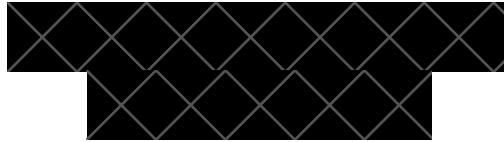# Homes. Design System Requirements
Inf 43 – Homework 1

Feb 8, 2022

Introduction

Homes. Designs is an interior designing consultation company that centralizes on providing its customers with an authentic, aesthetic, and functional interior living space.

Interior design company, Homes. Designs is interested in an interior consulting design firm that utilizes AI technology to provide customers with an interior design experience. Founder, Henry Homes, wishes to provide his customers with an experience in which their interior creations, design, and ideas come to life through Artificial Intelligence (AI) software. AI will create the customer's personalized renders based on the customer's details.

Overview / Executive Summary

Homes. Design's goal is to provide its customers with a personalized interior design consultation without the need for an in-person designer interaction. The key is to save money and increase revenue by replacing interior designers with autonomous AI interior designer.

Homes. Design will primarily be a web-based application for all users with a modern web browser to access. Future plans issue for the system to be accessible through multiple electronic mediums with capabilities that are suitable for the system's upcoming features (3D rendering, VR, AR), i.e., incorporating a mobile application.

The system will include features that provide AI generated renderings of living space arrangements. What the AI produces is solely based on algorithms that follow design trends and user text descriptions. The AI will learn design trends gathered from the web or real interior designers. User text descriptions will provide the AI with a centralized search of trends that closely relate to the text provided, this feature will allow users to receive a more personalized rendering of their living space. Renderings will be provided in the following forms: static images, 3D renderings, VR, and AR.

The system and its features will be free to use for all users. Additionally, users will have the ability to create accounts in which they can save their searches and renders for later use such as customizing or purchasing.

Revenue will be made by utilizing affiliate marketing techniques such as referring customers to a business or product. Moreover, products such as decorations, furniture, etc. that are displayed on the AI renders will provide customers with direct links to purchase products. As a referrer, Homes. Design would receive compensation from the business if the customer used the direct link to purchase the product. Transactions and refunds will be handled by the seller.

Using the Homes. Design web application should be a fun and user-friendly experience for everyone. The user will need to submit a photo of their living space along with details about the dimensions of the space. This option will present the user with an AI static image render of the room with an aesthetically pleasing layout picked by the AI. The other option includes the previous steps, but this time the user provides a detailed description of their preference(s) for the room such as color palette, furniture, decorations, styles, etc. The AI will now create a static image render that is tailored to the description provided.

Homes. Design should be fully supported by the AI renders by the first year of development. In its first year, the system is expected to provide static image renders utilizing the AI. By the second year, the system will have support for 3D rendering including 3D walkthroughs, VR, and AR capabilities. Additionally, Homes. Design will expand its business by incorporating a marketplace inspired by Facebook marketplace and eBay. Concepts and details will be provided upon Homes' approval of the project.

Application Context / Environmental Constraints

In its first version, the system will be solely a web-based application. The system will be free to use and accessible by any modern web browser. Users will have the option to use the system without needing to create an account, however, creating an account offers the user with additional features such as saving renders and the AI remembering styles from previous renders and preferences.

No specific device has been mentioned as the primary focus device. Therefore, it is unknown which device will provide the users with the best experience. Ideally, the system will provide the best experience on a computer rather than a mobile device. The assumption is based on the limited screen space and resolution of mobile devices and not performance.

For the web application, computational performance will be handled in the backend. This may require a lot of computing power, potentially expensive. For future developments such as 3D renderings, computational performance will be determined on the frontend to perform the computations. May be hardware demanding for users.

For appearance, UI should strive fun, friendly, and creative. UI should not look over cluttered or have instructions/tutorials on the page. Overall, the UI should be simple and easy for any user to quickly pick up and use.

For appearance and usability, there should be a query search box where the user will input their description and personal requests. On the same page, there should be a spot where the user must upload a picture and description of the layout and dimensions of their desired room. After the rendering has been processed, the user can refine their rendering by providing more details on specifications of products or aspects of the render such as color palette. A new render will be created after details are provided.

Saved renders will be stored on users' accounts for later use. Any products displayed on the render will have their own direct link for purchase. Any products that are no longer available by the vendor will be reported to the user in which the user can decide to discard the product or replace the product in the render.

