

Developing Markerless Augmented Reality for Furniture Mobile Application

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Abstract: In India, purchasing furniture online consistently faces a quandary regarding how one can comprehend whether the furniture is a solid match to purchase, regardless of whether it will fit in space without really contacting and looking at the furniture in detail. With such a dilemma there are chances for online stores to decline in their business. There is always a good certainty that technology can help to bridge the barrier and help one to overcome the dilemma. This study creates a unique light on how Augmented Reality can help to create and simulate buying furniture an online experience and enhancing customer experience provided uniqueness and mobility with the help of a mobile application. Our application allows users to simulate and experience furniture in 3D simulation using markerless augmented reality. Users can try a piece of furniture in their space supported by gestures and color furniture to try out diverse tints of the same. This research advances a new way of implementing markerless augmented reality for buying furniture products online provided by mobile applications and communicating with virtual objects in a real environment with an easy-to-use user interface.

Index Terms: Augmented Reality, User Experience, Online Shopping, Mobile Application, E-Commerce

1. Introduction

In this paper, the major research objective is to show how through augmented reality we aim at simplifying the user's experience and also enhancing the user's perception and interaction with virtual(3D) objects within the real world, in real-time. So the purpose of this research is that purchasing product such as furniture for interior design is a complex and hectic process and not satisfying to the consumer, and one of the major reason for this is the consumer cannot place or fit the furniture according to the space requirement of their place before buying, and the previous augmented reality-based research systems do not allow users to view virtual furniture with precise relative 3D models, motion tracking, and environmental understanding, in the context of the real-time environment and further, they do not allow the user to alter the dimensions and they had marker-based augmented reality approach. So we proposed an alternative solution ie: a mobile application that can be used for interior designing of home furniture through markerless augmented reality; wherein a customer can form a 3D object model of the furniture through which they can easily scale multiple 3D models of furniture object and place them in their space and can alter the color or dimensions of furniture according to their preferences in real-time and then can go on and buy the furniture with the details provided about the furniture in the android application, so the main aim for research in augmented reality is to enhance customer experience and making the 3D model object rendering more realistic and convenient as possible so the end customer is satisfied; which in turn can enhance and boost e-commerce and online shopping of furniture.

So for enhancing the user interaction and resolving limitations; we enforced motion tracking that is used to understand the motion of objects and track their movements and accordingly to that the 3D model will simulate to give a better perspective and also environmental understanding that allows the mobile application to detect the surface and according to its size and inclination such as horizontal, vertical or angled surface the projection of the 3D model will alter, and also estimation of light in the environment such as current light intensity and lighting condition so according to that the 3D model will render its projection and be more realistic and dynamic to the real object in the surrounding environment and make customer interaction more efficient. So we hope to achieve simulation of the furniture object and augment in the real-world environment.

2. Requirements and Feasibility Analysis

The application is more optimistic in results and higher mobility which leads to less requirement. Since the application is developed on mobile. It only requires the mobile itself. Alongside the IDEs, it is created on i.e: Android

Studio which is supported by macOS, Windows, and Linux. It is powered by ARCore Framework provided by Google and it is capable of running on Android OS and iOS since it is a multi-platform framework.

3. Working and Concept

The application has a simple interface that helps in providing clarity and interactivity to the user. It uses the camera of the mobile device which plays a vital role by communicating with the application and the framework that provides augmented reality features. A demo application is created that showcases the demonstration and the capabilities that augmented reality can show. We choose the ARCore SDK provided by Google because it is capable of providing Augmented Reality Experience on cross-platform devices.

The application working is divided into 3 parts:

- Working of the ARCore SDK
- Technical Working of the Application
- Working of the Application from the end-user perspective

ARCore SDK provides three key features that help developers to create a great user-experience in augmented reality. They are as follows:

