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## An Electronic Website for Viewing Products in 3- Dimensions

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### ABSTRACT

This project's research is focused on a surge in user demand for e-commerce product information acquisition. On e-commerce websites, the usage of 3D product presentation systems has become a web design trend. Through more creative actions and visual experiences, the study discovered that 3D product displays can provide users with a more natural and realistic online product experience. Users will have a better online product experience with 3D elements because they make online products more three-dimensional, enrich product details, and reduce the visual error produced by 2D online items. The study also discovered that, when compared to standard two-dimensional images for product display, 3D displays may more accurately depict the qualities of products in e-commerce and provide product specifics, allowing users to acquire relevant product information in detail and efficiently, hence enhancing users' purchase intent for the same product. As a result, this research asserts that 3D models for displaying products will continue to be popular in the future growth of e-commerce web design. To make 3D product displays more familiar and efficient, e-commerce merchants must invest more time, money, and human resources in this field; for web designers, it is also worth considering how to utilize 3D technology to create a more immersive web surfing environment for customers.

**Keywords:** E-Commerce, Web Design, Online Store, 3D Product Display, Online Product Experience, Consumers, E-Shopping Experience.

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### 1. INTRODUCTION

The term electronic commerce (e-commerce) refers to a business model that allows companies and individuals to buy and sell goods and services over the Internet. E-commerce operates in four major market segments and can be conducted over computers, tablets, smartphones, and other smart devices. Nearly every imaginable product and service is available through e-commerce transactions, including books, music, plane tickets, and financial services such as stock investing and online banking. As such, it is considered a very disruptive technology. Three-dimensional (3D) is something that has width, height, and depth. Our physical world is three-dimensional, and we can perceive 3D because of the depth perception in our eyes.

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Concerning computers, 3D describes an image that provides the illusion of depth or varying distances. This is commonly used in films, graphics, computer games and virtual reality. Before the creation of computers, a 3D vision was created. Mathematics and geometry can correctly track distance and position to create three-dimensional figures. The creation of 3D visuals is based on mathematical concepts. In the 1600s, Rene Descartes' global analytical geometry (coordinate geometry) could correctly track distance and position. James Joseph Sylvester pioneered matrix mathematics in the 18th century, which allows computers to make graphics. These mathematical theories and studies were initially primarily utilised in the military and science. Later, it was combined with art to create a new system known as "perspective," resulting from realism's continual evolution. With the introduction of perspective, an increasing number of people were exposed to the concept of three-dimensionality. The geometry of triangles, which are built on straight lines and composed of points, lies at the heart of 3D. It is worth noting that the more money invested in 3D computer graphics, the more realistic it will be, and the higher the credibility, the better the user experience. Furthermore, according to Jon (2013), computer power has expanded tremendously, democratising computer graphics and laying the groundwork for 3D graphic design and exploration.

Nike is an example of a web solution that incorporates 3D visuals. Nike values the user experience and tailored marketing so much that they examine big data and consumer information to conduct customised marketing to various target groups. The company uses computer 3D technology to create 3D visuals of sports shoes on its purchasing websites. On its shopping website, this marketing technique is exemplified by the use of computer 3D technology to create 3D visuals of sports shoes, allowing consumers to mix and match colours for customisation. 3D visualisation graphics are employed in some sales platforms, such as IKEA's online shopping interface, to make the sales model more personalised by allowing users to attempt the 3D positioning and matching of furniture in the area freely. When it comes to choosing furniture, one of the most crucial elements to consider is the amount of room available. Although 2D product images can provide most of the product information that customers require, relying on customers' imagination to determine the furniture's arrangement and colour of the furniture in a space is far from ideal. These issues are well-solved by 3D product displays.

