

House Remodeling Assistance Final Paper

Group 6

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Executive Summary

House Remodeling Assistance is an application for HoloLens, Microsoft's mixed reality smart glasses, that allows users to customize the color/material of surfaces, create or add existing 3D models such as furniture to a living space, and render a 3D model of the finished area, among other features. The goals of this application are to eliminate some of the time needed, sometimes days or weeks, for interior designers to create designs of living spaces, and to allow users to visually see and edit, in real-time, concepts and designs of living spaces.

The primary requirements for this project are:

- Real-time visuals and editing of surfaces, with the ability to add or create 3D models within the living space
- Accessing the database of materials/3D models provided by external companies
- Rendering a 3D model or picture of the finished area

To develop the app, the team will be using the Scrum development SDLC, allowing the team to deliver fast, incremental changes and improve iteratively on the app. The team will consist of roughly 10-15 people, including user-acceptance testers once the application is complete.

Section 1. Introduction

Our product is an app for HoloLens, Microsoft's mixed reality smart glasses, called "House Remodeling Assistance." The app allows users to customize the color/material of surfaces, create or add existing 3D models such as furniture to a living space, collaborate and provide feedback using a recommendation system, chat with other approved users on a single project, check for safety hazards according to building codes, and render a 3D model of the finished area.

The main stakeholders for this project are interior designers, house remodelers, and homeowners that already own a HoloLens. Interior designers and house remodelers will be able to reuse the app for every client they have, and may purchase a HoloLens for the sole purpose of using this app. Homeowners that already own a HoloLens can simply download the app if they have prior knowledge of its existence or are looking for tools to assist them. This expands the offerings of the HoloLens platform, reaching an entirely new market/audience in interior design/house remodeling.

The major goals for this project are to provide a system that mainly interior designers will be able to use to more rapidly develop designs for living spaces their customers are satisfied with, and allowing users to visually see concepts and designs of living spaces.

This app attempts to eliminate some of the time, potentially days and weeks, between an interior designer visiting a client's home and creating a design. With this app, interior designers will be able to come up with a design quickly and efficiently while still at the client's home.

The app also allows users to visually see, in real-time, the design of a living space, rather than looking at a design on paper or pictures, which can often differ greatly from the final product.

Section 2. Software Requirements and User Stories

2.1 Software Requirements

The following is a list of software requirements needed to implement the House Remodeling Assistance application for Microsoft HoloLens.

Functional requirements:

1. Real-time visuals and editing of surfaces, with the ability to add or create 3D models within the living space
2. Access database of materials/3D models provided by external companies (e.g. paints or furniture at Lowe's and Home Depot) and provide paint table/mixer for precise selections of colors
3. Render a picture or 3D model of room
4. Access to viewing from external devices and live chat from other perspectives
5. Pop up label/tag for items (price, dimensions, color, company, etc.)

Non-functional requirements:

1. Design recommendations/examples
2. Availability - regular updates of databases (e.g. out of stock or newly released products)
3. Easy to use UI with hand gestures/controls for selecting objects or surfaces
4. Projection of total cost, compiling a list of all furniture and colors/materials used and their cost
5. Structural safety checks (using building codes to check for safety hazards)

2.2 User Stories

User Story #1

As a homeowner, James wants to view specific details of each object he adds into his design.

When adding an object, a popup tab appears that shows James the best prices from different stores as well as dimensions, colors, weight, etc. By selecting the popup tab, he will be able to see the exact details of objects. Also, while adding objects, James will be able to sort selected objects by specific criteria including dimensions, prices, brand, etc. He can also view reviews of these selected objects to get a better idea of what they are choosing. Finally, James can choose to favorite/save an item or deal from different stores as a preset into a list to be used at a later time.

User Story #2

Sarah, an interior designer, is creating a design within the app but wants some input from her clients. She brought a second HoloLens that her company owns so that her clients can see and collaborate on the design as well. Sarah can create a design session or room where her clients can then join, allowing them to give input to her on what she can add or change, getting ideas on how to improve her design to satisfy their wants and needs. Collaboration between Sarah and her clients can be done through a live chat, where she can view suggestions and feedback on the side, showing specific locations of suggestions. Sarah can also choose to make her design project room public or private so that she can decide if others will be able to join as well.