Functional Requirements

In the first iteration of the Homes. Design, i.e., strictly static imagery renders, the system will include five types of actors: a user with an account, a user without an account, AI/Crawler, Homes. Design, and vender. A user with an account will represent a customer who has or is creating an account on the Homes. Design, this customer will have access to all features provided on Homes. Design and additional features such as saving renders, accessing renders, and maintaining their account and preferences. A customer without an account will only have access to Homes. Design features. Both user actors will have access to utilizing the search query, picture upload, product links, and

rendered images created by the AI. Actor, AI, will be the software program that will generate static imagery based on the descriptive text provided by the users. Depending on the stage of development, AI may be substituted with a crawler that will provide a similar experience to that of the AI. Homes. Design will oversee everything related to the backend such as computational power and providing the service of the AI and rendered products. Lastly, vendors will be a merchant or businesses that produce the product(s) presented in the AI renders. Vendors will oversee everything related to transactions (purchases and refunds), as a referrer, Homes. Design will take a percentage of revenue made from the transaction.

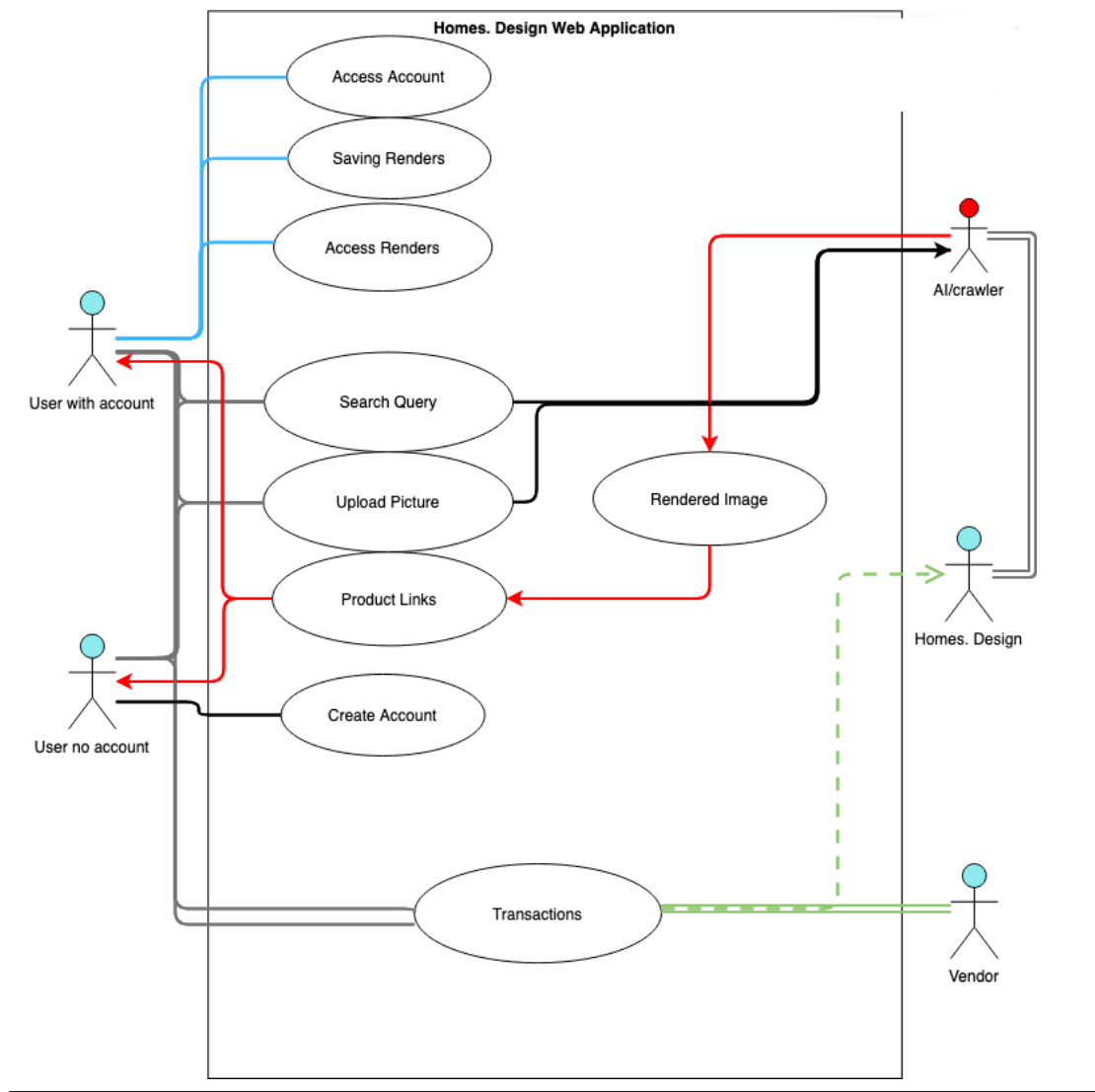*Figure 1: Homes. Design Use Case Diagram*

