Assignment VR and digital twinning

The "Smart Industry" course provides students with an opportunity to explore the concepts of automation and Industry 4.0 through hands-on projects and experiential learning. The Fischertechnik-based warehouse prototype serves as a practical tool for students to apply their knowledge in a tangible manner. Integrating virtual reality (VR) and digital twinning into this project can significantly enhance the educational experience and outcomes.

1. Enhanced Visualization: VR allows students to immerse themselves in a virtual environment and walk through the model of their automated warehouse. This immersive experience provides a more in-depth understanding of the design, layout, and operational aspects of the warehouse, enabling them to identify possible improvements and optimization opportunities.

2. Real-time Feedback: Digital twinning creates a virtual replica of the physical warehouse, which can be updated and modified in real-time as changes are made. This dynamic model enables students to experiment with different scenarios and instantly observe the effects of their adjustments, fostering a deeper understanding of the cause-and-effect relationships within the system.

3. Collaboration and Communication: The VR and digital twinning technologies can promote collaboration among team members working on the project. Students can share their virtual environment, discuss ideas, and propose solutions in a more interactive and engaging manner, thus enhancing teamwork and communication skills.

4. Risk Reduction and Cost Savings: By testing and optimizing the warehouse design in a virtual environment, students can identify potential issues and correct them before implementing the design in the physical prototype. This approach reduces the risk of costly mistakes and resource waste, resulting in a more efficient and effective design process.

5. Transfer of Knowledge and Skills: The integration of VR and digital twinning in the "Smart Industry" course enables students to acquire knowledge and skills more effectively. The immersive and interactive nature of the technology helps students retain information better and apply their learnings more confidently in real-world scenarios.

In conclusion, the combination of VR and digital twinning technologies in the "Smart Industry" course can greatly enhance the learning experience for students, facilitating a deeper understanding of automation concepts, fostering collaboration, and improving the transfer of knowledge and skills.

Dura-tion	Learning phase	Learning content **(What should the apprentice learn?)**	Learning activities **(Apprentice actions to meet the objectives?)**	Teacher/trainer activities **(What is the role of the teacher/trainer and what is he/she going to do?)**	Communication and collaboration forms	Resources, tools and media **(Which tools or media are used and how are they used?)**
30 min.	**Intro-duction and Orien-tation**	The kick-off meeting for the "Smart Industry" course project is an essential event that sets the stage for successful collaboration and learning throughout the course. By organizing a comprehensive and informative kick-off session, instructors can ensure that students have a clear understanding of the project objectives and expectations. The agenda for the kick-off meeting include the following components: Introduction (2 minutes): of the project's objectives, relevance to the course, and expected outcomes. Project Overview (5 minutes): concise overview of the customer order, layout, functionalities, and design requirements. Team Formation (3 minutes): Quickly divide students into groups, either through a predetermined assignment or by having them form groups based on their interests. Timeline and Milestones (4 minutes): Provide a brief overview of the project timeline, key milestones, and deliverable deadlines. Emphasize the importance of meeting these deadlines and maintaining consistent progress. Q&A Session (5 minutes): Time for a rapid-fire question-and-answer session, allowing students to clarify any doubts or concerns they may have about the project.	Active Listening: Listen attentively during the project overview presentation and Q&A session to gain a clear understanding of the project objectives, customer order, layout, functionalities, and design requirements. Participation: Participate in the Q&A session by asking questions or seeking clarification on any aspects of the project they may find unclear. Note-taking: Take notes during the kick-off meeting, capturing essential information about the project, timeline, milestones, and resources. Team Formation: Take part in the team formation process, being open to working with new people, and identifying their skills and interests to contribute effectively to their group. Familiarization with Resources: Take the initiative to familiarize with any resources, tools, or platforms provided for the project, such as software, hardware, or access to a VR platform. Communication and Collaboration: Maintain open communication with team members, sharing ideas,	Present a concise explanation. Use of visuals to make the content more engaging and easier to comprehend. Quickly divide students into groups either through predetermined assignments or by having them form groups based on their interests. Explanation of the timeline format students have on their computer, and how to phrase milestones. Interactive activity to help students better understand the project and its requirements.	Visual Aids: Use visual aids during the project overview presentation to clarify concepts and facilitate communication. Open Questions: Ask open-ended questions during the Q&A session, which can spark further discussion and promote a deeper understanding of the project. Online Collaboration Tools: Shared document, project management platform, or communication app Communication Norms: Encourage to discuss and agree upon communication norms for their group,	Presentation Software Video Conferencing: If the kick-off meeting is conducted remotely or in a hybrid format, use a reliable video conferencing platform. Interactive Whiteboards: Utilize interactive whiteboards for brainstorming sessions. Online Collaboration Tools Timer or Stopwatch: Timer or stopwatch to manage time during the kick-off meeting

