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Survey of Techniques and Application in AR Integrated Home Furniture App

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Abstract: ***This paper focuses on combining Augmented Reality technology with furniture stores to give customers the same shopping experience from the comfort of their homes. The mobile application uses the power of AR to allow users to place and view furniture in their positions in real time. Through a smartphone camera or tablet, users can see that there are many products available to add to their existing decor, such as a sofa, table, or chair, allowing them to make a purchasing decision. This AR furniture application not only simplifies the purchasing process, but also increases customer satisfaction by reducing the guesswork in the furniture purchasing process, and finally transforms the traditional rules of interior design into a conversational, interactive, and personal one. This paper studies the methodology and implementation of the AR app.***
Keywords: augmented reality, furniture, home design, mobile applications, visualization.

I. INTRODUCTION

Augmented reality (AR), is a technology that overlays computer graphics on the real world and has its applications in the field of engineering and architecture to tackle real life problems [2]. With significant advances in computer vision algorithms and the emergence of affordable devices, augmented reality is gaining ground. The furniture retail industry provides great benefits to the sector. However, most of these sales still occur through physical stores, which is troublesome and time-consuming for customers. AR technology is changing the furniture industry, with major players like IKEA, Wayfair, and Target leverage their ability to drive sales and design omnichannel experiences. In an AR environment, virtual furniture can be connected and function directly in the physical world, providing users with an interactive and engaging experience. This allows people to think about how certain furniture will fit into their living space. Whether installing a sofa in your living room or looking for a different color for your cabinets, AR can reduce the risks associated with product returns and delivery. As e-commerce continues to replace physical stores, augmented reality will play an important role in furniture retailing in the future.

AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it. Augmented Reality (AR) is a technology that connects a virtual environment with the user's physical reality. AR, often referred to as mixed reality, seamlessly blends physical and digital spaces [1]Augmented Reality (AR) is a new technology that aims to use ideas in engineering and architecture to solve problems in the world, providing images generated by a computer into the physical world. This technology, which is widely used in many fields such as fashion, gaming, and navigation, gives us a better reality experience.

We created an interior design application that allows users to preview virtual furniture in their real space before purchasing. Users can easily choose from a variety of virtual furniture options and place digital furniture in the captured space by dragging and dropping it into the real environment.



Figure 1

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II. EXISTING SYSTEM

Recently, AR technology is in heavy usage in various fields like science and medical but it has also started evolving in Engineering and architecture. Following are various methods to develop current system:

A. Marker-based Augmented Reality

It is also known as recognition-based augmented reality, involves the use of a camera to identify real-world objects or specific visual markers like QR/2D codes or NFT markers. It generates results only when the camera detects the designated marker. In marker-based applications, the device's camera scans for markers on any real-world object. These markers can be simple patterns like QR codes, actual images from the real world (NFTs), or physical objects. The system also calculates the orientation and position of the marker, allowing additional information to be overlaid on it. Once the marker is recognized, an object is superimposed onto it. If the user wishes to rotate the object, the marker itself is rotated, resulting in a corresponding rotation of the overlaid object.

B. Location-Based Augmented Reality:

Marker less augmented reality, also known as location-based augmented reality, leverages the device's built-in GPS, digital compass, velocity meter, or accelerometer to gather data pertaining to the user's present location. The proliferation of smartphones equipped with location-detection capabilities has been instrumental in driving the advancement of location-based augmented reality technology. This technology finds primary application in tasks such as navigation, identification of nearby points of interest, and other location-centric mobile applications.

C. Projection-Based Augmented Reality

Projection-based augmented reality operates by projecting artificial light onto the real-world environment. This light projection allows for analysing the position, orientation, and depth of a virtual or real-object. In this context, an object is carefully examined, and its structural characteristics are thoroughly explored. User interactions are detected by distinguishing between the expected and altered projections. One fascinating application of projection-based augmented reality involves the utilization of laser plasma technology to project an interactive three-dimensional (3D) hologram into the air.

D. Outlining Augmented Reality

While the human eye is often regarded as the finest camera in existence, it does have its limitations. It can't sustain prolonged focus on objects, struggles in low-light conditions, and is incapable of perceiving infrared wavelengths. To address such limitations, specialized cameras have been developed. Augmented reality applications, like those that create outlines (e.g., AR cameras), are a prime example of this technology. Object recognition forms the foundation for many features of outline-based AR, resembling aspects of projection-based AR in some cases. For instance, when parking a modern vehicle in the dark, outline-based AR technology comes into play.

