

Video through the following link:

<https://drive.google.com/file/d/1kl0w1mSnxiqHBCTK9MNStFRWfRWv-U0b/view?usp=drivesdk>

Video audio transcription:

In this video, we will explain an integrated framework for rehabilitating war-damaged public buildings using BIM technologies, artificial intelligence, virtual reality, and augmented reality.

First, we inspected this agricultural bank located in the town of Souran, Hama, on April 4, 2024, with the aim of assessing its damages. The process was conducted through three main stages:

1. Preliminary Inspection:

During this phase, we drew a sketch of the building's floor plans, as they were unavailable. This sketch was then transferred and stored in Revit software. The following images display sketches of the basement, ground floor, first floor, and finally the roof.

2. Detailed Inspection:

We collected data about the building and assessed the damages using two evaluation forms. The first was provided by UNICEF, and the second was approved by the Syrian Engineers Syndicate for assessing damaged buildings, as shown in the following images.

3. Damage Documentation:

Damages were documented with photographs to be structurally evaluated later, with suitable solutions proposed accordingly.

Revit Program: A Comprehensive Tool for 3D Modeling and BIM Applications

Revit is a 3D modeling program with numerous features, including project quantity calculations, and is one of the leading Building Information Modeling (BIM) software tools. In this article, Revit was employed as a bridge to convert paper-based floor plans from real-world structures into 3D digital models. This conversion enabled interactive experiences with virtual and augmented reality (VR/AR) technologies, particularly in the field of building restoration and rehabilitation .

After completing the modeling phases in Revit and obtaining a 3D model (as shown on the screen), damaged parts of the building were identified for restoration. A specific damage scenario was drawn and separately detailed, showcasing how it would be developed into a video. The rendered image of the building, produced in Revit, provides a realistic representation of its pre-damage state .

To export the model, navigate to the File menu, select Export, choose the DWFX format, and click Next. Name the file and press OK .

SimLab Composer is a 3D scene composition application that allows users to import 3D files in various formats, arrange components, adjust materials, add options, animations, simulations, and interactive behaviors. The composed scenes can be used for many purposes, including creating VR and AR experiences .

After opening SimLab Composer, go to the File menu, select Import, choose the DWFX file, and click Open. Confirm the file placement by clicking the green checkmark .

Using the Material tab on the right, you can change the floor color or apply a suitable wood texture for the doors by selecting the image slot, adding appropriate materials, and pressing OK. This step aids in decision-making by exploring material alternatives and assessing their realistic compatibility .

Next, navigate inside the building to document the selected damage scenario. These scenarios, assessed and photographed during a detailed site visit, can be applied to the 3D model as textures via the Material tab. This process helps convey restoration instructions to teams who cannot access the site physically .

For the specific damage case modeled in Revit, the structural supports were drawn as displayed. Restoration instructions can be added to the model using the text tool. From the Create menu, select Text, then 2D Text. A text box appears, allowing adjustments to the color, font, and size. Define the text's coordinates on the wall using the Plane option, selecting two points, and adjust its position or orientation as needed .

After completing this step, export the file from the File menu in the VR Package format. Name the file and press Save. A detailed form appears, prompting input for the model's title, publisher, and description. Once these details are filled, click OK .

The avatar appears, allowing adjustments to the model's height relative to a human body. Resize the model as necessary to fit its context. Next, create an account in SimLab by entering a username and password (twice for verification) and log in .

Download the SimLab app from Google Play on your phone, open it, and log in with the same credentials. To load the created model, click the plus icon, select the saved VR Package file, and transfer it to the phone's memory .

Open the file and select VR mode. The model appears at the avatar's location, and you can navigate and move using on-screen controls on the left and right. This process ensures clear communication of instructions to workers, simplifying collaboration across teams .

Returning to the main screen and selecting AR activates the phone's camera, prompting the user to scan a horizontal surface where the model can be placed in augmented reality for detailed examination.

With the help of ChatGPT, a new description of the building was generated, incorporating details about its location, purpose, environmental requirements, external appearance, and cladding. Recommendations were provided for improving the design and visualizing the structure post-restoration. After evaluating multiple outcomes, the best alternative was selected .

To display this alternative using VR and AR, the Revit model was updated with the described changes, following the same steps as before, and transferred to SimLab Composer. After applying the new materials, the rendering process was conducted to produce realistic images of the building after restoration and rehabilitation .

From the Render menu, Real-Time rendering was selected, adjusting sunlight and other visual elements before saving the image. The VR and AR experiences were carried out on mobile devices as previously described, resulting in these final outcomes.