Users and Use Cases:

All Users
- **Create Account**
  Every user that visits the site will have the opportunity to create an account for the additional features provided on the site. Creating an account is completely optional.
- **Search Query**
  Users will enter their descriptions of desired layouts/styles for their renders. The user may be allowed to describe in fine detail what they are looking for. From color, style, price range, categorical type, dimensions, and more.
- **Upload Picture**
  The user will need to upload a picture of their desired living space. They must also provide details such as the dimensions of the space and other key features of the layout.
- **Product Links**
  Product links will be sources that are provided in AI rendered images, every product displayed in the rendered image will have its unique source link. If a user is interested in the product, then they would use the direct link to be directed to the vendor's site for the purchase of desired product(s).
- **Transactions**
  This will be handled strictly by vendors Homes. Design outsources to the user. Transactions will handle purchases and returns.

Users with Accounts
- **Access to Account**
  This is a typical account sign-in. Users with accounts will use this feature to log in and access their accounts for the additional features provided to account users.
- **Saving Renders**
  After a render has been created by the AI, a user with an account will have the option to save the render on their account for future use.
- **Access Renders**
  Users that have saved renders from previous sessions will have the option to access their previously saved renders. They will have access to the render and its rendered products; the user may purchase products or alter their render as they wish. Any products that are out of stock will notify the account holder.

AI/Crawler
- **Rendered Image**
  Rendered image will be the static image rendering that the AI will provide to the user. What is presented will vary on customers descriptions and picture uploads.
- **Product links**
  Every product the in the render will provide a link for purchasing. Products selected by AI will be determined by following customer descriptions, styles, products in stock, and products that generate the most revenue for Homes. Design.
- **Crawler**
  Crawler may be an associate of Homes. Design, they will provide product details and recommendations to users. Crawler will mostly/only be used before AI is fully functional.

Homes. Design
- **AI**
  All computations will be produced through the backend by Homes. Design. AI will perform based on Homes. Design's configurations.
- **Transactions**
  Homes. Design will not be in charge of transactions; however, they will receive revenue for every product purchased from the renders.

Vendor
- **Transactions**
  This portion will be dependent on the vendor that was outsourced by Homes. Design. Transactions include purchasing and returns. Here will users provide payment and shipping details to the seller. Additionally, the user may perform returns with the seller. Homes. Design will have no handling on transactions besides collecting a percentage of revenue.

Software Qualities and Non-functional Requirements

Security and Privacy
Transactions will be made using the site. Customers' personal information should be protected. Personal information and the company's data should remain under strict security measures. Additionally, customers' accounts and saved renderings should remain private, though this portion is not as strict as personal information.

Quality
AI renders of any form (static image, VR, or AR) should maintain a high standard of accuracy to the user's search description. Each render should tailor to the user's response

as close as possible. Additionally, products rendered should be selected in terms of what the user has described and the most profitable for the Homes. Design.

Efficiency
Every render provided by the AI or search results should be produced in a "snappy" (quick) order. Delayed results are understandable; however, results should not take longer than 20 seconds (as stated by Homes). Ultimately, AI must produce its results quickly and accurately.

Adaptability
Software should allow for different configurations of the AI to be implemented. Software should be able to reconfigure item choice selection in renders to favor a temporary or permanent vendor/sponsor. Lastly, Homes. Design marketplace should be able to be integrated with later updates.

Portability
In later updates, the system should be accessible across other devices such as smartphones, tablets, and similar smart user products. All features accessible through the web application and more such as (3D renders, VR, and AR) will be applicable on the previously mentioned devices.

Usability
The system should have a straightforward experience, there will be no need for a tutorial or learning curve. People should be able to easily catch on to the mechanics of the system.

Other Requirements

Budget:
- $1,000,000 for the first iteration of the system
- $1,000,000 for incorporating walkthroughs/VR and other potential features
- Total budget: $2,000,000

Projected Timeline:
- 2 weeks - Specifications document
- 2 months – nonfunctional (layout) prototype, UI prototype
- 0 - 12 months – professional interior designers assisting with the project
- 1 year – support for rendered static images produced by AI
- 2 years – AI fully functional, 3D rendering, and fully functional 3D walkthroughs

User Interface:
UI for the customers should be a fun and creative experience, ideally, the customer's experience should feel authentic.

