

Using Augmented Reality for Setting Furniture

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ABSTRACT

The credit of ease with which humans live their lives today goes to the technological developments that has been growing at a tremendous rate and enhancing the human lives by wider applications of such technologies. We all live in a world where we make use of technology to reduce human effort for accomplishing tasks. The technology of Internet has facilitated buying clothes and accessories online without actually visiting the stores physically. However, when it comes to buying furniture online, the conditions are not as favourable as they are while buying clothes and accessories. Because, it is really very difficult to imagine how a particular piece of furniture item will look on our desired vacant area. Even if we imagine and order a sofa online and if it doesn't fit our vacant area, the return policies are really a headache. Hence, we usually do not prefer to buy such things online (like furniture) that we are not sure about. But thanks to the technology called "AUGMENTED REALITY" that has disappeared the issue of imagining how a particular thing will exactly look like in a real world. Augmented Reality is nothing but a technology that brings the virtual object into the real world via Stand alone cameras or cameras embedded in some other devices. Thus, this technology has a great application in the world of interior designing and proves helpful in setting furniture virtually to see how it looks like before actually setting it actually. It has been observed that the customers in a furniture showroom are in dilemma of which furniture piece will fit their desired vacant area well, how will it look with the furniture piece that it has to placed besides with (if any), how well its colour will match the colour of wall. Hence, all this problems can be solved with an application that uses augmented reality which is proposed further. The proposed methodology aims to deploy the application that lets user try furniture pieces virtually and thus reduce the time consuming human effort of physically visiting the furniture stores.

Keywords: Augmented Reality, Marker-based detection, Simple Markers, Rendering.

I. INTRODUCTION

Let us start by understanding the term "augmented reality" in a broader view. As stated in dictionary, "Augmented Reality is a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view." It is an enhanced version of reality where live direct or indirect views of physical real-world environments are augmented with superimposed computer-generated images over a user's view of the real-world, thus enhancing one's current perception

of reality[4]. As the word "augment" itself means "to add" or "to enhance something" the technology is used to add features like graphics, sounds, and touch feedback into our natural world for the purpose of creating an enhanced user experience. Augmented reality is often called as the cousin of Virtual Reality. Though both the technologies sound alike, but they are different. In virtual reality, the human is taken to the entire new virtual world. Thus, inhabitation of entirely new virtual environment has to be done in virtual reality. Whereas, in augmented reality, the object or features stated above are brought to the real

world. Thus, augmented reality just enhances the user experience by integrating the information or object or similar features on the top of real world environment by superimposing them. The well known social media that uses augmented reality is “Snapchat”. The application uses the smartphone’s camera to detect the face of a person, augments something over it and produces an image of the person with something extra on it, which is achieved by the term called ‘filter’.

Various filters are available on snapchat that lets you add a tiara on your head or turn your face to a dog’s face. This is done by augmenting dog’s ears and nose onto your face and makes you look like a dog. Another well known application that makes use of augmented reality is the game “Pokemon-GO”. It augmented various characters of Pokemon in the game and used them to allow user increase its score by capturing them. Apart from this, the technology has wide applications in various areas including Medical, Retail, Industrial Design, Commerce, Education, Entertainment, Flight Training, Military, Navigation, etc.

The rest of the paper is organised as follows. Working of augmented reality is explained in section II. Types of augmented reality are presented in section III. Proposed application of augmented reality in setting furniture is explained in Section IV. Concluding remarks are given in section V.

II. WORKING OF AUGMENTED REALITY

The hardware components that are required to apply augmented reality are processor, display, camera and input devices. Usually, modern smartphones contain all of these components. They have a camera or sensors like MEMS(micro-electro-mechanical systems) embedded in them. They have a processor and a display screen. Note that other display devices that are used are Special Glasses that augments object or Head-Mounted Display devices that are wore like

a helmet. Since, modern smartphones have all the hardware components in-built, augmented reality can be achieved through mobile devices with higher processor configuration.

