

# CSC1097

## FINAL YEAR PROJECT

### **ARrangelt**

## Functional Specification

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# Functional Specification Contents

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# 1. Introduction

## 1.1 Overview

Our project's main objective is to develop an Augmented Reality (AR) - based mobile application, ARrangelt, for home decor designed to help users visualise furniture and decor items in their living spaces before they buy them. By using AR technology, the app will overlay 3D models of furniture onto real-world spaces through smartphone cameras, allowing users to confidently decide on items based on how they will look and fit within their homes. This Android application will provide a smooth and interactive experience, enabling users to browse a comprehensive catalogue of furniture and place virtual items in their living spaces. Users can also save furniture configurations for future reference allowing them to preview spaces over time.

The inspiration for this project developed from the need for a more optimised and interactive shopping experience, as traditional methods often leave customers uncertain about a furniture's fit or aesthetic appeal in their own spaces. Existing tools, such as IKEA's AR furniture placement feature partially address this issue, but it is limited to IOS devices and lacks certain user-friendly adjustments like easy scaling and multiple-item placements. By improving accessibility across Android devices and enhancing these features, including easier scaling controls and room layout awareness, our app will provide a more versatile tool for home decor enthusiasts and anyone interested to redesign their space.

## 1.2 Business Context

The business context of this project will come from its usefulness in being integrated with existing furniture companies. Our app can be used as a means for businesses to have an AR experience integrated into their websites/ applications. By implementing this app as a customisable AR tool, businesses can upload their 3D- scanned furniture catalogue, allowing users to virtually place items within their homes. For furniture companies, AR technology like this adds real value to the customer experience by addressing common pain points. Traditional online shopping often leaves customers unsure about a product's compatibility or fit within their current decor. By giving customers the opportunity to preview furniture at scale in real time businesses can reduce the rate of returned items.

The growing market interest in AR shopping apps is supported by statistics: A study by DigitalBridge found that 69% of consumers expect retailers to launch AR apps to allow them to preview items in their own homes, with 33% reporting that they were more likely to purchase items on the spot if they were given access to AR platforms first (Grewal, 2017). This means that integrating AR features can increase sales, customer satisfaction, and brand differentiation in an increasingly competitive market. Furthermore in a recent study conducted by Harvard Business Review it was found that shoppers spent 20.7% more time on the app and viewed 1.28 times more products when using the AR function. They were also 19.8% more likely to make a

purchase compared to the customers who did not use the AR function (Chandukala et al., 2022).

The app's adaptability means it can be deployed by furniture brands of any size, from large chains to independent stores. For example, companies like IKEA have seen success with AR, but their AR functionality has been limited to certain platforms as well as only allowing users to place one item of furniture at a time. This leaves an opportunity for a more comprehensive solution that accommodates placing multiple pieces of furniture at a time. By offering an adaptable AR tool, this app could support an open platform model where various brands upload their own 3D catalogues, expanding the app's potential user base across multiple businesses.

### 1.3 Glossary

Term	Description
SRS	Software Requirements Specifications
AR	Augmented Reality

## 2. General Description

### 2.1 Product / System Functions

Our AR-base decor app, ARrangelt, is designed to provide users with an immersive, interactive experience for visualising furniture and decor items within their living spaces before purchasing. The primary functions of the system are:

- AR Visualisation of Furniture: The app uses augmented reality to project 3D models of furniture and decor items into the user's real-world environment. Through their smartphone camera, users can view virtual furniture items placed within their spaces, allowing them to access how each item looks and fits in real time.
- Furniture Catalogue Access: Users have access to a catalogue of furniture items, allowing them to browse, search, and filter options based on categories such as item, colour, material, and price. The catalogue will contain items displayed in high-quality 3D models that reflect real-world dimensions and details.
- Object Scaling and Rotation: The app allows users to adjust the size, scale and orientation of each furniture item to ensure precise fit within their space. By manipulating objects in this way, users can see how each item interacts with other furniture and the surrounding area, making it easier to create an aesthetically pleasing and functional arrangement.

- Room Measurement Tool: The app includes a built-in AR measurement tool, enabling users to measure their room dimensions and other key space elements. This tool is particularly helpful in ensuring that furniture selections are appropriate for the space and allows users to better understand spatial limitations.
- Saving Room Configurations: Users can save different room configurations, allowing them to revisit and compare layouts before making a final purchase decision. Saved configurations are stored in the app, enabling users to recall, adjust, or refine their design ideas as needed.
- Multi-Item Placement: The app supports placing multiple items within the same AR scene, giving users the flexibility to design entire rooms and experiment with full-room layouts. This function helps users visualise how multiple items look together and consider arrangement options for cohesive styling.
- User Authentication and Preferences: User authentication via Firebase enables users to create a profile where they can save configurations.

