E-commerce Store with Augmented Reality Features

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Abstract: Augmented reality as a technology is itself quite a new trend in the Tech world and the integration of this technology with the Ecommerce sector is a relatively less explored field. Currently, our Ecommerce sector is not capable of providing a virtual experience to the customers but with the help of Augmented Reality, we can eliminate this problem and elevate the user experience by creating a completely new way for users to interact with the Ecommerce websites. The next revolution in the Ecommerce sector will be with the help of Augmented Reality (AR) technology as more and more customers would want a shopping experience that is tailored to their personal preferences and AR is one such technology that is capable of providing such experience to the customers. In this work we have explored how augmented reality when fused with the Ecommerce sector will affect the new age shoppers, for studying this we have created an Ecommerce web application with augmented reality features, this web application is capable of augmenting 3D models of the products available on the website onto the real-time environment thus creating a completely new user experience.

Index Terms - **3D modeling, augmented reality, e-commerce.**

I. INTRODUCTION

Augmented reality (AR) term itself is pretty self-explanatory, we augment something (add something) to the reality or enhance the reality by adding digital components to it. Although the origin of this technology dates back to 1957 when the cinematographer Morton Heiling invented the Sensorama which was able to mimic visual, vibration, sounds, and smell to the viewers, Augmented reality as technology came to the limelight when Nintendo released the a mobile game called "Pokemon GO" in 2016. This game made it possible to interact with the superimposed pokemon 3D models in real-time. Since then Augmented reality has become really popular with companies like Apple releasing its ARKit in 2017 and Google launching its own web API prototypes.AR is usually categorized into five types: Location-based AR, Projection-based AR, Superimposition AR Outlining AR, Marker-based AR, and Markerless AR.

Talking about the applications of AR relevant to this paper i.e in eCommerce space is immerse and below are just a few statistics that indicate the impacts of AR in eCommerce is only growing:

1) 71% of the people say that they would like to experience the product first in their local environment before buying it.

2) 61% of people feel that AR provides the best shopping experience.

3) Recent studies show that integrating AR with Ecommerce increases the rate of conversion by 40%.

II. LITERATURE SURVEY

As discussed earlier AR is categorized into five types but out of those five types there are two which are usually used the most, they being the 1. Marker-based AR and 2. Markerless AR. Here in this literature survey, we have discussed a few papers which make use of these two types of Augmented Reality technologies for making their respective projects and contribute to this ever-growing field.

The first paper that we discuss can be a great insight into how augmented reality can be achieved by integrating it with a few other services. Tahirović, Talib, et.al. have brought new insight into this field as they have developed an augmented reality service that can augment the 3D models of the product for a Furniture Manufacturing company. They have developed a virtual catalog for all kinds of furniture. If the need arises the 3D models can be modified inside the applications without any hassle for the consumers, such provision is also made by them [1].

To truly understand the impact of shopping with the assistance of AR and virtual reality (VR) we first need to understand the likes and dislikes of customers and the second paper exactly discusses the various techniques that can be used for enhancing the shopping experience of the users. In this paper, they have done a complete sentiment analysis of consumers like how they will act to different modes of technology (AR and VR) when integrated with their shopping experience [2].

Everybody likes a shopping experience that is curated to their specific needs and there can be no better way to serve every specific need of an individual customer other than shopping assistance. Ashok Kumar P. et. al. have discussed how shopping can be done through mobile applications such as a personal assistant for shoppers with the help of AR. The mobile application will be able to assist the customers by giving them directions to a list of products that they might want to locate for e.g., in a store, with the use of in-store GPS that uses wifi sensor, INS sensor along with RFID sensor and AR image capturing. The app with the use of AR creates a 3D virtual image of a product. The application helps customers who are seeking sales and discounts, to find the products that might be available according to the customer's preference. Few customers tend to do window shopping and for those customers, they can scan any product through their camera, and the application will recognize the product and provide the best discounts available for that product [3].

