Dekut-Siemens Centre

# Virtual Car Assembly Documentation

# Introduction

The Virtual Car Assembly Training project is a comprehensive virtual reality experience designed to simulate the intricate processes involved in the manufacturing of electric vehicles. The project aims to provide users with a completely immersive environment where they can explore each stage of the car assembly  line, from material preparation to the final assembly.
The current focus is on body manufacturing, covering sheet metal work and body parts assembly, allowing trainees to experience and understand critical production stages. Additionally, the simulation aims to educate users on automotive components and their functions, enhancing their knowledge of vehicle mechanics and assembly.
This VR application is targeted at educational institutions, training centers, and automotive industry professionals, offering an interactive way to understand the complexities of modern car manufacturing.

## Key Features

### Immersive VR Experience

- Full VR support with 360-degree exploration.
- Interactive environment replicating a realistic factory setup.
- Hand tracking for a natural and intuitive user experience.

### Detailed Process Simulation

- Accurate simulations of  machining, stamping, pressing, and welding.
- Realistic robotic arm movements using ABB IRB 2600 and KUKA robots.
- Virtual assembly of EV components with real-world physics interactions.

### Educational Focus

- In-depth process explanations with guided, step-by-step training.
- Interactive learning elements, including disassembly and reassembly tasks.

- Real-time feedback to enhance industrial training.

## High-Quality Visuals and Sound

- High-definition models and textures for enhanced realism.
- Advanced PBR-based lighting and dynamic shadows.
- Realistic machine and environmental sound effects for an authentic factory atmosphere.

## User-Friendly Interface

- Intuitive UI with interactive training modules.
- Customizable settings for accessibility and performance.
- Interactive tags on industrial robots to display educational content.

## Performance Optimization

- Optimized for smooth VR performance at 72 FPS.
- Dynamic Level of Detail (LOD) for improved resource management.
- Polygon reduction strategies to maintain high-quality visuals with low performance overhead.

## How to install the Cyber Physical app on the Quest 3 using Side Quest.

This guides users on how to sideload the application onto their Meta Quest (Quest 2/3/Pro) using SideQuest.

### Prerequisites:

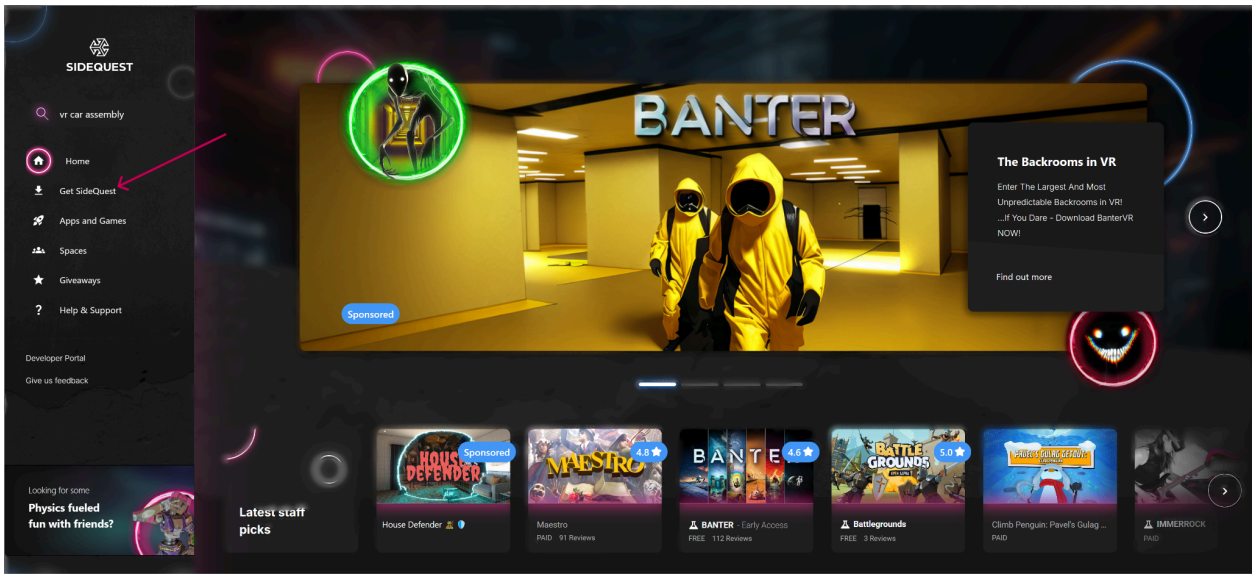
- **Meta Quest headset** (Quest 2, Quest 3, or Quest Pro).
- **Computer** (Windows, macOS, or Linux) with internet access.
- **USB-C cable** to connect the headset to the computer.
- **SideQuest application** installed on your computer.
- **Developer Mode** enabled on your Quest headset.