## 2.2 User Characteristics and Objectives

### User Characteristics:

Education Level: Users of the app may come from various educational backgrounds, from those with minimal formal education to professional designers with in-depth knowledge. To ensure inclusivity, the app interface will focus on simplicity and clarity. This means prioritising visual elements like icons and clear labels so that users can understand functions without advanced technical knowledge.

Experience with Interior Design / Furniture Shopping: The app is designed for users with different levels of experience in interior design and furniture shopping. Some users may have experience in arranging furniture and spatial design through their profession, while others may be new homeowners or users seeking guidance on decorating. To meet the needs of both groups, the app should include features like filtering options for style, size, and material, which can guide new users.

Technical Expertise: The app targets users with varying degrees of technical expertise. Some users may have previous experience using apps for design or AR features, whereas others may only have basic knowledge. For less experienced users, an uncluttered, labelled interface with options like help icons will make AR features approachable and reduce the learning curve.

Accessibility: Many existing AR apps are not compatible with android devices and as a result this is our primary focus. Accessibility in AR also means ensuring that controls for scaling or rotating objects are easy to use.

## **User Objectives and Requirements:**

Multi-Item Scene Creation: Users may want to place multiple items at once to visualise full room layouts. In this way they can style an entire room instead of just placing one piece of furniture.

*Requirement:* Enable users to add, arrange, and preview multiple furniture items within the same AR space, allowing them to create and save entire room configurations

Room Measuring: Since some users may have specific room measurements, they could benefit from an option to measure room dimensions for precise scaling.

*Requirement:* Include a feature where users can measure room dimensions, ensuring that all items fit accurately in the virtual layout.

Comprehensive Product Filtering and Sorting: Users will expect an efficient way to narrow down furniture choices based on attributes like category, colour, size and price.

*Requirement:* Implement multiple filtering and sorting options to allow users to easily find items that match their preferences or specific needs.

User-Saved Configurations: Users might like to save multiple room layouts to allow for review later.

*Requirement:* Implement user accounts with the ability to save environment layouts.

Easy Access to Product Information: Users will need quick access to furniture details like dimensions, materials, and colours without interrupting the AR experience.

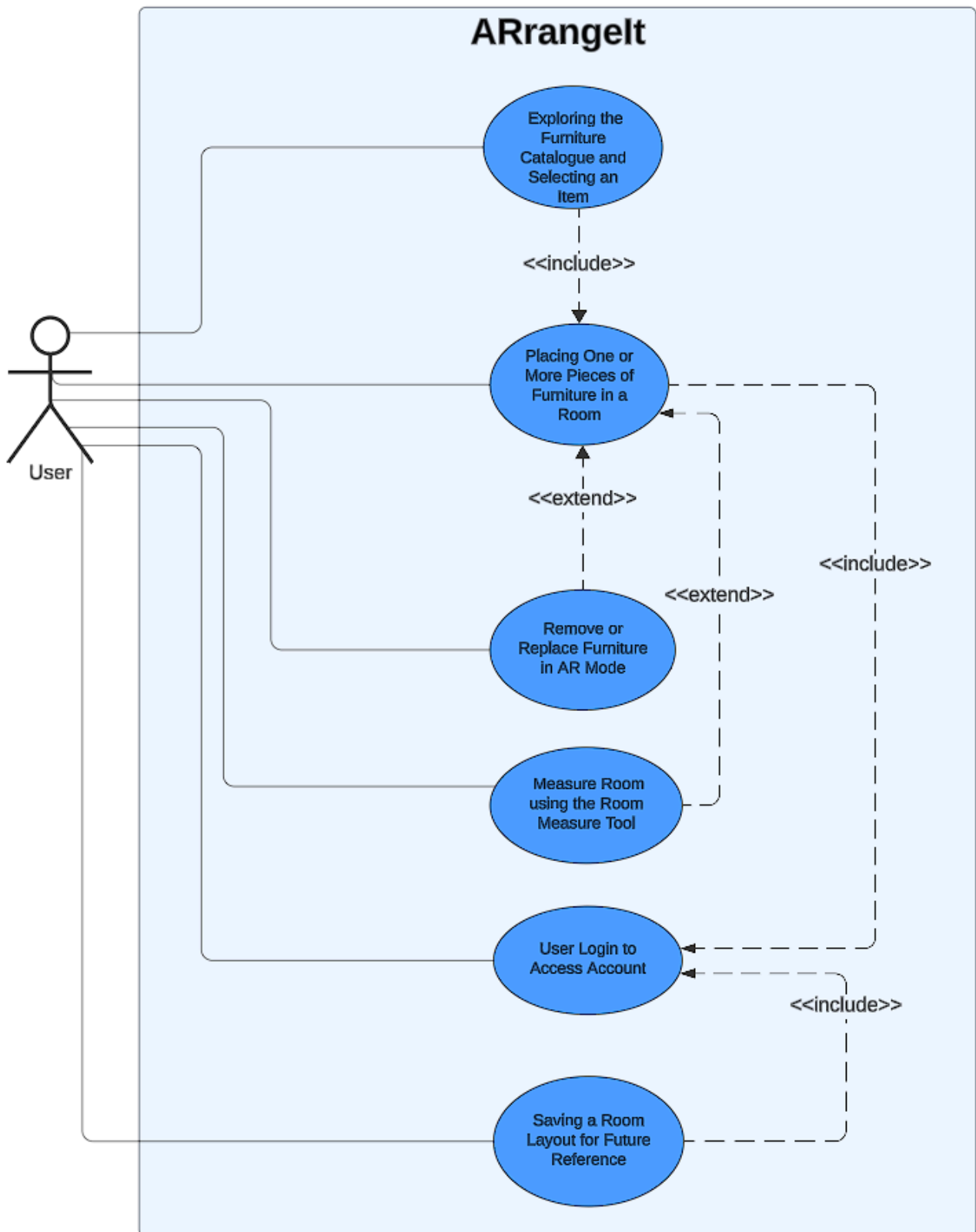
*Requirement:* A quick-access pop-up or tooltips should provide the relevant product information and options. This simplified access will allow users to focus more on exploring layout options instead of having to exit and search for item specifications separately.