Augmented Reality is a pretty trending topic and to fully grasp this topic we first need to understand the need for AR in today's world and its origin. To discuss this we referred to a research paper by Roxo, Mafalda Teles, and Pedro Quelhas Brito. In this paper the content of 328 papers produced between 1997 and 2016 in the field of AR are analyzed, unveiling 58 coding categories. This categorization has identified a few major topics covering different perks such as digital media aspects, domains of AR, theoretical framework, motivations to develop AR solutions, and technical dimensions (components, operating systems, tracking, and display techniques). The authors have deliberately selected the subtopics of "motivations to implement AR solutions" and have tried to understand the network of connections that the researchers considered in their research when studying Augmented Reality. This paper also addresses the question "How has the production of AR scientific knowledge evolved?" [4].

Along with Augmented Reality, there are two more new-age technologies 1. Virtual Reality (VR) and 2. Mixed Reality (MR) comes under the domain of shopping experience enhancement. To discuss more on this we got help from another paper by Qian Wang and Sheng Cao who have thoroughly discussed the concepts of VR and MR and the implications of their integration with Ecommerce. This paper also introduced the core concept and basic principles of Virtual Reality and Mixed Reality technology through scientific analysis and development of applications with these technologies in eCommerce[5].

In the coming decade most of the Ecommerce applications will adopt augmented reality technology and how this transition will happen seamlessly is discussed in a paper presented by Egaji, Oche A.,et. al. In this paper they have discussed the development of an AR application for bespoke jewelry solutions. The focus of this AR App is on rings and to be more specific, engagement rings. With around 80 types of different engagement rings to select from the app, customers will be able to pick out a ring or customize an existing ring to their particular need [6]. Improved navigation is the need of the hour and with the help of AR, we can achieve that, Jayananda, P. K. V., et. al. have developed a mobile application that utilizes AR core modules and Augmented Reality technology as their base along with Vuforia SDK, Unity, and SQLite as their database for making positioning and navigation systems for their application. Their application has been tested at the KEELS supermarket located in Pittugala, Sri Lanka. The idea of this paper can be easily applied to any mobile phone as an added physical shopping mall functionality using the mentioned technologies[7].

A. Summary of Literature Survey

Title & Year	Summary	Drawbacks
Designing Augmented Reality services for E- business: A project management perspective 2018 [1]	The goal of this paper is to study Augmented reality as a service for a furniture manufacturing company and has brought some new insights into this field.	Buying is not possible in case of a site crash. Lack of security may affect the overall augmented reality principle.
Shopping using Virtual Reality and Augmented Reality 2019[2]	This paper discusses how to enhance the shopping experience for the shoppers by discussing various techniques like Augmented Reality and Virtual Reality.	Lack of privacy. Lack of shopping experience
Prospects of Augmented Reality in Physical Stores's using Shopping Assistance App 2020[3]	This paper gives us insights about the development of a personal assistant for the mobile application to enhance the shopping behavior of users.	Lack of security.

Augmented Reality Trends to the Field of Business and Economics: A Review of 20 years of Research 2018[4]	This paper has reviewed the literature produced since 1997. It includes all the advancement that have happened in the field of Augmented Reality since then.	Filling the gap between technical aspects of AR and their effect on the user Study is based on two databases: WOS and Scopus.
Application and Prospect of AR Technology in E-commerce 2017[5]	This paper discusses the concept and basic principles of Augmented reality technology,development of applying Augmented reality technology in mobile E-commerce in China and analysis feasibility.	To understand the inferences that might be drawn from AR applications in digital media
An Augmented Reality Application for Personalised Diamond Shopping 2017[6]	This paper is a study of development of an Augmented Reality application for a jewelry shop.	Lack of privacy and Security
Augmented Reality Based Smart Supermarket System with Indoor Navigation using Beacon Technology 2018[7]	This paper has reviewed the effectiveness of AR technology in mobiles in the context of shopping and the way it will improve the user experience.	GPS does not support indoor navigation. Less accuracy of localization method.
Understanding E-commerce: A study with reference to competitive economy[8]	This paper gives us insights about the trend in e-commerce over the last 10 years and identifies the pattern of investment in e-commerce.	There are no ideas mentioned to overcome the challenges in e-commerce.

III. PROPOSED WORK

To study Augmented reality technology and its implications on the customers when integrated with Ecommerce, we have created a web application with augmented reality features. The detailed information about the development of this project is discussed in this chapter.