E. Superimpostion-Based Augmented Reality

It is the technique of enhancing an object's view by partially or completely substituting it with an augmented version of the same object. To achieve this, object recognition is pivotal in augmenting the original view with the correct one. A prime example of this is the outline-based AR technology that highlights road boundaries to aid drivers in low-light conditions while parking their vehicles. Similarly, this technology can also detect buildings and their supporting structures, making it useful in the fields of architecture and engineering.

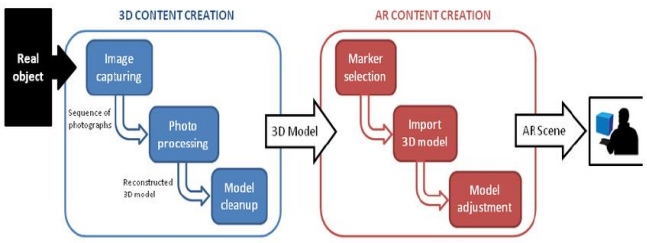


Figure 2: Proposed Methodology

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III. WORKING MODULES

A. Module 1: Login and Authentication

This module manages user authentication. The user enters login information. The mode defines itself. If the login is successful, all aspects of the application are accessed; otherwise provides a guaranteed truth-telling outcome.

B. Module 2: Augmented Reality Furniture Placement

The module allows you to select a piece of furniture from the user interface. Using augmented reality (AR) technology. Place the selected furniture in the real world as the camera tool sees it. This can give you an idea of how the furniture will fit into your space.

C. Module 4: Customizing Furniture

Using this module, you can interact with virtual furniture items by rotating, measuring, and placing them in the camera view. Your actions will be instantly reflected in the placement and orientation of the virtual furniture.

D. Module 4: Image Capturing and Viewing

When you want to take a photo of a site with furniture, the mod will capture a screenshot of what you see from the camera. After the image is captured, it is displayed on the screen for a short time and the user is given the option to save or discard it.

E. Module 5: Billing Calculation and Payment

This model calculates the cost based on the selected furniture. All changes made by the user. Determines the price associated with each item selected as the additional cost of the repair. After billing, it directs the user to payment gateway.

