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# 3D AR/VR Environment for E-Commerce

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**Abstract:** Over the past Decade, there has been a tremendous increase in E-Commerce with the use of latest technologies and trends. Use of internet and remote access to shopping has become a desired medium for online retail, advertisement, and marketing. It is seen that customers tend to use online shopping because of added layers of comfort and convenience. At the same time Ecommerce lacks the in-store experience of knowing the look and feel of the product. The coronavirus pandemic has forced many retailers including our local town shops to use internet for their business. Coronavirus pandemic has a great impact on shopping overall. With the increasing need of maintaining social distancing and zero contact environment in-store has slowed down. One can use development of technological waves, to mixed reality, to bring to life a new 3d virtual Shopping era. To bridge the gap between today's ecommerce and traditional commerce. This review paper is focused on how virtuality could be beneficial for today's E-commerce.

The use of Virtual environments in shopping has been in mind of many researchers and retailers, as it reflects the real world which increases an in-store experience for the user. Furthermore, it is convenient for both the retailer and consumer to advertise and inspect the product. The retailers can benefit by increasing their brand values and marketing of their product. The use of 3d and remote environment for shopping promotes social distancing and can be carried on even during a natural calamity.

**Keywords:** 3D environment, augmented reality, consumer behaviour, e-commerce, mixed reality, virtual reality, online shopping

## I. INTRODUCTION

The coronavirus pandemic has impacted our day-to-day life. It is safe to say that it has a major impact on traditional commerce and online retail.[1] According to bazaarvoice, more than 62% of customers now shop online than before the pandemic. Similar trends have been seen on the consumer behaviour such as [1] 36% of consumers now shop online weekly, since the rise of COVID-19, up from 28%. More and more shoppers want the mobile shopping environment and contactless store pickup. Around 24% shopped say that they cannot wait to shop in-store again.

The objectives of e-commerce are reduction in cost for retailers, expansion of customer reach and creation of unique and convenient user experience while shopping. Most of the Ecommerce focus on building a 2D environment, which makes it easier for the retailers to display and categorize their product. But the 2D environment lacks the benefits of a traditional commerce, such as the users have limited information about the product. The user may or may not interpret the product correctly and may suffer from ambiguous searching. The 2D shopping experience lacks interaction and a collaborative shopping experience with multiple users. The main difference between online retail and traditional retail is the digital transactions available in the online retail. As in traditional commerce the user must travel a certain distance to the local shop, have limited shopping time and have lack of options. As for the retailers, there is an increase in expense for the physical store which is not required in an online retail. The advantages and disadvantages of both 2D Online shopping and traditional commerce is discussed in the fig.1 and fig.2.

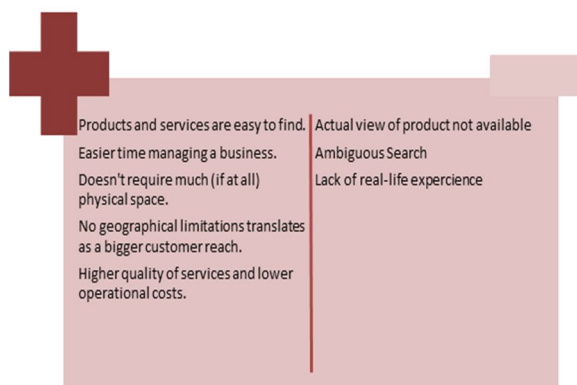


Fig. 1 The figure shows the advantages and disadvantages of the online shopping in a 2D Environment

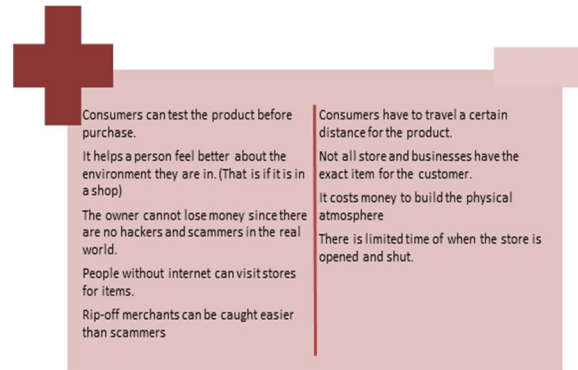


Fig. 2 The figure depicts the advantages and disadvantages of traditional commerce.

