Importance of virtual reality in modern glass plant design

Sebastian Pantel* assesses the application possibilities of virtual reality for plant planning in the glass industry.

Virtual reality in modern glass plant design.

Production has to meet high standards. Efficiency and a safe future are as important for a plant's construction as cost savings and error reduction during the planning phase. Today, the fourth industry revolution has started with Industry 4.0, and to meet these demands an investment in new technology is necessary. cm.project.ing has developed a technology that has the potential to positively impact plant construction in general, and the glass industry in particular.

Precision and efficiency are indispensable from the start of a project, well before a glass plant is put into operation.

In order to meet these requirements, cm.project.ing has invested in virtual reality (VR) technology and tested its possibilities as an efficient and future-proof layout planning tool for the glass industry.

A new perspective

In contrast to the conventional 3D planning of a plant, a colleague responsible for the layout is able to dive into the 3D model by putting on a head-mounted display (HMD).

The HMD view corresponds almost exactly to the human view so that the user feels as if they are actually inside the plant as they move about in this model. Distances and proportions seem to be real, even if the user is in fact standing in their office. In this surrounding the user is free to look and move around in every direction. The only limitation is the size of the actual office, however when reaching the physical limits of the room you can easily teleport yourself one area further.

The user is able to move around the glass plant and to interact with objects. It is possible to operate valves or to take glass bottles off the conveyor belt. The user can duck or pass objects, and thus obstacles are easier to identify.

Evolution of layout planning

When constructing a new glass plant, the investment is very high and each plant is unique and has to fit to the local and technical requirements of the site.

Especially with international projects, no two plants are the same and so every layout plan is significant in the overall process.

The layout of a glass plant determines plant components, access, machines and equipment for years to come. A thorough layout is particularly important. The layout planning was previously made on the basis of handmade sketches at the beginning of a project, via 2D layout, to complex 3D models of the layout. Two- or three dimensional plans of complex

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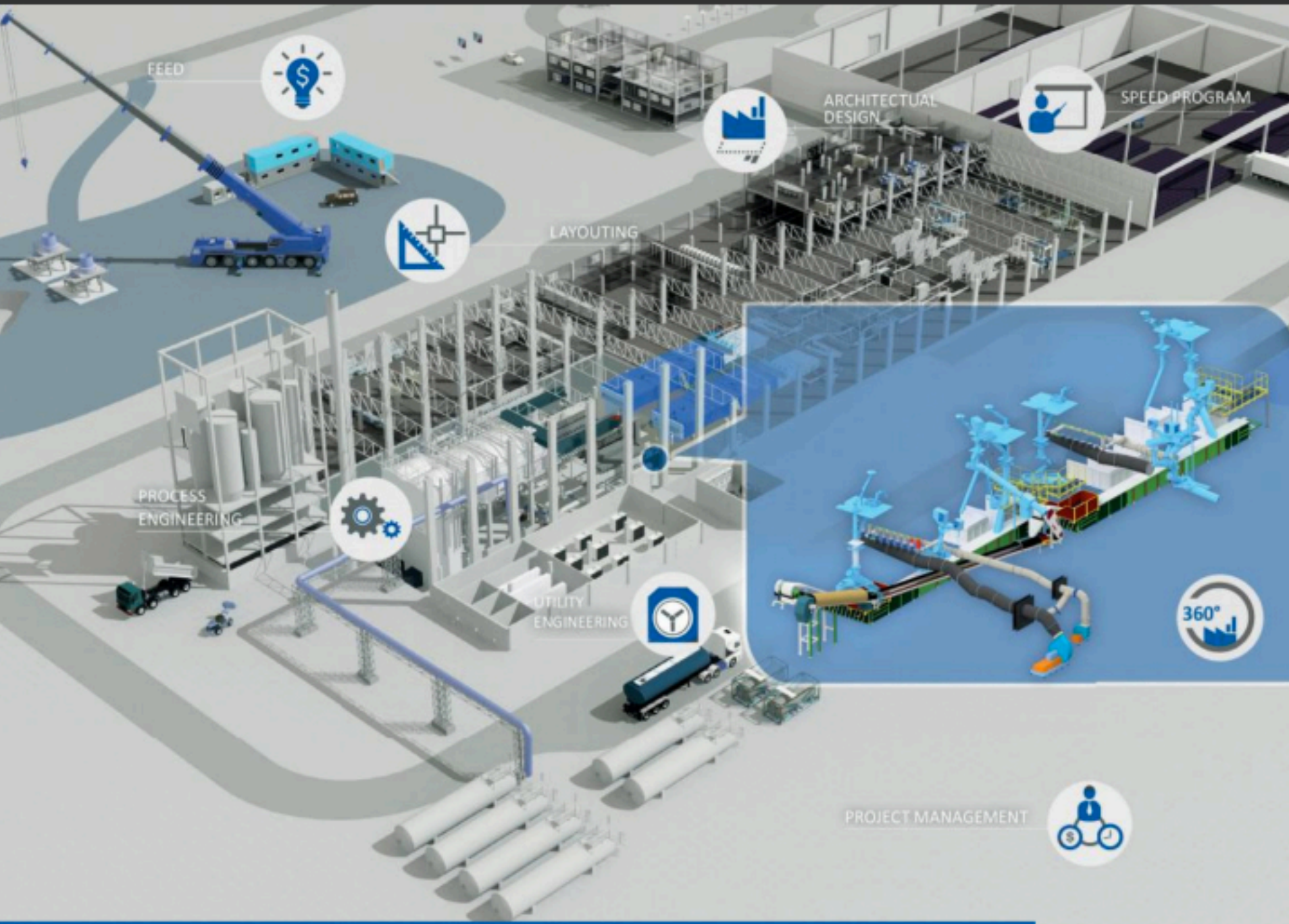