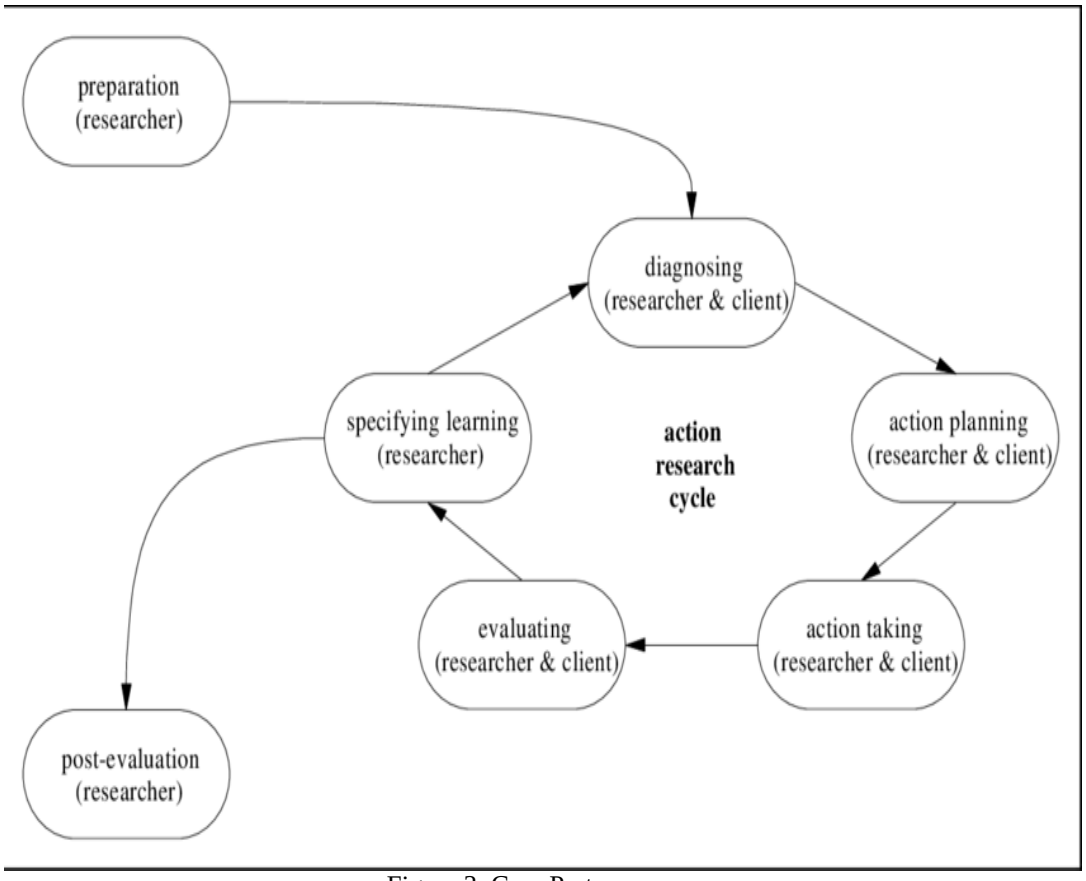


Figure 3: Core Part

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IV. TABLE

Table 1:Mobile AR Systems [4]

systems								/gprs							handheld	3Dstat / 2D
Virtual Character based	Billinghurst et al [35]	x					I		x		mb				handheld	3Ddyn
	Tamura et al [28]	x					I		x		mb				hmd	3Ddyn
	Cheok et al [27]	x					O	x			mb				hmd	3Ddyn
	Papagiannakis et al [44]	x					I,O		x		ml				hmd	3Ddyn*
	Hughes et al [32]	x					I	x			mb				hmd	3Ddyn
	Barakonyi et al [33]	x			x		I	x			mb	x		x	handheld	3Ddyn
	Peternier et al [24]				x		I,O	x							hmd	3Ddyn
	Wagner et al [39]	x			x		I,O	x			mb	x			handheld	3Ddyn
	Scmeil et al [40]	x					O		x	x					hmd	3Ddyn*
	Egges et al [11]	x					I,O		x		ml				hmd	3Ddyn*
Navigation and Path finding	Bell et al [14]	x					O		x	x					hmd	2D
	Hollerer [8]	x					O		x	x			x		hmd	2D, 3Dstat
	Olwal et al [17]					x	O	x				x	IR		handheld	2D
	Reitnayr et al [18]				x		O	x		x			x		handheld	2D
	Azuma et al [19]	x					O	x		x			x		handheld	2D, 3Dstat
	Elmqvist et al [29]			x			O	x						x	hmd	2D
	Newman et al [46]			x			O	x			x		inert	x	handheld	3Dstat
Edutainment and Games	Klein et al [20]		x				I		x		x		x		handheld	3Ddyn
	Henrysson et al [22]					x	I		x		mb				handheld	3Ddyn
	Rashid et al [30]					x	I	gprs					RFid		handheld	2D
	Piekarksi et al [50]	x					I,O	x			mb				hmd	3Ddyn*
Cultural Heritage	Vlahakis et al [36]	x					O	x		x	x		x		hmd	2D, 3Dstat
	Papagiannakis et al [12]	x					I,O		x		ml				hmd	3Ddyn*
Collaborative assembly	Revenier et al [42]		x				I		x	x			x		hmd	3Dstat
	Stork et al [26]		x				I				ml		x		hmd	3Dstat
Maintenance & inspection	Gausemeier et al [47]				x		I	x			ml				handheld	2D/3Dstat
	Vacchetti et al [13]	x					I		x		ml				hmd	2D, 3Ddyn*
	Goose et al [15]				x		I	x			mb				handheld	2D/3Dstat
	Rauhala et al [48]	x				x	I		zigBee, bluetooth		mb				handheld	2D/3Dstat
	Makri et al [49]				x		I	x			both				both	2D/3Dstat