### Step 1 :

- Visit the side quest official web page. https://sidequestvr.com/

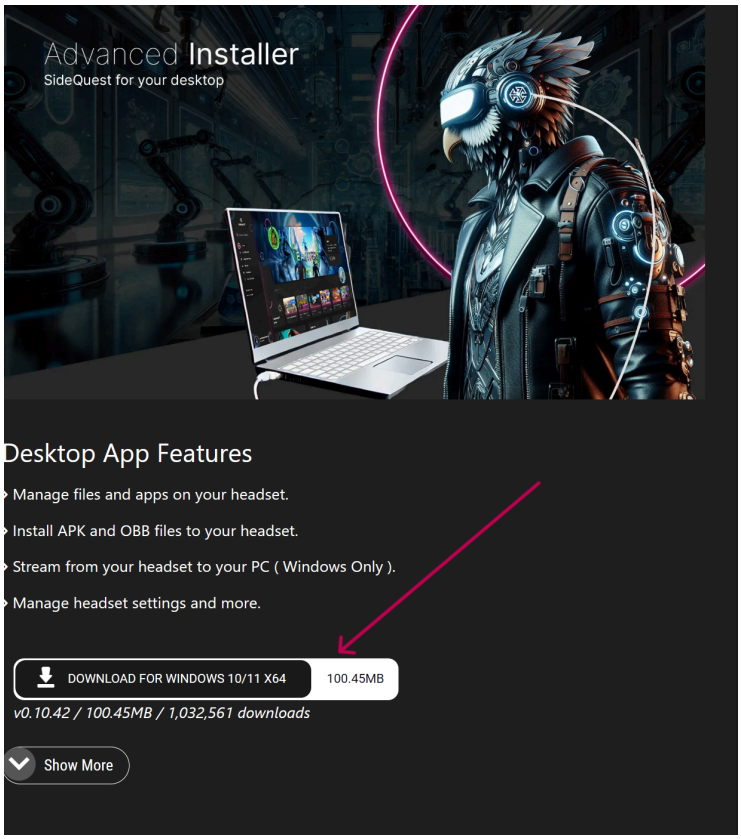
## Step 2 :

- Click on get side quest



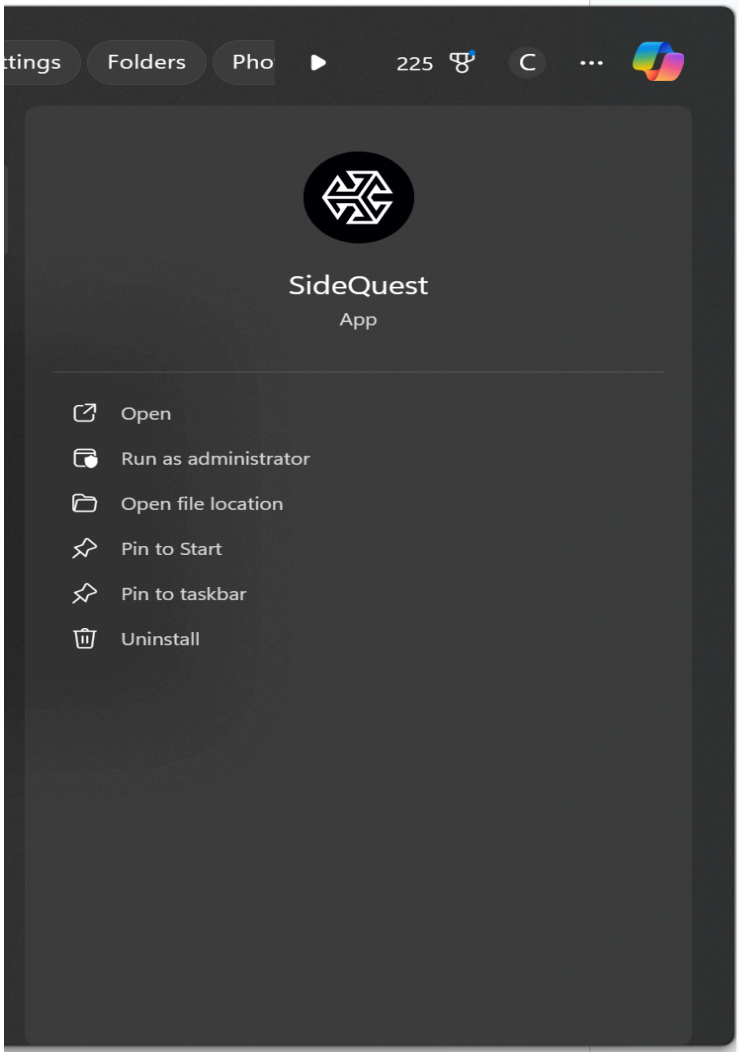
## Step 3 :

Then download and install the sidequest application on your computer.