Users can flexibly change the viewing angle and interact with it by using the right mouse button or screen sliding. In addition, the product's material and texture can be presented using the 3D model. The user benefits from being able to see products and their details in 360 degrees with clarity and accuracy. The constraints of the 3D product display model were identified by Potenziani, Dellepiane, Callieri, and Scopigno (2018) during its development. A large number of evaluators are necessary due to the diverse target groups and the complexity and distinctiveness of the 3D user interface. This viewpoint is shared by Xing, Bo, Feng, and Matteo (2019), who suggest that utilising controlled experiments to replace audience perceptions can quantify possible benefits. The advancement of computer technology is one of the reasons for the growing use of 3D product presentation technologies in e-commerce websites. Doug, Ernst, Joseph, and Ivan (n.d.) feel that the WOZ prototype, which is designed to be intelligent or high-fidelity controlled by a person and has a good impact on the development of 3D interactive technology and user interface, is an important prototype of a 3D user interface.

### 1.1 Problem Statement

3-D is becoming a reality. Currently, a lot of transactions for buying, selling, ordering and delivery are done online. Over time, it has been observed that most products ordered and delivered do not always meet the exact specifications the customer that ordered them perceived. The use of this is the limited capability of existing e-commerce sites to adequately display products comprehensively intended for order. Therefore, to address this problem, this study attempts to design a 3-Dimensional website that allows for an elaborate view of products before they are ordered.

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## 2. REVIEW OF RELATED WORKS

### 2.1 E-COMMERCE

E-commerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions. E-commerce is often used to refer to the sale of physical products online, but it can also describe any commercial transaction facilitated through the internet. Since the 1990s, when the Internet became widely utilised for commercial purposes, electronic commerce (E-commerce) has been a prominent theme in the literature. It might be considered a major achievement in the economic application of information and communication technology (ICT) (Rosen, 2000). The World Trade Organization's (WTO) Committee on Trade and Development defined E-commerce in 1998 as "the production, distribution, marketing, and sale or delivery of products and services through electronic means."

Types of E-Commerce. There 4 major types of E-Commerce, they include:

#### **Business-to-Business (B2B)**

Business to consumer (B2C) refers to transactions in which a business sells its products or services to consumers. B2C is the most common e-commerce business model and, therefore, many e-commerce niches fall under this category. For instance, think about retail and manufacturing goods like clothing, entertainment, and household supplies. These are just some of the e-commerce products that are sold directly to a consumer by an online business.

#### **Business to Business (B2B)**

A business-to-business (B2B) e-commerce model is one where a business sells its products or services to other businesses, rather than to consumers. This model is generally associated with high-end, high-priced products or services in industries in which the bulk of the revenue is generated by business purchases. The business-to-business model generally ends at the purchase stage. The company ends up selling its product to another company, which then sells it to its customers. As an example, think of your business' current or future relationship with an e-commerce wholesaler like Ali Express or Alibaba. Your business buys products from their business and then sells it to a consumer for a profit - this commerce interaction falls under the B2B e-commerce model.

#### **Consumer to Business (C2B)**

A slightly less common but no less effective strategy is the consumer-to-business (C2B) e-commerce model. C2B involves a consumer selling their products or exchanging their services directly with businesses. This generally occurs without the need for a middleman such as a manufacturer or a wholesaler.

Examples of C2B include a consumer leaving a customer review on an online store's website, participation in company surveys, or even sharing product-focused social media content as an influencer. This is done in exchange for some kind of perk like the chance to win a prize, receive a discount, or be awarded a free2 product.

#### **Consumer to consumer (C2C)**

C2C also referred to as peer-to-peer (P2P) is an e-commerce business model where a consumer sells their products or services directly to other consumers. It contrasts with business-to-consumer (B2C), where the focus of the business is selling products or services to consumers. C2C is a very popular e-commerce model because it allows business owners to broaden their customer base and reach a larger audience. C2C websites are often referred to as P2P selling platforms. The concept is very similar to classified ads, which are often posted locally at a neighbourhood or community level. Think of something like Facebook Marketplace, which is essentially a sub-platform off of Facebook's main platform. A place that connects consumers with other consumers.

