DIGITAL FORM OF TRAINING CENTER FOR LOGISTICS PROCESSES

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Abstract

This article shows the digital version of a laboratory designed for training logistics processes. Digital models are exact copies of real laboratory equipment. Models are created in SolidWorks. The laboratory also monitors the movements of objects and employees using RTLS technology. The whole laboratory training takes place using virtual reality technology. The digital model brings many benefits to training logistics processes. There is no need for a real training center, which saves space and time for implementation, in digital form it is possible to easily monitor the whole process, track the times and simply start the whole process again. The whole process of logistics process training brings us valuable information about the whole process from which we can draw. The creation of digital models and the entire training laboratory is time-consuming and experience with the programs is required.

Keywords: Digitalization, virtual reality, augmented reality, logistics 5.0, digital form

1. INTRODUCTION

In this article, we will discuss technical developments that greatly affect the process of logistics and everyday life. After outlining global developments, we will discuss the use of virtual reality and mixed reality in logistics processes. Last but not least, we will focus on logistics 4.0 and its transformation to logistics 5.0 and its indicator base. The course of green logistics is based on the foundations of the logistics pillar 5.0 because the global situation in logistics provides room for improvement, to increase the greening of work and the sorting and use of resources. The article further describes the Twinmotion program as the final program for visualization. The article also contains a digital model and in the conclusion, we focus on its future use.

The scientific objective is to prove the usability of modeling in 3D modeling software and the subsequent linking of programs into the resulting form of a virtual model. The model will serve as a training center after connecting with the PiXYZ program, where it is possible to subsequently train the operator and students using virtual reality.

2. DIGITIZATION IN LOGISTICS AND SUPPLY CHAIN

During this decade, the digital transformation has penetrated the essential life of humanity. As the population grows, so does the production and consumption of data, which is mostly generated automatically by intelligent sensors and monitoring systems, with a reliance on human activity, although the need to design algorithms will still be on the staff. The success of multinational companies such as Amazon, Google, or Alibaba is the result of their ability to process and analyze an enormous amount of information with the ability to analyze it and use it for further development [1].

2.1. VIRTUAL AND AUGMENTED REALITY

As virtual reality technology continues to improve, its impact is increasingly affecting business services. In the design of systems and environments, which I will address in the practical part, exploring alternatives to the design environment, in our case future laboratory spaces, structurally offers future users to explore specific design variants to provide feedback to the designer. As part of teaching logistics processes, it is possible to provide students with an overview and control of complex machines without the need to be in contact with real objects in the research of logistics. The use of virtual reality already in the game process provides a great point of reference for controlling the virtual interface [2,3].

In the logistics maintenance process, there are applications in which the on-site engineer receives instructions from a digital device that contains a complete model of the inspection object. As the name implies, mixed reality adds computer-generated information to elements observed in the real state. The information can take various forms, such as data from sensors that are not directly observed, in our case from RTLS antennas.

Virtual and mixed reality raises high expectations in training people for various roles in production and logistics, but also in helping to ensure security in logistics.

Table 1 Benefits of AR in logistics, source: (Stoltz, et al., 2017) [4].

Benefits	Key Characteristics
Minimizing the error rate	• Easy access to information. • Reduce complexity and needless memorizing steps. • Providing alternative solutions. • Easier to cross-check each operation. • Predicting bottlenecks.
Safety	• AR assistance for forklift drivers. • Receiving audio instructions besides visual ones.
Increased flexibility	• Provides solutions irrespective of the type/size of goods. • Reduce load on operators
Improved reliability	• Updated information. • Data can be visualized from anywhere. • Assist in decision-making.
Reduces time consumption	• Avoiding unwanted movements. • Reduces re-work. • Decreases unwanted paperwork.
Adaptability	• Advanced training methods. • Improve planning through simulation. • Better marketing strategies.

2.2. FROM LOGISTICS 4.0 TO LOGISTICS 5.0

Various changes in consumer requirements and needs, globalization, the spread of the technological communication network, and the diversification of activities that are needed in the logistics process have led to changes [4,6].

The transformation began primarily with the integration of production and logistics processes with information technology. This transformation process is associated with the exchange of product information within the company and production. Transformational changes have led to the emergence of the 4.0 concept in line with

Industry 4.0, which brings innovation and cutting-edge technological elements to logistics. Thanks to the elements of mutual communication between machines and personnel in logistics, storing information in the cloud will ensure that errors are reduced, and availability is increased. As a result, logistics processes will be able to respond flexibly to possible changes [5,7].

The unification of green, sustainable and digital logistics, which represents the concept of Logistics 4.0 with a human component, can be defined as another step in the evolution grouped under the name Logistics 5.0.

The main idea for logistics 5.0 is to eliminate or reduce waste to a minimum, whether it is energy, emissions, and chemical or solid waste.

For the sake of clarity, logistics 5.0 is divided into several subsections:

- **green transport:** reduce paper consumption, toner, and ink recycling, shutting down computers when not in use, use reusable containers and transport equipment, use reusable pallets, reduction of unused space in the vehicle, reducing downtime, increasing the usability of space in height within the vehicle, use of a vehicle with alternative (renewable) fuel sources (energy), the introduction of alternative energy sources in refrigerated vehicles, route optimization,
- **green warehousing:** reduce paper consumption, toner, and ink recycling, shutting down computers when not in use, use more efficient lighting devices, using light sensors inside the aisle to turn the light on only where someone is, use more efficient heating devices, use of more efficient air conditioning devices, optimization of transport flows within the warehouse, introduction of fans for circulation of hot and cold air,
- **green packaging:** requiring the supplier to take over the packaging in which he delivers the goods, existence of pallet management (return) systém, using packaging materials that have less weight, use of biodegradable materials, use of recycled packaging materials, use of recyclable packaging materials,
- **Infrastructure:** collection of data into databases in real-time, data archive Use of data from the database when defining a new work warrant, use of predictive analytics methods, connectivity to external databases, Big Data Manipulation State-of-the-art computer infrastructure, flexible and modular hardware solutions,
- **organization:** top connectivity with everyone in the value chain, special and high-performance communication channels (social networks), decentralization within the company, high motivation of each employee, and the willingness of workers to change [8].