		Next Steps (2 minutes): Conclude the meeting by summarizing the main takeaways and outlining the immediate next steps for students to begin working on their projects. Provide them with any necessary resources or access to platforms. Icebreaker Activity (Optional, 5 minutes): If time permits, conduct a short and engaging icebreaker activity to create a friendly atmosphere and help students get to know each other. This could be a brief introduction round or a rapid team-building game. Brainstorming Session (Optional, 4 minutes): If time permits, encourage groups to start brainstorming ideas for their warehouse designs quickly. This activity can help students begin thinking critically about the project.	discussing challenges, and collaborating on solutions. Icebreaker Activity: Engage in the icebreaker activity with enthusiasm and a positive attitude, to establish a friendly atmosphere and foster collaboration among team members.	Summarize to set the direction for their project work. Two Truths and a Lie: Have each student share two true statements and one false statement about themselves or their background. The rest of the group must guess which statement is false. Brainstorming Session: Encourage groups to start brainstorming ideas for their warehouse designs quickly during a 4-minute brainstorming session.		
4/5 weeks	**Execution of the task**	Research and understand the basics: Begin by researching and understanding the principles of automated warehouses, including the various components, subsystems, and technologies involved. This may include topics such as robotics, conveyor systems, storage and retrieval systems, and warehouse management software. Define project objectives: Clearly outline the goals and objectives of the project, such as optimizing warehouse space, improving efficiency, reducing operational costs, or enhancing worker safety. Develop a concept: Brainstorm and develop a concept for the warehouse design that meets the project objectives. Consider factors such as layout, storage systems, material handling equipment, and automation technologies.	Engage with course materials: Actively participate in lectures, workshops, and seminars to gain a solid understanding of the principles, concepts, and technologies related to smart industry and automated warehouses. Collaborate with peers: Work closely to share ideas, knowledge, and expertise. Collaboration fosters creativity and can lead to innovative solutions for the project. Hands-on learning: Actively engage in hands-on activities, such as building Fischertechnik prototypes, creating digital twins, and using VR technology. Practical experience is essential for gaining a deep understanding of the	Deliver lectures and workshops: Conduct lectures and workshops to provide students with theoretical knowledge and practical skills in smart industry concepts and techniques. Facilitate hands-on learning: Guide students through hands-on activities, such as building Fischertechnik prototypes, creating digital twins, and using VR technology. Provide mentorship and guidance: Act as a mentor and advisor to students, offering guidance, feedback, and support throughout the design and optimization process. Foster collaboration: Encourage students to work together, share ideas, and learn	In-person discussions: Face-to-face conversations during lectures, workshops, or team meetings can help students communicate their ideas, ask questions, and provide feedback. Online platforms: Utilize online collaboration platforms such as Microsoft Teams, to facilitate communication among students and between students and the teacher/trainer. Group projects: Encourage students to work in teams on their warehouse design and optimization projects. This fosters collaboration, promotes the sharing of knowledge and	Fischertechnik construction system: This versatile construction toy allows students to build physical models of automated warehouses, enabling hands-on learning and a deeper understanding of warehouse automation concepts. Digital twinning platforms: to create and manage digital twins of their warehouse designs for simulation and optimization purposes. Virtual Reality (VR) hardware and software: VR headsets Oculus Quest 2 combined with compatible software.