Facebook makes money from the buyers and sellers viewing on-site ads and the consumer gets the benefit of connecting to another consumer who wants to buy or sell second-hand goods.

Online Consumer behaviour toward e-commerce

Regular web consumers, according to Bell Man et al. (1999), are time-starved due to their wired lifestyle. To pass the time, these web users shop online. Online retailers should make standard or repeat-purchase increasingly useful (– click – the buy method), modify data for the buy option, and give a quick checkout process when building web-based shopping circumstances. In their writing audit, Miyazaki and Fernandez (2001) referred to five stages of the customer acquisition process (problem recognition, data search both inside and outside the system, appraisal of possibilities, decision/buy, and post-buy behaviour). They also stated that purchasing through, the Internet is distinctive, and the customer associates their distant purchasing experience with the Internet framework.

## 2.2 Problems Faced By Online Customers on E-Commerce

One of the most frequently claimed reasons why consumers do not buy online is a lack of trust (Petrovic et al., 2003). In the uncertain, internet-based environment of e-commerce, trust has always been the underpinning component, which is especially important (Gefen and Straub, 2003). Because of the geographical and cultural surroundings, as well as the fact that they reside in different countries and social cultures, consumers from various places may behave differently in e-commerce (Dabidian et al., 2016). As a result, purchasing habits may vary greatly from one region to the next (Zhou and Wang, 2014).

A WORLD IN 3D

## 1.3 E-Commerce & 3D Technologies

E-commerce and 3D technology are intrinsically linked. Technology has always played a crucial role in determining economic progress, from the discovery of the wheel to the revolution of the steam engine. 3D Internet technology can be described as a cutting-edge, quickly evolving form of online interaction. As a result of this involvement, customers have a better grasp of what they're buying and are less likely to return items that don't fulfil their expectations. Although not yet implemented, interactive three-dimensional presentations should eventually replace photographs and text.

Three-dimensional (3D) E-Commerce allows for an exciting range of interactions such as customers can use touch, swipe or drag facilities to interact with products (Nassiri, 2008). 3D E- Commerce is a business concept that uses a combination of virtual reality (VR) and augmented reality (AR) on websites and mobile apps to provide customers with high-quality 3D imagery and interactive support.

## 3-D Models

A Three-dimensional (3D) model is a mathematical representation of an object in a 3D software environment. To represent an object, one requires three components: a 3D scene description, a light source and a description of the camera that views the scene. The scene is the collection of all the individual parts or models that make up the 3D environment or object. In this scene, each model contains two descriptions: a mathematical representation of the shape and structure, and a way of figuring out how that shape would look if illuminated. (N. Badler, A. Glassner, 2009)

## The Shortcomings of 2D Product Display

Although the standard two-dimensional product display system, which is confined to text and images, may cover the fundamental demands of most products, the product experience that pictures can provide is limited. It solely affects the product's appearance and ease of usage.

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Users will be unable to examine in detail and determine the authenticity of certain products with high authenticity criteria, such as calligraphy and painting, and handicrafts, (Zhang & Wang, 2011), which will diminish the user's willingness to buy to a certain level. For example, in the furniture industry, a two-dimensional display cannot accurately depict the appearance and characteristics of mahogany furniture products, nor can it be manipulated interactively, making it impossible to gain a thorough grasp of the products. This flaw can also be seen in existing visualisation theories and methodologies that stress design expression in a static state. Interactivity and user interaction are lacking when the required information is simply given graphically. In this situation, meeting the user's deep emotional demands and creative thinking for knowledge is difficult (Sanyala & Hisamb, 2019). Furthermore, customers' perceptions of the complete product display scene are weakened by the widespread usage of two-dimensional text and picture display technologies.

