

VR-Based Industrial Safety Simulation – Developed in Unity for Nabertherm Furnace



Topic: Nabertherm Chamber Furnace

Prof: Anton Schmailzl

Case Study



Vishnu Prasad N V
Reg No. 12300792





CONTENTS

1. Assigned machine
2. Project Summary
3. Project plan
4. Integrated Safety Features in VR Simulation
5. Unity
6. Blender
7. Challenges & Solutions
8. Relevance to Industrial AR/VR Applications





Nabertherm Kammerofen



PROJECT SUMMARY

01

Objective: Develop a VR-based training simulation for safe operation of the Nabertherm industrial furnace

02

Tools Used: Unity (XR Toolkit), Blender, C#, Meta Oculus

03

Key Features: Realistic environment, interactive furnace operation, safety alerts, emergency protocols

04

My Role: Designed 3D models, implemented C# scripting for machine behavior, integrated VR hands & UI canvases

05

Outcome: Fully functional safety training prototype simulating emergency scenarios and proper operation procedures





PROJECT PLAN

TASKS	Start Date	End Date	Duration (Hours)
Get a feel of the tools required (Blender & Unity)	11.7.2023	11.18.2023	28
Exterior Environment Modelling (Rough)	11.21.2023	22/11/23	4
Machine Modelling (Rough)	11.26.2023	05/12/23	7
Progress presentation of the project	18.12.23	18/12/2023	
Brainstorming and knowledge transfer among us	13.12.23	18.12.23	36
Setting up final terrains and building	19.12.23	22.12.23	18
Machine remodelling	27.12.23	30.12.23	9
Setting up of VR hands and camera	30.12.23	02.01.24	22
Animation implemented	02.01.24	03.01.24	4
Safety Training Study	03.01.24	04.01.24	3
UI canvassing for safety instructions	05.01.24	07.01.24	10
Modification of modelling	11.01.24	12.01.24	3
Sound effects added	12.01.24	13.01.24	1
Scripting for proper functioning of machine	30.12.23	18.01.24	86
Testing of the final project	18.01.24	19.01.24	14
Further fixes and final testing	19.02.24	19.02.24	12
Final Presentation	20.02.24	20.02.24	



Safety Mechanisms

- Automatic shutdown if temperature exceeds 1200°C
- Manual emergency shutdown button
- Virtual fire extinguishing system
- Evacuation and hazard alert alarms



User Interface & Alerts

- Real-time temperature display on the furnace screen
- UI canvas pop-ups for overheating and emergencies
- Additional UI prompt to confirm use of safety gear



Personal Protection Simulation

- Mandatory VR prompts for gloves and safety glasses
- Visual safety posters and warning zones placed around furnace
- Simulated ventilation fans for environment realism





Created immersive factory environment using Unity 3D and ProBuilder



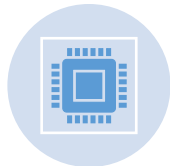
Integrated XR Interaction Toolkit for Meta Quest, enabling hand tracking and object interaction



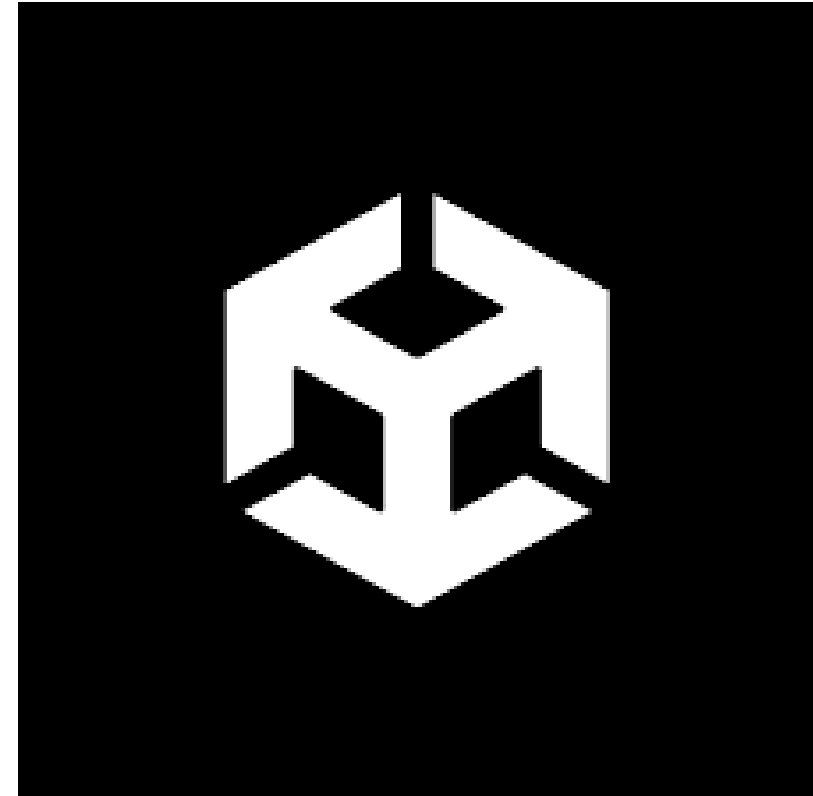
Developed C# scripts for machine behavior, including animated furnace doors and safety interactions