3. TWINMOTION

Before creating the overall visualization of the classroom, it is necessary to choose the appropriate software to create it. After the final selection of the Twinmotion software for the creation of the production hall with the help of 3D printing and its subsequent visualization, we got acquainted with it and at the same time we found out what possibilities it offers, what its advantages or disadvantages are. This 3D architectural visualization software takes us into virtual reality in real-time. It allows us to create high-quality images of our work, but also to transfer to this reality with the help of 360 ° VR videos, which are well made, and the rendering time is significantly shorter compared to other software. Another option is to enter with the help of VR glasses directly into the already created simulation environment at any time, whichever we choose. In addition to a few modifications and post-production of the environment, Twinmotion has a wide range of materials that, with its display, realistically responds to the set lighting conditions of the scene.

4. REALIZATION OF DIGITAL FORM

In the process of creating a visualization model, it was necessary to work with accurate data so that the digital model of the laboratory accurately reflected its properties. It was necessary to measure the laboratory premises and create technical documentation so that in case of a change or further use they were accessible to every user. AutoCAD Architecture from Autodesk was used for the transformation. In it, it was necessary to enter the dimensions of the laboratory and define the height of the halls, or windows and the location of the doors. **Figure 1** shows a digital model of the laboratory.

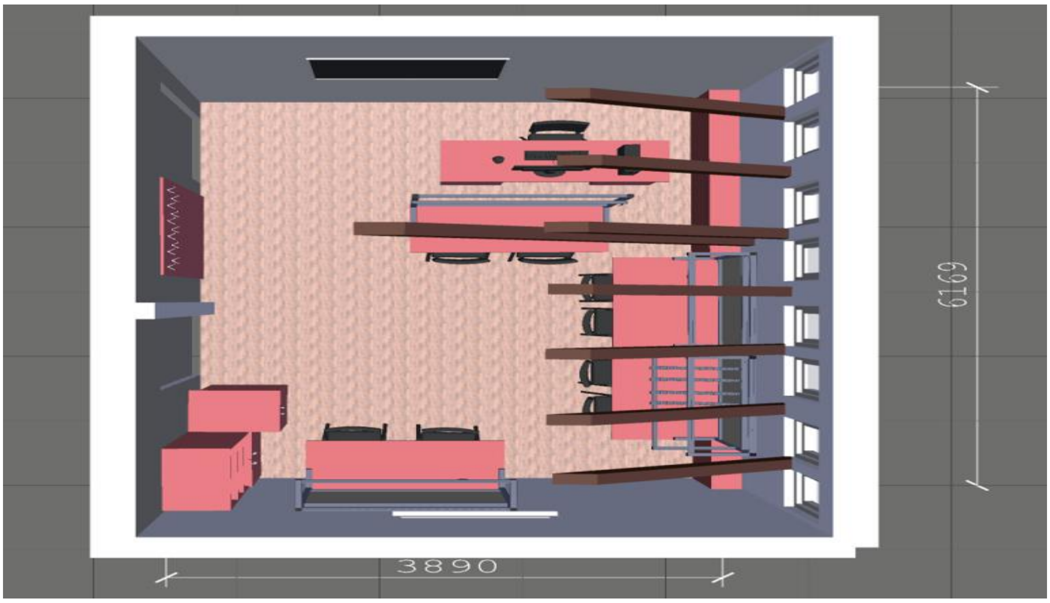

Figure 1 Digital model of the laboratory

Lab equipment such as tables, chairs, computers, stands, the cabin was, and beams were drawn in SolidWorks. As in the case of creating model walls, it was necessary to create technical documentation and follow it in the modeling process. **Figure 2** shows some parts of the laboratory equipment in digital form.

Figure 2 Laboratory equipment

Another visualization software used was Navisworks from Autodesk. It is necessary to connect the model of the laboratory and the modeled equipment. **Figure 3** shows the final view of the digital model in comparison with the real view of the future laboratory for logistics systems.

Figure 3 Digital model from Navisworks

In the final step, the whole model was recorded in the appropriate format with the Twinmotion program, which I described above. **Figure 4** shows the resulting form of the digital form of the laboratory for logistics processes. The digital form of the laboratory will be further used for the process of presentation of props and training in virtual reality.

Figure 4 Digital model from Twinmotion

5. CONCLUSION

In the case of the laboratory for logistics processes, the model is in its final form. In the future, we are working to equip the laboratory with additional equipment. in the planning process is intelligent monitoring of the logistics process, students will be able to examine the movements of staff in production and set a more ideal distribution of production components. The digital model will also serve as a presentation of work at the faculty with the possibility of educating the creation of digital models of logistics processes. As part of logistics, we will add additional conveyor equipment and equipment for moving material from one workplace to another. Another enrichment of the model itself is the opportunity to work with virtual reality, where it will be possible to disassemble and assemble parts and thus become more familiar with the company's logistics processes.

The scientific contribution of the authors is indisputable. Associate Professor Pekarčíková prepares the entire laboratory because she deals with the logistics processes for which the laboratory will be primarily intended. Ing. Trojan collaborated on the creation of 3D models.

In the laboratory of logistics processes, processes such as the transfer of material to production stations, monitoring and optimization of supply activities will be monitored. The planned equipment of the laboratory will also include mini robotic arms, which will simulate in a reduced form the handling and transportation of material within logistics.

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