### **3D Visualization In E-Commerce**

In e-commerce, one of the defining factors of success is the method and way product information is displayed. Of these methods, the form of sensory information is found to be one of the most defining factors in the success of the e-commerce platform (R. Ramanathan, 2010). To find the most effective method of showcasing their products, online retailers are continually searching for new innovative technologies to integrate into their platform. Of these methods, 3D visualization is a more effective method to enhance consumers' product understanding and limit possible sensory mistakes, than static 2D images. (Z. Jiang, I. Benbasat, 2007).

A method for viewing and modifying 3D objects is 3D product visualisation, often known as product rendering. It allows businesses to display their products on their websites using a 3D viewer. A 3D model of the product and a 3D viewer is required for this. These components can be obtained by merchants either designing them personally or outsourcing them to another company. Combining a sequence of images from every angle of the product into a 360° product view can also be used to create a 3D product visualization.

The use of 3D visualization gives consumers the ability to explore and inspect the product freely. Giving consumers control over information has been found to positively affect purchase intentions and the understanding of a product's attributes, features and characteristics (D. Ariely, 2000). This free navigation and inspection of the information of any part of the product have also been found to increase the chance that consumers will experience a heightened sense of presence (H. Li, T. Daugherty, and F. Biocca, 2002). While interacting with 3D products, consumers tap into past experiences, memories, and feelings, giving them a positive sensory experience (T. Daugherty 2001). Consumers interacting with 3D products become more involved and encourage to seek additional information regarding product characteristics (Fiore, 2005).

### **3. MATERIALS AND METHODS OF WORK**

The structure, as well as the bottom-up approach, were combined to form a sort of hybrid design methodology which was then adopted for the analysis and design of the 3D e-commerce site. The system employed the use of a use case, sequence, activity and class diagram