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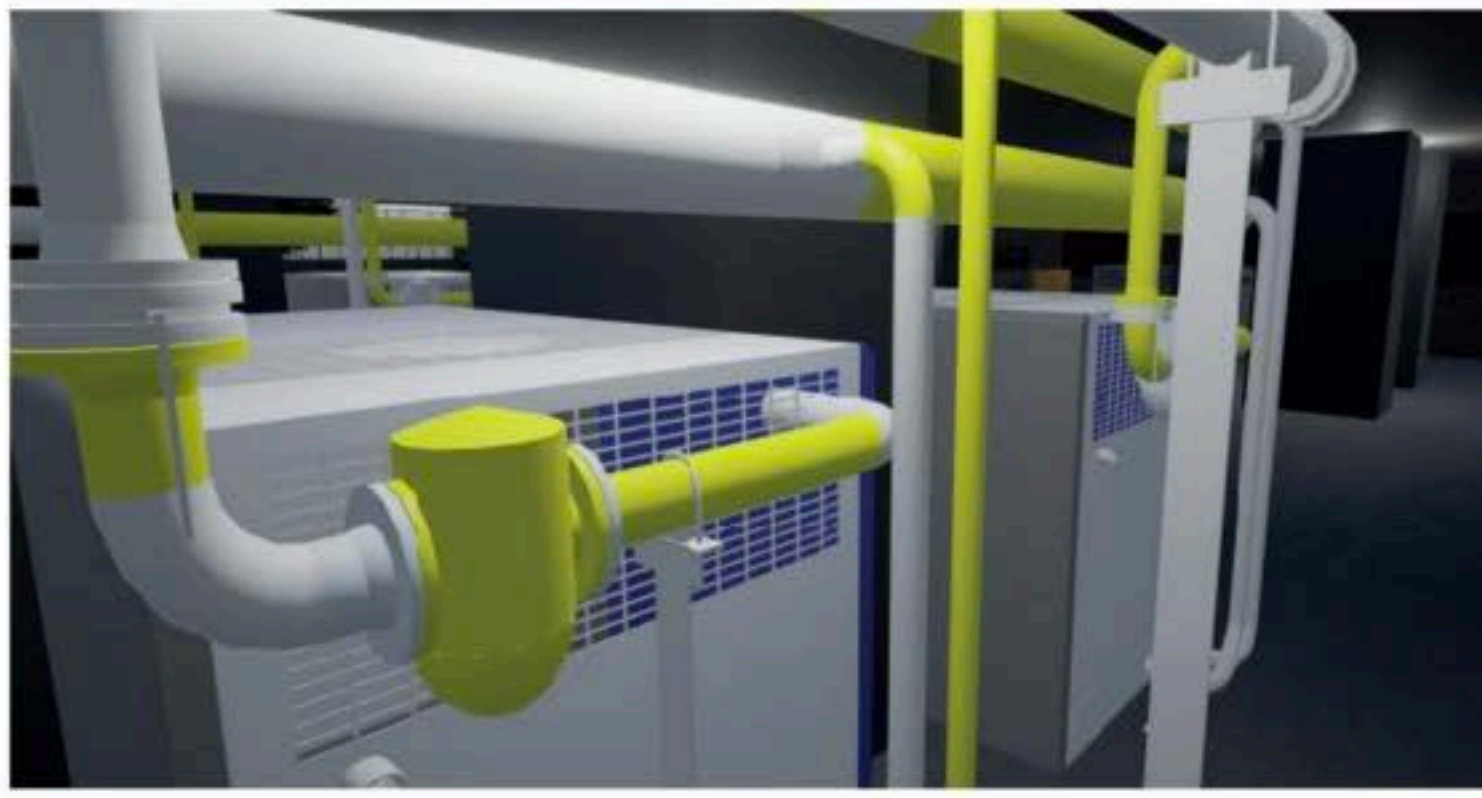
plants lack the exact spatial proportions. Even in complex 3D models, proportions look different than in reality.