The system architecture is given in Figure 1. Each block is described in this Section.
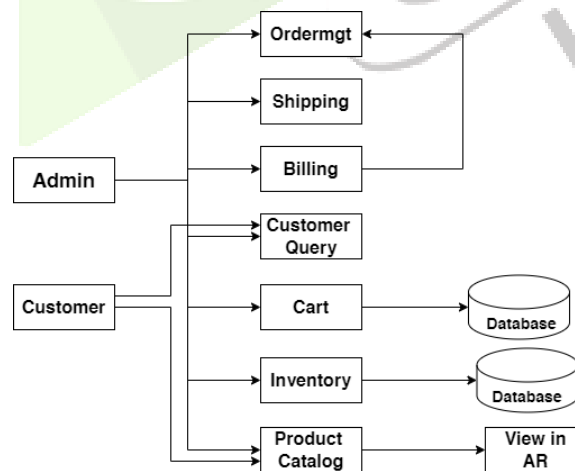

Fig. 1 Proposed system architecture

A. Admin: All Ecommerce websites need a controlling body that looks after all the operations of the website. The Admin panel inside our web app will allow doing just that, to control all the operations such as adding users, deleting users, tracking shipments, and so on.

B. Customer: Customers are the heart of the website and designing the UI of the website of our website such that it attracts more of them will be crucial for making our web application successful. The UI that customers will see will be completely different than what an admin will see.

C. Order Management: Order management is a necessary process in the Ecommerce business as it involves accepting, packing, picking, and shipping the order to the destination. There will be a complete section for orders inside our app that displays all the necessary information about all the orders.

D. Shipping :
There are two components in the shipping process of our application:
1. shipping status: Has the said item been shipped or not will be displayed inside the admin panel.
2. Shipping destinations: This will be displayed inside the admin panel.

E. Billing:
Billing will be handled with the help of an external API which can be either Razorpay or Paypal API, both these APIs will do the same work and all we need to do is to integrate it with our application. Once we do that, then our application will be able to generate a digital invoice for our customers when they make any kind of purchase on our application, also the invoice that is generated will also be mailed to our customers with the help of the said API.

F. Customer Queries:
Recent trends show that most customers don't like to wait and want a quick and easy solution for their queries, that is when the comment section of our applications comes into the picture, here people can post their queries about the products and anyone can answer those queries. This way all the queries get resolved quickly and efficiently bringing in more customers to our website.

H. Shopping cart:
The shopping cart feature is a must for any eCommerce business as it allows the shopper to shop with ease without any worry of forgetting the products that they wanted to buy because a shopping cart allows users to keep the product in the digital basket for as long as they want, it also makes it easy for the customer to take the final decision on whether they want to buy all the products in their cart or delete some products or delete all the products in the cart.
The three main functionality for the shopping cart in our web app are:
1. It will store all products in one place for the customers to take the final decision.
2. Customers will be able to place orders directly through the shopping cart.
3. It will also display additional information about the products.

I. Viewing products in AR: This is the most exciting feature in our app as the customers will be able to experience a completely new shopping experience with the help of AR as they will be able to see the products they wish to buy in a real-time environment with the help of just their mobile phones. All the 3D models of the products will be rendered using the model-viewer web component.

IV. REQUIREMENT ANALYSIS AND IMPLEMENTATION DETAILS

To begin with, we first created a website using React, which is a lightweight JS library and once the frontend development was complete, we started working on the backend for the project we have used MongoDB Atlas database for storing all the products and now to connect the backend with the frontend with backend we created APIs using Node.js and then the website was ready to use. Now to implement the augmented reality feature we used google's Model-viewer web component so that 3D models can be rendered easily inside the web app with the help of HTML. All the 3D models were made using Unity software. Now below we will discuss how each component of our website was made in great depth.

The development of 3D models and rendering of those 3D models is the main challenge for the completion of this project and to complete this task we will be using two things, first being the Unity software, which is used for the development of the said models and the other being the google model-viewer web component which is used in rendering those models inside the web application. The coding part of this project will be done using visual studio IDE.

