King Abdulaziz University
Faculty of Computing and Information Technology
Department of Computer Science
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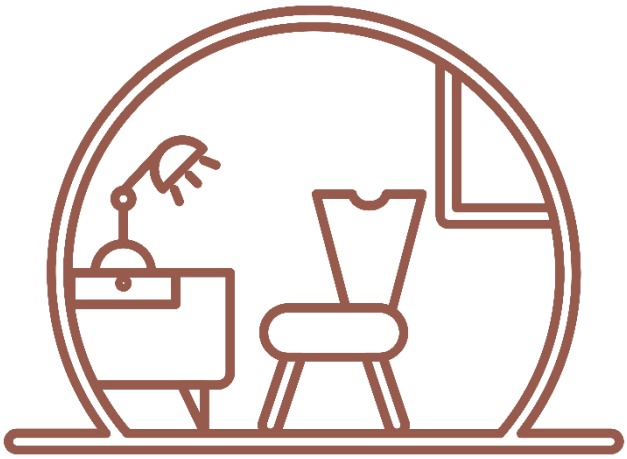

Design Your Space

Interior Design

Project ID: group 4

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1. Phase One: Project Description

1.1 Introduction

Interior design is the science and art of planning and designing the interior of a building to achieve a better environment for the people who use the space. Interior design is an essential part of our daily lives. As it can tremendously affect many aspects of our lives, such as how we live, work, and play.

Being an interior designer means that you need to have good knowledge in many areas. For example, space planning, materials, colors, software applications, and structural requirements. Nowadays, the whole process of finding a professional interior designer that will plan your space in the exact way you want can be an exhausting process. As it may cost you a lot of money, effort, and time.

In our project (Design Your Space) we are trying to build an application that helps people to have a professional interior design service that will save them time and money. The application will study all the user's requirements and provide him with a 3D design plan that matches his style and budget. Also, it will ensure a smooth process from start to end.

1.2 Project Description

This project aims to develop a web-based application that serves customers who want to design their houses/rooms. Our application studies the user's requirements and space, so it can offer him a suitable 3D design plan that matches his needs using Artificial Intelligent techniques. The user must provide the application with all the required details, such as the desired style and colors. Also, the application will help the user to find suitable furniture that matches the suggested design plan. As it will link the user to stores that sell the suggested furniture. The application will help users who want an interior design service to save money and time.

1.3 Project Objectives

- The application enables customers to register for an account.
- The application enables the customer to take a 3D photo of the room.
- The application determines the room size from a picture that the user takes.
- The user provides the app with the requirements, such as style, color, budget and type of the room.
- The application will offer to the user multiple 3D design plans using Al techniques.
- The user can choose the best design from a wide range of designs displayed by the application.
- The user tracks developments in home design through the application.
- The application links the user to the websites of the furniture stores that offer the suggested furniture.
- The application enables the customer to edit, share, save design plans.

1.4 Sources of Domain Analysis Information

Interior design is one of the most popular fields among people. There are many people who do not deal with interior designers because they cost a lot of time, effort, and money. Due to the importance of the interior design field and the desperate people's need for interior designers, we will develop the application called “Design Your Space”. Our application uses artificial intelligence techniques to help people to design their houses as they want and as required with less possible cost, time, and effort. The application’s sources include interior design companies, furniture fairs, professional interior designers, and artificial intelligence experts.

1.5 Stakeholders

The stakeholders of our system are the users who want an interior design service, furniture store owners, artificial intelligence experts, and system developers.

1.6 Project Goal

Our application aims to help people who want to design their spaces with professional interior design. It reduces the cost by allowing the user to determine the budget. In addition, it increases the opportunity to see multiple design plans in 3D virtual reality and then choose the best design plan.

1.7 Scope of the system

The project is a web-based application that presents suggestions for designing spaces using 3D displays of the area. The application studies the spaces and asks the user for the desired style, color, and budget. Then offers suitable 3D designs based on his selections.

1.7.1 This Application includes:

-The ability to select the preferred style, color, and budget.

-The ability to edit the selected design plan and save it.

-A camera access for taking a 3D picture of the area.

-Al techniques to provide the design plans.

-Sharing the interior design idea with the partner or roommates.

-Website links that facilitate the user access to stores that sell suggested furniture.

1.7.2 This Application Excludes:

-Products purchases processes.

-Communicating with interior designers.

-Users who don't allow access to the camera, or location.

-Users who aren’t connected to the network.

-Full display of the whole products of the stores except the suggested furniture.

2. Phase Two: Business Requirements Specifications

2.1 Techniques for Gathering Data

2.1.1 Survey

Data from 110 participants about our system have been collected via a survey technique. 86% of participants are interested in designing their home, but they are unsatisfied with the high cost. We will do our best to make our system much easier and cheaper to design home. Check Appendix A for more details.

2.1.2 Competing System:

Havenly is a mobile application that provides an easy interior design service. The application saves customer's money and time by asking the user about his requirements and then providing him a multiple design plans that suit his preferences. Design Your Space has similar functionality. Moreover, Design Your Spaces uses Al techniques in generating the required design plans easily and quickly, compared to Havenly which uses interior designers to generate them. In addition, Design Your Spaces has added new functions, such as the ability to edit and share design plans.

2.2 The Requirements

2.2.1 Functional Requirements

R1: The system shall allow users -guests and registered- to use the application.

R2: The user shall provide the system with a 3D photo of the space so it can determine the size of the room.

R3: The user shall provide the system with their requirements in designing their space in details. Such as the preferred style, colours, budge and type of he room.

R4: The system shall offer to the user multiple 3D design plans, which have been designed based on the user's requirements and preferences using Al techniques.

R5: The system shall ask the guest to register if they want to benefit from other facilities provided by the application.

R5.1The user shall enter his personal information.

R5.2: The system shall allow the user to register by e-mail or phone number.

R5.3: The user must verify their account.

R6: The system shall ask the registered user to log in.

R7: The system shall allow the registered user to browse the design plans.

R7.1: The registered user shall select any of the suggested design plans displayed by the application and save it.

R7.2: The system shall link the registered user to the websites of the furniture stores that sell the suggested furniture.

R8: The system shall allow the registered user to modify any design.

R10: The system shall allow the registered user to share any design plans on social media.

R10.1 The system allows the user to choose from two share options: link and photo

R11: The system shall provide each registered user with an individual profile.

R11.1: The system shall display all the design plans that have been saved by the user in the user profile.

R11.1: The system shall allow the user to edit their account profile.

R11.3: The system allows the user to deactivate their account.

R11.3.1: The system shall ask the user about the reason that made them deactivate their account, in order to help in developing the system.

R12: The system shall allow the user to log out.

2.2.2 Non Functional Requirements

R1. The system will be available for users 24/7.

R2. The system will be available in both Arabic and English languages.

R3. The system must run on all operating systems.