Virtual reality, a computer-simulated three-dimensional environment enables the users to experience a realistic shopping environment. 360o view and a walkthrough of retail shops where customers can explore numerous products and at the same time interact with retailers and other customers through avatars. [3]The design of a virtual shopping mall requires users with different skills and knowledge and most importantly, the desire and passion for online shopping. Looking at the perspective of a retailer, astounding growth of businesses at a global level can be produced. This not only requires them to sell the right products as per the purchasing pattern of customers. Today it has become very important to understand the mood and behavioral patterns of the customer to boost their sales. Thus a virtual 3D mall has the entire purchasing process which includes browsing, searching, selecting and payment. Customers can feel the aesthetics of this simulated and realistic environment irrespective of the latitude they fall in. Thus, a 3d Virtual shopping mall can bridge the gap between a 2d Online shopping environment and a physical/traditional commerce. The focus of this paper is to review the work of researchers in the same field and to find the gaps that 3d shopping malls can fill in today's world. The paper has following section:

## II. METHODOLOGY

As mentioned in the introduction and [2], the current use of AR/VR in online retail is very less and it is still not still widely used due to technical barriers. The technical barriers include connectivity, hardware integration, previsualization, and accessibility. This paper focuses on the use of the 3D environment and its use. The problem statement on which this paper is on and the research methodology is mentioned below.

### A. Problem/research Problem

[22]The outbreak of coronavirus is having a severe impact on people, economy, and business. As responsible corporations, all retail players are adopting necessary preventive actions to ensure safety of their employees and customers. The end objective is to ensure easy and uninterrupted availability of products at affordable prices so that people do not panic. [23]The Covid-19 crisis has spurred a new wave of online and phone commerce, powered by millions of kirana stores, or local shops, small merchants, cycle-riding delivery men, distributors on scooters, even farmers. Shopping is a very important element of our lives which cannot be put a stop at. Thus, it has become a necessity to find out a solution that enables us to maintain social distancing as well as continue our daily cores. The purpose is to find a solution that enables the retailers and the customers to enjoy in-store as well as the benefits of online shopping and to give a theoretical view of a 3d shopping environment.

### B. Search Method

The research method adapted in this paper is a thorough literature review of manual and web-based searches of relevant papers and journals on the same topic. The papers reviewed are or were published from 2011 to 2020. The papers were extracted and reviewed from IEEE Xplore, Google scholar, research gate etc. The articles were included if they contained related topics such as 3d shopping, AR/VR environment, Consumer behavior and prediction and so on.

### C. Evaluation

The articles were first categorized in two sections which included 1) AR/VR environment and the other being 2) Consumer behavior and prediction. Further, they were evaluated on the basis whether the paper contained any framework and models for the same and whether any survey was conducted. Primarily discussing the publishers review and contribution.

### III. RESULTS AND DISCUSSIONS

This section contains the results and a brief discussion as an overview of what the articles contain. Below we have mentioned the topics for discussion:

#### A. AR/VR Environment

Unlike many research domains such as health care, prediction, blockchain etc there has been very little research on how ar/vr would impact the users. Most of the papers discussed the benefits of AR/VR and a very few on its limitations. The 3d environments framework focused on giving the user a real life like experience. Further the authors mentioned that alone ar/vr environment is not enough for e commerce

1) *Benefits:* The AR/VR directly and indirectly affects the user in multiple ways such as one can build a fully immersive website and design a user friendly and interactive environment. The quality of service can be simply improved by providing customers with a live chat system with the vendors/retails as an added feature with the 3D Environment. It would not just be convenient but also be entertaining as it would be a completely new experience for a user. The user can benefit from the fact that they can get the view of a product in all sorts of perception and direction which leads them to better and faster decision making. The factors that are indirectly affected include how the retailers can showcase their product and would be limited to expense or a budget as it's an 3D environment which can be built according to desire and changed as in when required. It gives the retailers an upper hand as they give users a unique and new way for interaction.



Fig. 3 the figure points out the benefits of AR/VR in shopping.

2) *Technologies used:* According to the framework a retailer uses the consumer may or may not need 3D GOGGLES /VR headset. The software used for building these environments includes: OpenCV, Unity 3D, Vuforia. The retailers need to create a 3D environment using the above softwares or they may use Microsoft's Azure for the same.

#### 3) Barriers and Restrictions

- a) The early investment of time and effort for making the 3denvironment is high.
- b) Low bandwidth of network connections
- c) The limited capability of hardware.
- d) High latency of network connections
- e) A very complex environment may make the user experience complicated.

#### B. Consumer Behaviour Prediction

As mentioned in the above section a 3D environment is not enough for a successful ecommerce business. As the competition in the market grows it has become crucial to observe consumer behavior in this competitive world as markets are dynamically changing. [14]Building on developments in machine learning and prior work in the science of behavior prediction, one can construct a model designed to predict the behavior of consumers.