A. Unity:
Unity is basically a cross-platform game engine that is developed using Unity technology, the first version of this engine was developed in 2005. Unity engine provides a good interface for the development of 3D models with lots of options to customize them.

B. Model-viewer Web Component:
Model Viewer is an open-source web component that was developed by Google and maintained by GitHub. The model-viewer allows you to render the 3D models inside the browser with the help of HTML.
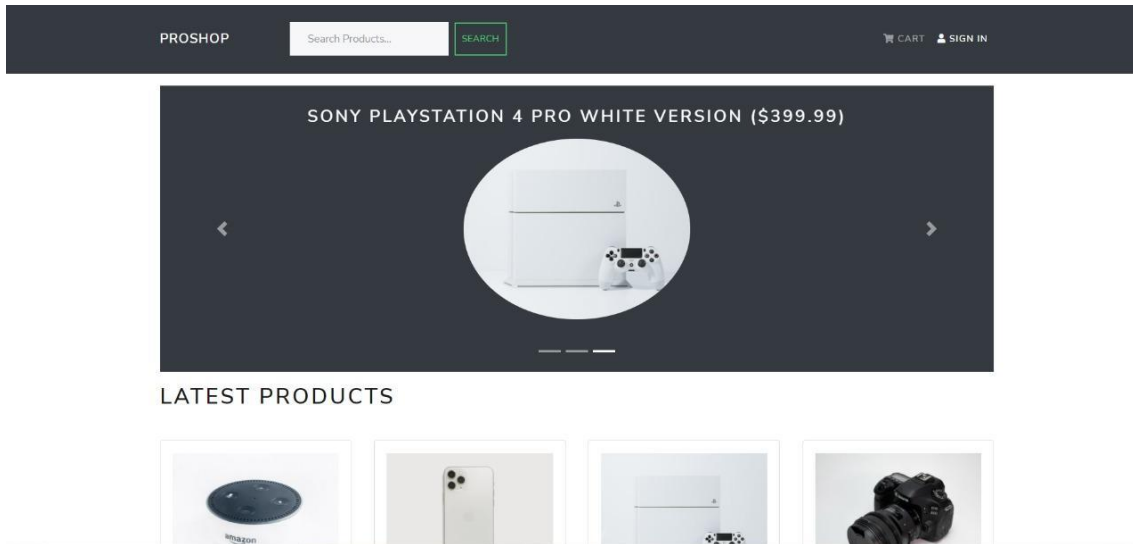
C. Visual Studio IDE:
Visual Studio IDE is a code editor which helps in the collaborative development of the codebase because it supports Git(version control). This editor makes importing and exporting plugins and debugging the code a really simple task.
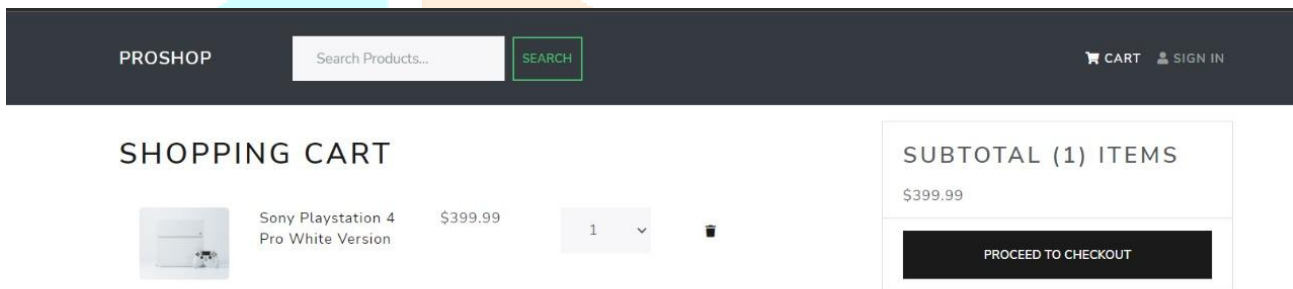
V. RESULTS

