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Merchandise Store

Bachelor of Science in Information Technology

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Certificate

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Abstract

Since the Internet's arrival, our lives have become virtually completely mechanised. Without the internet, the population would feel dejected. There have been so many technological and business breakthroughs over the last several decades, and not only the internet, but also the technologies related with it and the businesses tied to it. After widespread acceptance of the internet and the launch of the World Wide Web and the first browser to access it, e-commerce moved online. Online shopping is on the rise. It's fair to argue that this is the way contemporary company strategy will be implemented. Electronic commerce include both B2C and B2B transactions, as well as transactions carried out inside an organisation to support these external operations. Electronic marketplaces or market-spaces are used to execute business transactions. However, the game-changer known as Amazon boosted the consumer-oriented markets. In addition, Alibaba pioneered and refined the concept of B2B marketplaces. Moreover, social media businesses like Facebook, which have made their platforms dynamic and turned them into social commerce sites, have also fostered this behaviour. Merchandising, clothes, and other related industries have been the focus of this project's E-commerce efforts. When it comes to merchandising, it's not only about showing and selling things to customers; it's also about making money.

Acknowledgments

Starting with the name of Allah the most Beneficial and Merciful. Firstly, we would like to express our deepest gratitude to our supervisor, Ms. Mehroz Sadiq, Lecturer at Department of Computer Science, Bahria University, Islamabad. Our attempts to make this work as unique as possible have been pushed to a new level by her input and constructive criticism. We learned a lot about the subject topic as a result of her thorough investigation. We also value the support, encouragement, and constructive criticism we get from our loved ones and friends, all of whom assist us complete the project from start to finish. Additionally, we'd like to thank our professors for their dedication to this project, which would not have been possible without them.

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"We think someone else, someone smarter than us,
someone more capable, someone with more resources will solve that problem.
But there isn't anyone else."

Regina Dugan

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Acronyms and Abbreviations

2D	Two Dimensional
3D	Three Dimensional
5G	Fifth Generation
API	Application Programming Interface
AR	Augmented Reality
B2B	Business to business
B2C	Business to consumer
DB	Database
E-commerce	Electronic Commerce
FYP	Final Year Project
GPS	Global Positioning System
JS	Java Script
REST	Representational State Transfer
RnD	Research and Development
ROI	Return on Investment
UML	Unified Modeling Language
VR	Virtual Reality
VS Code	Visual Studio Code
GUI	Graphical User Interface

Chapter 1

Introduction

1.1 Project Background

Internet has made the lives of general population almost automated. They would feel empty without the internet. As many decades that have passed by, internet has made such enormous advancements but not just the internet but also the technologies associated with it and the industries connected to the internet have also made these advancements. E-commerce switched to the Internet as a result of widespread use of the internet and the creation of the World Wide Web and the first browser to access it. Mobile devices, including tablets, laptops, and even watches, have seen a recent uptick in e-commerce owing to the widespread availability of high-speed broadband internet. The concept of conventional business and retailing has been evolving by the introduction of E-commerce. This switch not just allows business's or entrepreneurs to get themselves automated but feel the necessity to compete on the internet to gain a greater degree of competitive advantage in the industry over their respectful competitors. Specifically, retail industry also known as E-commerce has been on a boom lately. And it would not be wrong to say that it is the future of modern business strategies. When talking about E-commerce,people are not simply talking about using computers and the internet to transact for the sake of doing business. Even while the term "E-commerce" is often used to describe solely the online exchange of products and services, it really encompasses a far larger range of activities. Electronic commerce include both B2C and B2B transactions, as well as transactions carried out inside an organisation to support these external operations. Everyday life and the way businesses and governments work have been profoundly impacted by E-commerce. Electronic marketplaces or market-spaces are used to execute business transactions. But the consumer-oriented marketplaces were enhanced by the game changer that is popular for being known as Amazon. Moreover, the business-to-business marketplaces were created

and evolved by Alibaba. Not just these giants but social media companies like Facebook encouraged this activity by making its' platform dynamic and converting it into a social commerce site. This project has also been focused on the domain of E-commerce that would be focusing on the industry of merchandising or clothing or apparel. When it comes to merchandising, it's not only about showing and selling things to customers; it's also about making money. Digital or physical, businesses employ merchandise to influence the buying decisions of their customers and boost their bottom lines. Most retailers will have different needs depending on their industry, the quality of the products they are selling, and whether they are exhibiting them in a brick-and-mortar or online shop.

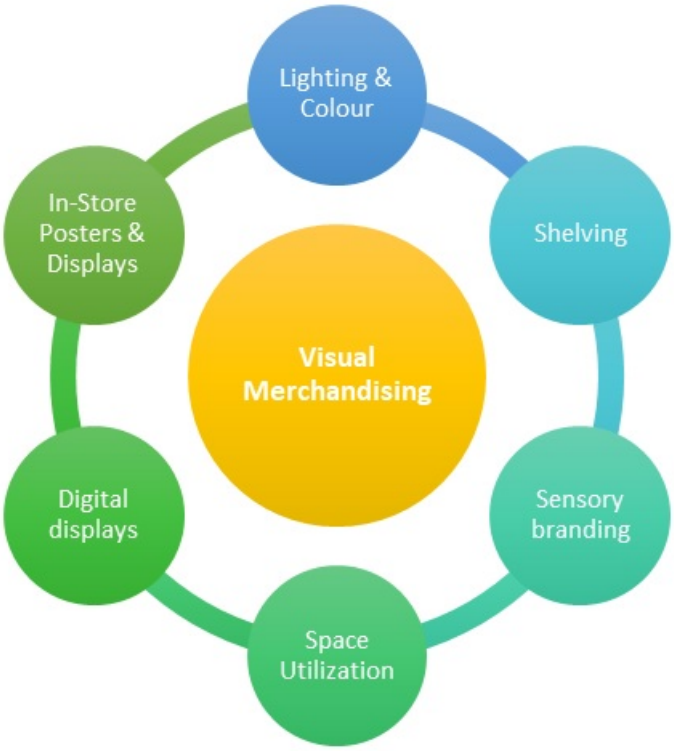


Figure 1.1: A diagram of Visual Merchandising

Figure 1.2: Illustration of a modern E-commerce

All promotional actions, both in and out of the shop, are included in merchandising,

including shelf displays and end caps, web design, on-site search on E-commerce platforms, and so on. E-commerce companies, much like brick and mortar shops, need to establish an ambiance on E-commerce sites that encourages shoppers to remain and purchase things. Before buyers ever touch a thing, you need to make it genuine. The art and science of E-commerce merchandising are intertwined. Connecting customers with the proper items is its primary purpose. E-commerce merchandising's most critical job is to assist customers on their individual purchasing journeys. E-commerce consumer journeys are more complicated than those at brick-and-mortar establishments. In brick-and-mortar establishments, almost every customer will encounter the same images, odours, and staff when they enter. As a result, customers might use a variety of routes to get to your E-commerce site. In order to guarantee that every client that visits your site gets a comparable experience but better than any other platform providing the same services, you may use E-commerce merchandising. To be at the forefront of digital merchandising, responsive merchandising must have one foot in the person-to-person sphere (where it has always been and always will be). This includes keeping up with the lightning-fast demands of internet users. You can use each of these micro-moments to enhance the consumer experience in real-time by analysing their scrolling, clicking, and purchases, as well as the emails you send when they leave their carts. When it comes to analysing data, it's no longer enough to just gather it, put it together, and generate insights that will be useful in the future. It's evolved into much more than that, in my opinion. The age of the consumer is arrived. Customers now have the power to shape product development, customer information access, and customer interaction. All of this means that consumers are able to easily share their product evaluations, acquire comparative price information with a single click, and influence product development at an incredibly fast rate. A distinct and distinctive identity or brand can only be created by making your platform stand out from the crowd. The customer-centric age has here. Product creation, customer information access, and customer interaction were formerly in the hands of companies, but now they are in the hands of consumers. To put it simply, this means that consumers can share their product evaluations with the whole world, get comparative price information with a single click, and drive product invention and development at a dizzying rate.

