



CS491- Senior Design Project

Project Specification Document

T2330

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1. Introduction

With the increase in the number of households in the world, the need for furniture and house effects keep increasing. The process of buying new furniture or replacing them can be tedious for most people. Most of the time, people try to pack their furniture in a way that everything barely fits in a room. But sometimes furniture might not fit as expected. Since the delivery and construction of furniture can be costly and time-consuming, seeing the furniture not fit as expected can be very frustrating. What if there was a way to see if a piece of furniture fit into a desired place, without having to buy it and deliver it to your house? vendAR is an application that lets people visualize the furniture they want to buy on their phones with the exact dimensions. It uses Augmented Reality technology with the rear camera of the mobile phones to place the furniture in their surroundings. The users can move and rotate the AR model of the furniture around the room to see if the furniture fits to their desired place. vendAR offers to solve the tediousness and frustration of purchasing furniture by giving the buyers a preview of the product as a 3D model. This report will contain information about vendAR, its constraints, professional and ethical issues, functional and non-functional requirements as well as a market analysis in detail.

1.1. Description

vendAR is an online retail mobile application that lets the buyers visualize the product they are buying using Augmented Reality technology. The main motivation behind the project is to simplify the purchase of large furniture that the buyer is not sure whether it will fit into the room. vendAR aims to eliminate the tedious process of physical measuring which is known to be not accurate. Hence, it is important to match the exact dimensions of a piece of furniture with a 3D model. In that sense, accuracy will be the most important aspect of vendAR.

There will be two essentials ways to deliver a 3D model to the buyer side:

1. Using the LIDAR technology to generate a 3D model from the product's images.
2. Creating a templated model section for the sellers to choose in case they have no access to the LIDAR technology.

In the initial stage of the project, the fundamentals of AR will be implemented. Since, vendAR will be built for both Android and iOS, ARCore and ARKit libraries will be used in the implementation of AR in Android and iOS respectively. Native development with the libraries ARCore and ARKit are hard to use and learn, so Flutter framework will be used which has both ARCore and ARKit plugins. The ARKit plugin of Flutter also lets the developers make use of the LIDAR technology which will make the implementation of such technology easier.

In the next stages, frontend and backend will be implemented using Flutter framework. The Augmented Reality part we implemented in the initial stage will work hand in hand with the rest of the application.

1.2. Constraints

1.2.1. Implementation Constraints

The implementation will be performed on two different platforms of IOS and Android using ARKit and ARCore libraries for Augmented Reality Technology and proper LIDAR library for the scanning objects that will be displayed. So having a built-in library for both of these utilities for both platforms is very pivotal since it would be very difficult to implement the project without them.

1.2.2. Economic Constraints

Our project depends mainly on free resources and libraries for the software side. However, in case of deciding to proceed with the Apple Vision Pro as the hardware, we need financial support from the companies that are willing to become our team's sponsor. Without the external financial support, the application will be modified such that it can run on the mobile devices that are either Android or IOS. So, sponsorship is decisive for the implementation of our project.

1.2.3. Ethical Constraints

It is important for our project to not violate any software license right through pirated content or any other illegal method. Also, the program should be easy to learn and understand by a vast range of users with various backgrounds. It should not have content that is discriminatory to some groups with different religion, nation, ethnicity or culture.

1.3. Professional and Ethical Issues

We must approach the project in a professional manner both through design and development processes. By handling the problems that we may have in terms of the development process or within the team in a professional and ethical way, we can easily solve the problems with taking the minimum casualty. Also, it is important for our project to not violate any software license right through pirated content or any other illegal method. Also, the program should be easy to learn and understand by a vast range of users with various backgrounds. It should not have content that is discriminatory to some groups with different religion, nation, ethnicity or culture.

1.4. Standards

Through design processes we must stick on to established standards to ensure quality and prevent any confusion. For the UML diagrams we will proceed with the UML (Unified Modeling Language) 2.4.1 standards to establish a common convention for all of our diagrams. We will also take advantage of the IEEE's guidelines for our reports to reach certain standards and enhance understandability.