After the successful implementation of our web app here in this section, we have presented the final results. This web app works with all browsers and the products created using Unity and rendered using Model-viewer web component are able to demonstrate the AR capabilities of our web app along with creating a really unique shopping experience for the users who have never experienced AR before.
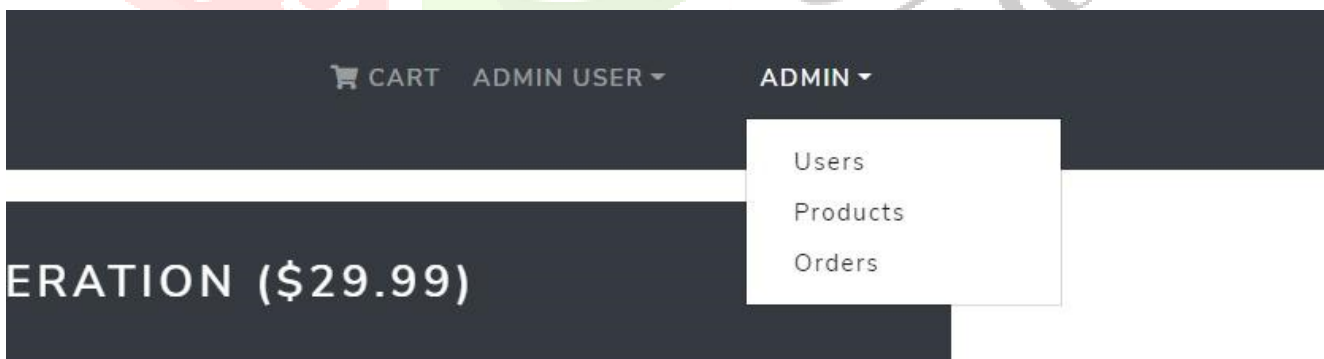
1. Landing Page for our website:

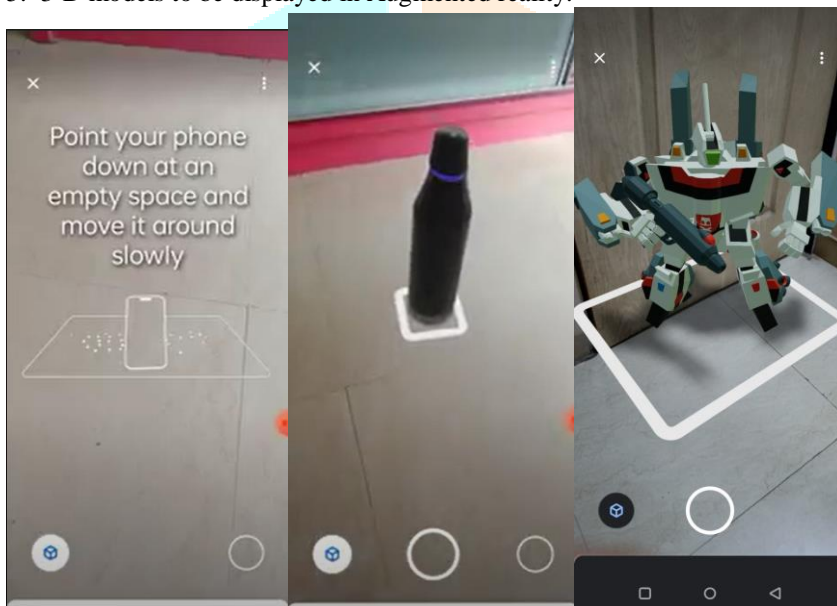
2. Shopping Cart feature for users:

3. Admin Panel:

4. Displaying all products in admin panel:

5. 3-D models to be displayed in Augmented reality:

VI. CONCLUSION AND FUTURE SCOPE

Since the main aim of this paper was to develop the web application for the eCommerce sector that is capable of augmenting the 3D models for the users to experience in a real-time environment, we can definitely say that the application that is developed is completely capable of doing the said work.

However, there is a lot of work that needs to be done in the Augmented reality domain and a lot of challenges that need to be addressed for example scalability is one such issue that needs to be worked on because rendering the 3D objects in real-time is quite a CPU heavy task and also we need to develop some way to compress the size of the 3D models because or else rendering them in geography with low internet speed will be a time-consuming task. Having said all this if we are able to overcome the said challenges then Augmented reality along with eCommerce will be the future of how customers do their shopping.

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