A Synopsis on

Using AR/VR In Shopping

Submitted in partial fulfillment of the requirements of the degree of

Bachelor of Engineering

in

Information Technology

by

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2020-2021

CERTIFICATE

This is to certify that the project Synopsis entitled ***"Using AR/VR In Shopping"*** Submitted by ***"Jaaie Kadam (18104017), Prachi Manera (17104013)"*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Information technology.***to the University of Mumbai, is a bonafide work carried out during academic year 2020-2021

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Abstract

The retail industry is ever evolving, and the online shopping has received wide attention from customers as businesses are differentiating themselves through technological hybridizations to appeal to their users in innovative ways. Previous research has identified the problem that traditional e-commerce will passive process as it often doesn't provide enough information about the product. Therefore, this paper represents a virtual environment engaging costumers through immersive experiences of simulated world by using the VR Headsets. This technology enables users to virtually navigate through the 3-Dimensional shopping malls bringing the natural experiences to the user and also helps in securing the future of physical stores. For this purpose, a prototype has been developed for UI which consists of 3D graphics and avatars. Our proposed system introduces a 3-Dimensional Shopping mall wherein a personalized recommendation system is built to improve the user experience. It also allows the user to shop from the comforts of their home. This multiuser interactive model is implemented with Unity game engine and 3D Language (C#) to achieve a realistic 3-Dimensional shopping experience.

Introduction

Current online shops may be functional and efficient, but do not offer enough of an immersive shopping experience. Not only have technological changes in online or popup shops brought economic benefits, they also caused a change in strategy, with retailers greatly emphasizing on customer satisfaction and the shopping experience. This is why it has already been devoted increasingly in research to improve the performance and usability of online shops. However, it is just as important for the performance of such user interfaces as it is for the customer’s satisfaction and shopping experience to provide the user with interactivity and information in an appropriate and supportive manner. Current online shops usually only offer ordinary 2D content and use simple 2D interfaces, which are used with the help of a mouse and keyboard. Here, the products must be found as quickly as possible for the sake of convenience, which leads to limited search functionality, confusion and product visualization. While the common list-based approach using scrolling or page-based navigation can have good usability ratings, especially in the search for products, it detaches us from the actual “3D world” of a store and neglects user experience and immersion, especially with increasing number of products and categories. It is claimed that shopping in VR offers a better shopping experience than two-dimensional e-commerce systems and that 3D applications are feasible for e-commerce. Clean content presentation and more adaptive user interfaces, could result in more positive consumer feedback and shopping experience. The use of VR systems in the retail sector has recently gained importance in the form of commercial applications and is becoming a new trend. However, there is a lack of user-friendly and intuitive user interfaces and interaction techniques. This work therefore focuses on the development and evaluation of innovative and immersive VR shopping experiences. The main goal is to advance in exploring efficient and user-friendly interaction techniques and user interfaces.

Objectives

The main objective of our project is to focus on bringing more approach to current shopping system.
The other objectives include:

- To advance the current shopping system by providing user an immersive experience. To allow the users get the feel of the object’s texture, pattern similar to that of real world shopping.
- To cut down the amount of time required to search the products by suggesting relevant items to the user.

Literature Review

In 1987, G. M. Nielson and D. R. Olsen has published, "Direct manipulation techniques for 3D objects using 2D locator devices". The methodology proposed is of the classic input devices, a Mouse and a Keyboard. The ability to map a 2d mouse interaction to a 3D space and the high degree of technological adoption makes this approach preferred by many beginners in VR. However due to the natural limitations of these devices such as their limited number of stated and necessity to use complex key combinations, navigation using such devices is often non intuitive and complicated.

In 2014, M. Roup, P. Bosch-Sijtsema, and M. Johansson has published, "Interactive navigation interface for virtual reality using the human body". The methodology used is Xbox 360 Kinect Sensor System. The interface of the XBOX Kinect makes it possible to navigate in VR and has the potential to provide a more user-friendly and natural interface with the 3D-model. The Xbox Kinect (Microsoft, 2013). captures the depth information in the scene, and is used as a human body interactive interface for navigation and interaction in gaming environments. The movements, poses and gestures from the viewers’ body are captured, encoded and translated into an event that triggers an action that controls something in the application. However it Requires too much space and it is very expensive. By far the most annoying part of the Kinect is the hand-over hovering menu system. While some of the games (such as Dance Central) omit this, the built in XBox menu interface has you hovering your arm over menu blocks for three seconds before anything happens.