The working of augmented reality is carried out in following stages : Capturing of Scene, Detection, Processing and Rendering and Visualisation. Let us see them one by one :

A. Capturing the Scene :

This phase refers to capture the scene where you want to augment the object. The scene can be captured via stand-alone cameras or the cameras that are in-built in smartphones.

B. Detection :

Detection is the next stage in applying augmented reality anywhere. As AR facilitates adding object to the real world, it has to be decided that where the object should be superimposed. Hence, detecting the area where superimposition has to be done is the first and foremost step after scene has been captured. We just cannot simply tell our phone’s camera to augment a Pokemon on our bike or add a star to our ceiling. This has to be pre-programmed which means telling the camera to look for a bike and once bike is found, augment Pokemon on it. Thus, detection is important, because if detection goes wrong then augmentation of object goes wrong. Detection is classified into two categories which is as follows :

1. Marker based detection :

In this approach of detection, markers are used. Markers are nothing but the simple 2D objects. They are mostly used in the form of visual tags. When camera finds the marker in the scene, which is pre-programmed, then detection is done. Markers can be any unique QR codes or similar visual codes. The following figure illustrates an example of marker.



Figure 1. Example of Marker

2. Non-Marker based detection :

In this approach, markers are not used. The detection depends on complex objects, online simple objects used in marker based approach. The complex objects here refer to any object whose shape or say configuration is not the same every time. Example of non marker based detection is a human face. The faces of all the humans are different, yet some algorithms are developed to detect the eyes, nose, lips and ears. Snapchat uses the non-marker based approach and augments the tiara on the human's head after the head of the face is detected. Various other things can be used for the purpose of detection depending upon the application.

C. Processing :

Once the detection phase is over, either through marker-based approach or non-marker based approach, the processing of the object that has to be augmented begins. Note that this objects are 3D objects or say animated objects. These objects are to be modelled using various softwares. Graphic designers play a key role here in designing and furnishing well-equipped and attractive objects. Various factors like setting the scale, rotation, position, enabling lights, shadows, reflections, etc are considered in this phase.

D. Rendering and Visualisation :

Once, the object is fetched and all it's processing is done, it is rendered into reality. If the marker-based approach is used for detection, then object is augmented upon the marker. Whereas in case of marker-less based approach, the objects are superimposed on the complex objects which is in real world thus giving user a better experience.

III. TYPES OF AUGMENTED REALITY

Although the technology is wide, it is categorised into few categories depending upon the objectives and applications in which it is used. The various types of technologies that contribute to make AR are listed as follows :

1. Marker Based Augmented Reality :

Marker-based augmented reality is nothing but a technology that uses markers in the detection phase. As discussed earlier, markers are the visual tags or simple put 2D or QR codes. This kind of augmented reality is often called as Image Recognition AR since the marker, may it be a QR code or any other 2D code is first recognised through camera and then augmenting of object takes place. Distinct yet simple patterns are used for generating markers since it is easy to recognise them and moreover, recognising simple markers do not require much processing power in order to read them. Figure 2(a) illustrates the example of marker based AR.

2. Marker-less Augmented Reality :

Marker less AR is nothing but the AR where objects are augmented without the use of marker. This category is also called as location-based, position-based or GPS AR. Mostly, features like accelerometer, Global positioning System (GPS), digital compass, velocity meter that are embedded into device are used. This helps to get data which is based on the location of the user. Mostly, applications of Markerless AR are used for the purpose of mapping directions or in order to find nearby places like theatres or hospitals or similar places like that. Figure 2(b) illustrates the application of marker less AR in mapping directions.

3. Projection Based Augmented Reality :

Projection based augmented reality is achieved by obtaining projection of artificial light. The projection is done on the surfaces of real world.

Usually, such kind of applications aim to obtain input from human interaction(i.e. touch) of the light which is projected. The detection of the user's interaction is done by sensing the difference in light. It is differentiated between a known projection or an expected projection and the altered projection which is caused by the user's interaction. Figure 2(c) illustrates the projection based AR application.

