## Introduction

Today we live in a more visual customer driven marketplace where customers cannot even purchase an item unless they can preview, customize and plan how the piece integrates into their interior space. Faced with this growing demand, a furniture design company is building a revolutionary desktop application that aims to enhance the collaboration of in-store designers and customers by providing a method to create room ideas. The use of this application will help the homeowner to visualize how different types of furniture such as tables and chairs fit into the customer’s space, in the room, working against size and shape and colour palette of the space.

Both 2D and 3D design capabilities with this tool will allow designers to model room layouts, furniture arrangements, pinpointing their exact positioning in real time. In addition to enabling clients to see how chosen furniture would appear in their houses, the system will help clients make better decisions by allowing them to see exactly how furniture would be used and how space and aesthetics would be maximized. In this paper, the main functional needs of the application are described, with a focus on the administrative functions necessary for in-store designers, who are key to granting customized design experience to clients.

**GitHub Repository Link: [Paste Your GitHub Link]**

**YouTube Video Link: [Paste Your YouTube Video Link]**

## Background

The need for individualized and graphically right home interior planning continues to grow, so modern furniture design tools need to present more than static catalogues or paper-based plans. This is being built as an interactive 3D room design platform primarily for use by in-store designers at a furniture maker so that they can bridge consumer expectations and design reality.

The purpose of the application is to give designers the capability to design precise room layouts aligned with customer preference regarding size, shape, and color scheme. Users can define room dimensions and attributes in the "Create Design Room" feature and visualize their setup, all in a crisp 2D and immersive 3D format. Labeled boxes with color choices provide real world material and finish options to place and adjust furniture elements inside a 3D space as designers can. With this functionality customers get better feeling how the chosen furniture pieces look and fit into their actual room.

The platform incorporates a large 3D furniture catalogue to which users can peruse and choose from a wide range of chairs, tables, etc. In the catalog, the users have the power over the final design because everything can be scrutinized three dimensionally and tailored by color and configuration.

To sweeten the experience one bit further, a customizable dashboard screen lets designers keep tabs on the next launches; load out saved layouts; and swap between design tools with no trouble. With this background, we present with this, a highly powerful, user-friendly application that allows better collaboration between customers and in store design professionals as well as help put interior visions to life.

## Requirements Gatherings

First, a detailed requirements gathering phase was conducted to kick off the development of the furniture design desktop application, so that the final product meets customer needs as well as the needs of in store designers. Stakeholder interviews, observation of in-store design sessions, surveys, and competitor analysis, for example, were all used to collect the requirements.

1. Stakeholder Interviews

We met with key stakeholders (store managers, interior designers and the marketing teams) to understand objectives, and run the application in the stores for real users. The primary goal being to create an interactive design platform that allows designers to preview furniture layouts for customer rooms and provide near realistic previews.

2. User Observation

Pain points were identified by observation of how designers work with the customers during actual customer interactions. They discovered that designers were having difficulty communicating how furniture pieces would look and be fit in to different room configurations. It underlined the requirement for accurate scaling, colour coordination, and real time visualization.

3. Customer Surveys

To get some insights in how customers expected us to function we surveyed some customers. Overwhelmingly, most customers were interested in the ability to see room designs in 3D, and to be able to interact with and move around different furniture models, colors and arrangements before purchase.

4. Competitor Analysis

To fill the gaps and find useful features, existing furniture design applications were reviewed. Some delivered basic 2D layout tools, but very few had a 2D-to-3D conversion in place, furniture that could be scaled, and a friendly dashboard to manage tons of designs at once.

From the information collected, the following core requirements were labelled:

• It is capable of performing room dimensions, shape, and color schemes definition.

• Design of an interface for making 2D layouts that become 3D visualizations.

• It features the integration with 3D models available on a furniture catalog allowing them to be made interactive and rotatable.

• offers the possibility to resize and reposition the furniture according to the room layout.

• The ability to create a customizable dashboard to manage designs, tools, and saved projects

• For designers, user authentication and secure login.

Designers can use these as the foundation of the application's design and functionality, and satisfy real world usage needs while increasing collaboration and decision making between customer and designer.

## Design

### Personas

**1. Designer Persona: Emily (Interior Designer)**

• Age:30

• Role: An in store designer at a furniture retail store.

• Goals: Emily's main goal is to create 3D views of room layouts with furniture in them to assist and help customers selectively visualize furniture in their rooms in order to help them make design decisions. She is hoping to streamline the design process and provide faster, more accurate renderings to improve customer satisfaction by giving them options for customizing their purchases.

• Challenges: Furniture often has a difficult time fitting into customer rooms, Emily says. Tools which are currently available are not very intuitive and lack smooth transition between 2D and 3D view summaries.

• Motivation: While Emily wants to provide a personalized high quality design experience for customers and herself, she is motivated to use tools that will help her work more efficiently.

**2. Customer Persona: John (Homeowner Looking to Redecorate)**

• Age: 40

• Role: My dad, a homeowner, needed to furnish his living room and dining area.

• Goals: John just wants to see how different furniture arrangements will look in his room, try out various color schemes, and see if the furniture he picks is going to fit his space. What he really likes is a seamless, easy to use tool where he can adjust and quickly see the result.

• Challenges: However, John struggles to picture what it will look like putting together pieces in space. Without seeing things in context, he's not able to visualize color and size combinations.

• Motivation: He wants a more interactive, engaging way to plan his home design such that he feels confident about his buying decisions.