In 2015, A. Kitson, B. E. Riecke, A. M. Hashemian and C. Neustaedter has published, "Navichair: Evaluating an embodied interface using a pointing task to navigate virtual reality". The methodology used is of Specialized equipment like gaming input devices(e.g. joysticks and pads) and dedicated VR devices(e.g. tracked controllers and haptic arms). The idea was to integrate multiple input devices into the same simulation to create an experience where the user interaction felt natural and intuitive. The HTC Vive and Leap Motion were used as input devices. The HTC Vive was used to track the orientation and position of the user’s head, while the Leap Motion was used to track the user’s hands. However The Leap Motion added some limitations. The device driver requires that the Leap Motion is mounted at the front of the Virtual Reality headset, which was achieved by using double sided tape.

The issue with the Leap Motion comes from the fact that, while it has an impressive 150◦ field of view, it is far too narrow to give real, functioning hand tracking for VR.

In 2015, J. J. LaViola, Jr has published, "Context aware 3D gesture recognition for games and virtual reality". The methodology used is Gesture recognition. This technique focuses on providing an intuitive natural interface which is user friendly even for non-experienced users. However the problem with using these natural interactions to design content is that it requires a significant physical effort from the user. For example, the average time a user can comfortably use Leap Motion which is a device for gesture recognition is about 20 minutes. Thus, this technique is not suitable for designing VR environments, as it is often a process that requires a long time and high accuracy.

• In 2015, S. Gebhardt, S. Pick, H. Voet, J. Utsch, T. al Khawli, U. Eppelt, R. Reinhard, C. Bscher, B. Hentschel, and T. W. Kuhlen has published, "flappassist: How the integrationof vr and visualization tools foster the factory planning process". The methodology used is Context based approach. Contextbased approach is an interaction technique popular in computer games, in particular simulations for example The Sims and Simcity series by Maxis and adventure games. This approach is not in itself based on specific input devices but focuses on the use of available devices to navigate through a real-time contextual interface. The content of this interface depends on the current state of the environment and its objects for example time, position, current object state. The Context based approach is often used in modern VR environments. However this approach is uncomfortable due to the mismatch between classic user interface elements that is buttons, menus, charts and the 3D virtual environment. In addition this technique is best suited for a limited number of possible states and is not convenient for entering data such as text or numbers. This is a serious limitations when the interface is used for the content design.

In 2017, G. Cortes, E. Marchand, J. Ardouinz and A. Lcuyer has published, "Increasing optical tracking workspace of vr applications using controlled cameras ". The methodology used is Marker tracking. Marker-based augmented reality experiences require a static image also referred to as a trigger photo that a person can scan using their mobile device via an augmented reality app. The mobile scan will trigger the additional content (video, animation, 3D or other) prepared in advance to appear on top of the marker. If the marker image is prepared correctly, marker-based AR content provides quality experiences and tracking is very stable, the AR content doesn't shake. When the mobile camera is moved away from the marker, AR experience disappears and the trigger photo has to be scanned again. It is possible to use extended tracking, but in most cases, extended tracking makes things worse. Scanning will not work if markers reflect light in certain situations (can be challenging with large format OD banners in ever-changing weather conditions)

In 2017, T. Piumsomboon, G. Lee, R. W. Linderman, and M. Billinghurst has published, "Exploring natural eye-gaze-based interaction for immersive virtual reality". The methodology used is Eye tracking. One advantage of eye-tracking technology is it records actual eye movements (Table 1). In consumer behavior research, reactivity (when participants change their behavior due to being observed) is a major concern. Eye-tracking technology reduces this concern because real eye movements are documented and consumers often forget their eye movements are being recorded.