R4. The system will have an easy and clear user interface that enables satisfying and pleasing

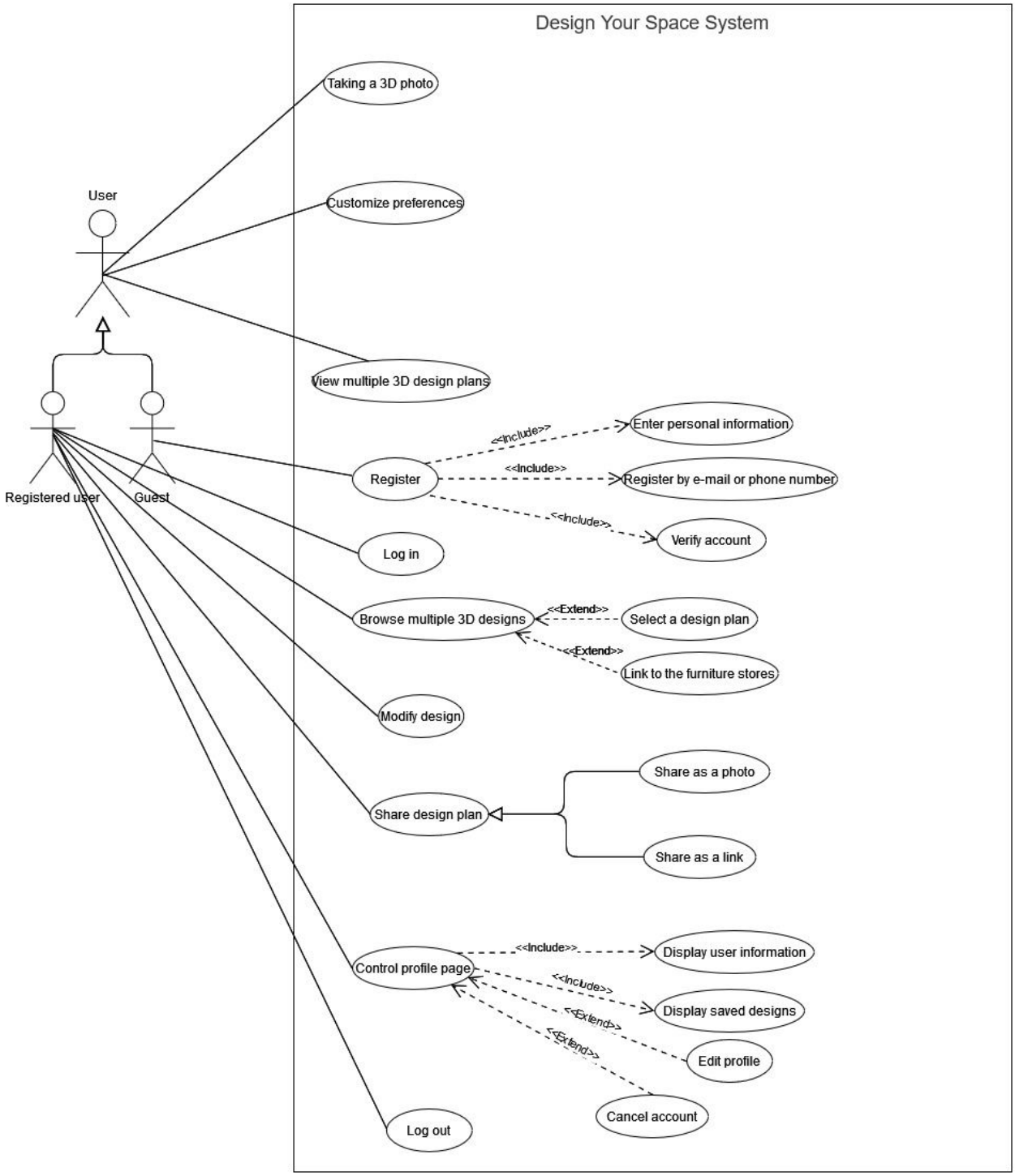
interaction for the user.

R5. The system's load time should not be more than two seconds for users.

R6: The system shall provide both dark and light modes.

R7: The system must protect user's personal information from any type of unauthorized access.

2.3 Use Case Model



2.4 Use Case Description

2.4.1 First Use Case:

Take a 3D Picture
Brief description: The users use their camera's phone to take a picture of the space that they want to design.
Actors: Guest and register user.
Pre-condition: Register user only must log in the system.
Basic flow of events: 1-The registered user logs into the system. 2-The users must be on the home page. 3-The users press the "Take a 3D Picture" button to take a picture. 4-The user take a picture by the camera.
Extension: - The user prevent access to the camera, so he could not take a 3D picture. * The system displays an error message to the user. * The system asks the user to allow access to the camera.
Post-condition: A 3D picture for the space to be designed has been taken.
Special requirements: The user must download the application on their mobiles. The user must allow access to the camera on their mobiles. The user must be connected to the Wi-Fi. The user allows access to the location on their mobile.

2.4.2 Second Use Case

Customize preferences
Brief description: The users design their space according to their preferences like style, colors, budget and type of the room.
Actors: Guests and registered users.
Pre-condition: Register user only must log in the system. The user must take a 3D photo.
Basic flow of events: 1- The registered user logs into the system. 2- The 3D photo has been taken by the user. 3-The system displays the user preferences page to the user. 4- The system displays a list of user preferences available for choosing. 5-The users must choose the preferred type of the room. 6-The users must choose the preferred style. 7-The users choose the preferred colors. 8-The users choose the preferred budget. 9- The users click "Ok" button.
Extension: -The user refreshes the page. * The selected user's preferences have not been saved. * The system asks the user to enter his selections again. - The 3D photo that has been taken is not clear, so the system cannot take the user preferences based on the photo. * The system displays an error message * The system asks the user to retake a 3D photo
Post-condition: The user preferences have been saved. The system will generate the suggested design plans based on user's preferences.
Special requirements: The user must download the application on their mobiles. The user must allow access to the camera on their mobiles. The user must be connected to the Wi-Fi The user allows access to the location on their mobile.

2.4.3 Third Use Case

Share a Design
Brief description: The users share the design that they want on email and any social media applications.
Actors: Register user.
Pre-condition: The actor must be registered into the system with an active/verified account. The actor must be logged into the system. The user must take a 3D picture for the space that he wants to design. The user provides the system with his requirements. The system provides users multiple design plans. The user must choose/select a specific design.
Basic flow of events: 1-The registered user logs into the system. 2-The user points to any design plan. 3-The users press the “Share a design” button to share a design. 4-The system displays multiple share options to share the desirable design such as link and photo. 5-The user chooses one of the suggested share options. 6-The system displays multiple share application options such as email, snapchat, Instagram ...etc. 7-The user chooses one of the suggested share applications options. 8-The system links the user to the selected application.
Extension: - The system fails to share the design plan. * The system displays an error message to the user. *The system asks the user to share the desired design plan again.
Post-condition: The design was shared.
Special requirements: The user must download the application on their mobiles. The user must allow access to the camera on their mobiles. The user must be connected to the Wi-Fi. The user allows access to the location on their mobile.