Accurate AR Visualisation: Users will expect accurate 3D visualisation with realistic scaling and smooth controls for item manipulation and object placing.

*Requirement:* The app should support accurate room scaling and options for rotating and resizing objects. This will enable users to ensure items fit within their required space

**Alignment with Business Objectives:** By addressing accessibility, inclusivity, and user-friendliness, these features aim to broaden the app's potential audience and increase engagement and customer satisfaction. The "wish list" of features is moderated by feasible technical solutions, such as filtering options and basic customisation instead of complex design tools, maintaining a balance between user desirability and ease of use.

## 2.3 Operational Scenarios



Use Case 1	User Login to Access Account															
Actors	User, System															
Trigger	User wants to log in to access saved layouts and preferences.															
Pre-Conditions	<ul style="list-style-type: none"><li>- User has internet access.</li><li>- User has a registered account or chooses to register.</li></ul>															
Post-Conditions	The user is logged in and has access to their account content															
Success Scenario	<table><tr><th>USER</th><th>SYSTEM</th></tr><tr><td>1. User selects “Login” or “Sign Up” on the welcome screen.</td><td></td></tr><tr><td></td><td>2. System displays a screen requiring (username/password).</td></tr><tr><td>3. User enters credentials and submits.</td><td></td></tr><tr><td></td><td>4. System verifies credentials and logs the user in or signs the user up</td></tr><tr><td>5. User is directed to the main interface.</td><td></td></tr><tr><td></td><td>6. System loads the main home screen including the user's saved layouts.</td></tr></table>		USER	SYSTEM	1. User selects “Login” or “Sign Up” on the welcome screen.			2. System displays a screen requiring (username/password).	3. User enters credentials and submits.			4. System verifies credentials and logs the user in or signs the user up	5. User is directed to the main interface.			6. System loads the main home screen including the user's saved layouts.
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Quality Requirements	<ul style="list-style-type: none"><li>- User data should be loaded quickly after login to ensure a smooth experience.</li></ul>															



Use Case 2	Exploring the Furniture Catalogue and Selecting an Item	
Actors	User, System	
Trigger	User wants to browse for furniture items in the app.	
Pre-Conditions	<ul style="list-style-type: none"><li>- User has internet access.</li><li>- User has launched the app and is on the home screen.</li><li>- User is logged in</li></ul>	
Post-Conditions	<ul style="list-style-type: none"><li>- The selected item is ready to be placed into the AR environment.</li><li>- The system displays detailed information about the selected furniture.</li></ul>	
Success Scenario		
	USER	SYSTEM
	1. User navigates to the furniture catalogue.	
		2. System displays a list of furniture items with filters.
	3. Users apply filters, such as type, price range and colour.	
		4. System updates the displayed items based on the filters.
	5. User taps on a furniture item to view details.	
		6. System displays detailed information, including dimensions and price.
Quality Requirements	<ul style="list-style-type: none"><li>- The system should load results within 5 seconds after filtering.</li><li>- High-resolution images of furniture items should be displayed to enhance the browsing experience.</li></ul>	