1.2 Problem Description

Henceforth, as mentioned before the existing merchandise selling platforms provide very limited or very few options when it comes to channeling through them. Such as these existing platforms, has the following features available to him/her, Upload Design of the product, Standard shirt size, Standard colors, Standard quality, Standard print on

the product. But if taking a look at the bigger picture what happens to the existing business or platforms that do not provide the functionalities of visual merchandising such as a 3d product configurator or customization tool, or even the latest strategies of E-commerce, they tend to fall behind in the race of fast growing modernisation. They tend to miss out on the benefits of cost effectiveness, better customer feedback and shopping experience, positive word-to-mouth feedback, value creation , efficiency, profits, automated convenience, enriched content interaction for the customers, increase in sales, ability to attract potential new customers, able to meet the forecasted or the present demands of the customers, chances of survival in this fast paced growing E-commerce world.Customers of now are really picky in the matters of fashion and clothing, a product not able to meet their experience of online shopping could be a disaster for the existing platform. The existing studies prove that 35 percent of the customers return their products because that did not match the exact specifications as shown on the website or the platform, or the E-commerce store. And a staggering number of 82 percent of the people believe that it is the responsibility of the owner of such platforms to provide a smart visualization of the product before ordering that the customer is at peace after ordering the product so that it would arrive as they have viewed and created it, and would ultimately decrease the chances of returned products. Until now, our online shopping experience was reliant on going through images, user reviews, and the occasional video. With the rise and amazing improvement of 3D visualization technologies, it was apparent that plain photos and videos will no longer cut it. Customers want more control over products, while manufacturers do not want to waste money on unsold stock.

Figure 1.3: An illustration of product customization.

1.3 Project Objectives

The idea for this FYP has been encouraged by this concept of E-commerce and merchandising as well as the 3D visualization,customization, or configuration. A Merchandise Store which is not only a mainstream E-commerce platform but also includes the unique feature of 3D product customization tool that lets you get a user friendly also a user centric feel and the functionality. Before diving into the main features of the platforms' details, a little bit of background should be given to better understand the purpose and necessity of the 3D product customization tools in the modern era of E-commerce merchandising or even the different types of products related to E-commerce.

To run an E-commerce store in this era you need to ask a couple of questions to yourselves.

Are we looking for a unique way to increase sale and customer engagement?

What does our competitor lack in running the same E-commerce business?

What difference can we make to stand out?

The proposed merchandise store platform is going to allow users to visit the catalogues to see some pre-designed merchandise products or the designs uploaded on the web by the designers, such as T-shirts, hoodies, sweatshirts, caps and jackets. If the customer is not satisfied by the designs available they would have the option to create a product of their own choice that they could be proud of and it feel as one of their own creations, making the customer feel more valued. A 3D product customization tool is going be provided on the platform, which is interactive, that allows customers to view their products in 3D form any direction, while allowing them to change details of the product such as color, texture, font ,size etc, in a way that is unique to them.But that is just not it, customers are going to be given the freedom to order the products as per the desired quantity such as ordering in bulking or even just a single amount of product. As mentioned previously about the designers, a dedicated portion on the platform is going to be accessible for the designers who are likely to show case their ideas and creativity in order to make a selling of their own. A product being sold in return of some percentage of commission charged by the owner of the merchandise store platform. Secure payment methods for example, jazzcash and easypaisa, even the credit card payment would be available on the platform. As many other platforms and E-stores are providing very limited services, this niche needs to be covered with some of these features. To be able to attract potential retailers and sellers, entrepreneurs and motivated designers.

1.4 Project Scope

It cannot be emphasised enough on how much the E-commerce industry is booming and, because there is a lack of information about the product, customers are growing increasingly unsatisfied. Returning products that are not true to the image is bothersome, and companies often have to get rid of returned stock, which is not beneficial for their ROI (return on investments).A big commerce product configurator or a 3D product customization tool can solve all these issues, and add much more value to your online store. In conclusion, for fashion E-commerce, a3D product user interface with a mix of virtual showrooms may indeed help companies to convey brand identity in a more creative way, while online product accuracy for consumer scan also be enhanced. This products' stand-alone user interface might be substantially improved in the future, when human model photographs and even virtual fitting elements are added into the design. Further study recommendations include incorporating additional human context into the user interface, such as material from fashion models and personal preferences or bodily traits of clients. Furthermore, this could be a cream for many businesses to skyrocket their conversions. So, unless if someone does not want to be left out, it is a high time that one should consider investing in an online model of such type. Not only will it improve ROI (return on investments), but it will also improve customer satisfaction, customer retention, loyalty and brand recognition.These are just a couple of benefits in the sea of others.

Chapter 2

Literature Review

2.1 Research Paper Review

2.1.1 Which Retailing Technologies Add Real Value to E-commerce in a Physical Store?

[1]Digital in-store technology have been integrated into the physical servicescapes of offline shops in order to stay competitive in a connected society. As a first step, a company may implement click collect, purchase from a website, or return to a shop. Consumer-facing sophisticated technology may be crucial in generating a distinct physical shopping experience for customers and giving advantages to shops, such as enhanced traffic, conversion and baskets or decreased operating costs for retailers. Consumers, on the whole, value retailing technology. Customers, on the other hand, evaluate the fairness of the exchange regarding processes, results, and treatment, as well as the value of the technology they get in comparison to what the store receives. Customers also have issues about satisfaction, trust, and privacy. Retailers must verify that their app works well and is safe for customers, and they must treat customer complaints seriously. In order for proximity marketing to deliver on its promise of boosting basket size or attracting new consumers, they must also handle privacy issues and create trust. Even so, the important issue is whether or not customers react favourably and whether or not the retailer's investment pays off It is essential that they strike a balance between conventional retail and cutting-edge technology, ask their customers what they want, thoroughly evaluate and appraise all technologies, deal with issues, and avoid running after anything showy that rivals may be attempting to implement. Customer response is so critical that advertising and application information must be as clear as possible. An interactive, two-way customer experience that is absolutely seamless and frictionless will be created by integrating the internet and actual

worlds. By 2020, smart devices will account for 30 percent of all human interactions, necessitating merchants to develop appropriate capabilities for both content and device management. As a result, apps that are considered "nice-to-have" but are still a long way from paying off may be a profitable investment in the long run.

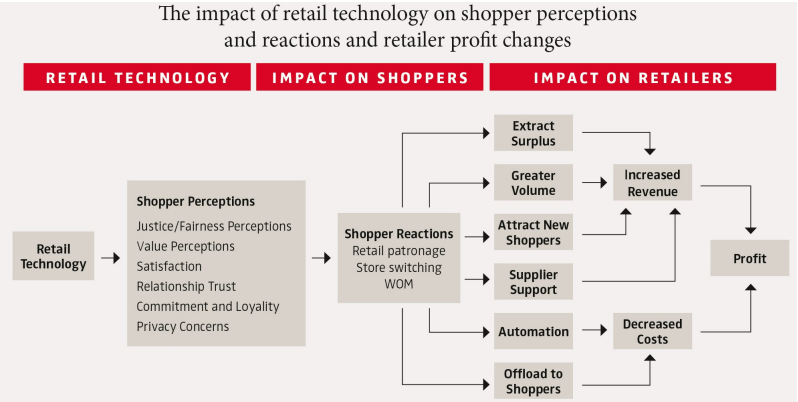


Figure 2.1: Provides some pointers for retailers and customers alike on what factors to take into account. Choosing consumer-facing technology should be based on more than just what the technology might possibly give, but on what the technology will really deliver to the customer.

2.1.2 Maintaining Relevance and Customer Access by Reinventing the Retailer

[2]Existing retailers have undoubtedly begun to digitise their whole offering and provide a multi- or omni-channel strategy. Manufacturers, on the other hand, are increasingly reaching out to end users in order to create a direct interface. Similarly, the platform idea, as seen in Alibaba, Wish, Etsy and Zalando, is gaining a lot of traction among consumers. The retailing business is undergoing a few, but significant, changes. Many conventional merchants are being pushed to adjust as more customers prefer the ease of internet-based shopping and direct-to-home delivery. In this era, all of the digitization is not enough for the retailers is not enough as they need to understand the whole concept of consumers thinking and requirements. Value creation is much more than this. Today's retailer must create relevance and purpose in the lives of customers as a brand. It must gain meaning outside of the retail contact. As a result, the attention shifts to more ordinary aspects of life, such as employment, leisure time, travel, holidays, hobbies, and so on – rather than merely the act of buying. Furthermore, the merchant must be physically and technologically accessible, and customers must be able to quickly receive information and contact the seller. As a result, in order to consistently create new value for customers, merchants must consider the following new value creation sources. Figure 2.2's traditional sources

of wealth generation aren't going away any time soon, so it's important to keep that in mind. To a large degree, they still need to be completed. There will be a whole new set of criteria due to the arrival of new technologies and the ever-changing needs of customers. New digitally enabled value sources described in this topic must be built on top of the existing ones. This means that new players in the sector will only be able to thrive if they can effectively convert these new features and benefits into meaningful and enjoyable experiences for customers. This is, in fact, where retailing's future is being created right now.