Eye-tracking recordings accurately depict natural eye movement and fixations. Eye-tracking technology also provides flexibility in terms of research locations. One of the main disadvantages of eye-tracking technology is not all eyes can be tracked. Contact lenses, glasses, and pupil color can all impact the eye-tracking camera's ability to record eye movements. Consequently, not everyone (typically 10– 20% of the sample) can participate in an eye-tracking study. As a result, the representativeness of the sample will be impacted. Eye-tracking studies also require considerable financial, time and labor resources Eye-tracking equipment (i.e., camera, computer, software) and training can be expensive. Additionally, only one person can be recorded at a time. Individual participation instead of group participation takes considerably more time and labor. The use of multiple eye tracking devices could help reduce the total experiment time, but could be more labor intensive.

In 2017, D. Zielasko, N. Neha, B. Weyers and T. W. Kuhlen has published, "A nonverbal vocal input metaphor for clicking". The methodology used is Verbal/Vocal input. Convenience is undoubtedly the primary driving factor behind the rise of ecommerce. However, the sector has yet to figure out a way to make up for the lack of personal interaction consumers experience when selecting goods, asking questions, or making purchases. People naturally like to engage with a flesh and blood assistant or customer service agent at some point in the buying process. Once again, AI is coming to the rescue – this time, in the form of virtual shopping assistants. The AI-powered shopping assistant learns about your tastes and interests while shopping online, and then uses this data to inform you about products you might like to purchase, creating a virtual experience that’s more like shopping in a virtual store. However its reluctance to understand and inability to hear due to various reasons like background noise,etc because it cannot differentiate between a person’s voice and other background noises.

In 2018, J. Sokolowski and K. Walczak has published, "Semantic modeling of user interactions in virtual reality environments". The methodology used is CAVE. Fully immersive CAVE virtual reality systems create collaborative environments ideal for design, engineering and simulation. In the automotive engineering and design fields, CAVEs allow teams to view exactly how parts fit with one another and interact directly with data for ergonomic tests. CAVEs can be particularly valuable by eliminating inefficient part placement and streamlining interior design. For all their value, the downsides of CAVEs must be weighed against their potential benefit. Classic CAVEs tend to be small, with a capacity of only a few people. And, while the usable area of a CAVE is small, the overall footprint is typically not.

Problem Definition

After the outbreak of novel pathogenic Coronavirus, it shocked the retail industry. Shopping malls, once popular meeting hubs, were suddenly devoid of customers as the world locked itself down in an effort to contain the virus’s spread. Now, even though they are permitted to reopen in some states, shoppers are not very keen on visiting these establishments as they prefer open-air areas to ensure Covid safety. Anyone who does choose to shop in person have to follow the mall restrictions like limited customers (leading to people having to stay in long queues), limited time for each customer, 6 feet social distancing, mask up throughout and making sure they stay safe by practicing measures to prevent infection, which, at this point is making people "COVID fatigue". Malls have to create a reason for consumers to return to in-store shopping post-COVID-19. Retailers and mall owners have to find ways to keep malls relevant in the new normal.

Two most popular methods to showcase products in ecommerce websites- 2d images and 3d models, in terms of customer engagement and conversion rates. Customers do enjoy looking at cool 2D images. However, online shoppers are reported to have a lack “a touch and feel” experience that they receive in brick and mortar businesses, when they rely on electronic images to make purchases. Because these traditional images do not offer a holistic view of product education and engagement. This prevents many of them from fulfilling their shopping needs online and accounts for also one of the most important reasons why customers do not receive immediate gratification, compared to shopping on traditional commercial platforms. There is also uncertainty about product details, fitting, custom orders. Finding and achieving confidence that proposed products can meet their needs and expectations is a challenge. This is one of the reasons why growth in e-commerce, although speedy is still limited.