<b>Use Case 3</b>	<b>Placing One or More Pieces of Furniture in a Room</b>	
<b>Actors</b>	User, System	
<b>Trigger</b>	The user wants to visualise multiple furniture items in their room setup using AR.	
<b>Pre-Conditions</b>	<ul style="list-style-type: none"> <li>- User has selected an item from the catalogue.</li> <li>- User's device supports AR and has camera access.</li> </ul>	
<b>Post-Conditions</b>	<ul style="list-style-type: none"> <li>- The room layout with multiple items is displayed in AR view.</li> <li>- User can save the layout or make further adjustments.</li> </ul>	
<b>Success Scenario</b>	<b>USER</b>	<b>SYSTEM</b>
	1. User has selected an item from the catalogue they want to place in the room and clicks 'Place in Room' option	
		2. System activates AR mode, accesses the camera and places the item in the room.
	3. User points the camera at the desired area and adjusts the furniture position and/or orientation.	
		4. System places the virtual model in the selected location.
	5. User repeats steps 1-4 for each new item they wish to add	
<b>Quality Requirements</b>	<ul style="list-style-type: none"> <li>- The system should seamlessly integrate multiple items in the AR view.</li> <li>- The layout should be displayed accurately, without any visual overlap or glitches.</li> </ul>	

<b>Use Case 4</b>	<b>Remove or Replace Furniture in AR Mode</b>	
<b>Actors</b>	User, System	
<b>Trigger</b>	User wants to remove or replace furniture items in AR mode.	
<b>Pre-Conditions</b>	<ul style="list-style-type: none"> <li>- User is in AR mode with at least one piece of furniture placed in the room.</li> </ul>	
<b>Post-Conditions</b>	<ul style="list-style-type: none"> <li>- The selected item is removed or replaced with a new item.</li> <li>- The AR view updates to reflect the new layout without requiring the user to exit.</li> </ul>	
<b>Success Scenario</b>		
	<b>USER</b>	<b>SYSTEM</b>
	1. User selects an item to remove or replace in AR mode.	
		2. System highlights the selected item and displays options for removal or replacement.
	3. User chooses to remove or replace the item.	
		4. System removes the item from the AR view or loads a new item in its place.
	5. User adjusts the new item's position if applicable.	
		6. System updates the AR view to reflect the new layout configuration.
<b>Quality Requirements</b>	<ul style="list-style-type: none"> <li>- The system should instantly update the AR view after an item is removed or replaced.</li> <li>- User actions for removal or replacement should be intuitive and require no more than 3 clicks.</li> </ul>	

<b>Use Case 5</b>	<b>Saving a Room Layout for Future Reference</b>	
<b>Actors</b>	User, System	
<b>Trigger</b>	User wants to save their current room setup for later reference.	
<b>Pre-Conditions</b>	<ul style="list-style-type: none"> <li>- User is logged in.</li> <li>- User has placed at least one item in the AR view.</li> </ul>	
<b>Post-Conditions</b>	<ul style="list-style-type: none"> <li>- The layout is saved and can be accessed from the user's account.</li> <li>- User can assign a custom name to the saved layout.</li> </ul>	
<b>Success Scenario</b>		
	<b>USER</b>	<b>SYSTEM</b>
	1. User clicks the "Save Layout" button.	
		2. System prompts the user to name the layout.
	3. User enters a name, e.g., "Living Room with Black Sofa".	
		4. System saves the layout with the custom name and displays a success message.
<b>Quality Requirements</b>	<ul style="list-style-type: none"> <li>- The save process should complete in under 5 seconds.</li> <li>- Saved layouts should be retrievable within 1 second after selection.</li> </ul>	

Use Case 6	Measure Room using the Room Measure Tool															
Actors	User, System															
Trigger	User wants to measure the dimensions of their room for a more accurate experience															
Pre-Conditions	<ul style="list-style-type: none"><li>- User’s device supports AR and has camera access.</li><li>- User has launched the AR view for placing furniture.</li></ul>															
Post-Conditions	<ul style="list-style-type: none"><li>- The room dimensions are captured and can be used for accurate placement of virtual furniture.</li><li>- Measurement data is stored temporarily to assist in furniture placement.</li></ul>															
Success Scenario	<table><tr><th>USER</th><th>SYSTEM AND CAMERA</th></tr><tr><td>1. User activates the Room Measurement Tool in AR.</td><td></td></tr><tr><td></td><td>2. System accesses the camera and displays measurement options.</td></tr><tr><td>3. User follows on-screen instructions to measure room dimensions.</td><td></td></tr><tr><td></td><td>4. System captures and processes the room dimensions in real-time.</td></tr><tr><td>5. User completes the measurement process.</td><td></td></tr><tr><td></td><td>6. System saves the dimensions and uses them to optimise furniture placement accuracy.</td></tr></table>		USER	SYSTEM AND CAMERA	1. User activates the Room Measurement Tool in AR.			2. System accesses the camera and displays measurement options.	3. User follows on-screen instructions to measure room dimensions.			4. System captures and processes the room dimensions in real-time.	5. User completes the measurement process.			6. System saves the dimensions and uses them to optimise furniture placement accuracy.
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		4. System captures and processes the room dimensions in real-time.														
	5. User completes the measurement process.															
		6. System saves the dimensions and uses them to optimise furniture placement accuracy.														
Quality Requirements	<ul style="list-style-type: none"><li>- The tool should capture accurate measurements within ±5 cm.</li><li>- Measurement data should integrate seamlessly with the AR furniture placement.</li></ul>															