Designed and implemented UI canvases for safety alerts, instructions, and temperature displays



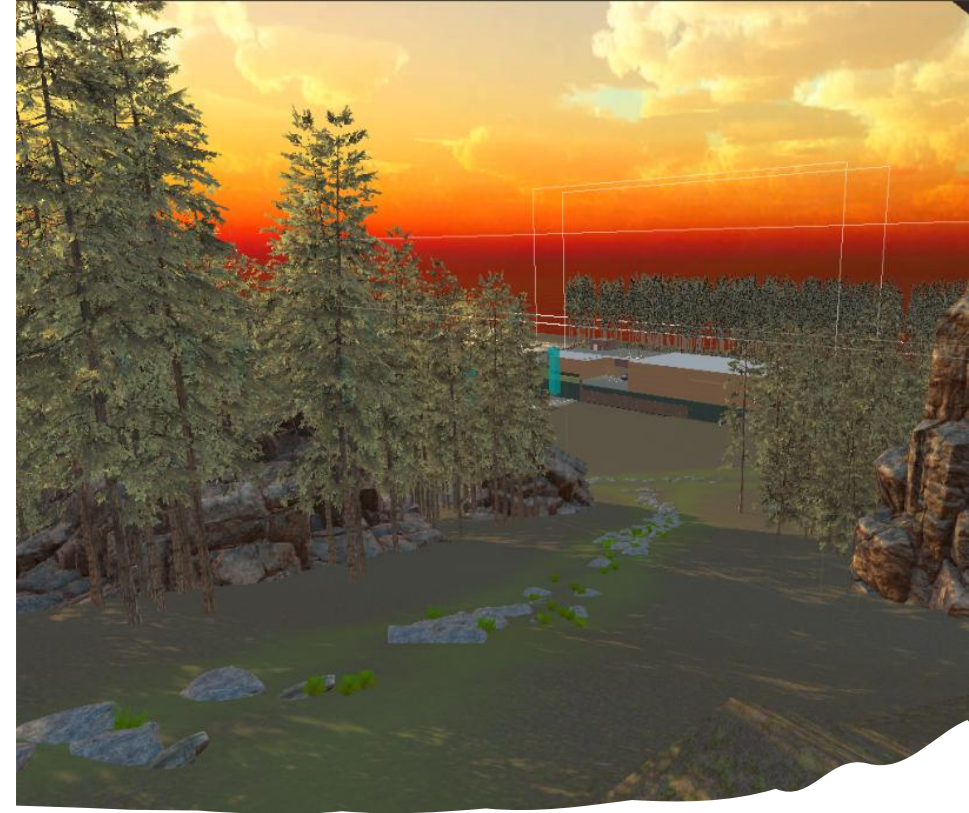
Imported and optimized 3D assets to enhance realism and navigation in the VR scene