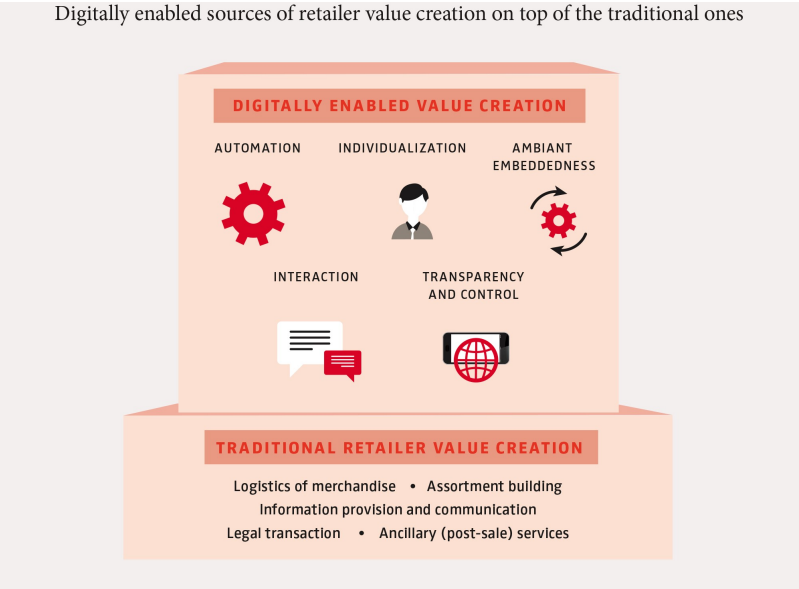


Figure 2.2

2.1.3 The use of e-commerce and Web 3D to involve customers in the design process: the instance of a 3D configurator for gates

[3]It is with this publication's emphasis on the work of the Living Lab, a new paradigm recognised by the European Commission for its work in RnD for the general public, that we hope to evaluate the future worth of a particular product or service. Using web3D models in the Living Lab and current E-commerce environments is a benefit to both. Particularly those in the 3D modelling sector, such as furniture, clothing, the automation industry, tourism, and so on. A web 3D solution for E-commerce that may be used to construct a 3D configurator for a broad public user of the gates 3D configurator. Action-Research was used to conduct this study. This tool was tested by 27 people. Using an interactive 3-D depiction of the thing is advantageous since a single picture does not generally enable the

Questions	Yes	No
Is the possibility of 3D interaction is important for the buyer?	89%	11%
Does a 3D visualization of the product (and not an image) is a plus for the buyer?	89%	11%
Does 3D visualization for sale online is necessary?	67%	33%
Does the Web3D improve the view of the product?	89%	11%

Figure 2.3: Questionnaires on the contribution of Web3D

consumer to visualise the product in its future context, according to the results. Web 3D for E-commerce allows the user to be a part of the creative process via interactive features. The Web3D's E-commerce advantages may be shown in this empirical investigation. For improved visualisation and purchasing motivation, we found that a Web3D application using realistic 3D models outperformed existing Web3D solutions. With these data, we can confirm [4]'s claim that the third dimension in E-commerce enables customers "to visually inspect product performance and aesthetics prior to purchase." Customers are more likely to buy a product if they have a "enhanced" first encounter with it. Using sale-commerce websites to configure and customise desired products is still essential today. Its own product configuration is also considered as a crucial component of success in terms of financial performance and productivity [4]. As shown in Section 2, these configurators are completely extended. All items that must be placed in our homes or offices will be sold in three dimensions in the near future. In [7], writers suggest that virtual learning environments enable users to be more inquisitive, interested, and joyful. For things that are normally sold only by a store assistant, the absence of a feeling of presence on e-commerce platforms might be a negative. The research also considers the use of avatars to assist users in the portal configuration process, since avatars have the additional advantage of introducing a social component [7]. Finally, augmented reality opens the door to interesting new avenues of exploration. Since most smartphones and digital tablets, such as the "iPad," contain a camera, they are well-suited for augmented reality applications. GPS-enabled apps, such as those that help you find nearby businesses or restaurants by offering contextual information, are now widely available. The in-place gate setting feature of an online configurator might be added by one of these devices. There is still a need for dependable and user-friendly marker-less solutions that are compatible with the bandwidth constraints of the internet and the limited computing power of mobile devices.

2.1.4 Digital Innovation in Fashion - How to 'Capture' the User Experience in 3D Body Scanning

[4]Due to changes in the way we buy online, consumers' expectations are evolving. The bulk of internet purchases will be made on mobile devices in 2019, according to 'Statista,' a research firm. Product images and real-time information on even adjustable things are what customers are looking for (which 49 percent of Americans want, at least according to Sourcing Journal). Customers are more likely to walk away without making a purchase or to return an item if they don't have access to these in-store images in real time. Online clothing purchases are already the most likely to be returned, as Fortune reports. The cost of generating additional images using normal product photography rapidly becomes prohibitive as demand grows. A nice example of this is 3D configurators. Because retailers utilise software algorithms and 3D data to generate product visuals, they can produce many more photographs in far less time – and for far less money. Digital colour and pattern adjustments, rather than requiring a full picture session, may also be made instantly, saving businesses money. As an added benefit, 3D configurators enable customers to see a product from every angle, which is more convenient than looking at a series of still images. The use of this technology on a fashion retailer's website is thus a strategy for preparing for the future. Customers are prepared to pay more for personalised items and are more likely to acquire such things if they can picture them before making a purchase, which is important information for online clothing sellers. That's achievable thanks to 3D configurators. According to Shopify, 360 billion dollars worth of goods were returned in the United States in 2017, with industry experts estimating 550 billion dollars in returns this year. Fashion retailers may address the problem by providing detailed size charts and information on a model's measurements and the size items they're wearing. If you offer personalised products, it's likely your consumers aren't seeing any visual representation of what they'll get before they click "buy." Currently, 64 percent of product returns occur because the goods received vary from the online picture the buyer viewed. A 3D configurator may help cut down on returns by letting consumers see exactly what they're receiving before it arrives in the mail. However, according to a Snap36 study, 360-degree photographs of products on e-commerce sites have been shown to reduce returns by 35 percent. A 3D configurator's economic case for lowering yields is compelling, but it does not tell the whole story. Most Americans (82 percent) feel that merchants have a duty to do whatever they can to restrict returns because of the enormous environmental impact of e-commerce returns. According to Harris Poll. Customers may build and personalise their own apparel using a 3D configurator, which retailers can then sell them just the pieces that catch their eye. The key to the power is the ability to produce accurate representations of clothing

without having to manufacture them. There has been a shift in the way we shop online, and that trend is only going to become stronger. Shops may use 3D configurators to meet the needs of today's customers while also positioning themselves for future success as online shoppers grow more knowledgeable. There will be fewer returns and a better brand reputation among eco-conscious purchasers thanks to 3D configurators, which will reduce the initial costs of product photography. The only issue remaining is which companies will be the first to take advantage of these benefits and apply this game-changing technology.

2.1.5 During COVID-19, the development of 3D E-Commerce: online purchasing becomes real with virtual reality and augmented reality.

[5]Since the outbreak of Covid-19 many business ran out of order and sustainability. And this outbreak of Covid caused many ventures throughout the globe to change their business operations. Online demand continues to rise as a consequence of this shift away from traditional offline platforms. Online stores with two-dimensional interfaces have been around for a long time because they make it simple for customers to find what they want. Despite the importance of virtual representations in fostering trust, most virtual representation sites fall short of emulating real-life representation. Virtual reality (VR) and augmented reality (AR) may be used to overcome limitations and improve E-Commerce operations, as shown in this article. Incorporating principles of user-centered design, it was created as a web-based shopping assistant that can be used from a range of computer platforms, including desktops and mobile devices. Mattsson and Barkman, 2019 indicate that their research targets India's urban youth, who are now or will soon be engaged in virtual reality (VR) through video games, movies, and other mediums. This is the target audience for their study. This group is more open to exploring virtual reality. Fashion is the main area of E-Commerce that we are focusing on. In this case, the average user need more in-depth understanding about the product than just textual information, such as how they would appear in a garment or if the size listed on the website would suit them or not. Many researchers have stated that this disease is set to be dangling around for quite a long time, but it is claimed that the physical "brick and mortar" stores would tend to exist as face-to-face is shopping is preferred by people still. However, these stores still and will be facing difficult times in the future. Immersive technology is being used now to evolve and enhance the in-store experience whether conventionally or at the E-commerce level. As it is the melody of the future.