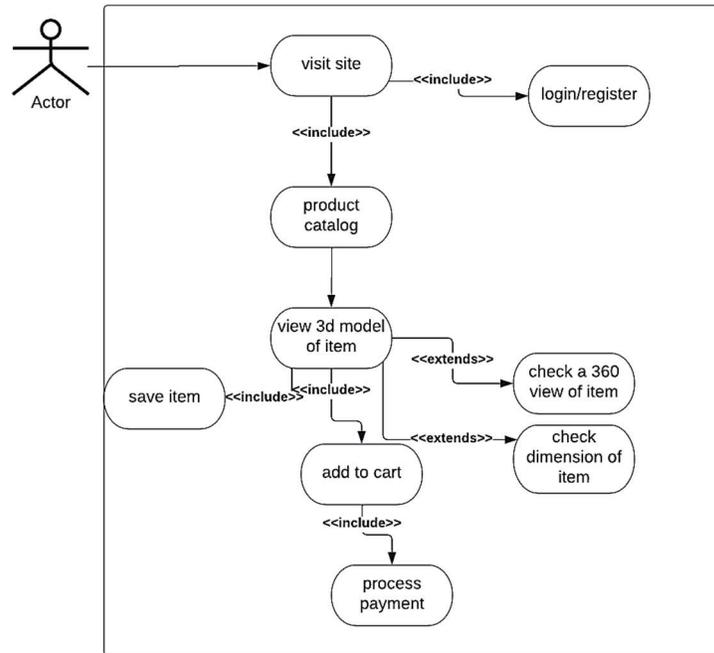


Figure 1: Use Case Diagram Of The System

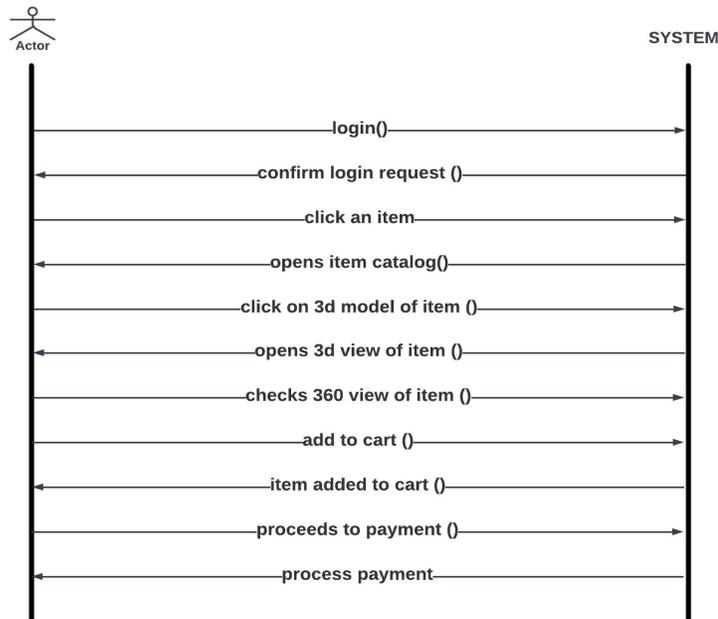


Figure 2: State Sequence Diagram Of The System

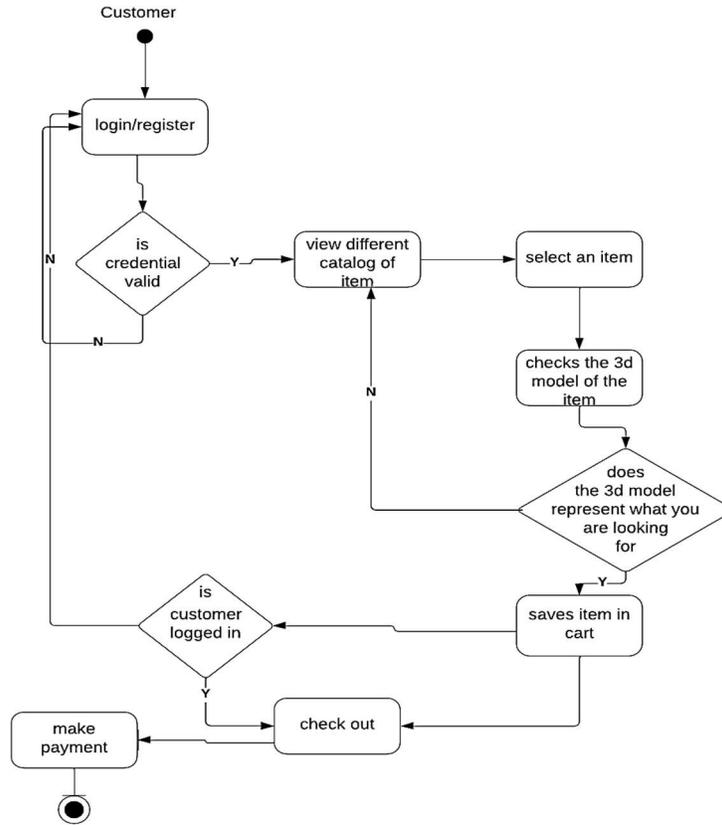


Figure 3: Activity Diagram Of The System

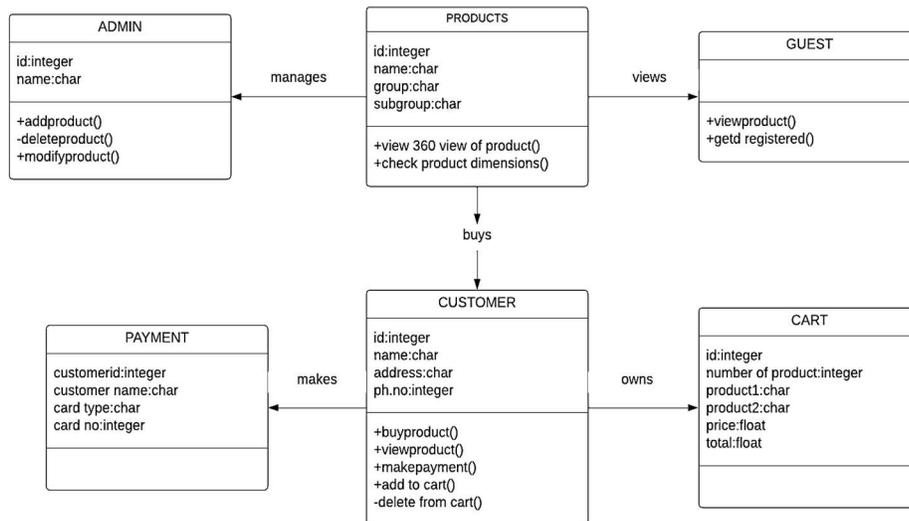


Figure 4: Class Diagram Of The System.

#### 4. SYSTEM IMPLEMENTATION

This system was developed using the three-tier web architecture which consists of the back-end, front-end and middle-end, system output and result. It also includes the screenshots of the application pages as the user uses them alongside each interface. The programming languages used in this system are PYTHON (DJANGO), HTML, JAVASCRIPT (THREE.JS) and CSS. The Visual Studio Code (IDE) used in this system enables simultaneous system creation and testing. The IDE simplifies the development of web, enterprise, desktop, and mobile applications that use PYTHON and HTML platforms. This functionality was frequently utilised during the development and testing of this system. After thoroughly testing the system in the implementation environment, it was packaged for offline deployment on a local server. The following are the findings of this extensive testing, as well as the system's documentation:

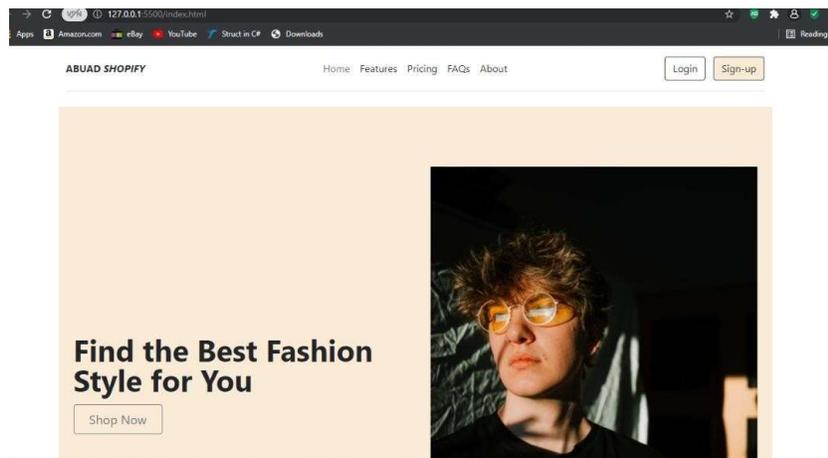


Figure 5: Landing Page Of The System

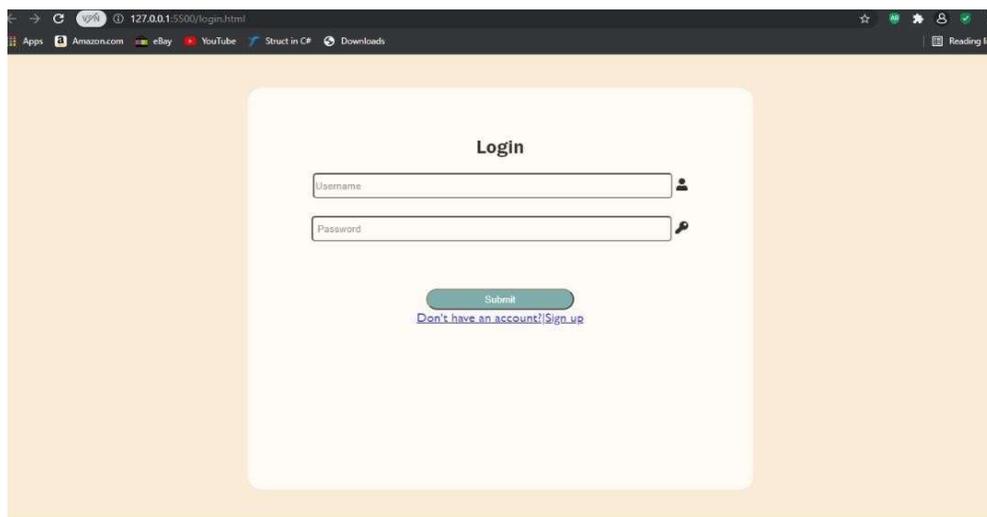
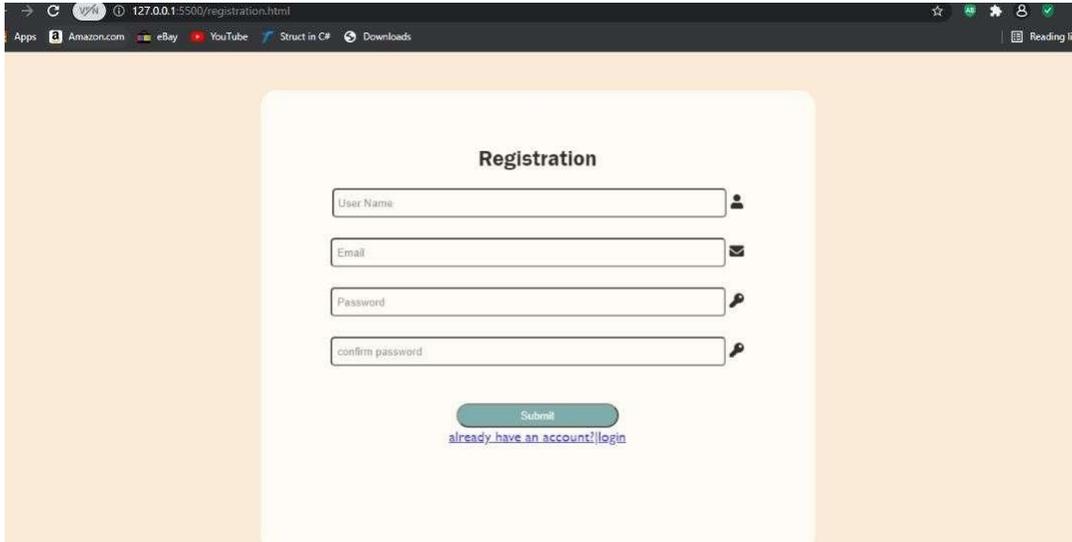


Figure 6: Login Page Of The System



**Figure 7: Registration Page Of The System**



**Figure 8: A 3D image of a Product In The Item Section Of The System**

Figure 5 shows the landing page which is the first screen that appears after launching the system. Figure 6 shows the login page where users can input their verified credentials (username and password) to gain access to the system. Figure 7 shows the registration page of the system where users can register and use their verified credentials to gain access to the system. Figure 8 shows a 3D modelled product in the item section. This 3D image can be zoomed in or out, rotated at a 360° angle and viewed in motion.

## 5. CONCLUSION

The demand for information interaction and in-depth acquisition has expanded as a result of the Internet's growth, as indicated in the problem statement. When standard 2D product interfaces fail to satisfy user expectations, 3D product display technologies are gradually becoming more popular.

## 6. RECOMMENDATIONS

Firstly, the generalizability of the results is limited by the student sample, and cannot be generalized to all online consumer groups. Secondly, since this study is focused only on a clothing line, which we consider to be products that are associated with more search or experience, it is unclear to what extent the results can be generalized and applied to other online products. Lastly, to get accurate measurements of the products being ordered, a 3-Dimensional ruler will have to be implemented.

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