2. Design Requirements

2.1. Functional Requirements

- Users must be able to login and register the system and log out from it.
- Users must be able to put their products on the app to make it visible to others.
- Users must be able to remove a product from their page.

- Users must be able to assign an AR model to each of their products to allow customers to visualize it in their devices.
- Users must be able to use 3D model templates to create their product models.
- Users must be able to import their own created models if they want to.
- Users must be able to attach animations/audios to their models in interactive products.
- Users must be able to visualize the product they select via using the camera of their device.
- Users must be able to play the animations or audios on the model of their chosen product.

2.2. Non-Functional Requirements

2.2.1. Usability

- The application should be released on a mobile application store so the user community can contact each other by downloading and installing it over the store.
- The application should have a user friendly interface so it is usable by people of all ages. A user manual should be provided at the beginning.
- The concept of the application should be easy to understand for people who are not professional in the field.

2.2.2. Reliability

- The application should not crash during installation or running.
- The application should not lag during the camera usage.
- The application should not crash on any mobile-based operating system.

2.2.3. Performance

- The application should be effective in terms of the software system with respect to time and allocation of resources.
- The application should be able to run on older generation smartphones which have cameras.
- The data transaction should be fast so the performance of the program would not be ruined.

2.2.4. Privacy and Security

- The program should collect data as needed according to PDPA (1).

- The program should only use the camera of the device as needed while running the program.
- Images or videos should be saved privately in the database if needed.

2.2.5. Scalability

- Many users should be able to use the program at the same time.

3. Feasibility Discussions

3.1. Market & Competitive Analysis

vendAR aims to be used by everyone who uses online shopping. The app is designed to be convenient and help people better understand their constraints, such as the size of the product they are interested in, while shopping. We intend to use vendAR as a helper app that can be redirected from shopping apps so that the app will reach wider audiences. Because of these reasons vendAR has a very large target audience. Considering how underutilized AR is and how there is a large market with AR that is just starting to become competitive, vendAR has relatively small competition.

The competition vendAR has is the brand specific apps that are becoming more widespread. For example IKEA has similar functionality in their own apps. Apart from large companies there isn't much competition. This gives vendAR the chance to be useful for independent sellers who utilize online shopping with other apps like Trendyol. This makes vendAR have a target audience who wouldn't otherwise get to use AR or HR. Until such apps become more common vendAR should be very competitive. Another component of vendAR would be its free to use nature which utilizes advertising as its revenue model. The app being free would mean that an average user wouldn't have many reasons to not use the app if they think it would be helpful, which they wouldn't think if the app was only available after purchasing it.

The weakness vendAR has is the technical limitations it will face. HR support would only be available for Apple devices. In the event of a LIDAR assisted 3D model construction system to be integrated, we would limit ourselves to only the latest and high-end Apple devices which would shrink our target audience considerably. The

solution vendAR will use will be to have different versions depending on the device of the users.

3.2. Academic Analysis

vendAR could be used for research on how AR and HR could be used for marketing and how the app affects the sales of products. Assessing the effectiveness of these technologies in marketing could help us improve marketing in the future for online shopping.

vendAR could also help us understand how much potential these technologies have, depending on how the app is received. This could help us make educated guesses about future technological trends regarding AR and HR.

4. Glossary

Augmented Reality (AR): Augmented reality (AR) is an interactive experience that combines the real world and computer-generated content. (2)

Hyper Reality (HR): The term we use to refer to the AR and mixed-reality experience that is provided by Apple Vision.

LIDAR: LIDAR, an acronym of "light detection and ranging" or "laser imaging, detection, and ranging") is a method for determining ranges by targeting an object or a surface with a laser and measuring the time for the reflected light to return to the receiver. For vendAR it is a potential tool that would help users to make 3D models for their products. (3)

ARCore: ARCore is Google's augmented reality SDK offering cross-platform APIs to build new immersive experiences on Android, Unity, and Web.

ARKit: Similar to ARCore, ARKit is Apple's augmented reality SDK offering APIs to build immersive experiences on iOS devices.

5. References

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