2.1.6 Intelligent Real-Time 3D Configuration Platform for Customizing E-commerce Products

[6]In this publishment it states all of the components and features, plus the limitations to a 3D product configurator. A 3D product configurator is software that enables users to examine a product picture from any angle. Users can alter the colour or size of a product, for example. The tailored model is then shown on the screen for the consumer to see. By demonstrating how various options would appear in 3D, the 3D product configurator may better engage potential buyers. The design can also give sufficient detail, such as price and how to construct a product depending on a customer's preferences. Businesses use 3D product configurators most commonly on their websites. This is a useful addition to E-commerce and product sites since it allows customers to view a variety of possibilities. Consumers may personalise complicated items using comprehensive visual configurators before proceeding to online checkout. Companies that utilise 3D product configurators provide their consumers the ability to configure and see a wide choice of products, as well as show them how a product appears in a real-world setting—such as a room. Advertising, marketing, and product websites may all benefit from a 3D product. Using the tool improves manufacturing efficiency and sales as well. A list of benefits include, driven sales, market and advertisement empowerment, boost of productivity, elevation of the customer experience, as well as the enhanced product development. With all these benefits the only limitation to a 3D product configurator could be the price of the tool or the services provided by the third party tool owners.Customers are more engaged and sales are higher with 3D product configurators. They may even enable you to increase the price of some bespoke items while also allowing you to produce things more effectively. The following are some of the benefits that a product configurator may provide:

- Configurators Simplify the Work of Your Designers and Sales Team: Designers are aware of what clients desire. Sales agents can use a configurator to offer consumers things they already want.
- Customers are looking for it: According to a Deloitte study, 36 percent of buyers are interested in purchasing a customised product.
- Manufacturing-on-Demand: As a manufacturer, you may link demand to production directly, resulting in reduced waste and expenditure.

The utilisation of 3D product configurators and how they are used by businesses will continue to evolve. Consumer engagement, as well as how businesses use it to produce and sell things, will change.

2.1.7 Fashion Apparel Industry 4.0 and Smart Mass Customization Approach for Clothing Product Design

[7]It's no secret that customers want to be treated like unique individuals, and they are willing to pay a premium to get it. Manufacturers are under pressure to develop ways to make their processes more available to individuals beyond their four walls as a result of this demand. 3D configuration tools provide companies the confidence to quote intricate things while balancing rising product complexity and customer demand for bespoke, distinctive experiences.. Consumers no longer accept simple "one-size-fits-all" products. Customisation and personalisation have become more important to consumers in today's market. In order to go from mass production to mass customisation, firms must completely overhaul their design and manufacturing processes, which is no small feat. Today's on-demand services and instant gratification have made it easier for customers to compare prices and choose the products that best meet their needs, and as a consequence, many of them have changed their brand loyalty. As if that weren't enough, gadgets have become significantly more complex as embedded circuits, software, networking and next-generation materials have been included. Consequently, manufacturers have had to learn a lot about interdisciplinary techniques, complex simulations, digital technologies, and new manufacturing processes and materials. Using 3D models, customers are able to quickly analyse and re-select characteristics such as colour and size until they discover the optimal design for them. Complex product manufacturers might benefit from this since it can be difficult to visualise how product features or alternatives interact with one another. It's a new concept, not a rehash. With Configure One's visual configuration technologies, manufacturers have profited for over two decades from JPEGs and static 2D images of objects to real-time development in 3D models and 2D drawings – enabling complete personalisation of otherwise typical products. Is there anything in store for the future? There will be more and more data available to the future generation thanks to the launch of 5G technology. As a result, users will be able to access a wider range of high-quality material.

2.1.8 E-commerce in Fashion in the 3D Digital Era

[8]Companies may communicate their corporate identity while simultaneously reducing online shopping return rates with the use of virtual showrooms and 3D user interfaces, as

discussed in this article. Researchers found that a more interactive 3D product, a new way of showing information, and a more accurate product might all help fashion companies better exhibit things on the internet. Users are more likely to notice details they may have otherwise overlooked if given lists of shortcuts to product information and the option to interact with the product in 3D. Although greater accuracy is necessary to entirely eliminate the colour difference under different lighting, users may benefit from dynamic virtual lighting conditions to enhance their impression of product colour. Currently, the development of a 3D user interface is constrained by technical issues, and the rendering of 3D models results in long loading times. However, related research topics such as high-quality, low-polygon 3D scanning, virtual fitting, and faster internet access have become increasingly popular recently. Progress will be made in the removal or reduction of technical difficulties. Classic 2D material still has benefits when it comes to efficiently communicating a company's brand via stunning fashion model photos and fascinating advertising videos. For fashion e-commerce, today's 3D user interface design should include both 3D and 2D content. Online pop-up shops, a new retail concept based on inventive advertising campaigns and unique online shopping experiences, might be built using virtual showrooms. A 3D product interface with a combination of virtual showrooms may assist fashion e-commerce enterprises better communicate their brand identity while also improving the accuracy of online product information for customers. Human model images and even virtual fitting aspects might be included into this product's stand-alone user interface in the future, which could significantly increase its usability. Additionally, the research recommends combining content from fashion models and personal preferences or biological attributes of customers into the user interface.

Comparison Table Of Research Papers

Paper no.	Author(s)	Working	Techniques	Results	Efficiency	Advantage(s)	Disadvantage(s)
1.	1.Peter Linzbach, 2. J. Jeffrey Inman and 3.Hristina Nikolova	Evolution of E-commerce & the need for 3D modelling tools	1-Evaluation of Shopper's Perceptions. 2- Use of Marketing tools. 3- Smart Shelves. 4-Automatic queue.	Customers' perceptions varies person to person regarding the advancements in the retail one-to-one shopping experience.	Process Automation	1-Cost efficiency is improved. 2-Better customer feedback and shopping journey. 3-Easy to use technologies. 4- Automatic queue technology was perceived as good. 5- Positive word-to-mouth feedback.	1- Customer privacy issues in smart shelves. 2- Change is always resistant. 3- Retailers yet not trusting the new technologies.
2.	1. Werner Reinartz	Reinventing retailing	1-Automation 2-Individualization 3- Ambient Embeddedness 4-Transparency/ Control 5- Interactions	New era customers would have more requirements. Retailers need to adopt the techniques mentioned as a way to tackle the problems related to future retailing.	Process Automation	1-Value creation. 2-Automation increase value creation and efficiency. 3-More convenience because of the individualization . 4- More data available for analysis of the customers. 5- Ambient embeddedness ensures that customers are connected to	1- Customer privacy issues as they trade off their personal information in return for value.

			S			more convenient channels. 6- Enriched content interaction the 3D modeling technologies. 7- Better decision making by the customer due to transparency of data.	
3.	1-Romain Rolland, 2-Etienne Yvain, 3-Olivier Christmann, 4-Emilie Loup-Escande, 5-Simon Richir	E-commerce With relation to 3D configuration In customer design process. Testing for an organization known as Living Lab.	1-Web3D tool tested by multiple users. 2- Data collection. 3- Quantitative and qualitative analysis of the data.	Results show that an interactive 3-dimensional visualization of the object is an advantage for the sale, because a single image does not usually allow user to imagine the product in its future environment. The use of Web3D for e-commerce gives the customer the ability to get involved in the design process.	Several participants suggested visualization similar to reality. Hence, better evaluation of the product used.	1-Value creation. 2-Increased sales. 3- More interactive buying experience for the customer. 4- Better visualization of the product. 5- Ability to attract new customers.	1- Limitations for the tool in some areas or categories of E-commerce sites. 2- Such as food or simple product. Nothing much to be extracted from it using a 3D tool. A picture would be enough.