Proposed System Architecture/Working

The proposed system is in contrast to previous studies which utilized VR in conjunction to typical interaction methods, such as a mouse, and interfaces heavily relied upon existing online webpage designs of luxury brands . The proposed system is designed to be easily deployed in a small space. Any projection or television device that could produce stereoscopic 3D visuals could facilitate the system which could be provided as a standalone application. The interaction with the proposed system could either use typical game controllers, mouse or gesture recognition for a natural interaction with the real-life size and photorealistic VR items. With the intention of providing the user with a more holistic experience and capitalizing on the unique features of a monitor, the system is designed for 3D monitors or high-resolution 3D projection systems that have the advantage of presenting realistic output. To this end, the use of head tracking and gesture recognition is considered to be the most efficient and intuitive method for direct manipulation and interaction with the VR objects in a large-scale display scenario . The realism of the mentioned system and its impact on perceived experience value presents new prospects for e-commerce systems. The proposed minimalistic interface does not overload the customer with unnecessary visual information which could retract his/her attention from the main item. Furthermore, if the customer utilizes a gaming controller they could easily perform any customization to the preferred item without the navigation issues encountered in online applications. The proposed system enables the customer to operate a number of interactions following a typical real-life shopping process. As such the customer could select any 3D photorealistic, grocery product. In turn, the customer could manipulate (rotate, pan and zoom) the product in three dimensions and investigate all the exterior and interior features. For both exterior and interior, the customer could change materials, size, and various details currently provided by the particular product. As stated above, the visual interface is designed based on a minimalistic representation of the required functions and offer large buttons, positioned wide apart in order to accommodate a fast, easy and convenient interaction.

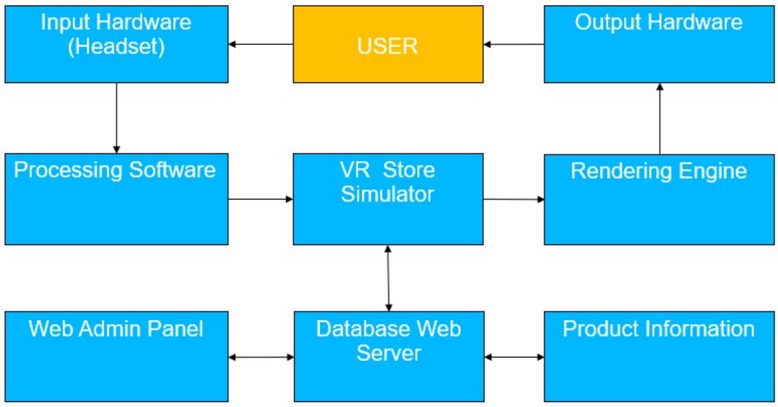


Fig1. Proposed System Architecture

In Fig1. How the user will be able to view the virtual environment from the software to the VR goggles, and store working architecture, is explained. User will wear the headset with an eye-tracking module, position and Bluetooth controllers and then the software will be processed(it acquires and processes the data from input devices) and then the processed data will be sent to VR Store Simulator(it simulates shopping environment and enables a user to move through the store and interact with its products) which will be sent to Rendering Engine(it will show visual of 3D Graphics) which will output the data to User through VR Headsets. VR Store Simulator will be connected to Database Web Server. The Database Web Server will include Web Admin Panel (it is used for database management and access settings) and Product Information Management(it automates exports product information to VR system.)