For this—Customer sentiment is one of the vital aspects, the consumer behavior to predict whether the user finds the product positive, negative, or neutral. Using a predictive model retailer can design effective retargeting methods and make use of dynamic pricing policies to set the price of their products to reach the maximum Productivity. The prediction model could give the retailers details about the willingness of the user to buy a product. Algorithms such as random forest tree algorithm, KNN, LSTM models have been discussed in the paper.



### C. 3D Avatar

[3]Avatar are graphical representations of characters - typically people - and are used in various applications including chat, instant messaging, blogs, games, and virtual communities. The authors of the papers referred discussed [6]a collaborative shopping system based on multi agent that can provide the customers with simulation of the shopping experience in the real world. [16]3D graphical representations of the participants (avatar) raise acceptance and usability for the customers by providing a more natural interaction with the medium Internet.

With the application of 3D avatars in Virtual shopping malls and integrating sociality with the virtual environment, the entire system will be realistically interactive among different customers, especially between the ones having similar purchasing or product choices. The idea of collaborative shopping can be fulfilled when family, friends and acquaintances come together. 3D avatars inside the virtual environment engage customers in a real-world experience.

Real time communication between consumers and retailers will provide fair shopping experience and this will help retailers grow their business by and large. Product personalization is achievable only when avatars can effectively express their emotions through their buying patterns.

### D. Product Recommendation

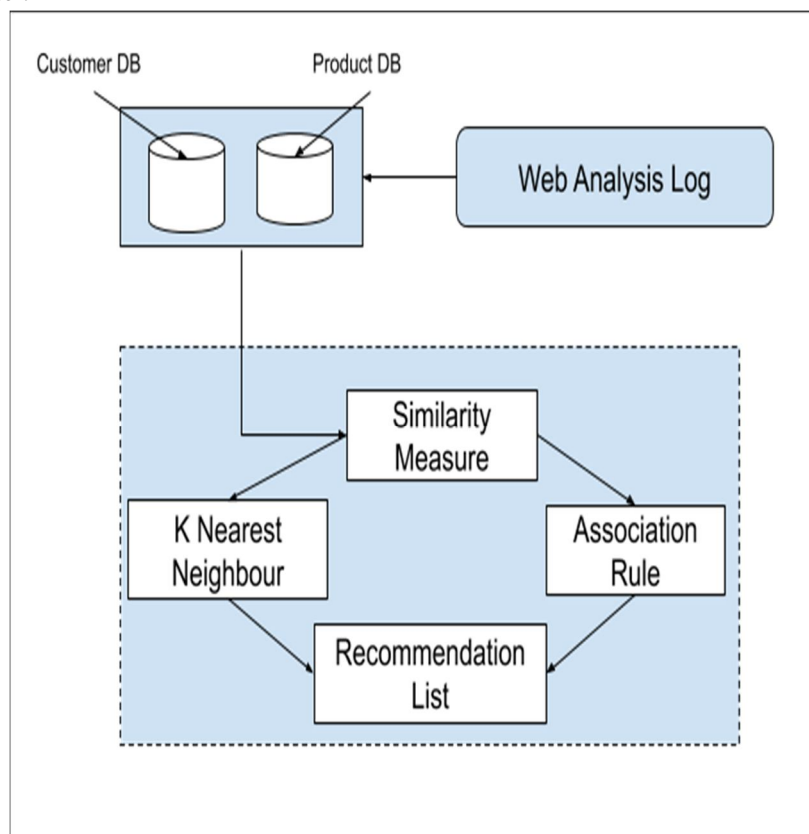


Fig. 4 Simple Model for Recommendation

Personalized recommendation enables the software to recommend customers their desired product attributes by utilizing their past purchases. The rapidly increasing information over the net causes the problem of searching a lot of information which customers are not interested in or is not needed. To rectify this problem, the system provides product recommendations on the basis of analyzing the purchasing behavior of customers.

A simple model that generates a recommendation list. using similarity measures which give the similarity index of the user with another user and place them into a cluster or category using association rules and KNN approach to finally give a recommendation list using the purchase history and frequently bought products of the users of the same category. While considering VR aspects the authors suggested personalized avatars, for oneself and the recommender both. It discussed proximity sensors, touch sensors and visibility sensors used in VR.