2.4.4 Fourth Use Case

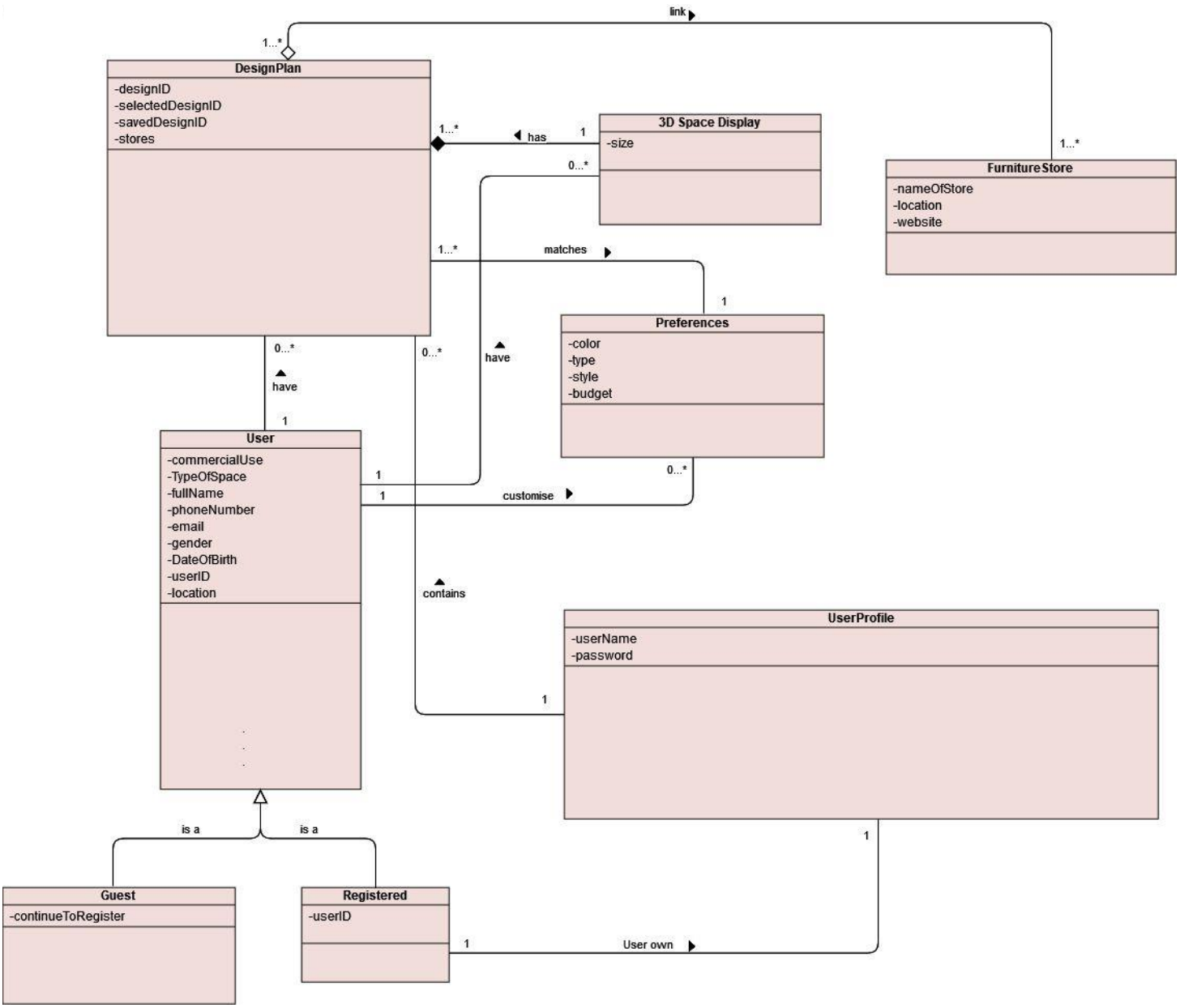
Control Profile Page
Brief description: The registered user controls his own profile page.
Actors: Registered user.
Pre-condition: The actor must be registered into the system with an active/verified account. The actor must be logged into the system.
Basic flow of events: 1-The registered user logs into the system. 2-The user access profile page. 3-The user can choose one of the two tabs: user information tab, saved designs tab. 4- Based on the user's choice in the third step, if the chosen tab is "user information tab" the system will display all the user information, such as: name, telephone number, email, address... etc. 5- Based on the user's choice in the third step, if the chosen tab "saved designs tab" the system will display all the designs that have been saved by the user. 6-The user can edit his profile by choosing the edit button. 7-The user can cancel his account by choosing the cancel account button. 9-The user exits profile page.
Extension: -If the user enters his personal information in a wrong way, when he wants to edit his profile. For example: using the wrong phone number format. *The system will reject any changes and display an error message.
Post-condition: The registered user can display his information any time. The registered user can display his saved designs any time. The registered user can edit his profile. The registered user can cancel his account
Special requirements: The user must download the application on their mobiles The user must allow access to the camera on their mobiles. The user must be connected to the Wi-Fi The user allows access to the location on their mobile.

2.5 Risks and Difficulties Analysis in the Domain

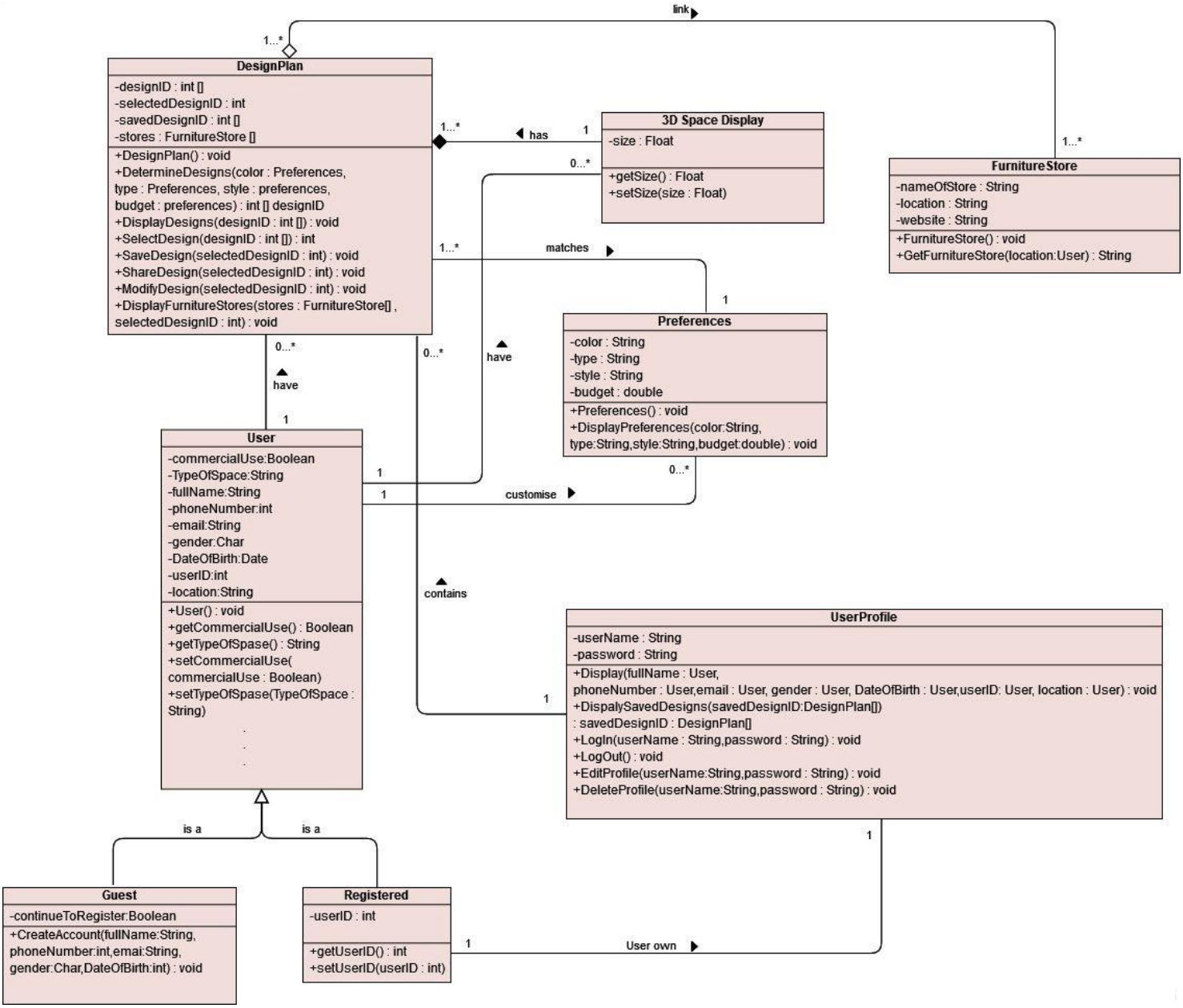
- Difficulty in collecting information from experts in the interior design field.
- Formulating requirements demand full knowledge in the interior design field.
- Implementing non-functional requirements might be difficult with inexperience team.
- Requirements might change during working on the project.