- Motion Tracking
- Environmental Understanding
- Light Estimation

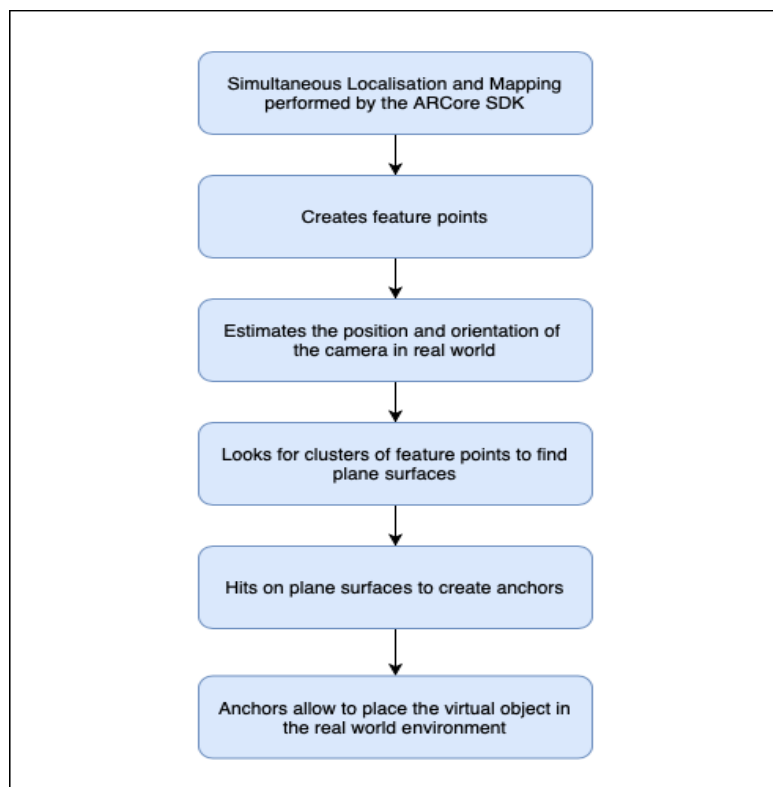


Fig.1. ARCore SDK Core Functioning to help the app provide the AR Experience

Motion Tracking: The framework uses a technology called simultaneous localization and mapping (SLAM) for understanding the devices' relative positioning in the world. It then creates points from the captured image by the camera known as the feature points which then help to compute the changes while moving the device around the world. With the help of the feature points, it provides to creates hits on the feature points to place the 3D objects in the form of anchors

Environmental Understanding: It continuously learns the environment and finds feature points and planes (horizontal/vertical/angular) ie: walls, tables, and angular slopes. By creating the features points with the help of motion tracking, it allows placing objects on the recognized planes.

Light Estimation: The framework provides the ability to provide lighting to the 3D Objects with intensity and color correction with the help of the given camera captured image. Even in a night/dark environment, it provides the ability to provide lighting and intensity to the virtual object to make it feel in a realistic environment.

The above figure showcases how the ARCore Sceneform SDK works in the application that helps to provide an interactive augmented reality experience with the virtual objects. Firstly it begins with motion tracking with the help of the camera image, it performs SLAM (Simultaneous Localisation and Mapping) process which helps to understand the environment and creates feature points on the surface it can detect properly. It calculates and estimates the position and orientation of the camera in the real-world and looks for a cluster of features points to perform hit tests to create anchors that will place virtual objects in the real-world environment according to the position and orientation estimated by the camera. This is how the ARCore SDK core functioning works and helps the application to provide such an experience.