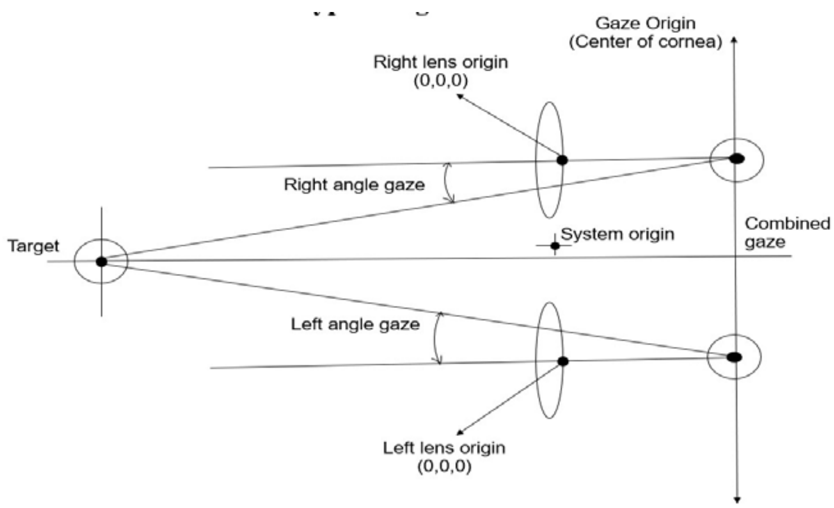


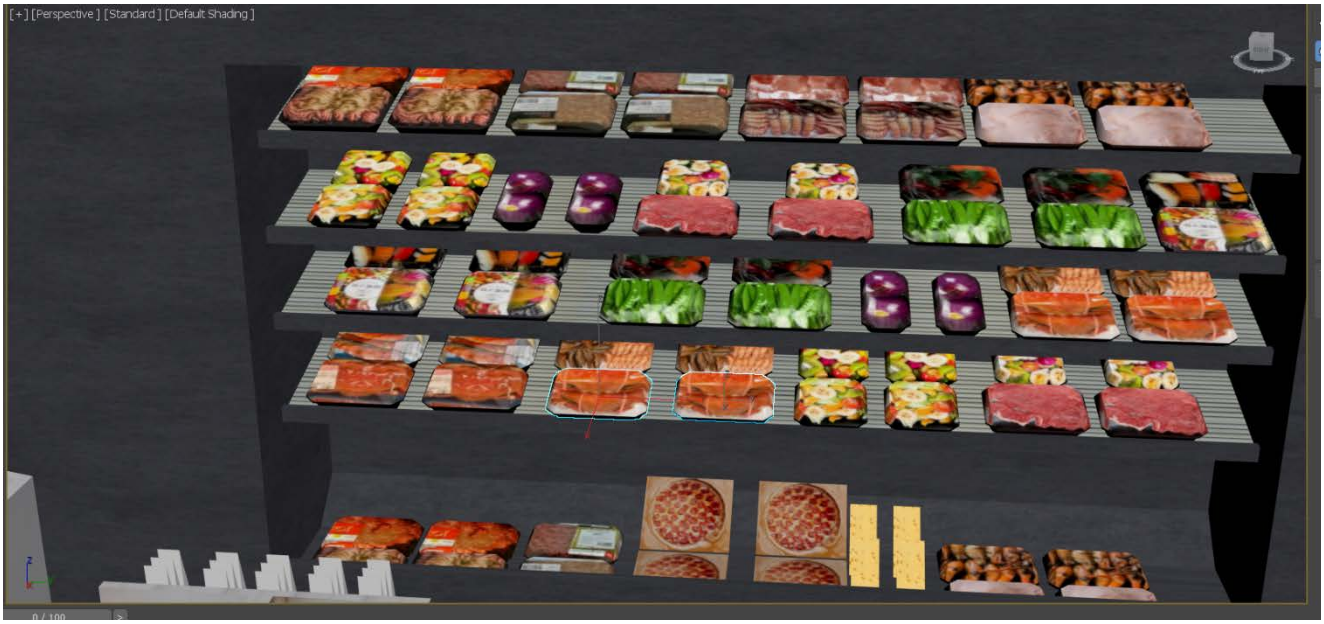
Fig2.Prototype Design

In Fig2. How the objects are targeted and manipulated using external input devices, is explained. Virtual reality is a completely computer generated simulation, where your entire view is virtual. The headset used, to view this virtual world comprise of a stereoscopic head-mounted display (providing separate images for each eye), stereo sound, and head-motion-tracking sensors which include devices such as gyroscopes, accelerometers, magnetometers or structured light systems. The VR glasses use a technology called head-tracking, which changes the field of vision as a person turns their head. VR headset also has eye-tracking sensors. The lenses of the headset are responsible for mapping the up-close display to a wide field of view, while also providing a more comfortable distant point of focus. There is an eye tracker embedded in the VR headset. The headgear uses the measurements of the gaze origin and the angle made by the intersection of the center line of cornea with lens origin point and the gaze direction (where the person is looking). The eye tracker records the ocular movements and based on the measured data the target is tracked. Then for the selection of an object we use controllers which have sensors in them. The user is required to keep its hand that has the controller roughly aligned with the eye position then the user will press the button on the controller to select the product.