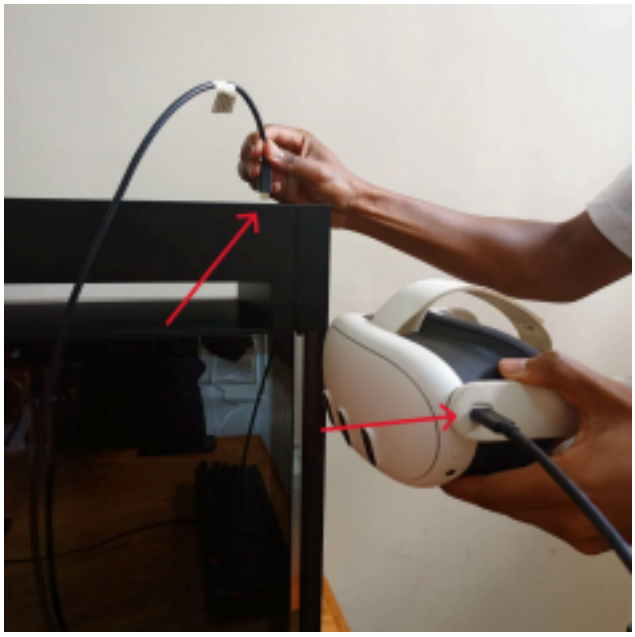
## Step 4:

Launch the application.



## Step 5:

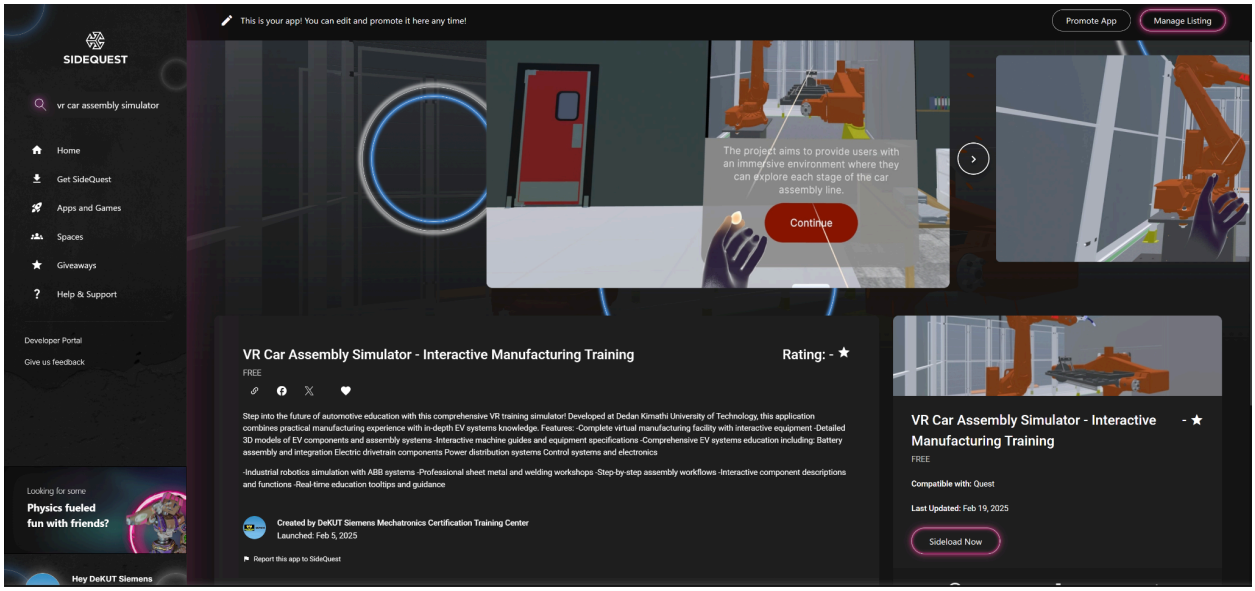
Connect your Quest to the computer.