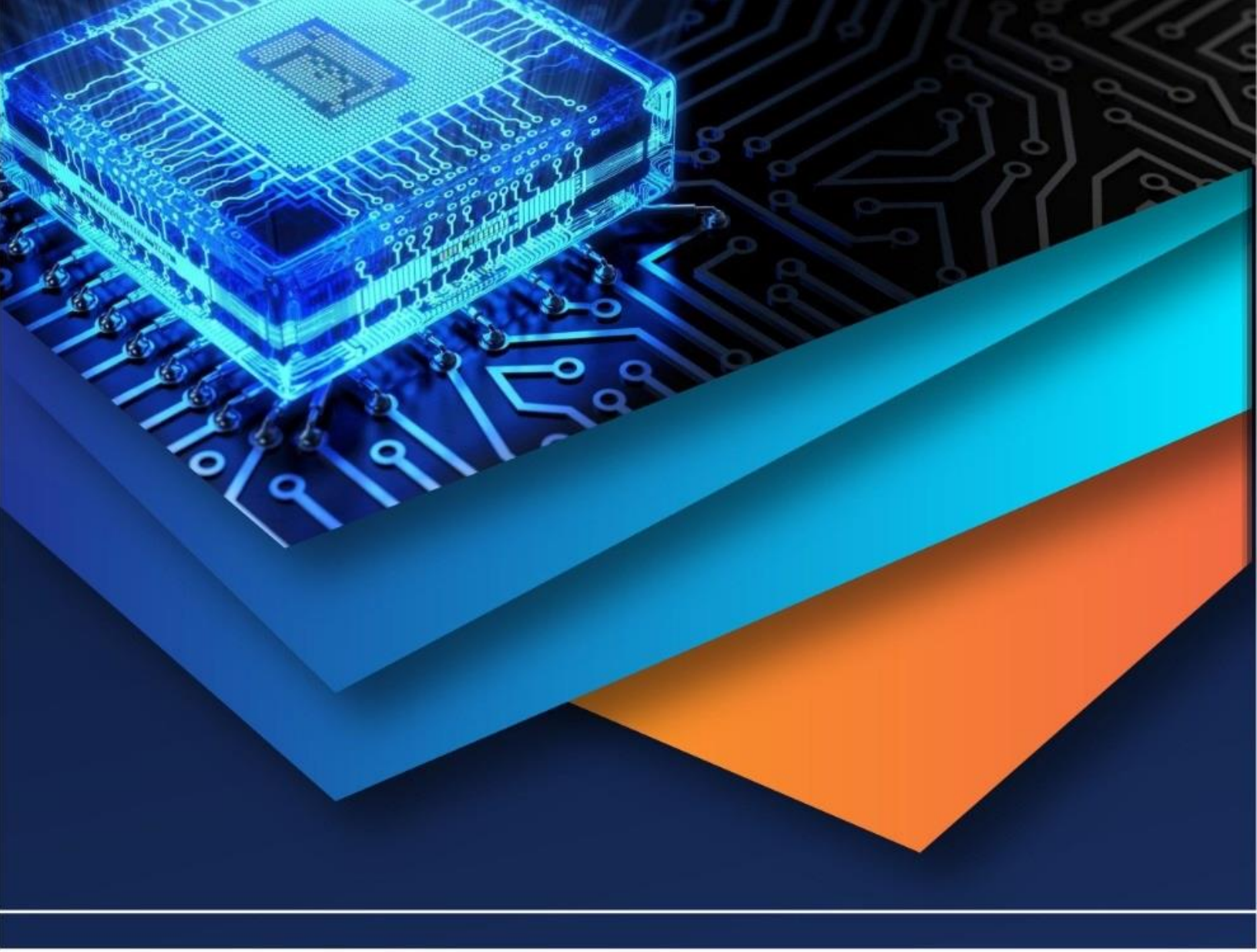
V. CONCLUTION

In conclusion, this research paper highlights the innovative integration of Augmented Reality (AR) with e-commerce, focusing on virtual furniture applications. Utilizing ARCore and Sceneform in the Android Studio development environment, the application enables users to place virtual furniture in their physical spaces, offering an intuitive and personalized experience.The combination of AR technology with Firebase libraries enhances user engagement through rapid collaboration and content updates. This not only redefines user interaction but also opens new avenues in digital communication and home customization. Users can adjust their living spaces in real-time, making the digital shopping experience more immersive and tailored to their preferences.

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