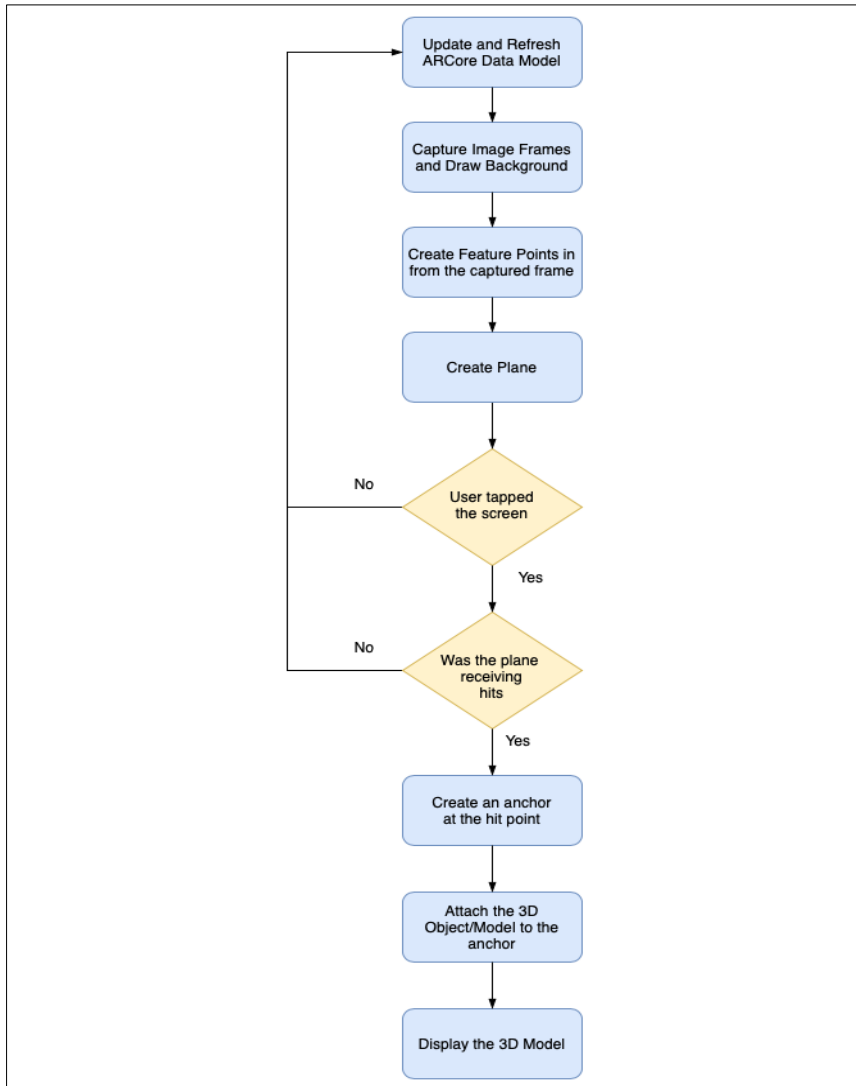


Fig.2. Technical working of the application

The above figure showcases the technical working of the application on how it works with the help of the ARCore Sceneform SDK. The mobile camera is considered to be an essential part of working in providing interaction with virtual objects in the real world. The application provides an AR View allowing the virtual objects to place in the environment. With the help of the camera, the data model provided by ARCore refreshes to capture image frames and detect to create feature points which allow to find the plane and allow the user to tap to perform a hit and the hit result is created by understanding the orientation and position of the hit created by tapping on the image frame captured by the camera, it then creates the anchor from the hit result and position provided and it allows to place the 3D Furniture Model to place it at the given anchor. The app also allows users to change the color of the 3D Object and the app does this by changing the material of the 3D Object.

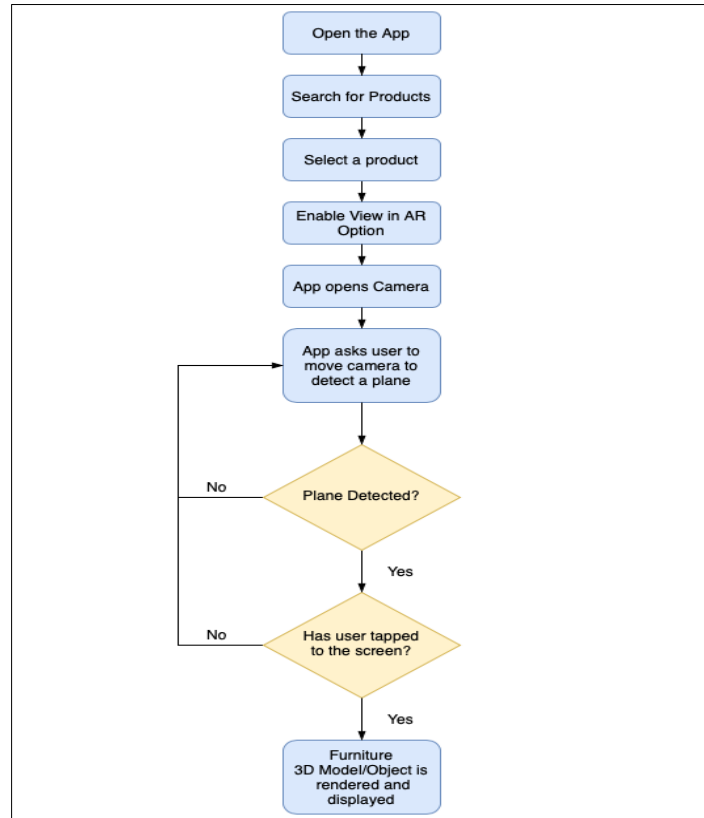


Fig.3. Working of the application from the end-user perspective

From an end-user perspective, the app appears to be an e-commerce product and the user searches and selects a product to view the information, the app provides a View-In-AR call to action where the app opens up an AR View and allows user to find a plane and tap on the screen to perform a hit test to place the anchor and interact with the virtual object in the real-world environment, the user can also be able to change the color of the furniture as per convenience and also add multiple models for a better experience.