4.	1-John Kim	Evolving nature of buying and selling by analysis of traditional visualization compared to Modern 3D visualization.	1- Quantitative and qualitative analysis of visualization methods.	Analysis showing the benefits and some limitations of the modern methods of buying and selling products.	The way we purchase online has evolved, and it will continue to do so in the future. 3D configurators can help shops not only fulfil today's consumer wants and expectations, but also position themselves to succeed as online buyers become more sophisticated.	1-Reduced upfront product photography cost. 2-Increase top line sales. 3- Reduced product returns. 4- Improved brand perception among increasingly eco-conscious customers. 5- Empower retailers to meet the current demands and trends easily.	1- Tools with all of the premium features can be a bit costly.
5.	1- Satish Rupraoji Billewar, 2-Karuna Jadhav, 3-V.P. Sriram, 4-Dr. A. Arun, Sikandar 5-Mohd Abdul, 6-Kamal Gulati,	Affect of Covid-19 on the Ecommerce and its future. And the need for Virtual Reality (VR) & Augmented Reality (AR).	1- Implementation of VR and AR in E-Commerce. 2- Study the implementation of VR in E-Commerce. 3-Study the implementation of AR in E-Commerce. 4- To study the customer satisfaction of users using VR	The regular user needs to have more immersed knowledge about the product rather than just the written information like how would they look in a dress or will the size available on the website fit me or not.	VR and AR are defining the future through their effective functionality.	1-Daily increasing online demands. 2-more precise product information in 3D E-Commerce environments. 3- Enhanced in-store experience. 4- Chances of survival for the retailers to be increased.	1- Not a very perfect technology. 2- Still needs to be improved in-order to attain maximum customer satisfaction. 3- Expensive technology as well.

	7-Dr Narinder Kumar Kumar Bhasin		stores.				
6.	1-Sonia Schechter	Real Time 3D Configuration Platform for E-commerce	1- Research on several use cases.	The utilization of 3D product configurators and how they are used by businesses will continue to evolve. Consumer engagement, as well as how businesses use it to produce and sell things, will change.	A very powerful tool that helps in elevating the level of finesse in E-commerce related to certain popular categories.	1-Empowers marketing and advertising. 2-Drives sales. 3- Elevates customer experience. 4- Boosts productivity. 5- Enhances product development.	1- Tools with all of the premium features can be a bit costly. 2- Tools that are open source and free of cost do not provide all the features and functionalities.
7.	1-Jonny Williamson	Fashion Apparel Industry 4.0	1- Research	The biggest development (and opportunity) he sees, however, is around augmented reality and what it represents. As a result, expectations for rich content will	Seamless experience in order to improve greater brand awareness and customer satisfaction.	1-Brand loyalty. 2-Innovation in products. 3- Products according to customer's needs.	1- High level expertise needed in order to achieve this level of innovation.

				continue to rise.			
8.	1-Hanyue Zhou	E-commerce in Fashion in the 3D Digital Era.	1- User testing 2- Hypothesis 3-User testing plan 4- Measuring brand identity 5- Quantitative and qualitative analysis.	For fashion e-commerce, a 3D product user interface with a mix of virtual showrooms may actually help companies to communicate brand identity in a more creative way, while online product accuracy can also be enhanced.	Efficient but still has some limitations to it.	1-Display products better in a new way. 2-Higher customer satisfaction. 3- Reduced product returns. 4- Brand loyalty increases. 5- Meet customers demand more effectively.	1- Still room for improvement. 2- Different shopping habits. 3-Different background of users. 4-Different end devices. 5- Slow rendering of the 3D models in the interfaces.

Chapter 3

Requirement Specifications

3.1 Existing System

Existing systems or platforms are really limited to the proposed technology and aspects. Known platforms include Etsy, Red bubble, Warehouse, Custom Freaks. These platforms lack interactive content, high fee being charged on your design postings, charging designers to affiliate themselves with them, limited choice of customization options for the customers.

3.2 Proposed System

The proposed platform or system is going to provide interactive content, a 3D visualization, customization, configuration tool, free affiliation for the designers, no fee being charged for the design posting of the designers, customer centric catalogues to attract customers, option for customers to choose from preset products or create one of their own through the 3D tool. Allowing customers to view their products in 3D for many direction, while allowing them to change details of the product such as color, texture,font ,size etc, in a way that is unique to them. That is just not it, customers are going to be given the freedom to order the products as per the desired quantity such as ordering in bulking or even just a single amount of product. As mentioned previously about the designers, a dedicated portion on the platform is going to be accessible for the designers who are likely to show case their ideas and creativity in order to make a selling of their own. A product being sold in return of some percentage of commission charged by the owner of the merchandise store platform. Secure payment methods for example, jazzcash and easypaisa, even the credit card payment would be available on the platform. As many other platforms and E-stores are providing very limited services, this niche needs to be covered with some of these features. To be able to attract potential retailers and sellers,entrepreneurs and motivated designers.

3.3 Requirement Specifications

The software requirements for this project are

- Vs code
- React.js
- Node.js
- NPM Package Installer
- Fiber Three.js
- MongoDB Database
- Browser
- Postman API Tester
- Blender

3.3.1 Hardware Requirement

- Personal Computer or Laptop
- Internet Connection

3.3.2 Functional Requirement

After opening web application on the browser the users will be able to see the Catalogue on the web platform. In order to make order of product and to use our customization tool the user must Register on Platform first.After getting Registered on Platform he or she can make purchase or can use customization tool available on platform .

1. **Registering on Platform**

   If user is not registered on platform, he/she has to sign up first to use the system functionalities fully.

2. **Logging on Platform**

   User should Login to use the software functionalities fully or user have to Register, if he/she has not registered earlier.

3. **Customization Tool**

   In case user want to make some customization on item available on platform before purchasing it. Then user can use the customization tool to customize the product as he or she wants before buying it.

4. **Catalog**

   All the product available on platform for sale are displayed on the platform.There will be number of catalogs for items on sale .for example Catalog for Shirts ,hoodies,pants,Shoes etc

5. **Shopping Cart**

   In the shopping cart user can see the products he selected for purchase and the total of selected product will be displayed to him and also the items user put in wish list are also displayed there.

3.3.3 Non Functional Requirement

The non-functional requirement of web platform are

1. **Performance**

   The web application is going to perform accurately in any scenario as it is intended to work in ideal scenario.

2. **Usability**

   Platform is interactive and easy to use, its user friendly.

3. **Maintainability**

   In case, any error occur in the web application.It can get detected and debug .

4. **Flexibility**

   In order to make any change in web application . The application can adopt the change without disturbing the functionality of whole web application.

5. **Responsiveness**

   Platform's design and development should be responsive to the user's behaviour and surroundings depending on screen size, platform orientation, and other factors.

6. **Availability**

   This system will be available for all users 24/7.

3.3.4 Assumptions and Dependencies

As the work on this project is currently underway so if there is something found that can be beneficial or can be used in design, it is going to be incorporated in the project and the requirements given here may change according to that.

3.4 Use Cases

Use case diagrams for different scenarios are follow

Table 3.1: Use Case Description for Sign Up

Use-Case Name	Sign Up
Description	This use case allows user to sign up into the database. So, he/she can login to the web application.
Primary Actor	User
Pre-Condition	None
Post-Condition	The system displays relevant page

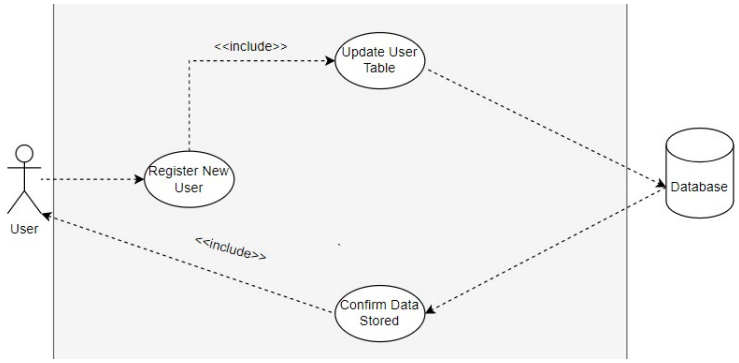


Figure 3.1: Use Case Diagram for Sign Up

Table 3.2: Use Case Description for Login

Use-Case Name	Login
Description	This use case allows user to login into the platform to access the functionalities of platform fully.
Primary Actor	User
Pre-Condition	User must be registered in database.
Post-Condition	The system displays relevant page