## 2.4 Constraints

1. Hardware Constraints: The app is designed specifically for Android devices, requiring compatibility with a range of models, screen sizes, and performance capabilities. The app will be optimised for devices that support Google ARCore, as ARCore is essential for the AR features, including environmental mapping and motion tracking. The Google Pixel 6a will be the primary device for testing, but ensuring compatibility across other ARCore supported devices is necessary.
2. Performance and Speed Requirements: The app must deliver real-time AR visualisation with minimal lag to ensure a smooth and realistic experience. This includes fast response time for scaling, rotating and placing 3D models in the AR view, which is resource-intensive.
3. Battery and Resource Usage: AR applications are resource-intensive, often consuming high levels of battery power and device memory. To address this, the app should be optimised to use battery and memory efficiently without compromising AR quality lower-resolution textures as needed.
4. Network and Data Constraints: The app relies on internet connectivity to fetch updates from the furniture catalog, synchronise user preferences, and save configurations to the cloud. Data usage should be optimised to prevent excessive data consumption, especially when downloading 3D models. Offline functionality for browsing previously saved configurations may also be considered to accommodate users with limited connectivity.
5. 3D Model Quality and Storage: High quality 3D models are essential for creating realistic representations, but they can be storage intensive. The app will need to balance model quality with storage requirements, ensuring it does not consume excessive device storage.
6. User Interface (UI) and Usability Constraints: The interface must remain intuitive and simple, considering the complexity of the AR features. This includes ensuring that scaling, and placement controls are easy to access and use. Given the need for the app to cater to a broad audience, UI elements should adhere to Android guidelines for clarity and accessibility.
7. Industry Protocols and Security Standards: The app will handle user preferences, saved configurations, and potentially login information. It must adhere to privacy and security protocols, ensuring secure storage and handling of personal data. Compliance with GDPR and Android's security standards will be essential for user data protection.
8. Testing and Device Availability: Testing AR features requires physical access to compatible devices and environments. Limited access to a variety of Android devices with ARCore support could restrict testing across different hardware configurations, which could impact performance optimisation for a broader user base.

### 3. Functional Requirements

#### 1. Real-Time AR Visualisation of Furniture

- Description: The app should enable users to visualise 3D models of furniture in their physical space in real time through their smartphone camera. The 3D models should overlay accurately within the environment, aligning with floors or walls as needed.
- Criticality: High - This is a core feature that defines the AR experience and the primary functionality of the app.
- Technical Issues: Requires ARCore compatibility and advanced environmental mapping to ensure accurate placement and scaling of models. Additionally, real-time rendering can be resource-intensive, which may impact device performance and battery life.
- Dependencies with Other Requirements: Depends on the 3D Model Integration requirement to source high-quality models.

#### 2. Interactive Furniture Catalogue

- Description: The app should provide users with an interactive catalogue that allows them to browse, search and filter furniture items by categories such as type, colour, size, material and price.
- Criticality: High - Essential for user engagement, enabling users to explore furniture options.
- Technical Issues: Requires database management to store and retrieve catalogue data efficiently, especially for large datasets.
- Dependencies with Other Requirements: Depends on Firebase Integration to handle catalogue storage.

#### 3. Object Scaling and Rotation Controls

- Description: Users should be able to adjust the scale and rotation of the virtual furniture items to fit their space accurately.
- Criticality: High- Key for accurate and user-friendly AR interactions.
- Technical Issues: Requires intuitive UI controls for scaling and rotating objects, with consideration for usability across different screen sizes.
- Dependencies with Other Requirements: Depends on Real-Time AR Visualisation to handle the updates immediately as objects are resized or rotated.

#### 4. Saving Room Configurations

- Description: The app should allow users to save multiple room configurations, which they can revisit and edit later.
- Criticality: Medium- Important for user experience and decision-making.
- Technical Issues: Requires integration with Firebase for storage and retrieval of user configurations, which may require storage optimisation for high-volume users.
- Dependencies with Other Requirements: Depends on User Authentication to save configuration tied to individual user accounts.

## **5. AR Measurement Tool**

- Description: A built-in AR measurement tool should be available for users to measure room dimensions or furniture spacing within their physical space.
- Criticality: Medium- Supports accurate furniture placement and helps users understand spatial relationships.
- Technical Issues: Requires precise interaction with ARCore's environment detection and sensor data to calculate distances accurately.
- Dependencies with Other Requirements: Support Real-Time AR Visualisation by allowing more accurate placement based on measured space.

## **6. Multi-Item Placement and Layout Design**

- Description: Users should be able to place multiple furniture items in a single scene to create full-room layouts.
- Criticality: High- Key for allowing users to visualise room design holistically.
- Technical Issues: The app must handle multiple 3D objects in a single scene, which increases resource demands and can affect performance on lower-end devices.
- Dependencies with Other Requirements: Depends on Real-Time AR Visualisation to display multiple items concurrently.