User Story #3

As an employee at a house remodeling company, Michael wants to be able to look back at his previous projects from a while back as well as browse through other projects within his company that have been previously shared with him, so he can get ideas of what the design will be.

Michael will be able to open these projects and view a list of all objects and materials used in the design. The list shows specific criteria of the objects including the cost, dimensions, brand, etc.

He will also be able to view feedback that was given over time on the projects and a record of the chat, if applicable. Finally, he will be able to upload his projects to the cloud as well as save them personally on his own file space.

User Story #4

Madison, a homeowner, really likes an addition to her project, but doesn't realize that there could be a potential safety hazard such as dimension issues or poor structural support. The system scans Madison's room and allows her to upload the building's blueprint or building codes, if she has access to them. If the app correctly identifies and recognizes a potential safety hazard, fire hazard, or structural issue, Madison will be notified of the issue and potential generic or general solutions. For example, Madison adds a refrigerator to her living space but it is too close to the wall. The system recognizes this and inform her of the obstruction to the refrigerator. Another example of this is if Madison were to add in an object but is blocking something important like an outlet, vent or smoke detector, the system will attempt to recognize this and inform her.

Section 3. Context Diagram and Architecture

We selected the Model-View-Controller Architecture because our program is an application for HoloLens. In order to use our application, a user needs to have HoloLens, a controller. Through the lens, the application provides users with an augmented-reality view of their environments. All the data created by users are stored in and retrieved from our cloud system. The HoloLens, application, and cloud system are the three separate and interchangeable components since they can be modified and replaced without any need to change the whole system.