In a classic 3D model, the planning person takes a floating position from outside instead of being within the 3D model, which is often why avoidable mistakes during planning only become apparent after construction starts.

The application of virtual reality breaks this boundary and enables the layouter to enter the model virtually and to get an 'inside-the-factory' perspective.

Virtual reality is by no means a replacement for 2D and 3D planning, instead it has to be seen as an expansion of, and in addition to, existing planning steps towards an intelligent layout.



▲ The HMD allows you to see life-like positioning of equipment and piping, etc.

Minimal costs and errors

When planning a glass plant, different aspects of several departments, suppliers and employees, as well as demands and expectations of the client have to be taken into account.

The more complicated a factory is and the more parties involved in the process, the more errors are likely to occur. Where multiple interfaces exist, errors are unavoidable. Virtual reality helps to locate and minimise errors at an early stage.

It can detect weak spots in 3D models during layout planning. Inconveniently positioned equipment, pipes, instruments or valves that are hard to reach can equally be a problem, as is insufficient space for maintenance.

Using VR in plant construction, a new level of intelligent layout planning can be reached while keeping the focus on the holistic concept. Quality is improved and unplanned additional costs are reduced. Expensive adjustments during and after the construction phase can be minimised or avoided.

The earlier an error is recognised the higher the cost saving is compared to fixing the problem at a later date.

Interaction

The layout for a new glass plant usually undergoes many different changes and adjustment phases. Especially in the beginning of the layout planning, equipment such as pumps or compressors are moved or newly positioned in the layout to guarantee the optimal use of space and operation of the equipment.

This basic layout is followed by adjustments from the client, machine suppliers and the architect until the right layout is found. Using VR it is possible to test different installations in the 3D model in a short time.

Compressors, for example, can easily be moved from one place to another by touching the manual controller. The required distance to other equipment close by is noticed and adjusted immediately. The relocation of equipment does not need to be made by a draftsman, but can be made by the user in the virtual model without profound knowledge of the software.

Simulation of future events

In a virtual model, future work processes such as production or maintenance can be simulated. The staff can adapt and be trained virtually for their new work place. It is possible to check if there is enough room for replacements or reparations of equipment before the construction starts.

The virtual model also helps to verify that signs and buttons are positioned sensibly, and if paths for vehicles such as forklifts or trucks are wide enough.

The positioning of a compressed air filter in the piping is a good example for this potential problem. A good position for the filter in the 3D layout can prove wrong in the real glass plant if no one considered the space needed to exchange the filter cartridge.

In the VR model, this problem would have become apparent much earlier when testing maintenance procedures. During the planning, process adjustments and changes can be made in the model to create a well thought-out layout concept which is submitted to virtual testing in all aspects. Only if the planned factory has passed the practical test is it ready for the real execution.

All project areas

VR has other advantages, beyond the planning stage. It is also possible that the operator of the future plant can move virtually through the plant and gain an impression of the planning process.

The same is true for his colleagues – they can be in the virtual plant at the same time and can discover and adjust together.

2D layouts show only parts of the plant and are often not easy to read. With VR however, one can have an immersive tour for all project partners through the future plant. It is a playful way of showing laymen connections and adjustments 'on-site'.

Where, in former times, 2D paper printouts were presented, VR today lets one dive right into the 3D model. It involves the whole project team and the planning process profits from the cross exchange of experiences. VR helps to put a traditional industry in a new perspective, and supports plant construction.

Experience virtual reality

If you are interested, please visit us at glasstec 2016 Düsseldorf, hall 13 booth B34. You will get the chance to visit a virtual glass plant yourself.

In terms of intelligent positioning of equipment, we would like to show you the advantages of VR in the planning of glass industry plants as well as our concepts for an intelligent and future-proof layout planning. ■

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