## **7. User Authentication and Profile Management**

- Description: Users should be able to create profiles and log in to access their saved configurations.
- Criticality: Medium - Essential for a personalised experience but not core to AR functionality.
- Technical Issues: Requires secure authentication, storage, and retrieval of user data, which is handled via Firebase's authentication features.
- Dependencies with Other Requirements: Supports Saving Room Configurations.

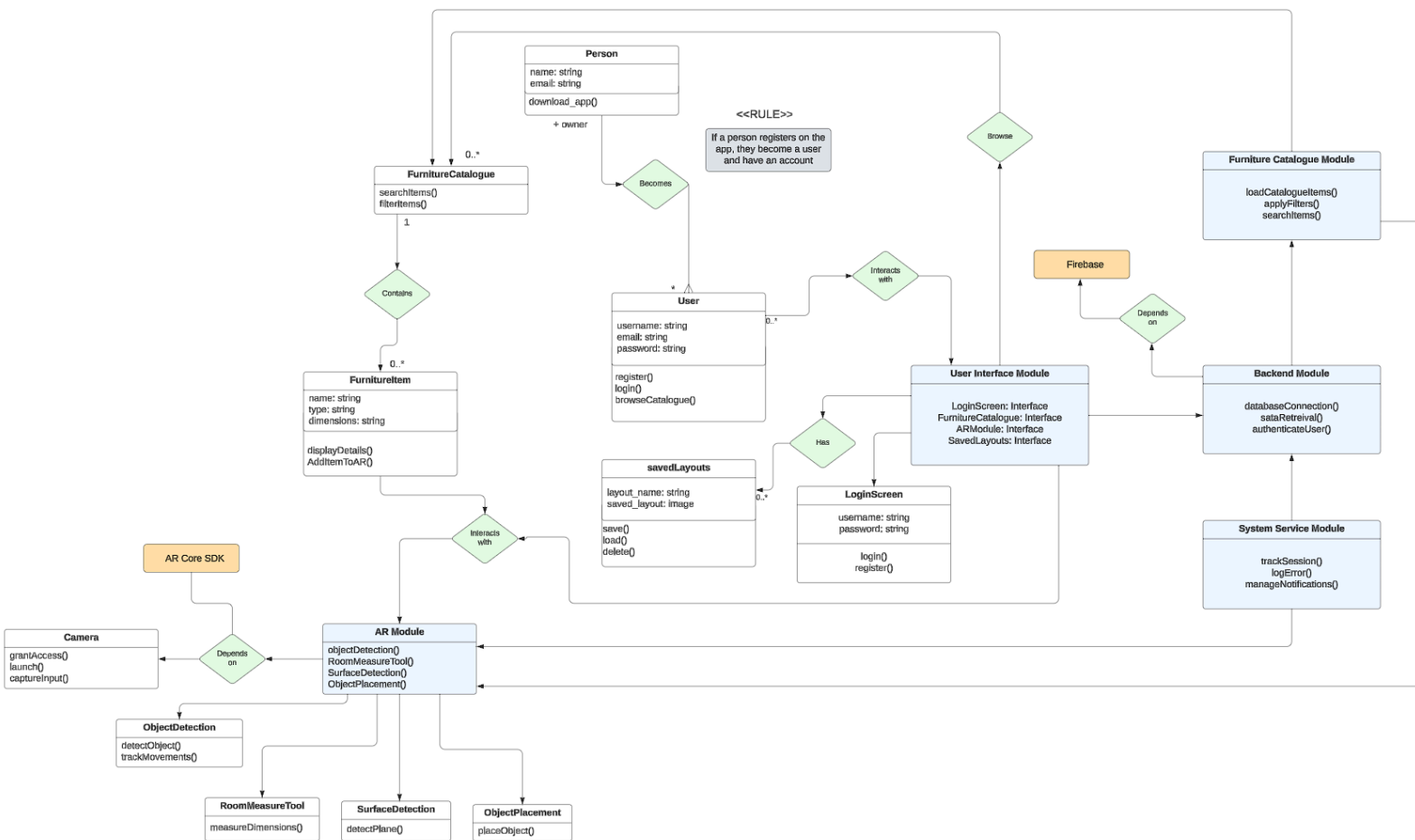
## **8. Firebase Integration for Data Storage and Syncing**

- Description: The app should integrate with Firebase to store catalogue data, user profiles and saved configurations.
- Criticality: High - Necessary for managing data consistency and persistence across sessions.
- Technical Issues: Requires secure and efficient data handling practices to protect user data, as well as data synchronisation to avoid loading delays.
- Dependencies with Other Requirements: Supports User Authentication and Profile Management, Interactive Furniture Catalogue and Saving Room Configurations.



## 4. System Architecture

Domain Diagram for ARrangelt



**User Interface Module:** This module is what the user will visually see when using the application. It provides screens for user login, the saved configurations section, the furniture catalogue and the AR view.