3. Phase Three: Software Design and Structuring

3.1 Domain Model



3.2 UML Class Diagram



3.2.1 Association Relationships and Their Multiplicity

1-Between Registered user class and User Profile class

- A registered user own one User profile only.
- A User profile is owned by only one Registered user.

2- Between User class and 3D Space Display class

- Each User have zero or more Spaces.
- Each Space is owned by only one User.

3- Between User class and Preferences class

- Each User customise zero or more Preferences
- Preferences can be customised by one User only.

4- Between User class and Design plan class

- Each design plan is created for one user only.
- Each User can have zero or more Design plan created for him

5- Between Design plan class and Preferences class

- Each Design plan matches each Preferences
- Each Preferences is matched to one or more Design plans.

6- Between User profile and Design plan

- Each user profile contains zero or more design plan.
- Each design plan is placed in one User profile only.

3.2.2 Generalizations Relationships

User class inherited by Registered user class and Quest class.

3.2.3 Aggregation Relationship and Its Multiplicity

Between Design plan class and Furniture store class

- Furniture stores are part of each Design plan
- Each Design plan links one or more Furniture store and each Furniture store could be linked by one or more Design plan

3.2.4 Composition Relationship and Its Multiplicity

Between 3D Space Display class and Design plan class

- If there is no Space, there is no Design plan
- Each Space has one or more Design plan created for it.
- Each Design plan is created for one Space only.

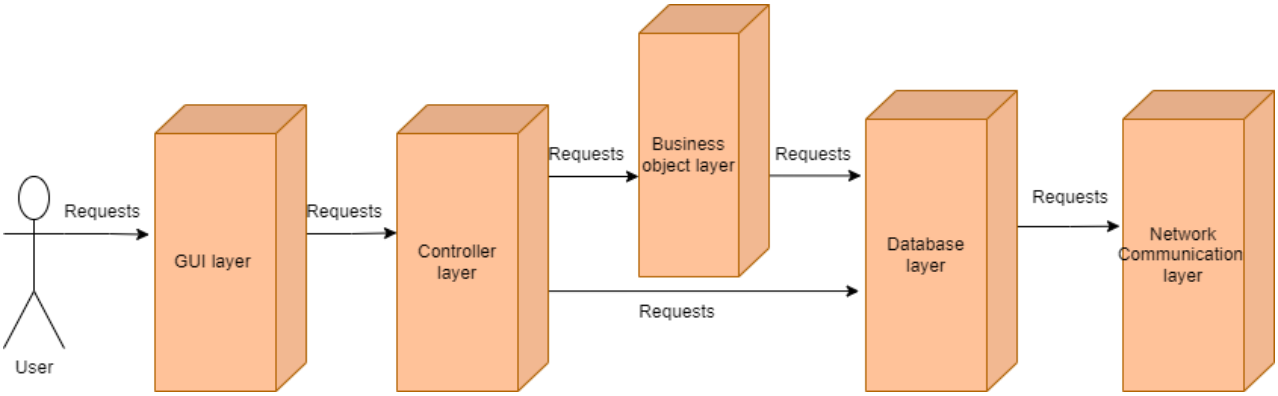
3.3 System Architectural

3.3.1 Type of the system

The “Design Your Space” system responses to guests and registered users requests. Our system is an interactive system because it allows user to take a 3D photo, determine their design preferences, save, modify and share design, browse the design plans and control the profile page.

3.3.2 Architectural Design

We used N-tier architecture with this interactive system.

