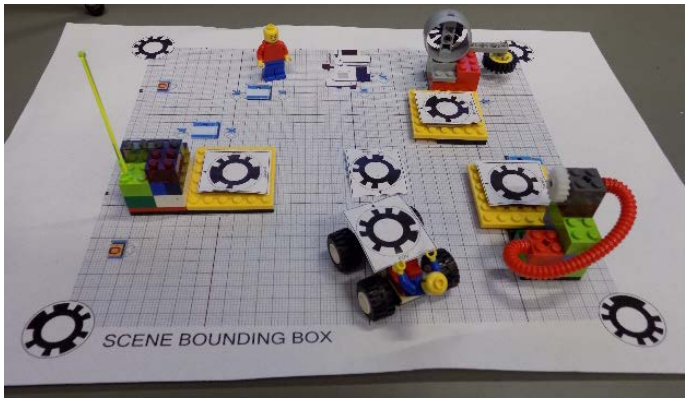

Figure 2: Objects used in the experimentation

This working paper describes the development of an intuitive, visual and collaborative design approach coupled with near real-time computer virtual simulations. A design platform is developed which represents the physical factory being investigated and develops a seamless connection. In the process, an initial design of the factory is developed on paper and is modeled in a virtual simulation tool in 3D environment. And a printout of the factory design is taken on a scaled paper. LEGO bricks are used to form physical objects to represent machines and equipment in the factory.

2. System Setup

The digital twin approach in factory design consists of two main components i.e. a physical space and a digital space. The physical space is based on a plan view with fixed assets i.e. walls, machines etc. of the factory. The layout is printed on a paper and is placed on a table. There are 3D printed objects and LEGO objects to represent machines and assets in the factory. The virtual space is built in Tecnomatix Plant Simulation in 3D environment. All the rules and constraints regarding stochastic simulation are defined in the Tecnomatix Plant Simulation software. A software Edddison is used as a bridging component that develops a connection between the collaborative design-platform and virtual simulation.

Figure 3: System setup

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