Figure 1: Model-View-Controller for User Interaction

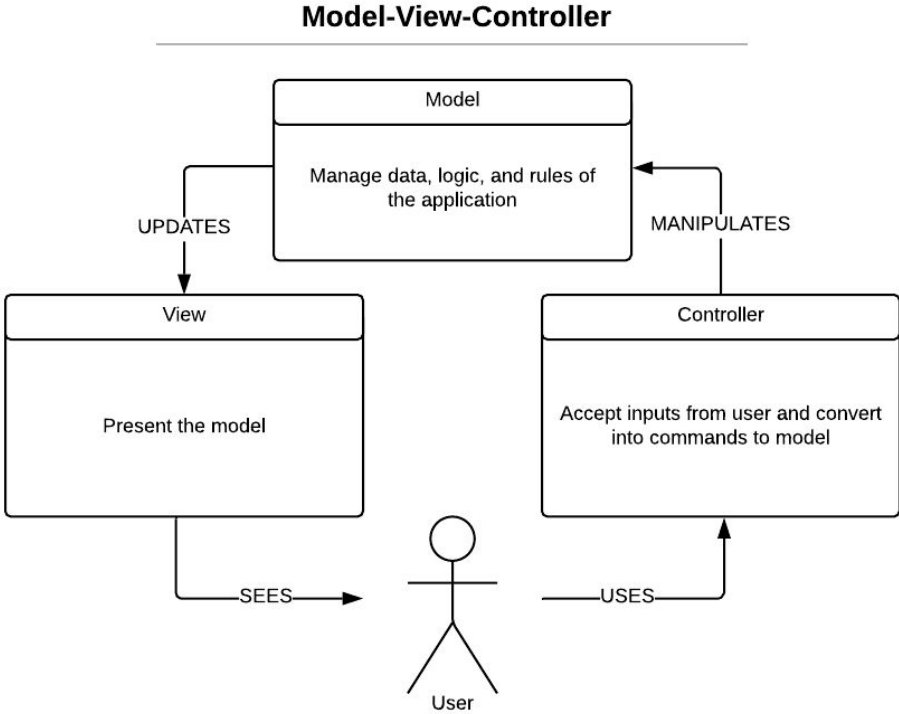
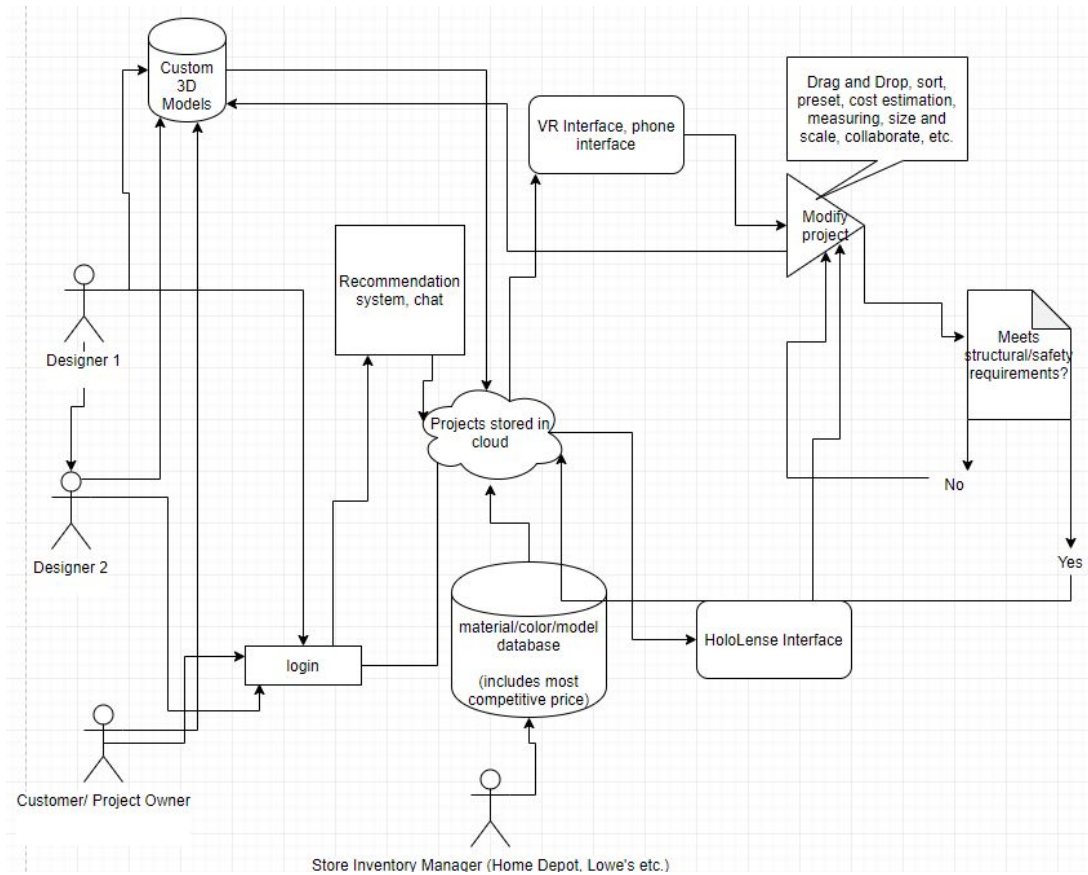


Figure 1 shows us how the user interacts with the House Remodeling System.

Figure 2: Architectural Pattern



In Figure 2, we see a scenario with 2 designers, a product owner (could be a customer of the design company) and a store inventory manager. They all need to log in with the exception of the store inventory manager, who only needs access to the material database to upload new materials. After logging in, users have access to the Custom 3D model database, and can access the recommendation system and chat. Everything is centered around the cloud, which is where the project is stored. The project can be accessed from a VR, phone AR, or the HoloLens interface. When the project has been modified, a new save is automatically sent to the cloud if and only if it passes the structural safety/regulatory requirements.