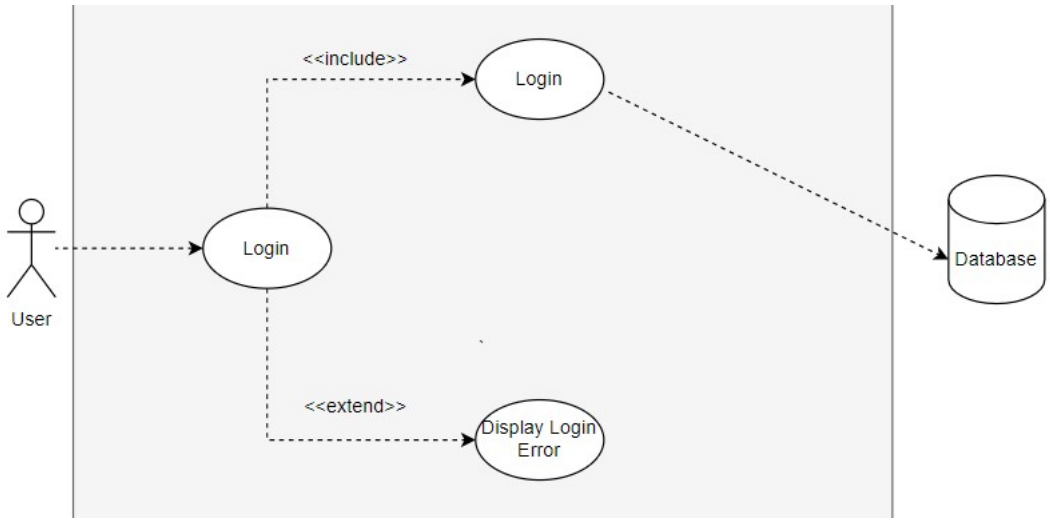


Figure 3.2: Use Case Diagram For Login

Table 3.3: Use Case Description for Logout

Use-Case Name	Logout
Description	This use case allows user to logout from platform.
Primary Actor	User
Pre-Condition	User must be logged in.
Post-Condition	Relevant page will be displayed to user

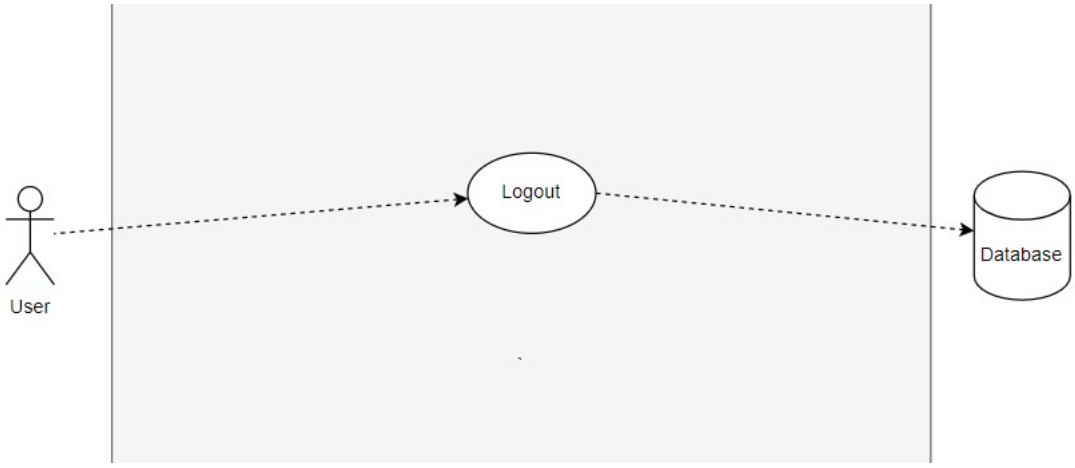


Figure 3.3: Use Case Diagram For Logout

Table 3.4: Use Case Description for Catalogues

Use-Case Name	Catalogues
Description	This use case allows user to see the catalogs of items available for sale on web platform.
Primary Actor	User
Pre-Condition	None
Post-Condition	Catalogs of items will be displayed to user

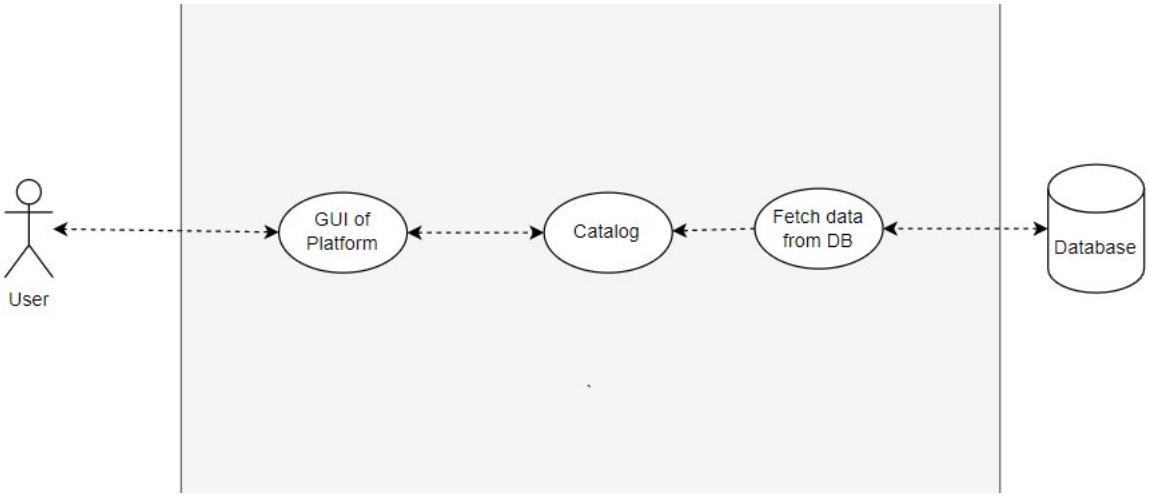


Figure 3.4: Use Case Diagram For Catalogues

Table 3.5: Use Case Description for Purchase

Use-Case Name	Purchase
Description	This use case allows user to see the catalogs of items available for sale on web platform and make the purchase of item available. To make Purchase user must be register on platform.
Primary Actor	User
Pre-Condition	Login to platform
Post-Condition	Items user purchased will be deducted from stock after user made the payment.

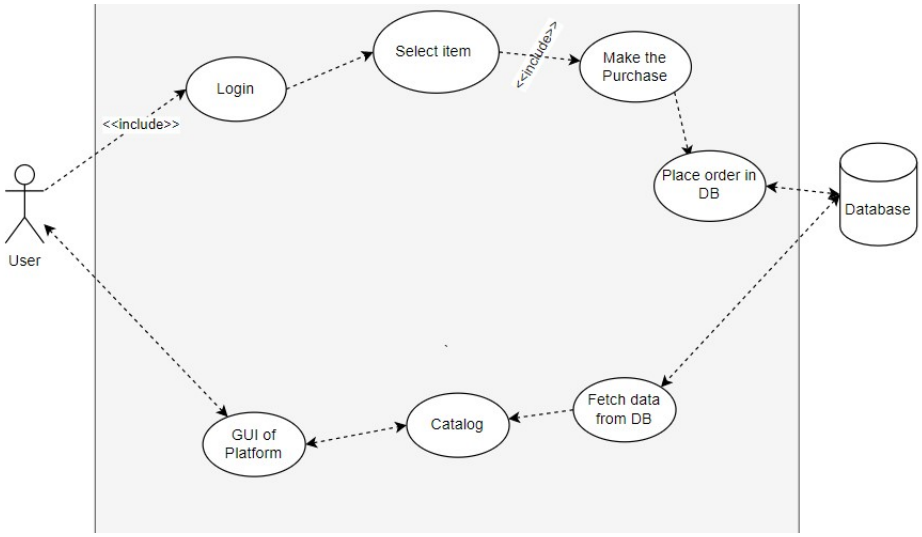


Figure 3.5: Use Case Diagram For Purchase

Table 3.6: Use Case Description for Customization

Use-Case Name	Customization
Description	This use case allows user to see the catalogs of items available for sale on web platform and user can select item from catalog and can make customization on item and purchase the customized Item.
Primary Actor	User
Pre-Condition	Login to platform
Post-Condition	User will be able to purchase the customized item.