Renders:
Render outputs will be determined on user descriptions and products prioritized by Homes. Design. User descriptions may include a specific color, style, layout, material, price range, etc. For instance, the user may filter results by asking for products under $100 or their total budget for the project. Products prioritized by Homes. Design will be configured in the backend, what determines a product's priority is the amount of revenue the purchase of the product will generate. Products with the highest revenue will be placed as a higher priority, these may be products that are included in sponsorships or partnerships.

System:
- Experience does need to be snappy for every result. However, the system should provide results within 20 seconds as the upper bound
- Security relating to people's designs is not important. However, billing and accounts must be secure to protect the customer's and company's data.

Glossary of Terms	
Artificial Intelligence	Artificial Intelligence (AI), using machines that produce results of that of human through problem solving and decision making.
Augmented Reality	Augmented Reality (AR), a 3D rendering of objects being produced in real time and space in which it is projected.
Crawler	Someone or program with the task of populating content for their site through means of collecting and indexing information from other sites.
Query Search	Text search box that is part of the customer UI. Customers will input their text descriptions for their desired living spaces.
Render	Generated image(s) created by the AI system. Can be presented in the following mediums: static images, 3D Virtual or Augmented Reality.
Research and Development	Research and Development (R&D), gathering information for and product and continually improving and building the product.
User Interface	User Interface (UI), this is what the users will see and interact with on the site. This provides users access to interact with the system.

Virtual Reality	Virtual Reality (VR), a projection that captures all objects and the living space into a virtual 3D reality. In VR, everything is virtual.

Assumptions / Risks

- AI not working as intended due to complications
    - AI may take a while to properly configure and integrate into the system, in the meantime use real designers for the job until AI is competent for the task.
- Starting out, the system will not have any vendors or sponsors, it may take a while to accumulate vendors and sponsors to support the plans of the system.
    - In the meantime, A crawler will be used to simulate the marketplace experience. Additionally, the system will be relying on Amazon affiliate marketing for revenue until sponsors and vendors are created.
- The system will be computationally expensive due to the renders taking place in the backend and not through the frontend. Thus, handling all computations.
    - Maintaining computations will need high profits. In general, the system may fail due to profits not being sufficient to cover the costs.
- Future Assumptions regarding rendering 3D, VR, AR:
    - 3D renders will be too intensive through the frontend, thus limiting its availability to customers.

Priorities / Implementation Phases

Homes has expressed his concerns and interests in the AI imaging system. Due to its complexity and impact on the project, this feature holds priority over all other features. Subsequently, AI will have the earliest form of R&D in the project.

The AI should be able to create static image renderings within the first year. Images must be both accurate and detailed renderings based on the descriptive text provided in the search query.

Homes prioritizes that AI should be able to create static image renders by year 1 of development. Homes does not expect 3D, VR, or AR capabilities until year 2 of the project. Additionally, Homes would like to be up to date with the project's progress through prototypes/mock-ups of the software's capabilities. According to Homes, prototypes should be a representation of the UI that the customers will see, thus early builds of the UI must be present during presentations of AI capabilities.

Homes prioritizes that the UI for the customers should be a fun and creative experience, ideally, the customer's experience should feel authentic.

During development, the team should research how companies such as eBay and Amazon marketplace handle their refunds and transactions. Note, the team must obtain approval from Homes before proceeding with building Homes. Design marketplace.

Future Directions and Expected Changes

At a future date, additional features will be added to the system. Features that will both enrich and personalize the user experience. New features will be added accordingly to Home's authorization.

- Homes. Design will later incorporate other languages besides English, this solely depends on the demand of users.
  - Additionally, Query search will later be able to recognize languages besides English, this depends on the demand of users.
- Improvements to rendering experience:
  - Plans to venture into providing users with a Virtual Reality (VR) experience.
  - Augmented Reality (AR), a walk-around simulation of real living space and seeing the rendered 3D figures happen in real-time.
- Marketplace:
  - Create a marketplace that is loosely inspired by Facebook Marketplace and Craigslist.
  - Marketplace will branch out to other countries
  - Handle marketplace returns in the future when partnerships with dealers have been established.
  - Collect revenue from sponsorships. For now, use affiliate marketing for revenue.
- A year from now, AI will take full control of handling the design layout of users' requests.
  - First-year will still depend on an interior designer for outputs until AI is competent for the task.