4. Superimposition Based Augmented Reality :

This kind of approach deals with the superimposition of the object in the real world. It is done either partially or the original view of an object is fully replaced with newly augmented view of that same object. Here, the recognition of the object plays an important role since replacing of original view with the augmented one cannot be done unless and until it can determine what the object is. Figure 2(d) illustrates the superimposition based AR application.



Figure 2(a)



Figure 2(b)

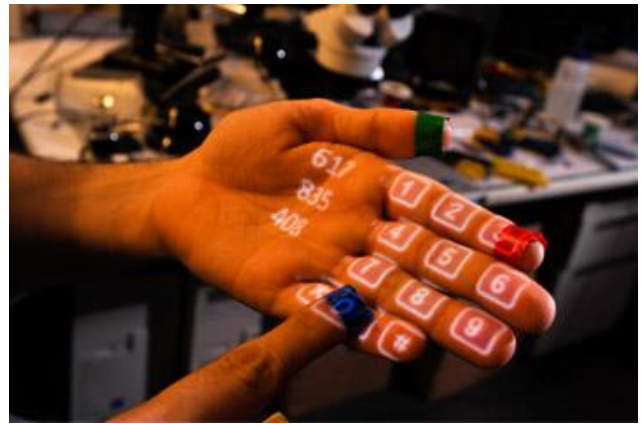


Figure 2(c)

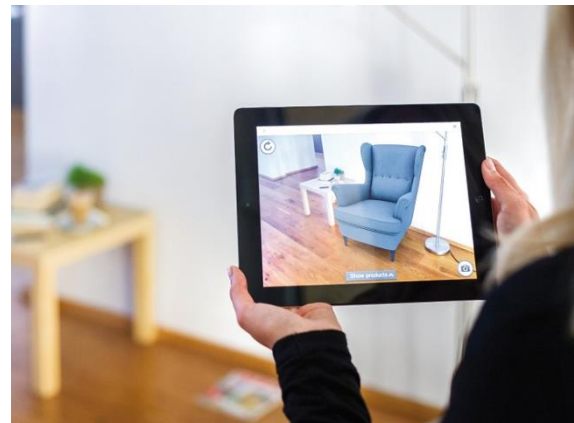


Figure 2(d)

Figure 2. (a) Marker Based AR application (b) Marker-less Based AR application (c) Projection Based AR application (d) Superimposition Based AR application

IV. PROPOSED APPLICATION

The proposed application of Augmented reality aims to build a mobile application that lets the users visualise the furniture pieces in their desired vacant area. The application aims to build a hassle-free user interface for helping user view and try out the furniture pieces in their workplace by selecting furniture piece(s) from a range of furniture pieces that are listed in the application. This application will be useful for the users to try furniture items before actually buying them. The application makes use of marker less superimposition based augmented reality where furniture pieces are superimposed on the vacant area thus making user visualise their

rooms or workplace and giving them actual feel of how well their desired vacant area or workplace will look like. This application thus reduces the labour of the end user to physically go and purchase the furniture pieces without having actual idea how well it will fit or how good it will look with the wall scheme. The motivation here is to deploy the mobile application that uses augmented reality to allow ease in the world of setting and buying furniture online.

3D Modelling of all the furniture items that are to be listed on the application is done. Some furniture pieces like sofa, coffee table and a chair has already been modelled and augmented. The following figures illustrates the screenshots taken from iPhone.

Figure 3(a) shows how a sofa looks like when placed at a vacant place. All the views of sofa are illustrated as well.