BUILDING THE VIRTUAL WORLD

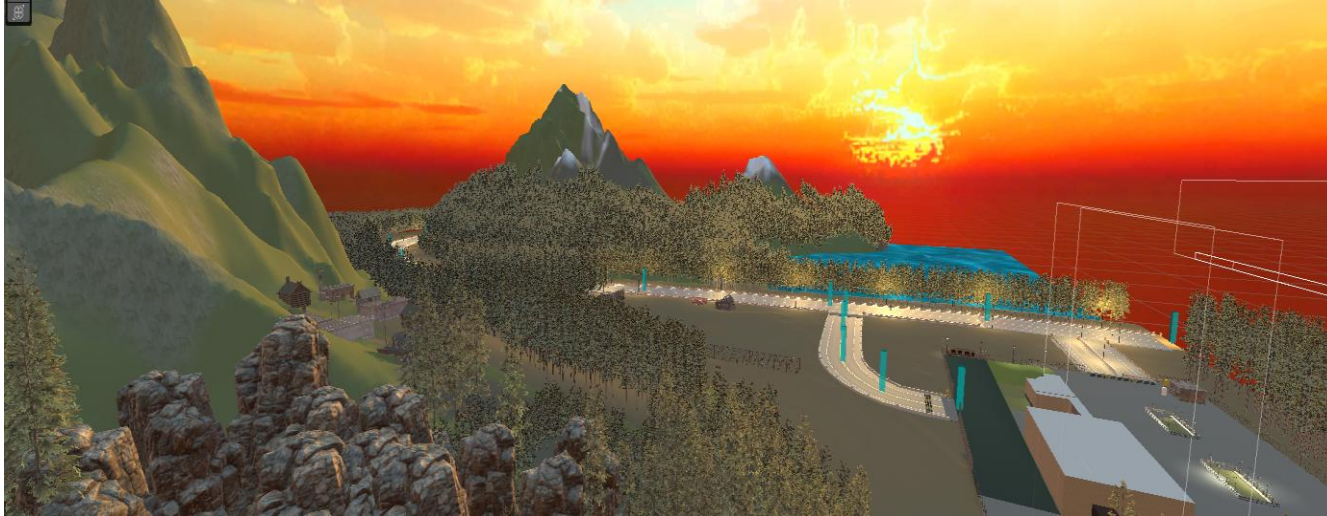
- Designed and built a detailed factory layout in Unity to simulate real-world industrial settings
- Modeled environment elements (walls, terrain, machinery) to match actual workspace scale and layout
- Integrated lighting, textures, and ambient sounds to enhance immersion and spatial awareness
- Optimized environment performance using baked lighting, occlusion culling, and object grouping



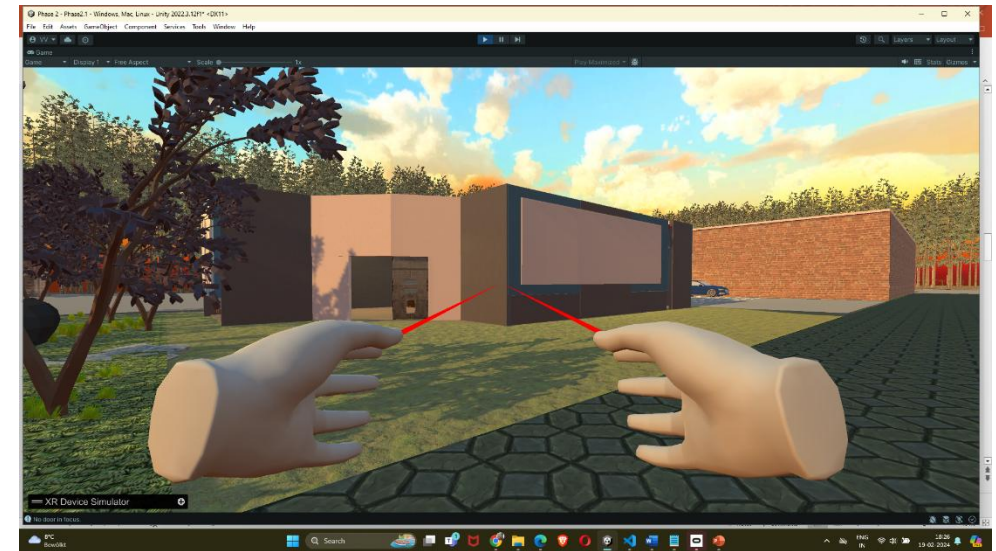
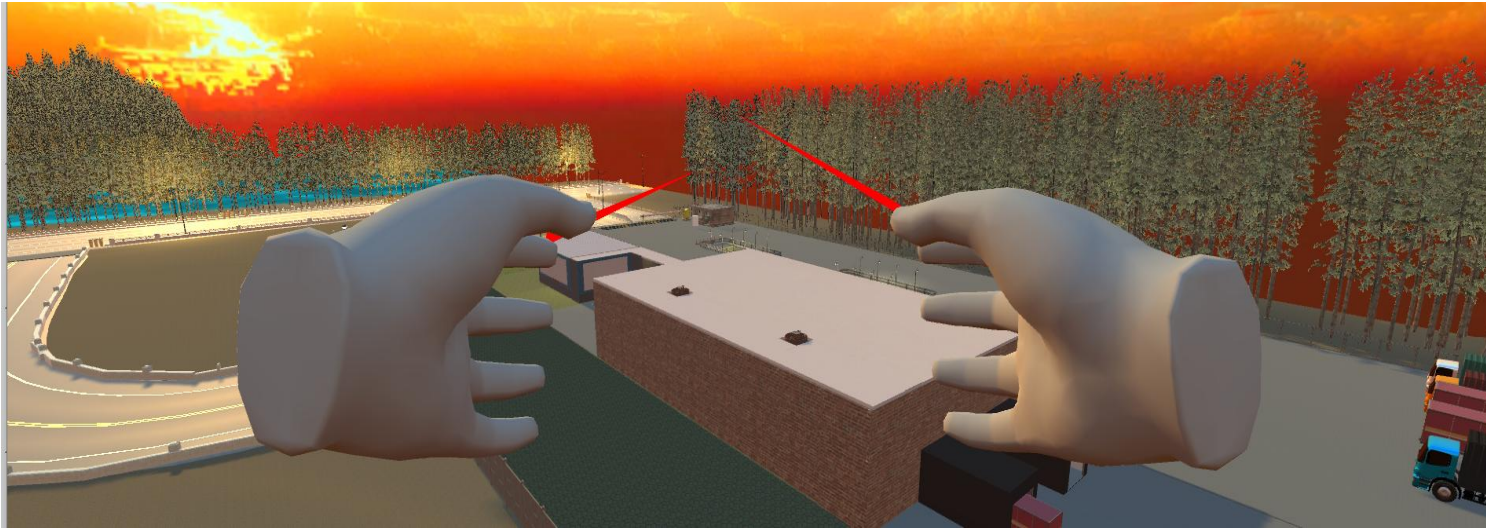