Table I  
Discussion Topics And Their Barriers

Sr No	Topic	Barriers
1	AR/VR environment	<ul style="list-style-type: none"> <li>• Designing of easy and user-friendly environment</li> <li>• High early stage investments</li> <li>• Technical issues such as low bandwidth, high latency</li> <li>• Affordability of hardware</li> <li>• Design architectures</li> <li>• Product views</li> <li>• Social Presence and Perceived Security</li> </ul>
2.	Consumer behaviour prediction	<ul style="list-style-type: none"> <li>• Design of dynamic predictive model</li> <li>• Increasing the accuracy</li> <li>• Handling of data</li> <li>• Feature extraction</li> </ul>
3.	3D avatar	<ul style="list-style-type: none"> <li>• Highly Interactive 3D assistant.</li> <li>• Eloquent expressions</li> <li>• Prediction of consumer mood</li> <li>• Understanding customer query and providing instant solution</li> <li>• Creating accurate mini flows conversations</li> </ul>
4.	Product recommendation	<ul style="list-style-type: none"> <li>• Association with business rule</li> <li>• Designing accurate model</li> <li>• Product identification even after mistype</li> <li>• Product Presentation</li> <li>• Understanding latest trends of market and matching those with the suggestion box</li> </ul>

#### IV. PROPOSED SOLUTION

The solution for the research problem can be designed in four stages:

The first stage is the conceptual stage. In this stage the retailers and the developers discuss and research the necessity features required for their particular business. It should focus on how the retailer can increase their market presence. Designing and selection of reliable human computer interaction interfaces. Such that these models become highly convenient for the user and must be feasible for the retailers at the same time.

This stage would include the answering questions like whether or not to include added features like virtual try on. etc. Basically designing the flow of the environment. Our solution consists of the following site map shown in fig.5

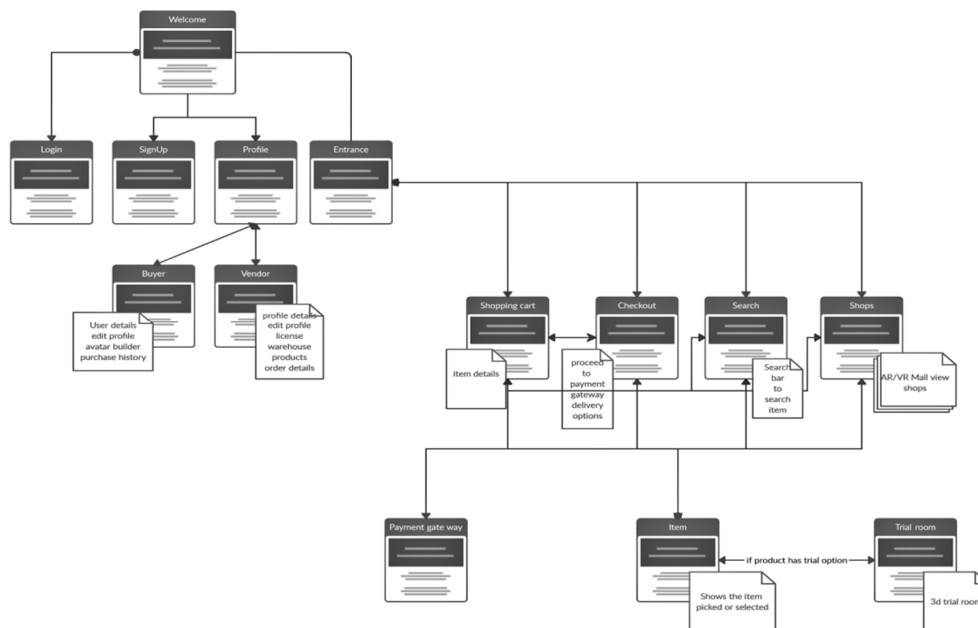


Fig. 5 The site map of the proposed solution of how the user navigates to a particular section and its details

The second stage is the designing stage (of 3D environment). Our proposed solution includes:

- 1) *Fully Immersive 3D Environment using Mixed Reality:* This should have easy navigation from one point of the 3D shopping mall to another. Ensuring interactive and clear view of products.
- 2) *Agent:* With such a diversified shopping experience there needs to be a guide to assist the customers with the proper flow of the virtual environment and hence the virtual shopping agent will allow the users to interact with him like a mall manager and get the answers for all their queries and also guide them towards accessing the virtual environment providing a feel of an actual sales man addressing the customers in a real mall.
- 3) *Collaborative Environment:* The System should be able to show multiple users and should include ways for communication between them using a simple interface such a live chats or messenger system.