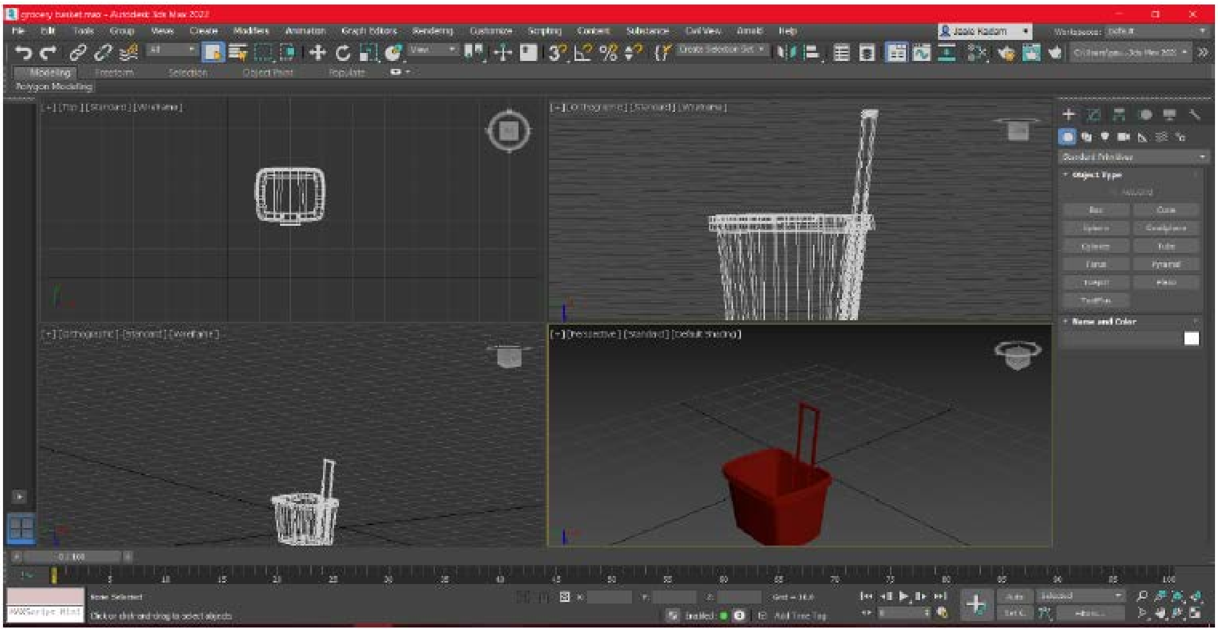
Design and Implementation

<u>Convenience store design:</u>

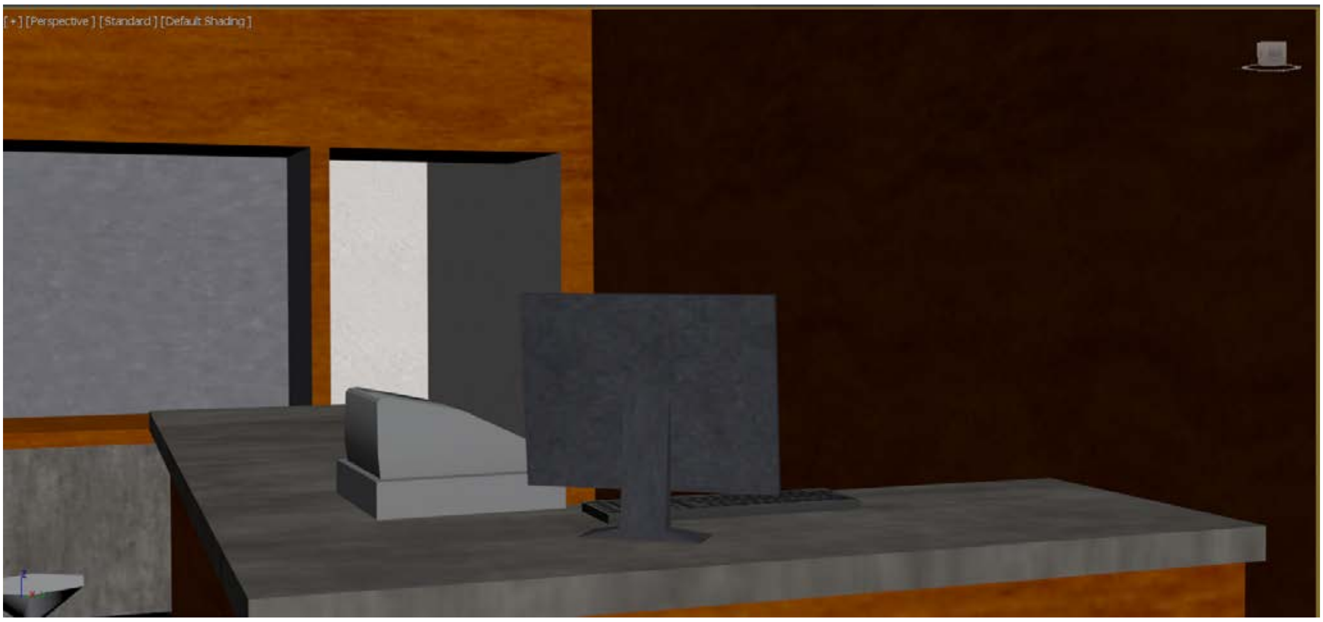
Convenience store design involves the “realistic representation” of the store, landscape and other models. To obtain ideas on the final outlook and effect of the mall, some requirements analysis and related survey has been done. The final design model for the mall is as follows. One floor store having all the essential monthly products, fruits and vegetables, meat and dairy, packaged and canned foods, beverages.



Walking through in the store, Easy navigation, Grabbing the object and getting a detail look of the products (feel of the product, the quality, Zooming and panning) are some of the important features, in terms of customer satisfaction towards the products, are available at this store. Customers can see from 360 degree all attributes of the product clearly including textures, sizes, colors and many more. 3D technology can boost customer’s product education and engagement positively by limiting mistakes that would have otherwise occurred with the use of static 2D images.



Grocery basket-trolley available as a replacement to the cart feature in 2d ecommerce websites. Carts in Online shopping websites help provide the customers with a recommendation list of items they would like to buy or the same items purchased can be recommended depending upon the ratings given.



Self-checkout counter, where a final look at the shortlisted products in the cart will be provided and payment will be done along with generating payment receipt. Security in payment is guaranteed with the following options available for payment: Credit/Debit payment, NEFT, MasterCard and Cash on Delivery.

Summary