Building the Virtual World





FACTORY





BLENDER



Modeled high-detail industrial furnace (Nabertherm Kammerofen) from reference photos



Applied mesh smoothing and proper topology to ensure clean geometry and VR readiness



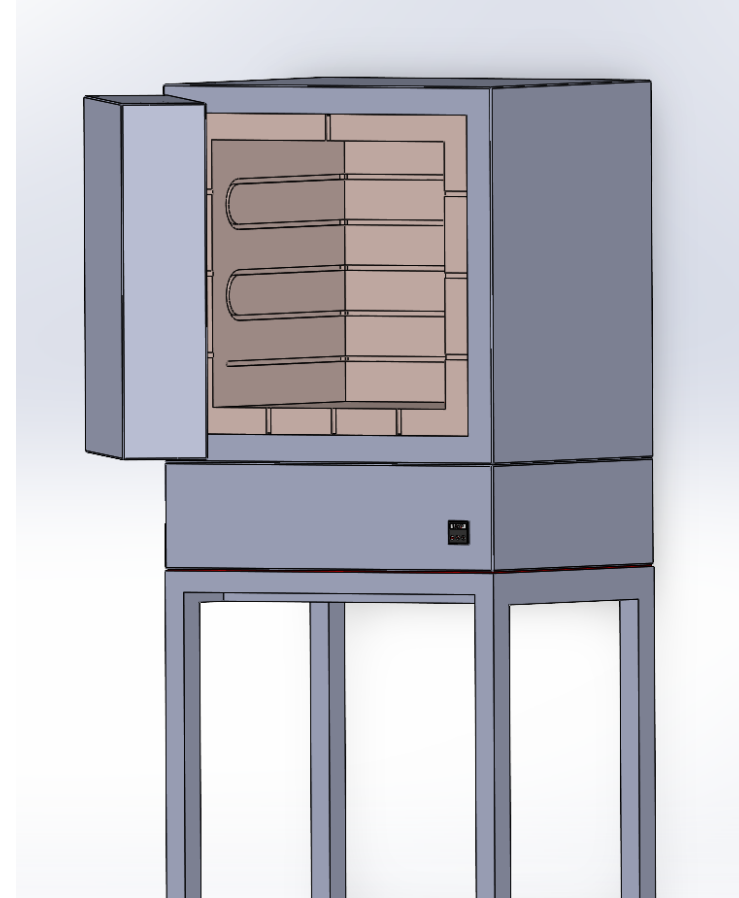
Combined and rigged moving parts (e.g., furnace doors) for Unity animation compatibility



Applied basic materials and exported models to FBX format for use in Unity



Ensured model scalability and positioning for accurate spatial interaction in VR





CHALLENGES & SOLUTIONS

1. Overcame scripting bugs and logic loops while developing interactive features in C#
2. Resolved VR hand calibration issues and alignment problems within Unity
3. Learned to optimize 3D assets for performance without compromising visual quality
4. Tested without full headset access at times, requiring creative debugging methods
5. Managed complexity of combining multiple systems (UI, animation, interaction) in one environment



THANK YOU