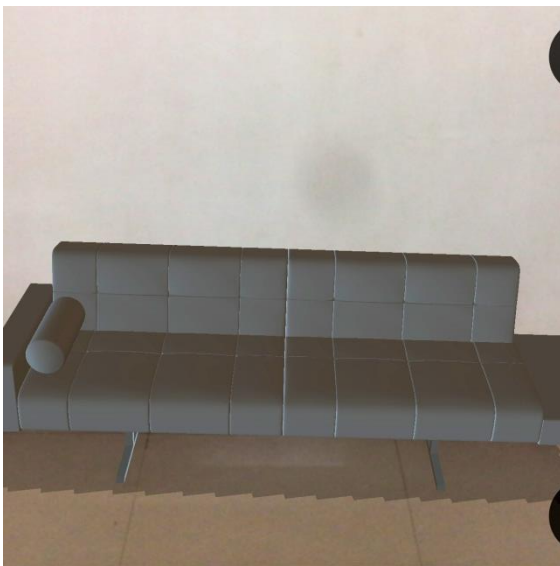


Figure 3(a)



Figure 3(b)



Figure 3(c)



Figure 3(d)

Figure 3. (a) Sofa on vacant area (b) Front view of Sofa (c) Top view of Sofa (d) Side view of Sofa
Another model of a coffee table was made and augmented which was attempted to place in front of a sofa that was already at home. Thus, this gives us an

idea of whether the colour and design of table looks good with that of sofa. Following figure illustrates the screenshot of table augmented in front of sofa and the view of table from few angles.



Figure 4(a)



Figure 4(b)

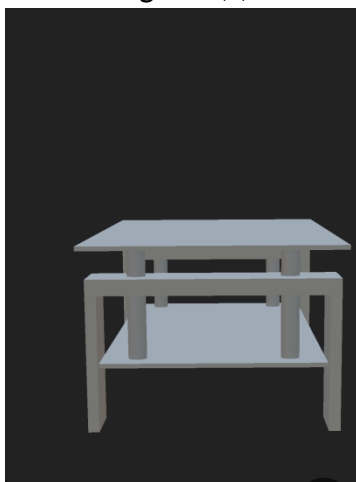


Figure 4(c)

Figure 4. (a) Augmenting table in front of Sofa to see how it looks (b) Top view of table (c) Side view of table

Also, the table is augmented between two already existing furniture pieces. As we can see in the figure, its colour does not look good with the already

existing furniture pieces which are brown in colour. Thus, using this application can save us from such situations where we have to imagine about how furniture piece will look like.



Figure 5. Augmenting table in between existing furniture piece to see how it looks

Next, we have augmented a chair besides an already existing table. The figures below illustrate the screenshots of how chair looks and its view from different angles



Figure 6(a)

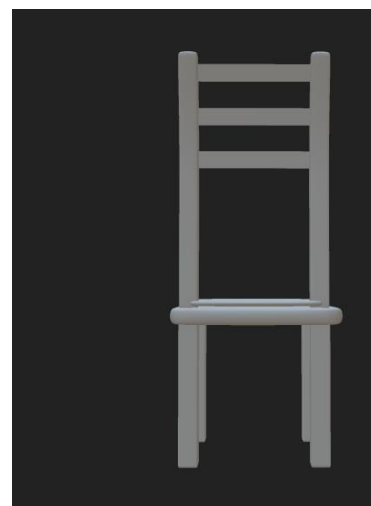


Figure 6(b)



Figure 6(c)

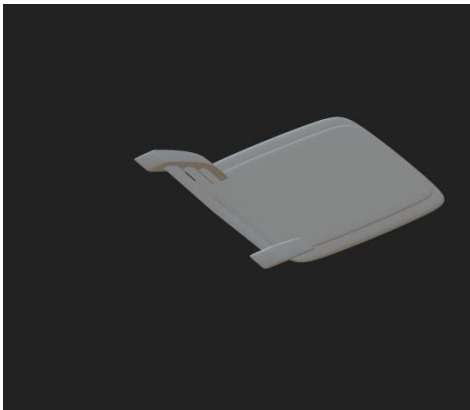


Figure 6(d)