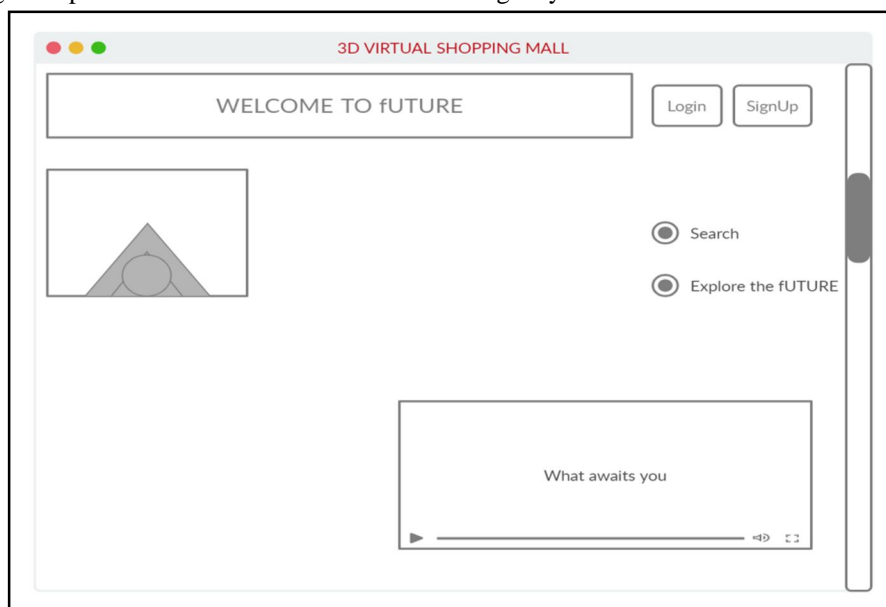


Fig. 6 Page

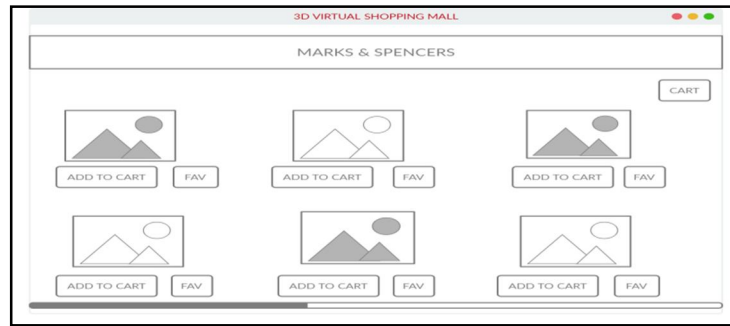


Fig. 7 Product view

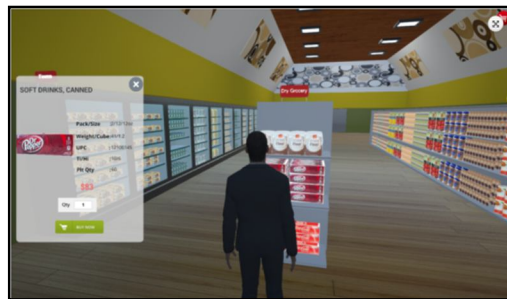


Fig. 8 3d environment for shopping



Fig. 9 Multiuser and collaborative environment.

The next stage would be addition of consumer behavior and prediction models. These are necessary for today's market environment for successful business. Choosing a correct model with high accuracy is important and consumer behavior is a very dynamic feature and tends to change frequently. After the second phase, the retailers a need to evaluate the user shopping experience, ensuring customer satisfaction of the interface, .The model should facilitate consumer learning, to make appropriate collaborative and social presence of users in such interfaces.

The last and final stage would be inclusion of business models to ensure high profitability and lawful environment.

## V. CONCLUSION

3D online mall/store represents a 3D UI with the ease of shopping and buying products in a virtual space. It allows the customers to feel as if they are present there and thus provide the confidence to buy the products. The technology of 3D virtual malls provides the ability to simulate real world environments into a virtual reality space and allows the clients to experience the products and services like in traditional commerce. This environment plays an important role in changing the customer beliefs towards online shopping and brings a new life towards E-Commerce Business. It led to enhanced customer behaviour, belief, attitude, and interaction with the products. It gives a clear vision to the seller about the mindset of the customer which allows him to increase his sales and provide the user not only with ease of use but also entertainment. This environment plays an important role towards predicting the needs of the customer and allowing the sellers to target the right audience thus boosting the E-Commerce Market and creating a relation of trust between the consumers and sellers.



## VI. FUTURE WORK

For the future perspective, there is a lot of scope to research in the field of 3D environment and virtual reality. The major scope lies in bringing this technique to Android and IOS Applications too.

## VII. ACKNOWLEDGMENT

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