4. Application Screenshots



Fig.4. Application detecting a plane through understanding the environment - Playground View

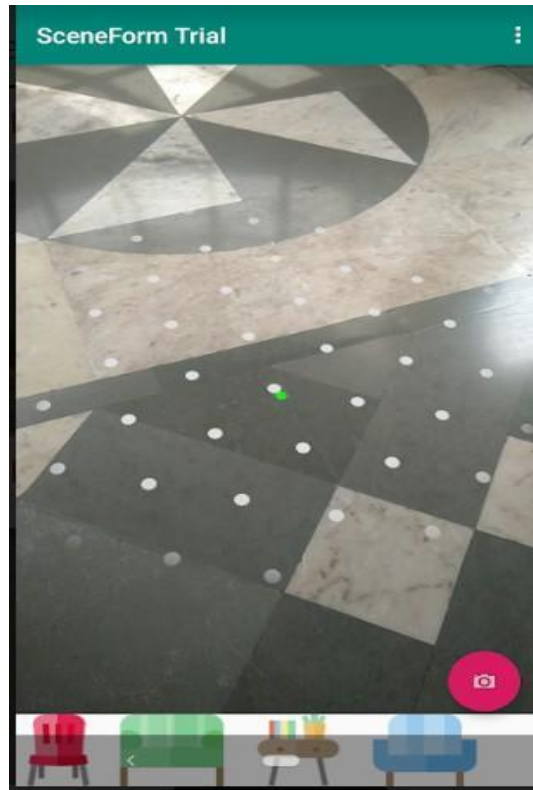


Fig.5. Application has detected plane through understanding the environment and shows users - Playground View



Fig.6. Application rendered the 3D model - Playground View

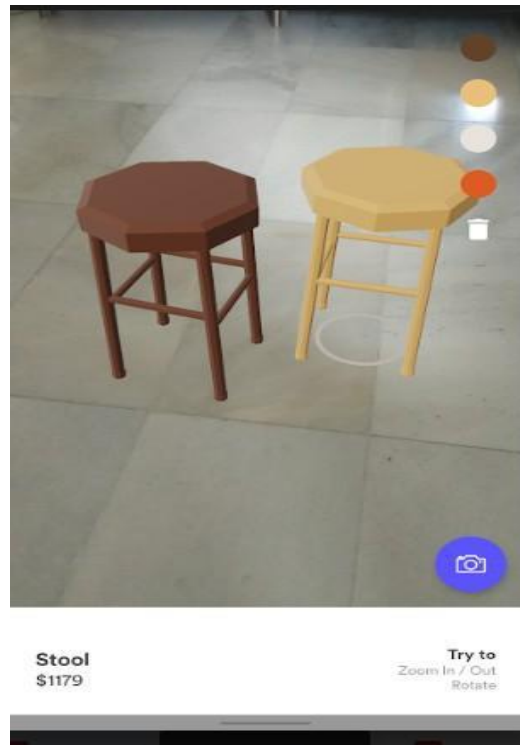


Fig.7. Application has the ability to change color of the furniture product for concise furniture buying atmosphere

5. Conclusion

The research concludes and states how Augmented Reality can not only leverage online shopping ecosystems but also boost user interaction as it provides interaction with products in the real world environment that leads to catering products with better user experience and mobility. Due to an increase in the adaptation of online shopping in recent years. The application can play a vital role and provide a unique selling point for businesses to grow in their vertical. Many businesses have started to adapt this to their work-related purposes such as interior decoration and design, decoration, and home-planning. As mobile phones are coming equipped with better camera features like depth interaction, augmented reality drawing support and LiDAR scanners, there will be huge growth in the adaptation of markerless augmented reality mobile applications and the application is a starting point in product innovation for online e-commerce businesses and providing a noteworthy edge of advancement in this domain of technology.

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