		Create a detailed design: Based on the concept, create a detailed design of the warehouse, including floor plans, 3D models, and a list of required components and materials. This design will serve as the blueprint for the physical model and digital twin. Build the Fischertechnik prototype: Using the Fischertechnik construction system, assemble the physical model of the automated warehouse according to the design. Ensure all components, such as robotic arms, conveyor belts, and sensors, are properly connected and functional. Use of VR technology: Allowing students to immerse themselves in the virtual warehouse environment and explore the design from a first-person perspective. Test and optimize: Conduct simulations and tests using the digital twin to analyze the warehouse's performance, identify areas for improvement, and optimize the design accordingly. This may involve adjusting the layout, altering the automation systems, or modifying the material handling equipment. Iterate and refine: Continuously update the physical model and digital twin based on the optimization results. Iterate and refine the design until the project objectives are met. Document and present: Throughout the project, document the design process, findings, and insights. Prepare a final report or presentation to showcase the project's results and the lessons learned.	concepts and developing the necessary skills. Apply critical thinking and problem-solving skills: Use critical thinking and problem-solving skills to identify challenges and develop creative solutions throughout the design and optimization process. Reflect on learning experiences: Regularly reflect on the learning process and progress, identifying strengths, weaknesses, and areas for improvement. This self-assessment can help apprentices better understand their learning journey and guide their future development. Practice effective communication: Develop strong communication skills to effectively present ideas, share knowledge, and collaborate with team members. This is crucial for success in any team-based project. Document the project: Maintain detailed records of the project, including design iterations, test results, and insights. Proper documentation is crucial for effective communication and collaboration within the team and for presenting the project's outcomes.	from one another. Facilitate group discussions, team projects, and collaborative activities that promote teamwork and cooperation. Assess student progress: Regularly evaluate students' progress and performance, providing feedback and guidance to help them improve their skills and understanding of course concepts. Adapt to individual needs: Recognize and accommodate the diverse needs of students, adjusting teaching methods and providing additional support as needed. This may involve offering one-on-one guidance, modifying assignments, or providing extra resources. Foster a positive learning environment: Create a supportive and inclusive learning environment that encourages students to ask questions, share ideas, and take risks. Promote a growth mindset and emphasize the importance of learning from mistakes and embracing challenges.	ideas, and helps students develop teamwork skills. Peer review and feedback: Implement a system for students to review and provide feedback on each other's work. This can help students gain different perspectives, improve their projects, and enhance their communication skills. Presentations and demonstrations: Encourage students to present their project progress, findings, and insights to the class or a panel of experts. This can help students practice their public speaking and presentation skills while sharing their knowledge with others. Guest lectures and expert input: Invite industry experts or professionals to contribute to the course through guest lectures, panel discussions, or workshops.	Simulation and optimization software: To analyze warehouse performance, simulate various scenarios, and optimize designs based on the obtained results. Collaboration and communication tools: Microsoft Teams Presentation and visualization tools: Microsoft PowerPoint, or Prez to create visually appealing presentations and share their project findings and insights. Video conferencing tools: Zoom, or Microsoft to conduct virtual lectures, workshops, or meetings, making it easy for students to connect and collaborate remotely.

30 min.	**Assess-ment /Check**	<u>Project evaluation</u>: Assess the students' warehouse design and optimization project based on criteria such as functionality, efficiency, innovation, and alignment with project objectives. <u>Presentations and demonstrations</u>: Require students to present their project progress, findings, and insights to the class or a panel of experts.	This can be done through a combination of evaluating the physical prototype, digital twin, and any supporting documentation. Assess their ability to effectively communicate their ideas, justify their design choices, and respond to questions or feedback.	Observer Evaluator Assessor	Making videos for reflection with the students	Observation list Camera's Beamer
Each group 15 min.	**End of the lesson**	Customers presentation of al the solutions students came up with.	Presenting the results for an audience of peers, parents, teachers, and employees of compagnies involved in Smart Industry	Hosting the product presentations. Be the chairman in the jury consisting of a student and two employees of Smart Industry compagnies	An original and fascinating presentation in which the process and product are clearly explained.	Prestation room with beamer