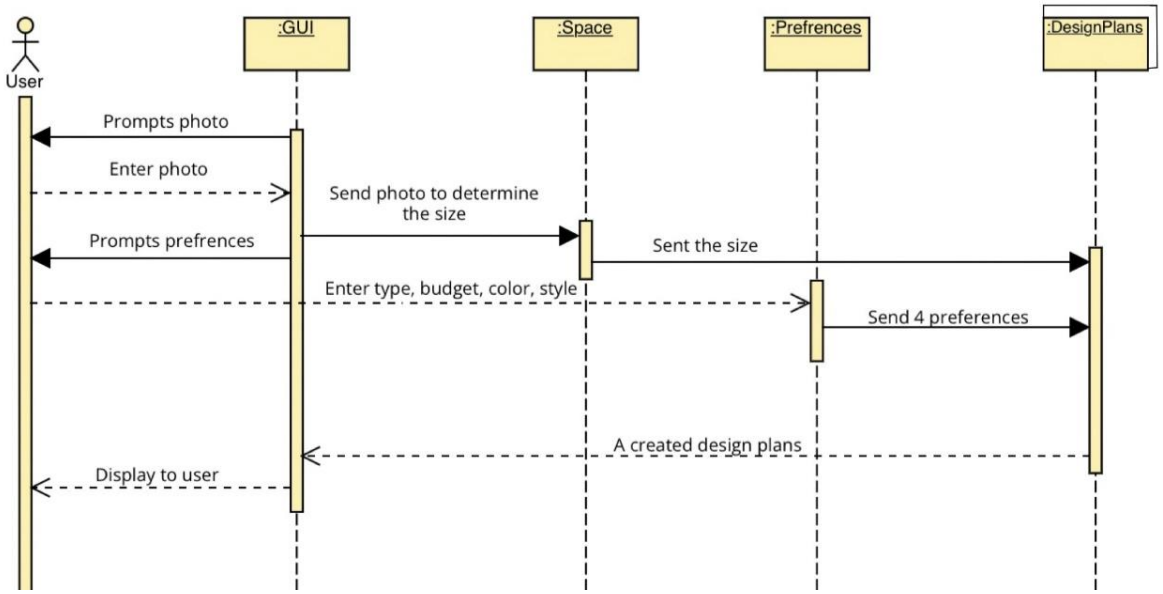


4. Phase Four: Modeling, Interaction and Behavior

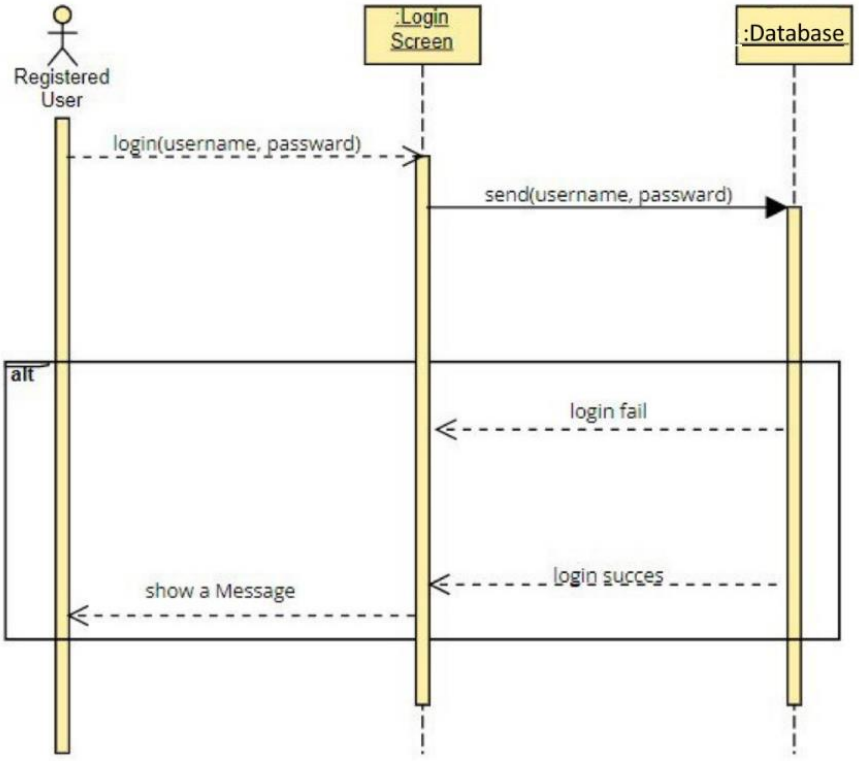
4.1 Interaction Diagrams

4.1.1 Sequence Diagram

Use Case 1: View design plans

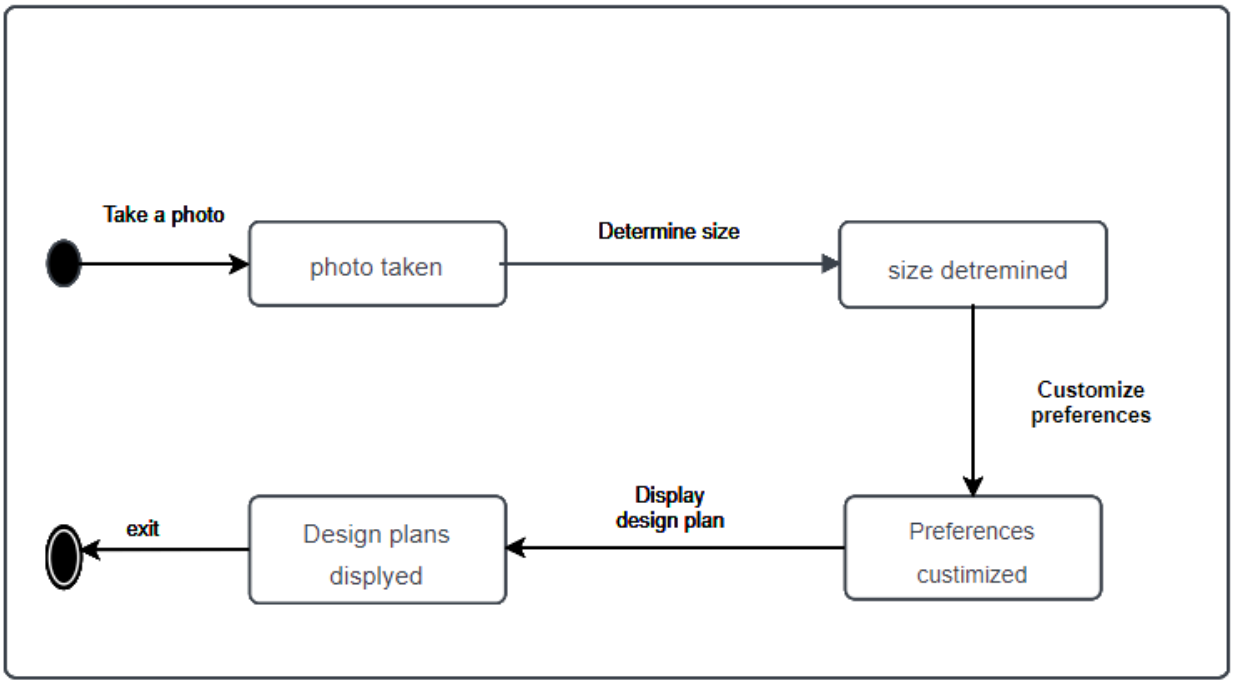


Use Case 2: Register a user

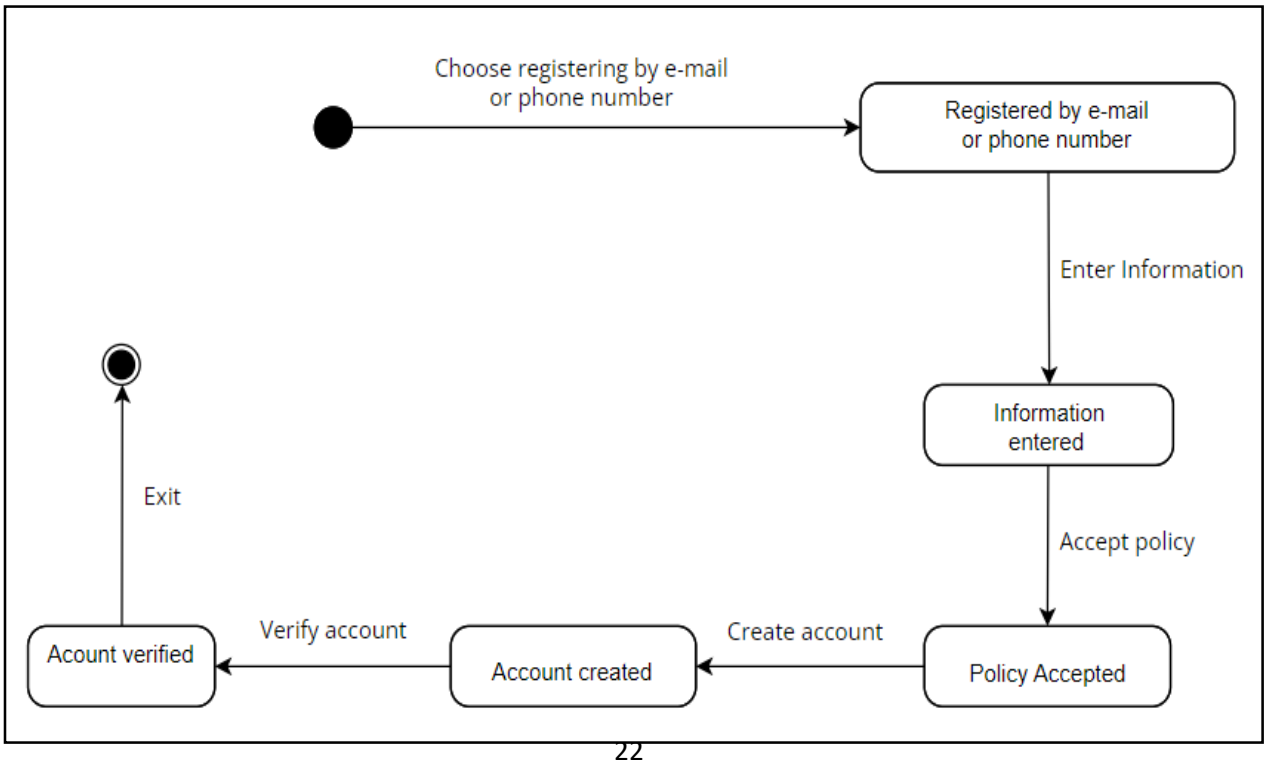


4.1.2 State Diagram

Use Case 1: View design plans

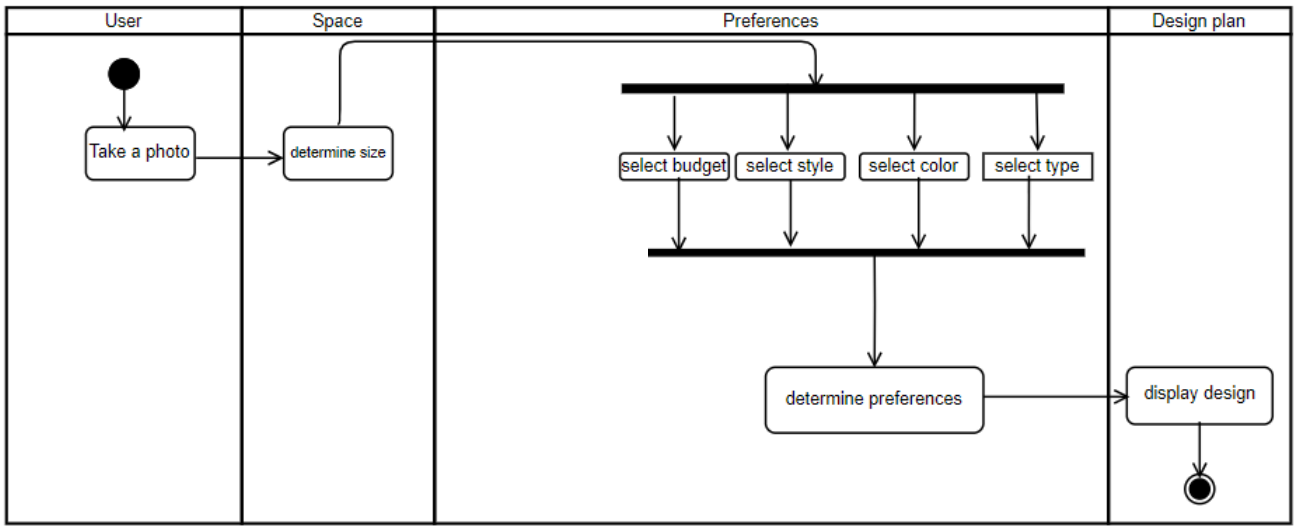


Use Case 2: Log in a resisted user

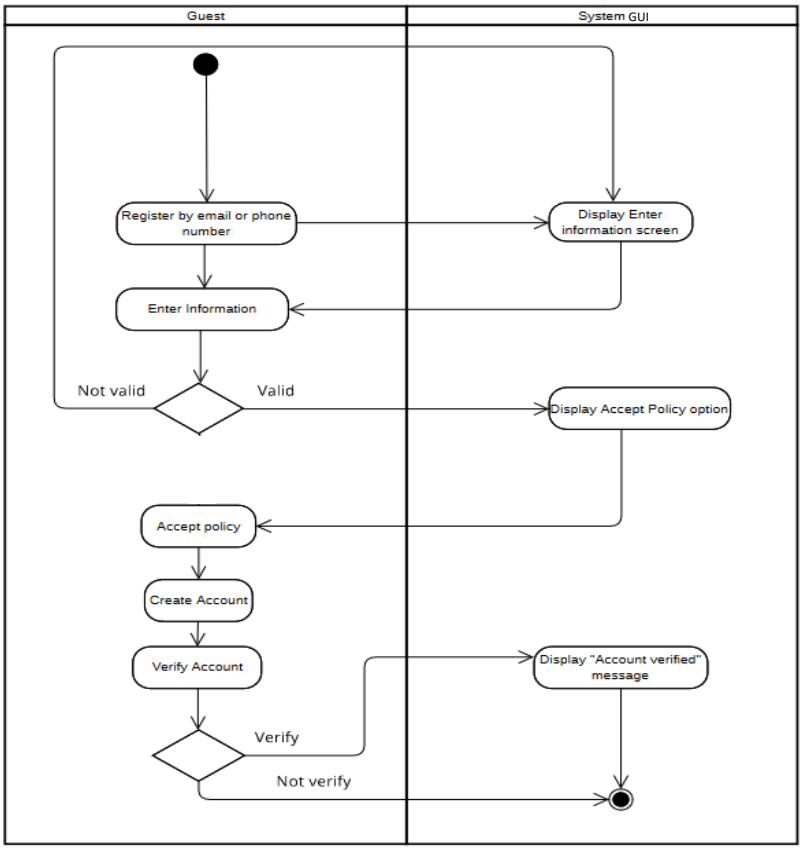


4.1.3 Activity Diagram

Use Case 1: View design plans



Use Case 2: Register a user



4.2 Testing

4.2.1 Objectives

Testing is used to check whether the "Design Your Space" system satisfies the requirements and works as expected, to detect and identify errors or bugs, and to fix them. In addition to that, testing is used to check the system performance and to ensure system quality.

4.2.2 Strategy

The essential goal of testing is to get customer satisfactions and to satisfies the user's requirements. In our project we selected three functional requirements to test:

1-Register a user

2-Display saved designs

3- Display design plan

4- Log in a user

4.2.3 Approach

The approach that we used in our project and in this report is the black box testing. We chose this type of testing because in the testing phase, we will focus on testing the behavior and the interaction with the user interface instead of focusing on the implementation. The testing will be done by entering the inputs and examining the outputs.