**Components:** The login screen, catalogue browsing interface, AR view interface, and layout-saving options.

**Dependencies:** Connects to other modules, such as the backend for login and saved layouts, and the AR module for viewing and interacting with AR content.

**AR Module:** This module manages all augmented reality features such as scanning the room, detecting surfaces, placing virtual furniture, and enabling object scaling and customisation within the AR view.

**Components:** Object detection, object placement, camera access, and room measurement tools.

**Third-Party Components:** ARCore is used here to implement AR functionalities like surface detection and object tracking.

**Backend Module:** The backend module handles data storage and retrieval, managing user accounts, saved room layouts, and catalogue information.

Components: Database connections, data retrieval APIs, and authentication processes.

Third-Party Components: Firebase is used for user authentication, database storage and real-time data synchronisation.

**Furniture Data Module:** This module is responsible for managing the furniture catalogue, including retrieving and displaying catalogue items. It also provides functions for filtering and searching through items.

Components: Catalogue item loader, filters, and search capabilities.

Dependencies: Connects with the backend which uses Firebase to fetch catalogue items and other related data. Reliant on existing AR 3D models.

**System Services Module:** Provides supportive services for the app, including session management, error handling, and system notifications.

Components: Session tracker, error logger, and notification manager.

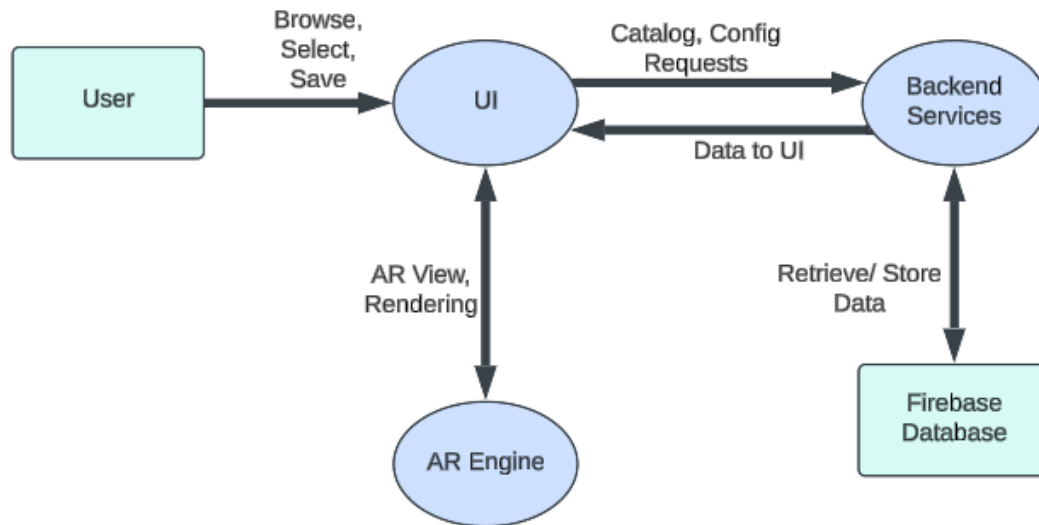
Dependencies: Interacts with the backend for session management and connects to the AR module to monitor and handle any AR-related issues.

### **Third-Party Elements**

ARCore SDK: Used within the AR Module for core AR capabilities, including tracking surfaces and placing virtual objects in real-time.

Firebase: Provides authentication, database, and real-time data features, enabling user management, storage of saved layouts, and easy access to catalogue data. Firebase also offers scalability and reliability for handling large amounts of data and users.

## 5. High-Level Design



- **User:** The user initiates actions like browsing the catalogue, selecting items, launching the AR view, and saving room configuration.
- **User Interface (UI):**
  - **Inputs:** Receives user actions and sends requests to other components for catalogue, AR rendering, or configuration management.
  - **Outputs:** Displays catalogue items, AR views, and configuration options to the user.
- **Backend Services:**
  - **Catalogue Service:** Manages requests to retrieve catalogue items and details.
  - **User Profile Service:** Handle login and profile management.
  - **Configuration Service:** Stores and retrieves saved room layouts or design.
  - **Data Flow:** Receives data from Firebase and sends it to the UI to display or update.
- **AR Engine:**
  - **Inputs:** Receives the selected item data and environment data to visualise 3D models in AR.
  - **Outputs:** Sends real-time visual data to UI for display in the AR view
  - **Processes:** Uses ARCore to detect surfaces, track motion, and render items in real space.
- **Firebase Database:**
  - **Catalogue Data:** Stores furniture items, including item IDs, names, 3D models, descriptions, and pricing
  - **User Data:** Manages user profiles, including login credentials and saved configurations.
  - **Configuration Data:** Holds saved room designs and configuration for future use.