### User Stories

The following user stories have been collected respectively from online forums, and from interviews held by our group.

So, how would I as a designer, want to upload the room’s size, shape and colour scheme, and generate a 2D layout for the customer.

• So when I am a designer, I then want to see the 2D layout in 3D space, so I can show the customer how the furniture will fit in the room from different view angles.

• I would like to be able to design furniture items to be created in a user specified color and size to match what a customer is looking for and what will look good in their room.

• I want to be able to try out different furniture models and color schemes in my room as a customer, without having to commit to a purchase, and determine which furniture and color scheme that I find fit my style and space.

While as a customer I want the ability to choose the furniture, I want to see what it looks like in different locations, so I can see how the room changes, and flow is impacted by different arrangements.

These are the collected user stories culled from the requirements gaggles.

### Low-Fidelity Prototypes

The low fidelity prototype given below for the

1. Login Screen

A screen shot of a login form

AI-generated content may be incorrect.

1. Dashboard Screen

A screen shot of a computer

AI-generated content may be incorrect.

1. Room Designer Screen

A white rectangular object with black lines

AI-generated content may be incorrect.

1. Furniture Catalog Screen

A white rectangular object with black text

AI-generated content may be incorrect.

### High-Fidelity Prototypes

The high-fidelity diagram is attached below

A screenshot of a login form

AI-generated content may be incorrect.

A screenshot of a computer dashboard

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

### Usability Principles Applied in Design

1. Consistency: Across all screens, the navigation of the application is the same. Everything follows the same pattern, icons, buttons, and fonts.

2. Feedback: Whenever a user interacts with anything, they get clear visual feedback. For instance, in furniture resizing, an example is the dimensions display while previewing a color adjustment shows up immediately.

3. Visibility: In uppercase letters, everything is clearly laid out and easy to work with; there’s no reason the user should feel overwhelmed by opening the application, whether it be the toolbar, the furniture catalog, or customization options. Complex options are avoided as well as hidden menus.

4. Error Prevention: User input in input fields is validated, for example input fields such as room dimensions and furniture sizes to prevent errors (e.g. a room dimension being too small to fit a piece of furniture) in the system. Every user is clearly notified of issues.

5. Efficiency: The changing of furniture size and viewing the design in 3D are done to a few clicks. By allowing users to save and come back to a design later, it saves time at the same time.

## Implementation

This furniture design application was developed using Java and JavaFX. The project setup uses Maven to manage dependencies and build tasks. JavaFX is used to create both the 2D and 3D user interfaces, making it possible to build rooms and view furniture in a 3D space.

### Key Features

• 3D Room Designer: You can easily enter in room size, color and shape and view a 3D layout. The 3D rendering is handled by JavaFX using built-in tools, like Subscene and Perspective Camera.

• Furniture Catalog: I then show a collection of 3D furniture models. Items such as chairs and tables can be dragged and dropped into the 3D room via users. Each item can even change color, size, and position.

• Customizable Dashboard: From the main screen, users can create new designs, open saved layouts, and move between tools including 2D and 3D views.

• Data Saving: Using the Gson library, you can save designs as JSON files. Additionally, users can open saved files and continue their efforts later.

### Tools and Libraries Used

* JavaFX: For creating the user interface and handling 3D scenes.
* jimObjModelImporterJFX: For importing .obj furniture models.
* Gson: For saving and loading room data.

### Interaction

Users can interact with the 3D room using the mouse:

* Click and drag to rotate the view.
* Scroll to zoom in and out.
* Drag furniture models to place them in the room.

### Error Handling

The app checks for invalid inputs (like wrong room sizes) and shows error messages. It also prevents the app from crashing if a model file is missing.

## Testing

For the furniture design application, several rounds of testing were performed to ensure that actual functionality, usability and performance met expectations. Our core goals were all met, allowing designers to draw, edit, and visualize room layouts in either a 2D or 3D manner. Usability tests with users and towards our target users, i.e. in-store designers, showed that the interface was intuitive and straightforward. There was praise for the drag-and-drop aspect of adding and situating furniture, and the real time 3D rendering that would give you instant visual feedback.

It was tested to learn how easy it was to navigate through and manage multiple design projects in the customizable dashboard. According to users, switching between saved layouts and using design tools was intuitive and effortless. Early feedback, however, settled upon a couple areas for improvement. However, 3D model rotation caused lag in some users, particularly on low end systems, where performance could be improved. They also made suggestions on making the zoom and camera controls in 3D view nicer to adjust to a more accurate level.

In the end, the testing confirmed that the app serves its purpose, empowering customers and designers to collaborate with a clearer visual pattern of room layouts. Feedback will help improve it in the future by possibly expanding the furniture catalog, by adding material and texture customization, and by improving its responsiveness between different hardware configurations.

## Summary

First, I started the development process by gathering requirements, creating personas, and drawing early design sketches then prototyping the first proof of concept and using it to iterate the design. Informed by key design choices—including an intuitive dashboard, 3D visualization for room layouts, and real time customization—Room Designer aims to become an indispensable tool for design applicators, both in the design world and beyond. Through user feedback, interface usability was improved, and interaction flow was refined. JavaFX and OBJ model support allowed for no frills, design-to-visual, experience. We also learned from the lessons of iterative test and early user involvement. Future versions could improve performance, offer a greater range of furniture and the ability to edit textures and use augmented reality for previews in immersive design.

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