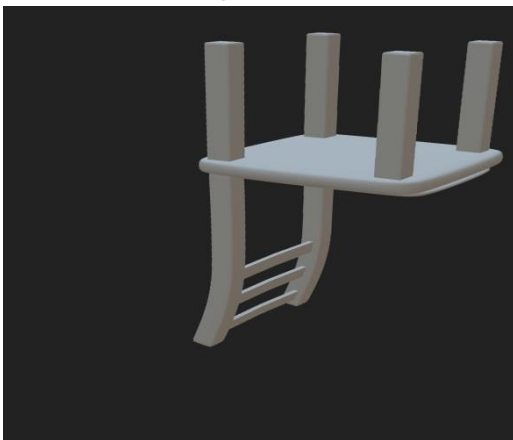


Figure 6(e)

Figure 6. (a) Chair besides an already existing table
(b) Front view of Chair (c) Side view of Chair
(d) Top view of Chair (e) Upside down view of Chair

Note that all this pictures are taken in the co-creation session from participants' own home.

Working :

The main feature of the proposed methodology is that the AR based application is meant to be deployed on both iOS and Android Operating System using a

single technology. As we know that building an application for Android OS needs coding for application in Java using Android Studio whereas building an iOS application needs the coding in Swift/Objective-C. Usually, for deploying an application on both the operating systems, two different teams are required to work on each OS. However, we have used here a technology called "React-Native". Here are the few highlights about React-Native.

- ✓ React-Native is the open source framework by Facebook.
- ✓ React-Native is an open source project by Facebook that lets the developers deploy real applications (note : not web apps or hybrids)[5].
- ✓ React Native is the next generation of React – a JavaScript code library developed by Facebook and Instagram, which was released on Github in 2013[5].
- ✓ React Native is a framework that uses React to describe the user interface for native devices. With React Native you can build applications that run on iOS and Android devices using JavaScript[5].
- ✓ React Native uses the same fundamental UI building blocks as regular iOS and Android apps. You just put those building blocks together using JavaScript and React[5].
- ✓ The best part of the React-native is its HOT RELOADING feature. Instead of recompiling, you can reload your app instantly. With Hot Reloading, you can even run new code while retaining your application state[5].
- ✓ The apps built in React-Native are indistinguishable from the apps built in Java or Objective-C. Moreover, the apps are robust and are able to handle million users on Facebook[5].

The Facebook and Instagram has redesigned their applications in React-Native. Moreover, Tesla, AirBNB, Walmart, Baidu, Facebook Ads Manager, Bloomberg, Skype, Uber Eats are the few renowned names that use React-Native. Most of the start-ups

and business opt for React-Native because of its incredible support and amazing features.

React-Native has helped saving time in building AR based application of our proposed application. The technology was learnt using the official documentation of React-Native whose link is mentioned in the reference section.

V. CONCLUSION

As illustrated in the figures above that show the screenshots of the application after rendering various models like chair, table and sofa, it can be concluded that the application proves to be a boon in the field of online furniture selling since it aims to reduce the effort of physically going to the store and facilitates the feature of how the furniture piece will actually look like by placing it virtually before buying thus eliminating the headache of imagining the furniture pieces.

VI. REFERENCES

- [1]. "Rise of Augmented Reality : Current and Future Application Areas", *International Journal of internet and Distributed Systems*, 2013, 1, pp 25-34.
- [2]. "Virtual Furniture using Augmented Reality", *IOSR Journal of Computer Engineering(IOSR-JCE)*, e-ISSN : 2278-0661, p-ISSN:2278-8727
- [3]. "User-centred design of augmented reality interior design service", *International Journal of Arts & Sciences*, Vol 6, No.1, pp. 547-563
- [4]. <http://www.realitytechnologies.com/augmented-reality>, blog about augmented reality
- [5]. <https://poojachawla9.wordpress.com/2018/03/10/react-native-what-and-why/>, blog about React-native
- [6]. <http://facebook.github.io/react-native/docs/getting-started.html>, Documentation of React Native.