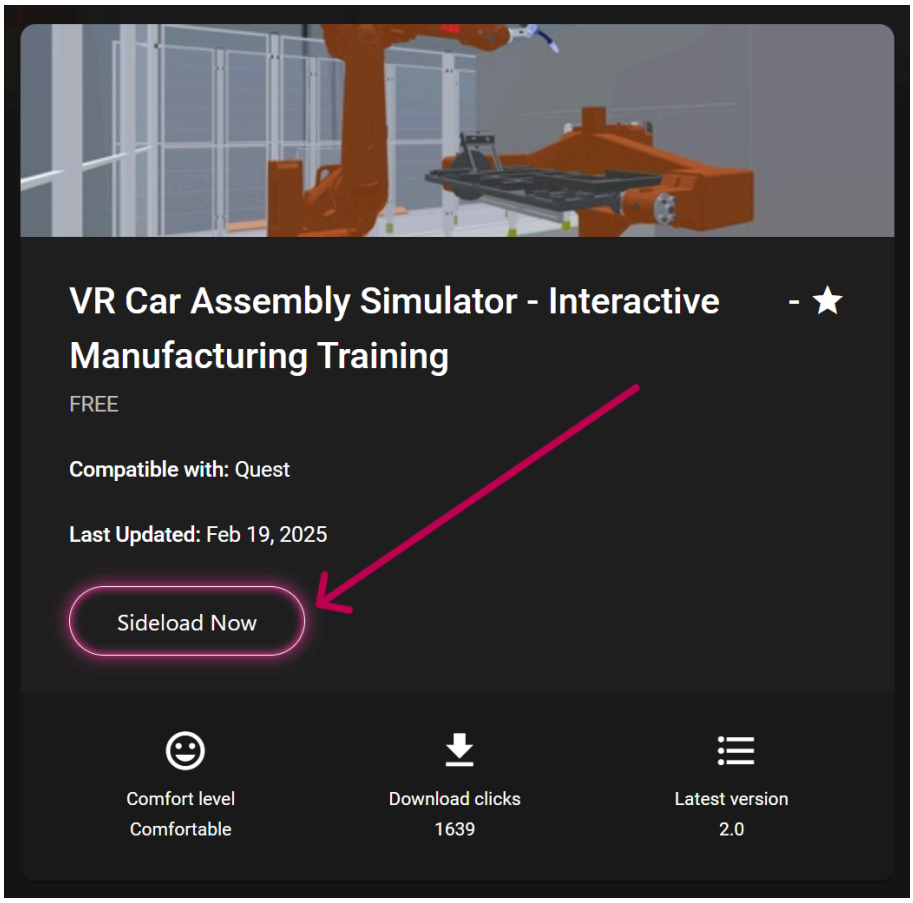
## Step 6:

- Search for the VR Car Assembly Simulator



## Step 7:

Click on the Sideload Now button.




## Step 8:

Done.

# Development Workstation Specifications for VR Car Assembly Simulation

Below is a detailed overview of the hardware and software specifications of the PC utilized during the development of this simulation.

1. Hardware Specifications

- **Processor: Intel Core i7-10700K**
    - **Cores**: 8
    - **Threads**: 16
    - **Base Clock Speed**: 3.80 GHz
- **Graphics Card: NVIDIA GeForce RTX 4070**
    - **Memory Address Range**: 0xB3000000-0xB3FFFFFF
    - **Key Features**: Supports real-time ray tracing, high-definition graphics, and VR rendering. This GPU is suitable for high-quality visual outputs and can handle the graphical demands of VR applications.
- **Memory (RAM): 16 GB**
- **Storage**
    - **Primary Storage**: SSD (Solid State Drive)
    - **Free Space**: Ensure at least 10-20 GB free for optimal performance, especially when handling large assets and builds.
- **Motherboard and Connectivity**
    - **Model**: HP OMEN 25L Desktop GT12-0xxx
    - **BIOS Version**: AMI F.20
    - **PCI Express Slots**: Multiple slots, with configurations for high-performance components like the NVIDIA RTX 2080 and Intel PCIe controllers.

2. Software Specifications

- **Operating System**

    - **OS Name**: Microsoft Windows 11 Pro
    - **Version**: 10.0.19045 Build 19045
    - **Description**: A reliable and widely supported OS for VR and game development.
- **Development Tools**
    - **Unity Editor Version**: Unity 6 LTS
        - **Description**: Long Term Support (LTS) version ensures stability and ongoing support, essential for production projects.
    - **IDE**: Visual Studio (recommended for C# development)
    - **Version Control**: Unity DevOps Version Control,
- **Additional Software**
    - **Meta Quest Link Software**: Used to connect Oculus Quest to a PC for running VR applications, essential for testing and debugging VR features.
    - **Blender**: Open-source 3D modeling software used for creating and optimizing 3D models.
    - **Autodesk Fusion 360**: Professional 3D CAD, CAM, and CAE tool for detailed design and prototyping, useful for creating precise components and assemblies.

3. Performance Considerations

- **Power Management**: System set to high-performance mode to fully utilize CPU and GPU capabilities.
- **Cooling and Thermals**: Ensured proper cooling mechanisms are in place to prevent thermal throttling during intensive tasks.
- **VR Optimization**: Implemented best practices such as LOD (Level of Detail), texture atlasing, and efficient shader management to optimize performance and maintain a high frame rate in VR.