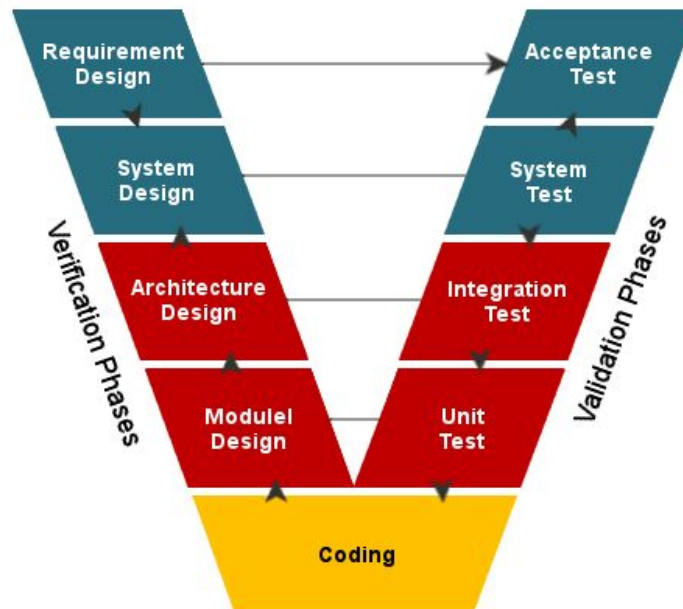
Section 4. SDLC Process

We will be using the Scrum model as our SDLC for developing our HoloLens app, called ‘House Remodeling System.’ This will allow us to get our product out in a faster time period and to iteratively improve our app. The agile software development from the Scrum model will provide for fast, incremental changes and will be beneficial for us since apps require constant updates/user feedback. This incremental process of code release will allow us the small changes we make to build up over time with very little lost time if things go south.

We would have a smaller sized team where we would work on our product in sprints and we will be able to communicate about the things we need to update in our app. This will allow us to hold weekly meetings to go over any bugs/changes that need to be fixed based on testing and user feedback. Communication would be done via Discord, GitHub, and daily scrum meetings.

Since we will utilize a smaller sized team, our communication will be more efficient and no messages will be lost. We will communicate things we have to fix and tasks we have to complete through team meetings as well as any needed outside communication. We will communicate with stakeholders through customer feedback options for any desired functions/app improvements. Users will be able to do this by in-app reviews/feedback as well as our weekly posted surveys that they will be able to provide any helpful input.

Section 5. Testing Approach



For our application, we create a test plan for every test type like unit, integration, system, usability, load, performance and security. The test plan for each type includes description why the test should be conducted, when to start, and details of testing approach and tools. But because we follow agile development, instead of focusing on documentation, our team would focus more on test execution and problem solving.

In test execution, we will define the steps for each activity and see whether it causes any defects. After every test cycle, if no other defects are found, we sign off the test. At the last stage of testing, we open this application for open beta for a final test. During the open beta, we can locate problems that users may find and resolve them before final release.

Section 6. Team Description

Since our team will be relatively small and given our use of the Scrum as SDLC, communication will be key in achieving milestones of the project. Having this small, tightly knit team allows for more efficient communication and development. The team will be composed of roughly 10-15 individuals with experience in VR-related projects consisting of software developers, a scrum master, a project manager, software testers, and user acceptance testers (once the software is done).

- The **project manager** will be responsible for creating the plan for the project, setting deadlines and making sure they are met, managing team members and leading them, assigning tasks, and communicating with stakeholders/clients/users.
- The **software developers** will be responsible for implementing features for the application.
- The **Scrum master** will be responsible for managing the Scrum process and how it is being carried out among the development team.
- The **software testers** will be responsible for testing the software as new features are implemented and ensuring that the interactions between features are functioning and have no major bugs or issues.
- The **user acceptance testers** will be responsible for performing real-world tasks such as designing a living space using the application and all of its features. This allows the development team to see how the product will be used in real-life applications. These testers will be brought in/hired once the application is complete.

Section 7. Conclusion

Our project delivers on several fronts. By the time we launch, we would have created a versatile subscription based platform that allows interior designers to better fit the needs of their customers, a live service that lets customers check the progress of their remodel at any time, without having to pay for costly mistakes, miscommunications, and design disagreements. Our database allows corporate housing appliance wholesalers to market and advertise their products in a virtual environment, which allows for an in-person showcase feel without the extra cost of labor. The brand that we establish would allow us to expand into a consumer driven product once the price of the AR HoloLens-like technology becomes widely available and affordable.