PlayBricks in Virtual Reality Technology: An enhanced architectural design for cultural preservation

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Introduction

In a world that is continuously being digitalized, hybrid cultures emerge. This mixture of cultures pose a risk on future generations that will find it hard to identify their own heritage. On the other hand, flaws in architectural design ruin the purpose of buildings, and are more susceptible to appear in complex buildings, like Islamic architectural models. Fixing these mistakes is costly and might lead to the destruction of the building. These flaws might not appear during the design phase, whether on 2D sketches or using CAD software.

Literature Review

Elmedin Selmanovic et al.[6], published a study in 2020 that discusses Virtual reality technology in the domain of preserving cultural heritage. The focus is to create a digitalized storytelling experience in the context of preserving heritage. This study uses VR technology to allow a higher degree of immersion and presence for the user. To be able to analyze the differences, the same experience was simulated on a desktop environment through a web application. This research investigates two aspects: performance expectancy (PE) and effort expectancy (EE). In this study, the authors present bridge diving at Stari Most, the old bridge in Mostar Bosnia. The VR experience consists of an introduction and the simulation. It includes a history of the bridge, its destruction and then reconstruction, elaboration on the architecture of the bridge and a dive experience into the Neretva River and come out of it to increase the sense of immersion. The Web application presents the same content. For the study, the authors made sure the users invited would be diverse to represent different groups. Two groups were formed: one group, of 41 participants, to test only the Web application, the other, including 52 participants, would test it after VR. Two questionnaires were designed. The first aims at measuring PE and EE of the web application. The second questionnaire aims at comparing the VR and the Web application. Both questionnaires use the 7-point Likert measuring system. Results of the questionnaires show a preference for the VR with PE items ranging from 5.19 to 6.10. As for the Web-only group, the PE items were in the range of 4.44 to 5.78. For the EE items, mean values ranged from 5.44 to 5.92 for the Web after VR and 4.98 to 5.58 for the Web only group. This indicates that simulation is an essential mechanism to preserve cultural heritage as it challenges the user's empathy with a real-world experience via participation in the virtual environment. It allows a more intimate and personal connection to the culture. In this study, the VR technology was proven to be better at transferring the intangible part of the cultural heritage to the user.

Methodology

1. Setup

The application was designed to work on the Oculus headset, using Unity game engine. The user can navigate in the scene by physically walking inside the scene or by using the joystick on the controllers.

2. Importing Models and Customization

The models used for the bricks were previously designed on Rhinoceros. The bricks can be customized using the controllers.

3. User Interface

The UI consists of a tablet that allows all user controls. The tablet has 4 tabs: a guide tab that explains all the controls to new users, a tab for picking the needed brick, another for picking the color/material and the last one is the scenes tab. This tab allows the user to choose one of 4 different scenes –including an empty scene- to design their building in.

Results

(A)

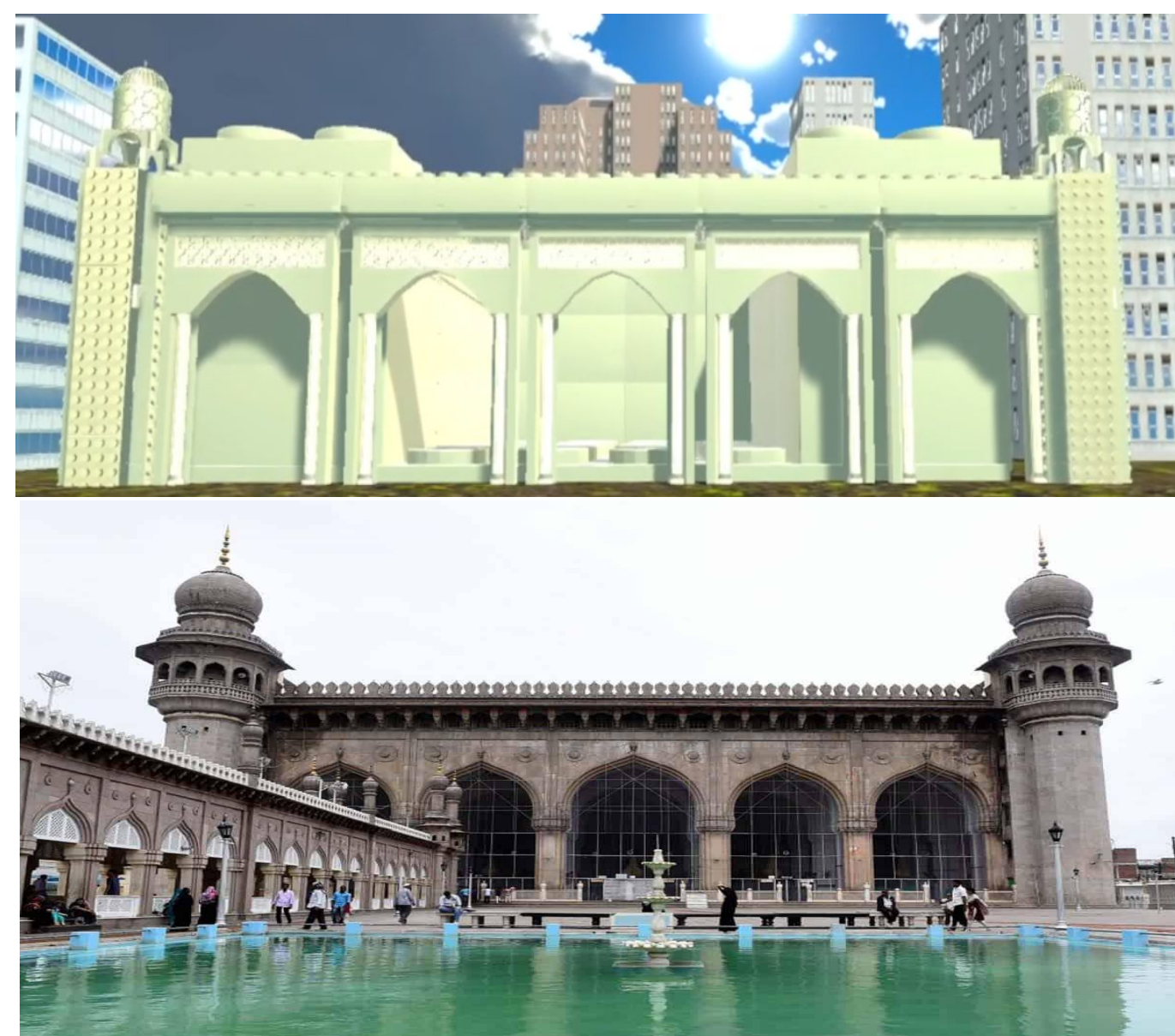Fig: Tablet tabs   Fig: Scenes

(B)

Fig: A replica of Masjid Mecca and its original picture

Conclusion

This application aimed at preserving the Islamic culture through its incorporation in the modern day architecture, using VR technology for the design process. The VR experience allowed an easy design process for buildings influenced by the Islamic architecture. Using play bricks as the building units, the user was able to customize and view their design in real time and get a realistic view of the buildings. PlayBricks is the only VR application that helps preserve the heritage of the Islamic Architecture by including Islamic models and allowing its representation in the modern buildings.

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