The work presented in this report is related to 3D Convenience Store. The project entitled “Using AR/VR for shopping” is a mobile application developed in UNITY ENGINE using C# LANGUAGE and 3Ds MAX for 3D Modelling. Here, we have designed a Virtual Convenience Store, which is aimed to replace the traditional on-site shopping and/or 2d ecommerce shopping, in terms of the customer satisfaction. The primary features of the project entitled " Using AR/VR for shopping " are virtual store navigation, site security, payment gateway support and API. The benefits are enhancing brand value, extending revenue channel and bridging offline and online shopping. The users will be allowed to navigate in the virtual environment and to interact with particular products in an intuitive way, without having to remember the complex interaction rules, which is usually required in the current immersive VR atmosphere. This commercialization route based on an online or standalone VR system can be deployed in the store or the home environment. As such, the implementation of the 3D-VR system for in-store conditions, product visualization, and customization will be another area that is eligible for future inspection. In addition, the perspective of the user, as well as that of the store advisor, could be further examined for advancement in the current VR shops. The aforementioned technique are promoting further experiments and system development based on technologies that can enhance ecommerce. Finally, this prototype VR system could be further applied and appraised with other customizable luxury goods such as imported goods, accessories, clothes and fashion, electronics, and home furnishings.

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Publication

Paper entitled “VR based Convenience Store using ML” is presented at“3rd International Conference on Communication and Intelligent Systems ICCIS 2021/SPRINGER”.