TechViz XL helps KITs Formula Student Car "Become Alive"

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Figure 1: TechViz solution at Lifecycle Engineering Solutions Center

Abstract

TechViz has been a supporter of Formula Student at KIT for several years reflecting the companys long-term commitment to enhance engineering and education by providing students with powerful VR system software to connect curriculum to real-world applications. Incorporating immersive visualisation and interaction environment into Formula Student vehicle design is proven to deliver race day success, by helping to detect faults and optimise product life cycle. The TechViz LESC system helps to improve the car design despites the short limit of time, thanks to the direct visualisation in the VR system of the CAD mockup and the ease of usage for non-VR experts.

1 Introduction

The use of Virtual Reality system within a product life cycle has become more and more present whatever the industry, such as car manufacturer or factory design companies. Benefits of adding such process along the PLM have been expressed over the years and match the challenge of always shortening the cycle of prototypes [1], [2]. Nonetheless, appropriate solution can be difficult to select and find: different 3D applications, various choices of hardware elements, scenarios, etc. TechViz XL driver solution is such that it fits the choices without changes, so that fast and reliable VR sessions can be programmed. Applying processes carried out at the industry level, students of the Formula Student Team KA-RaceIng of the Karlsruhe Institute of Technology (KIT) used such a VR system at the Lifecycle Engineering Solutions Center (LESC) at the KIT in order to validate their formula car design, taking into account their short life cycle. Benefits of the experience are communication, better decision over the design and mistakes avoidance.

In this paper we present elaborative examples of how the KA-RaceIng team uses the TechViz XL driver solution in LESC to validate their construction work.

2 TechViz

TechViz is a software company based in Paris, France, providing the solution TechViz XL that renders any OpenGL based application within any kind of VR environment (VRE) such as CAVE, Wall or HMDs. Models designed in those 3D native application are then displayed in real time within the VRE, without any requirement of export or import, so that modifications on models can be done in real time, integrity of data being ensured. Combined to a tracking system, the appropriate users point of view is computed in order to immerse him. Then, add-ons options may be added to create a dynamic interaction with models such as cutting models, doing snapshots, etc.

The open features of TechViz XL, handling any hardware and software, enable it to be integrated as easily and transparently as possible within a PLM workflow, providing a fast and intuitive tool for any kind of industries or institutes.

Figure 2: TechViz - handling any kind of hardware setup and 3D applications.

3 Lifecycle Engineering Solutions Center

LESC was established in 2007 as a central platform for the research results of the Institute Information Management in Engineering (IMI), the interdisciplinary exchange of knowledge at the KIT, and the transfer of technology into practice. It offers scalable and flexible development environments, from individual work spaces to large screen projections for innovative engineering solutions within the framework of product lifecycle management and virtual engineering. The three-sided CAVE setup allows to dive into virtual worlds using the TechViz XL solution (see Fig. 3).

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4 Formula Student Competition and KA-RaceIng team at KIT

The Formula Student is a student design competition organized by SAE International since 1978. Universities from all over the world are challenged to design and build a single-seat racing car (RC) based on a series of rules, whose purpose is both ensuring on-track safety and promoting clever problem solving. The competition aims to inspire and develop enterprising and innovative young engineers.

KA-RaceIng, the Formula Student Team of the KIT has about 80 members. Each year they develop, design, manufacture and test a race car with combustion engine and an electric RC in interdisciplinary teams.

Figure 3: The formula car displayed in LESC at KIT with TechViz XL.

5 Using TechViz at LESC to support the short product development cycles

The KA-RaceIng team has the opportunity to use the Virtual Reality Lab at LESC and the TechViz solution to support their RC development. Each year they realise two prototypes: combustion and electric and the design process is characterized by very short development cycles (see Fig. 4). It starts with the concept phase (4 weeks) followed by the design phase (10 weeks), which includes the construction, simulation and validation, followed by the production and test phase each of them 12 weeks long.

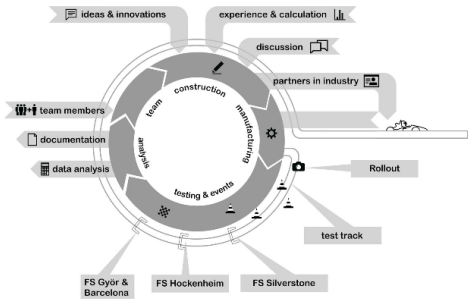

Figure 4: The KA-RaceIng short lifecylce.

Virtual Reality is used to examine the current CAD model created with PTC Creo at regular intervals, which is normally less than 10 hours per year. Unlike normal PC workstations, VR is an opportunity to recognize problems, to highlight and solve them quickly and flexibly. This work is more effective due to the very intuitive and extensive interaction provided by the VR hardware and software. Both the navigation, and useful functions, such as hiding and re-arranging the components, and the use of cutting planes in real time, support the development process significantly. Using VR is possible for both inexperienced and experienced team members to detect problem areas quickly and to discuss them clearly based on the 3D view.

KA-RaceIng has made great progress in recent years using TechViz in LESC and achieve success in the field of packaging, visibility check and communication. In the following paragraphs some examples are pointed out:

- Packaging, mounting and unmounting issues: Brakes are one of the most important part of the vehicle due to the drivers security. From a technical point of view it is important that all brake pipes are assembled horizontally. The clipping plane together with the fade out feature of TechViz XL solution helps to inspect if the brake pipes are without inclination or if there are some collisions with the other parts in a fast and easy way. This procedure is accelerated with the possibility to rotate the 3D model intuitively in the 3D space.

- Another issue is the planning of the installation space: both RC prototypes with combustion and electric engine have a similar problem with the fuel tank respectively battery. Both have to be mounted and unmounted very quickly and be easy for charging during the races. Furthermore the removement of the battery is important for the access to the electronic if configurations or repair are needed. The VR spatial representation of the car helps to check potential collisions in the installation space as well as mounting and unmounting procedures can be simulated with ease.

- Communication: One of the most important benefits of using the CAVE as VRE during the product development is the communication between the team members. Each sub-team in the structure of KA-RaceIng has the responsibility for a particular part of the vehicles. In the VRE the sub-team members meet and discuss the interfaces between the different car parts.

  Similar benefit happens when meeting in LESC with external experts, consultant working for Formula 1 and expert in the area of car dynamics, familiarizing rapidly with the developed racing cars and looking for errors.

6 Conclusion

Virtual Reality (VR) has proven over the years to be one process saving time and money, when applied at the different phases of the product life cycle. Nevertheless companies or organisations often cannot invest much time in preparing (converting and importing) the graphical information from the CAx tools into a Virtual Reality Visualization Software, especially when the product development phase is very short. The added value of TechViz XL solution is the avoidance of the steps for preparation, saving time along the process, which matches the really short life cycle. Besides the ease of use provided allows even non-VR expert to take benefits of the technologies, looking at real scale virtual mockup instead of physical one, and the better communication between teams or with outsiders improved the decision making process as well as mistakes detection.

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