## 6. Preliminary Schedule

### ★ Phase 1: Initial Setup and Requirements Gathering

- Tasks
  1. Define project goals, scope, and objectives.
  2. Conduct detailed requirements gathering and analysis.
  3. Research and download the necessary tools and technologies (Firebase, ARCore, Android Studio)
  4. Complete Functional Specification
  5. Create the initial coding environment
  6. Start Ethics Form
- Duration: 2 Months
- Tentative Dates: October 1st - November 24th
- Dependencies: Project Approval

	OCT 1 - 6	OCT 7 - 13	OCT 14 - 20	OCT 21 - 27	OCT 28 - NOV 3	NOV 4 - 10	NOV 11 - 17	NOV 18 - 24
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
Phase 1								
Task 1								
Task 2								
Task 3								
Task 4								
Task 5								
Task 6								

### ★ Phase 2: Backend, Frontend and Database Development

- Tasks
  1. Compile and create the AR furniture catalogue by finding free 3D Models and implement backend functionalities for user authentication, data storage and retrieval (Firebase)
  2. Set up data retrieval to be able to fetch furniture from the catalogue
  3. Design and develop the user login and catalogue browsing UI screens
  4. Implement the search and filter feature for the catalogue by categories such as type, price, colour etc
  5. Begin working on basic AR functionalities (camera access, object placement)
  6. Conduct initial unit testing on backend functions
- Duration: 1 ½ Months
- Tentative Dates: 25th November - 12th January
- Dependencies: Completion of requirements and initial set up

	NOV 25 - DEC 1	DEC 2 - 8	DEC 9 - 15	DEC 16 - 22	DEC 23 - 29	DEC 30 - JAN 5	JAN 6 - 12
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
Phase 2							
Task 1							
Task 2							
Task 3							
Task 4							
Task 5							
Task 6							

### ★ Phase 3: AR Module Development

#### ○ Tasks

1. Connect UI with backend for user login and data retrieval of furniture
2. Continue working on AR features including refining object placement and beginning room measurement and surface detection.
3. Add object detection and scaling functionalities to allow for realistic furniture placement.
4. Conduct component testing for AR functions such as usability testing.
5. Design and develop the AR view UI
6. Design and develop the layout saving UI

○ Duration: 1 ½ months

○ Tentative Dates: January 13th - February 28th

○ Dependencies: Backend and UI components are operational

	JAN 13 - 19	JAN 20 - 26	JAN 27 - FEB 2	FEB 3 - 9	FEB 10 - 16	FEB 17 - 23	FEB 24 - MAR 2
	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
Phase 3							
Task 1							
Task 2							
Task 3							
Task 4							
Task 5							
Task 6							

## ★ Phase 4: Backend Integration, Testing and Final Adjustments

- Tasks
  1. Connect UI with backend to enable functionality (login, data retrieval, saved layout loading)
  2. Conduct component and system testing for both backend and frontend.
  3. Perform usability testing with a sample user group.
  4. Refine features based on feedback, focusing on performance, usability, and stability.
  5. Prepare Testing Documentation
- Duration: ½ Month
- Tentative Dates: 1st March - 16th March
- Dependencies: AR Module fully developed

	FEB 24 - MAR 2	MAR 3 - 9	MAR 10 - 16
	M T W T F S S	M T W T F S S	M T W T F S S
Phase 4			
Task 1			
Task 2			
Task 3			
Task 4			
Task 5			

## ★ Phase 5: Documentation

- Tasks
  1. Prepare video walkthrough
  2. Prepare User Guide
  3. Prepare Technical Specification
  4. Create Expo Poster
  5. Last checks and Project Submission
- Duration: ½ Month
- Tentative Dates: 17th March - 31st March
- Dependencies: All development phases must be completed.

	MAR 17 - 23	MAR 24 - 30	MAR 31 - APR 6
	M T W T F S S	M T W T F S S	M T W T F S S
Phase 2			
Task 1			
Task 2			
Task 3			
Task 4			
Task 5			

## Resource Requirements

- **Hardware:** Laptop with ARCore-compatible emulator / Android device (for our testing we will be using the Google Pixel 6a), reliable internet connection.
- **Software:** Android Studio, Firebase, ARCore SDK, GitLab for version control.
- **Wetware:** Developers with knowledge on Androids, AR, ARCore and Firebase, user

## 7. Appendices

Chandukala, S.R., Reddy, S.K. and Tan, Y.-C. (2022) *How augmented reality can - and can't - help your brand*, *Harvard Business Review*.

Available at:

<https://hbr.org/2022/03/how-augmented-reality-can-and-cant-help-your-b>rand (Accessed: 18 November 2024).

Grewal, K. (2017) *Retailers have up to six months to develop AR apps or risk losing customers*, *DIYWEEK.net*. Available at:

<https://www.diyweek.net/retailers-have-up-to-six-months-to-develop-ar-a>pps-or-risk-losing-customers (Accessed: 18 November 2024).