4.2.4 Test Plans

Test Plan 1: Log in a user

- If a user has an account, he will click on the login button
- Proceed with your recorded email and password correctly

Conditions	**Email**	F	T	F	T
	Password	F	F	T	T
Actions	**Expected result**	Error: Please enter email.	Error: Please enter password.	Error: Please enter email.	Login processed

Test Plan 2: Register a user

- Click on the register button
- Enter user's information
- Log in not available for new users, only for registered users

User name: the user name can be between 4 and 16 letters

Invalid	Valid	Invalid
0 (character) 1(character) … 4 (character)	5 (character) 6(character) … 15 (character)	16 (character) 17(character) …

Phone number: the phone number must consist of 10 digits

Invalid partition – Valid partition Lower boundary		Invalid partition – Valid partition Upper boundary	
BV Below the boundary	BV above the boundary	BV below the boundary	BV above the boundary
0	10	10	11

Password (Contain characters and numbers): the password will be allowed if it consists of 7 to 15 characters and numbers

Invalid
1(characters and numbers)
2(characters and numbers)
3(characters and numbers)
4(characters and numbers)

Valid
5(characters and numbers)
6(characters and numbers)
7(characters and numbers)
8(characters and numbers)

Invalid
9(characters and numbers)
10(characters and numbers)
11(characters and numbers)
….

