

HoloDesigner : A Mixed Reality Tool for On-site Interactive 3D Visualization of Design Object

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1. Introduction

1.1. BACKGROUND

In architectural design or urban planning field, the relationship between design object and existing environment has been constantly emphasized since modernism movement¹⁾. Many famous designers preferred to work closely with design context and spend significant time imagining, developing and assessing their design proposal on site²⁾. Nowadays, designing on site has gradually become an essential means for designers to cope with complex urban building environment in actual projects.

However, designing on site never been an easy work. Because limited by design tool, 2D drawings and 3D models are difficult to integrate into real design context and make adjustment in typical design work.

1.2. POTENTIALS OF MIXED REALITY

Mixed Reality (MR) is the merging spectrum of real and virtual worlds³⁾, which provides huge potentials to implement the new tool to realize on-site visualization and even real-time interaction of design object. Although experiencing long discoveries, there are few effective tool supporting specific designing on site presently.

With technology leaps, an advanced wearable MR device Microsoft's HoloLens has emerged, allowing 3D visualization of hologram and immersive interaction experience in MR environment⁴⁾. HoloLens has been successfully applied into medical field⁵⁾, educational field⁶⁾, geography fields⁷⁾. Although rarely involving in urban planning or architectural design until now, the properties presented by HoloLens, likes true visual sense, natural interaction and spatial depth perception, bring the possibilities for improving MR design tool further.

1.3. OBJECTIVE

Therefore, the objective of this study is to present a new MR design tool on HoloLens for on-site interactive 3D visualization of design object to support designing on-site effectively.

2. Method

2.1. MR TOOL DESIGN

In reality, the conceived new tool HoloDesigner is a MR software application based on HoloLens (Fig 1).

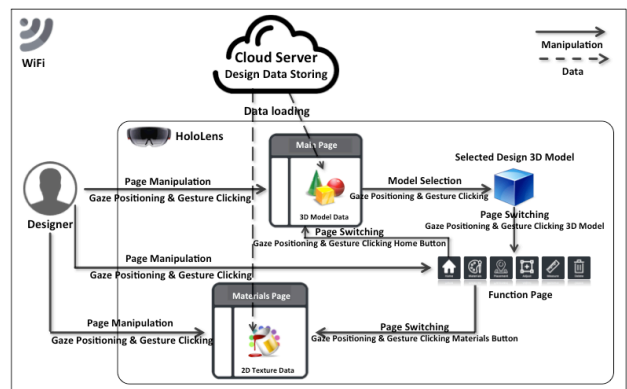


Fig 1. Concept design of mr tool

2.2. MR TOOL DEVELOPMENT

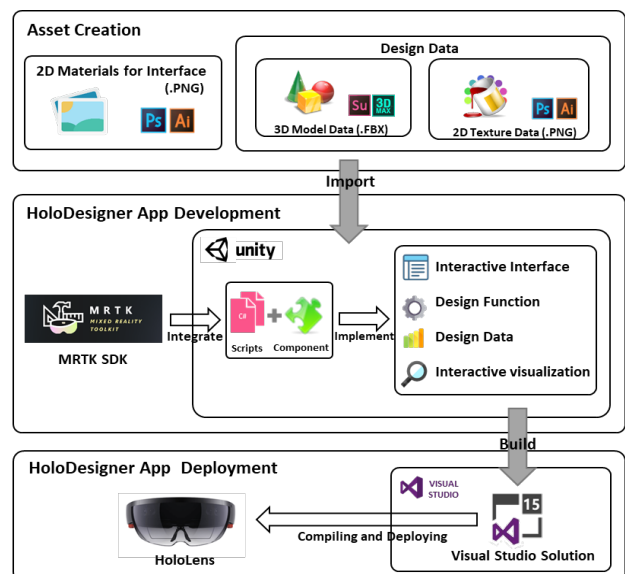


Fig 2. Development process of mr tool

The designed new tool HoloDesigner was implemented with three primary processes in personal computer (Fig 2): Assets Creation; MR Application Development; and MR Application Deployment.

2.3. MR TOOL ON-SITE DEMONSTRATION

To present the final outcome of the new MR tool, we choose a typical community public space to operate HoloDesigner on site. We made a design proposal for the place to supplement some landscape furniture and recreational facilities (Fig 3).

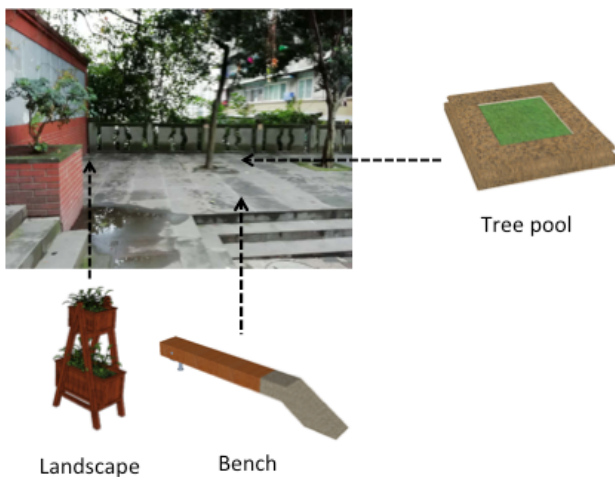


Fig 3. On-site demonstration scene of mr tool

3. Results

3.1. ON-SITE 3D VISUALIZATION

In HoloDesigner, we can select the suitable design object to immerse into the real community public space (Fig 4). Visualization of complex design scene with multi objects can be archived in HoloDesigner. Also HoloDesigner provides us the possibilities to review the design object on site from multi views.



Fig 4. On-site 3d visualization effects

3.2. REAL-TIME INTERACTION

Real-time interaction between real scene, design object and user can be construct by HoloDesigner (Fig 5). Spatial mapping can archive digitization of physical environment for design object contacting. Meanwhile, user control of design object has been realized by gaze and gesture.



Fig 5. Real-time interaction effects

4. Discussion

4.1. IMPROVEMENT

HoloDesigner not only contributes to designer's free perception and intuitive decision on site, but also redefines the interaction mode of MR design tool. Also, HoloDesigner brings new design functions.

4.2. LIMITATION

HoloDesigner can only support slight design adjustment based on prepared digital design data on site, rather than creating design object under physical scene from scratch.

4.3. CONCLUSION

HoloDesigners offer the possibilities for designer to understand physical environments at multi-perspective and check design object at multi-scale on site, and to develop design proposal in real-time according to real scene effectively.

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