Days in birth date: the range of number of days is from 1 to 31

Invalid Partition – Valid Partition Lower Boundary		Invalid Partition – Valid Partition Upper Boundary	
BV below the boundary	BV above the boundary	BV below the boundary	BV above the boundary
0	1	31	32

Test Plan 3:

System: Your Space iOS/Android Application

Test Case Name: Register a user

Description: Testing user ability to register into the system

Precondition: User isn't registered into the system

Postcondition: The user has successfully registered into the system

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
1	Check system behavior in registering into the system when valid case is entered	1-Choose registering by e-mail or phone number 2-Enter information 3-Accept policy	**Full Name:** Hanin Suleiman **Phone Number:** 0565612544 **E-mail:** hanin7@gmail.com **Gender:** Female **Date of Birth:** 12/2/1997	User has been successfully registered to the system	As Expected	Pass

		4- verify account	**Location:** Saudi Arabia, Jeddah			
2	Check system behavior in registering into the system when invalid case is entered	1-Choose registering by e-mail or phone number 2-Enter information 3-Accept policy 4- verify account	**Full Name:** Ali Ahmad **Phone Number:** 6538 **E-mail:** aliah@gmail.com **Gender:** Male **Date of Birth:** 17/4/2003 **Location:** Saudi Arabia, Abha	An interruption occurs in step 2 showing an error message "Invalid phone number"	As Expected	Pass

Test Plan 4:

System: Design Your Space iOS/Android Application

Test Case Name: Display Saved Designs

Description: Testing user ability to see his saved design plans

Precondition:

- A user must register in the system
- A user must log in the system

Postcondition:

- A user saw his saved design plans successfully

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
1	Check system behavior when a user want to display his saved design and he has at least one saved design plan in the profile page	1-Log in to the system 2-Go the profile page 3-Click on "Display saved designs"	There is no test data. The user does not require to fill anything.	The system will display the message "These are your design plans" and display the saved	As expected	pass

				design plans to the user		
2	Check system behavior when a user want to display his saved design and he has not any saved design plan in the profile page	1-Log in to the system 2-Go the profile page 3-Click on "Display saved designs"	There is no test data. The user does not require to fill anything.	The system will display the message "You do not have any design plans to display".	As expected	pass

Test Plan 5:

System: Your Space iOS/Android Application.

Test Case Name: Display Design Plan.

Description: Testing the user ability to display the design plans.

Precondition:

- The user must take a photo of the space.
- The user must choose his preferences.

Postcondition:

- Design plans display successfully.

Test Case ID	Test Scenario	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
1	Check system behavior when a user want to display the design plans	1-Open the app 2-Take a photo of space 3-Press done	**Type of space:** Bedroom	The system will display multiple design plans	As expected	Pass

		4-Choose the type of the space 5-Choose the style 6-Choose the color 7-Determine the budget 8-Press display design plans	**Style:** Modern **Color:** Black **Budget:** 4000	based on the chosen options		
2	Check system behavior when a user want to display the design plans without specify the type of the space.	1-Open the app 2-Take a photo of space 3-Press done 4-Choose the type of the space 5-Choose the style 6-Choose the color 7-determine the budget 8-press display design plans	**Type of space:** - **Style:** Modern **Color:** Black **Budget:** 4000	The system will display error message “Choose the Type of space”	As expected	Pass
3	Check system behavior when a user want to display the design plans	1-Open the app 2-Take a photo of space	**Type of space:** Bedroom	The system will display error message “Choose Style”	As expected	Pass

	without specify the style.	3-Press done 4-Choose the type of the space 5-Choose the style 6-Choose the color 7-determine the budget 8-press display design plans	**Style:** - **Color:** Black **Budget:** 4000			

5. Conclusion

In conclusion, our project “Design Your Space” focuses on facilitating the process of interior design by providing to the users who wants to design their spaces an easy interior design service that save time, money, and effort.

We faced many challenges during working on our project, like collecting information and time management. Also, we had a difficulty in finding and communicating with interior design experts and AI specialists. But we succeeded in overcoming these challenges by working together as a team.

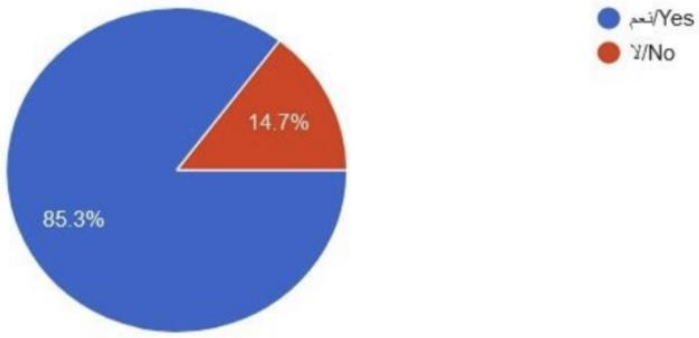
“Design Your Space” is a user-friendly application that provide a professional interior design service with many unique features.

Appendix

Appendix A

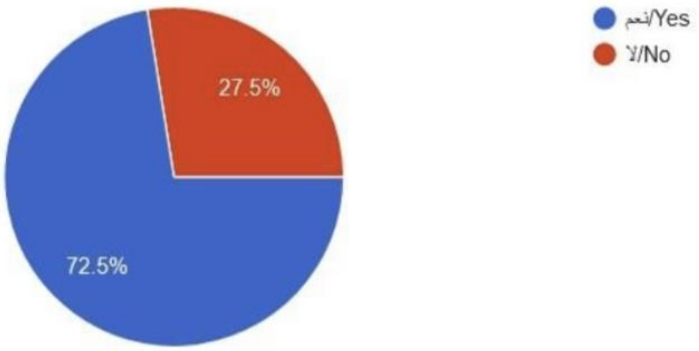
هل أنت مهتم بالتصميم الداخلي؟
are you interested in interior design?

109 ردود



اذا كنت ستنتقل الى منزلك الجديد هل ستستعين بمصمم داخلي لتصميم منزلك؟
If you will move a new home, would you consider designing your home with the help of an interior designer?

109 ردود



اذا كانت اجابة السؤال الماضي لا ، لماذا؟
If above answer is no, explain why?
إجابتك

29 ردًا

بسبب ارتفاع اسعار المصممين

بسبب ارتفاع أسعار المصممين

افهم في التصميم

Too expensive, not a priority

غاليين

تكلفة عالية وامتلك الخبرة لتصميم منزلي الخاص

احب اصمم واختار بنفسي

I like to implement my very own vision

لعدم توفر الامكانيه

لو فيه فلوس اكيد لو مافي فلوس لا

احب ذوقي وافكاري وما يناسبني

لان بالغالب اسعار المصممين مبالغ فيها

لأنه غير مستدعي ادفع مبلغ لأجل تصميم شيء يكون ولا غلطة بينما اقدر اسوي حاجه مناسبه وتناسبني بنفسي

ارتفاع التكلفة

لارتفاع اسعارهم

احب اصمم منزلي بنفسي

اجبت بنعم

بسبب ارتفاع التكلفه

لان انا ملهمه في التصميم ولكن لمى تاتي لي الفرصه

لان دايم يكون عالي

عالي

التكلفه مرتفعة

بسبب التكاليف الباهظة لاستشارات المصممين، وبسبب قلة خبره بعض المصممين

احب التصميم والاجتهاد بنفسي

افضل تصميمه بنفسي

احب ذوقي

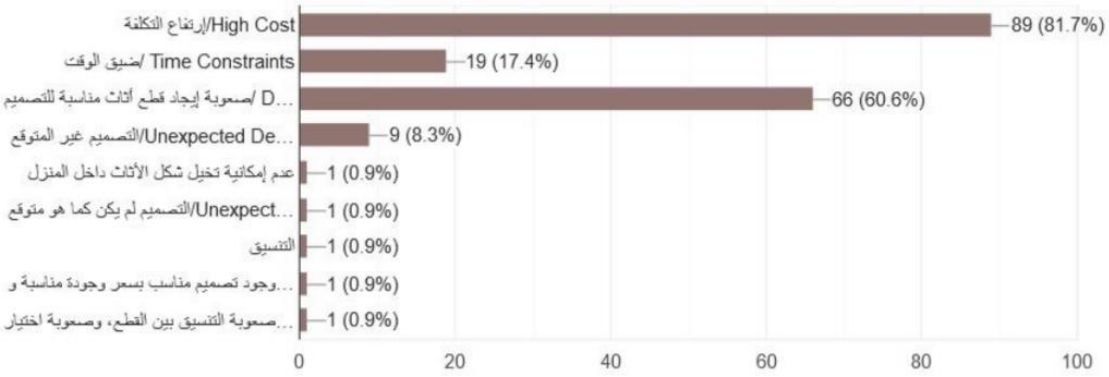
بسبب التكلفة المادية

نسخ

ما هي الصعوبات التي تواجهك عندما تفكر في تصميم منزلك؟

?What difficulties do you face when considering designing your home

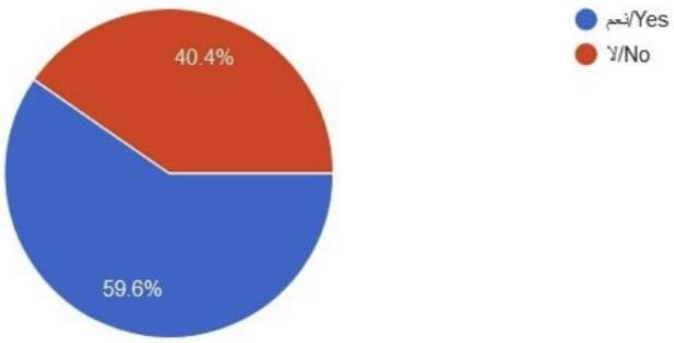
109 ردود



هل واجهتك صعوبة من قبل في شرح التصميم الذي ترغب به لمصممك؟

Did you find any difficulties before in explaining the design that you want for your interior designer?

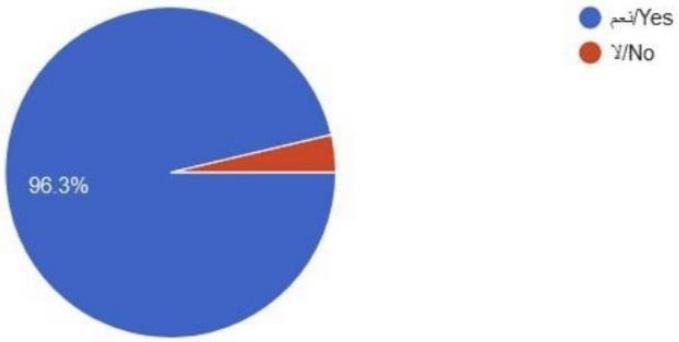
109 ردود



اذا قمنا بإنشاء تطبيق يصمم منزلك بناء على اختياراتك وتفضيلاتك الخاصة كنوع الاثاث و الألوان، و بحدود الميزانية التي تحددها ، هل ستفكر بإستخدام هذا التطبيق؟

If we design an application able to designing your home based on you selections such as styles and colors within the budget you set, would you consider to design your home by using this application?

109 ردود



خدمات أو مميزات ترغب أن توجد في هذا التطبيق؟

?Services or features you want to be present in this application

41 ردًا

سرعة التنفيذ /والاسعار قليلة .

توافر ارقام مصممين بنفس البرنامج

خدمة وجود مصممين دخلين في نفس التطبيق لمشاركة التصاميم معهم في حالة وجود شي يحتاج للتعديل

ان تكون الافكار مبهره والتصاميم جميله

استخدام تصاميم اثاث موجوده في اماكن يمكن الشراء منها مثل ايكيا و هوم سنتر

Provide a price range

ميزه التصوير بخاصية 3D

خدمة تخيل تصوير الاثاث وتوضيحة بشكل واقعي او افتراضي؟

لايوجد .تطبيق رائع الى الامام

التصميم حسب مساحة الغرفة

خدمات مجانيه وغير مكلفه

أن تكون الخيارات متعدده ومتنوعة واقتصادية

السعر رخيص والافكار المميزه

تطبيق رائع لايوجد

القدره على عمل التصميم الي يرغب فيه العميل من البرنامج

سهولة التعديل في التصميم

صوره نهائيه بالالوان تبين لي المنزل بعد ان قمت بتصميم المنزل

الله يعطيكم العافية

ان يكون بسيط جدا وغير معقّد

صور للتصميم بعد الانتهاء

لاشي

لايوجد

السهوله اهم شي

ان يكون سهل الاستخدام من قبل الجميع امكانيه الدفع باكثر من عمله

تصور للنتيجة النهائية

دعم الواقع الافتراضي، بARKit من ابل على سبيل المثال لتسهيل عملية تخيل التصميم النهائي للعميل

يفهم اللي ابغاه

يدعم تقنية الواقع الافتراضي أو الVR؛ ليسهل تخيل التصميم وفهمه

سعر مناسب وخدمة 3d

سهوله التصميم باستخدامه وتوفير ادوات مختلفه لرسم التصميم لابراز بعض الاجزاء في التصميم

لا يوجد

اماكن شراى الاثاث وبيان للاسعار والجوده

الوان ، واثاث حلو

بالتوفيق يا رب❤️❤️

انواع الاكسسوارات المناسب منها وغير المناسب بحيث تفادي وضع بعضها في غير مكانها لانها جزء جمالي مهم في اي غرفه كذلك تناسق الالوان مهم يكون فيه خيار الالوان اللي تناسب والالوان اللي تسبب اتساع للمكان واللي تضيق المكان الصغير وهكذا كذلك نوعيه الاثاث وحجمه بالنسبه للغرفه اذا كان مناسب او لا وبالتوفيق👌

طرح اكثر من خيار

أن يكون هناك خدمة استقبال صور للمنزل قبل وبنزل في التطبيق صور 3d للتغير الذي سيحصل عليه بعد التجديد

الواقع المعزز؟ بحيث يمكنني رؤية القطعة على الغرفة من خلال الكاميرا