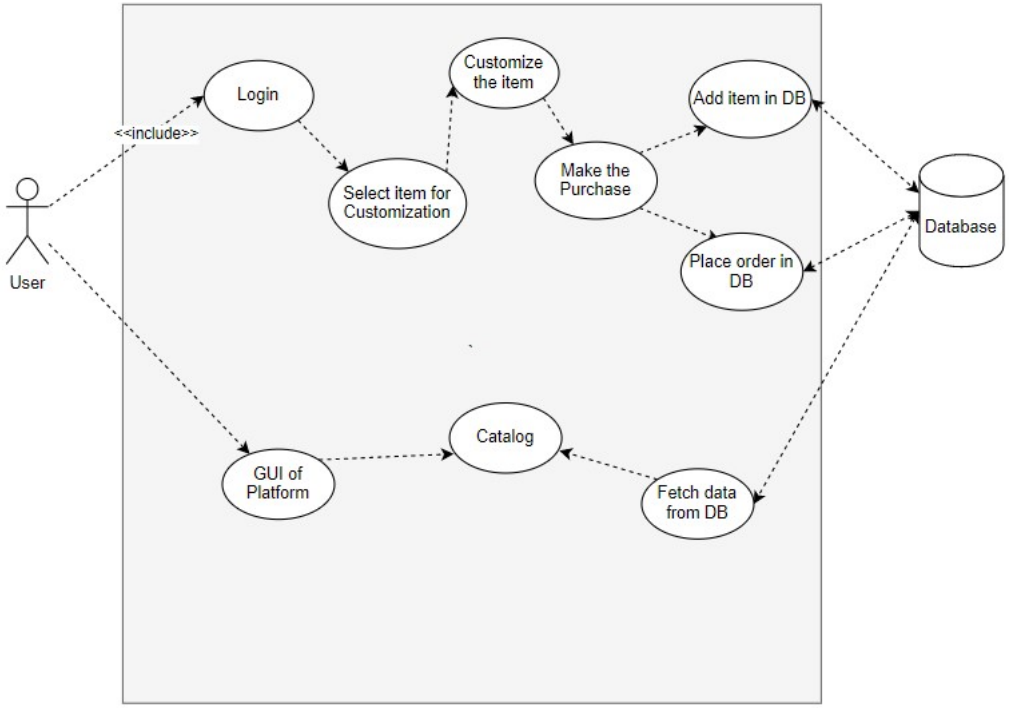


Figure 3.6: Use Case Diagram For Customization

Chapter 4

Design

Defining the architecture, components, modules, interfaces, and data of a system in order to meet certain criteria is known as the "Systems Design" process. The following parts are included in this chapter:

4.1 System Architecture

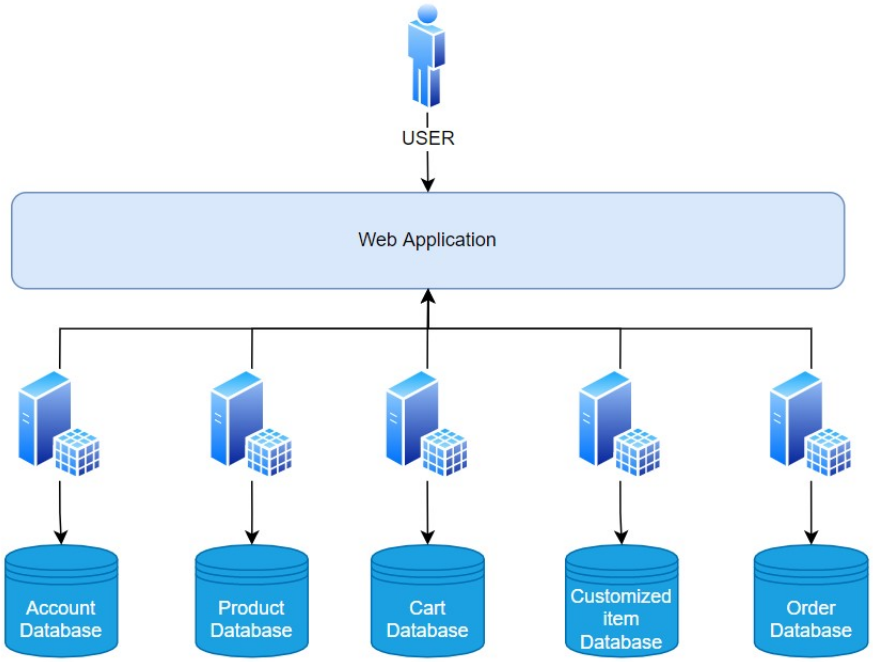


Figure 4.1: System Architecture Diagram

4.2 Design Constraints

This section discusses any limitations in the system design (such as resource usage vs productivity or conflicts with other systems) and any assumptions made throughout the process of establishing the system design.

4.3 Design Methodology

Agile software development model is being used for this platform.Platform is divided into modules, each module consists of different units which are needed to be incrementally developed. Agile model consists of these step:

- Planning
- Requirement Analysis
- Design
- Development
- Testing
- Evaluation

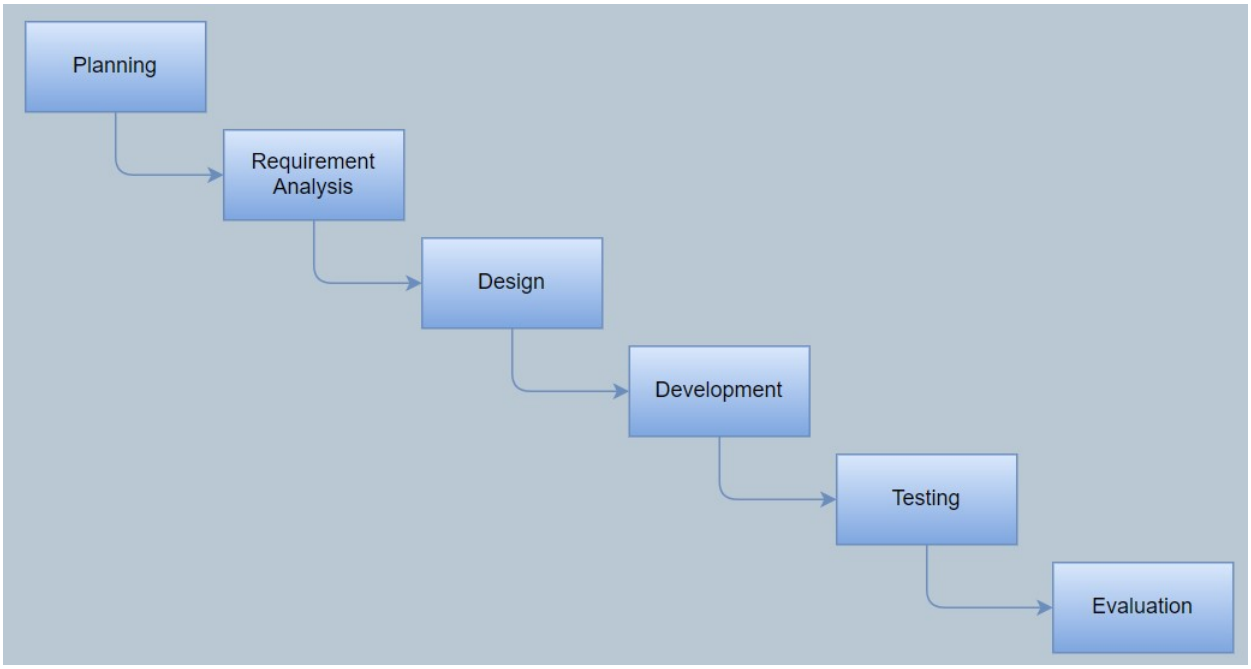


Figure 4.2: Agile Model Diagram

4.4 High Level Design

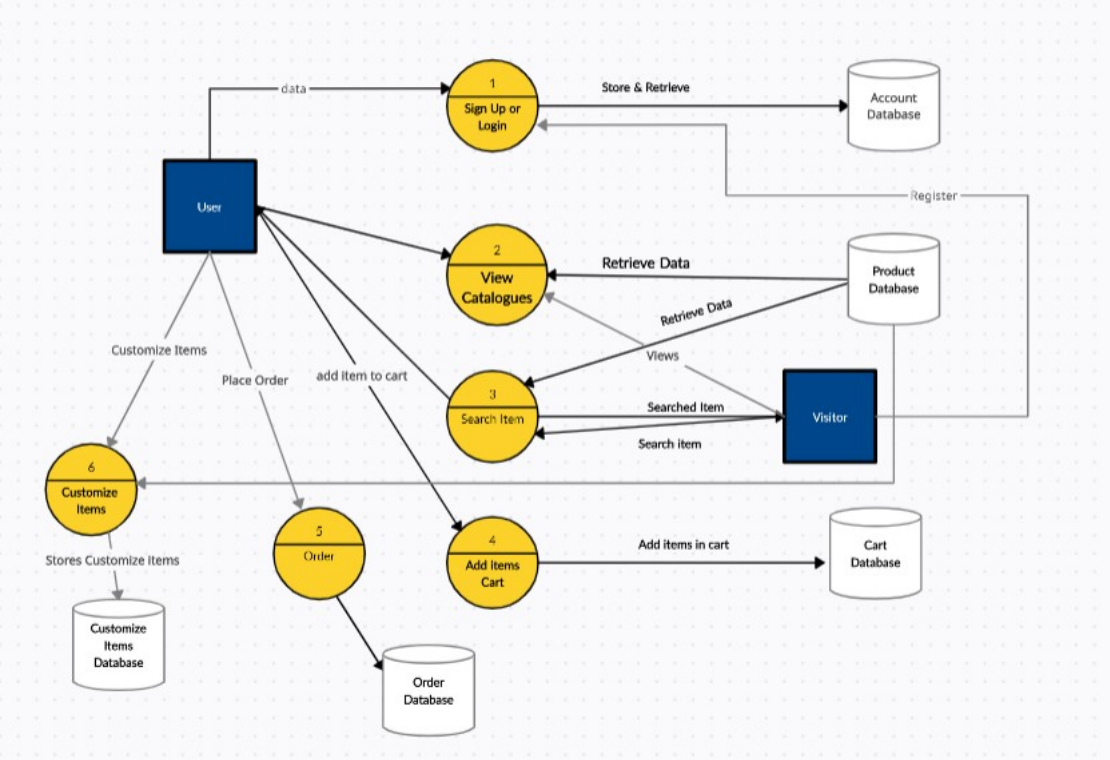


Figure 4.3: High level Design Diagram

4.5 Low Level Design

4.5.1 Sequence Diagrams

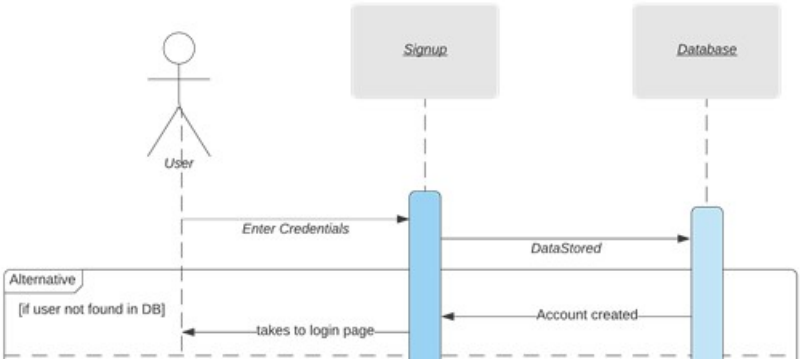


Figure 4.4: Sequence Diagram For Sign up

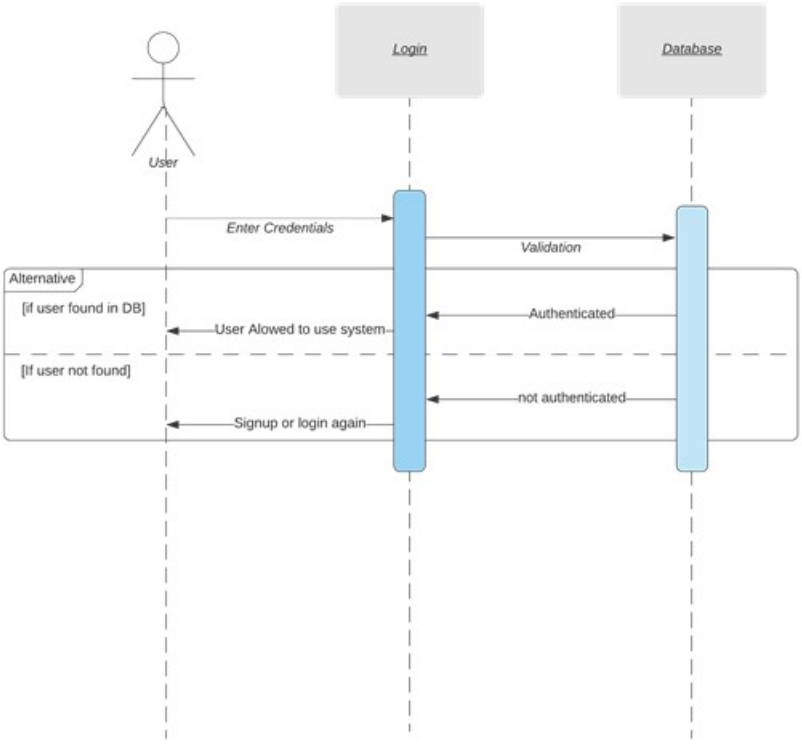


Figure 4.5: Sequence Diagram For Login

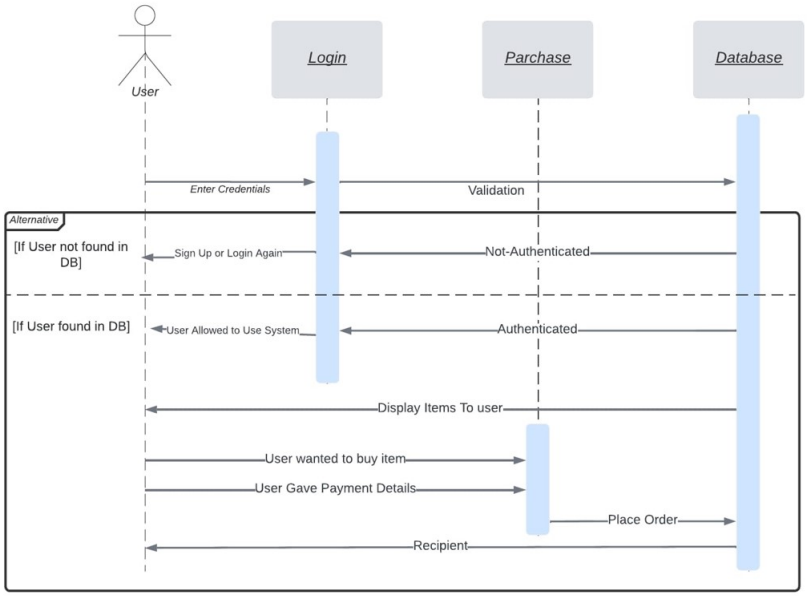


Figure 4.6: Sequence Diagram For Purchase

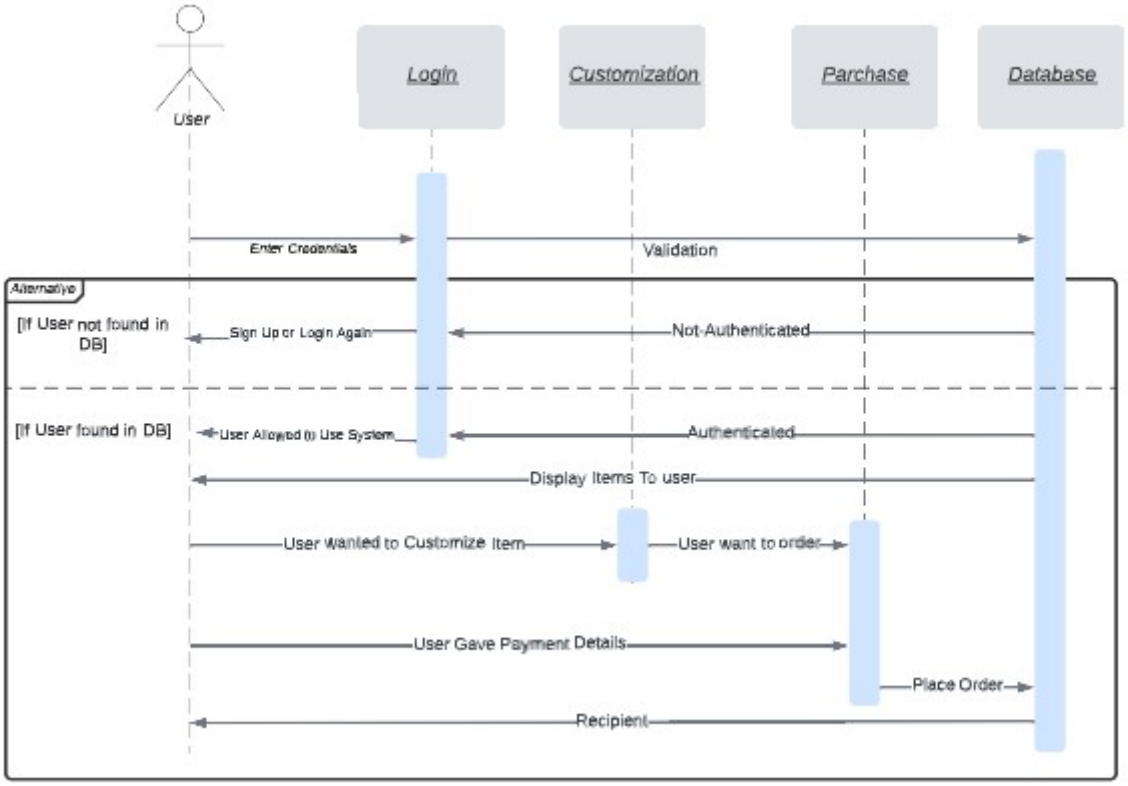
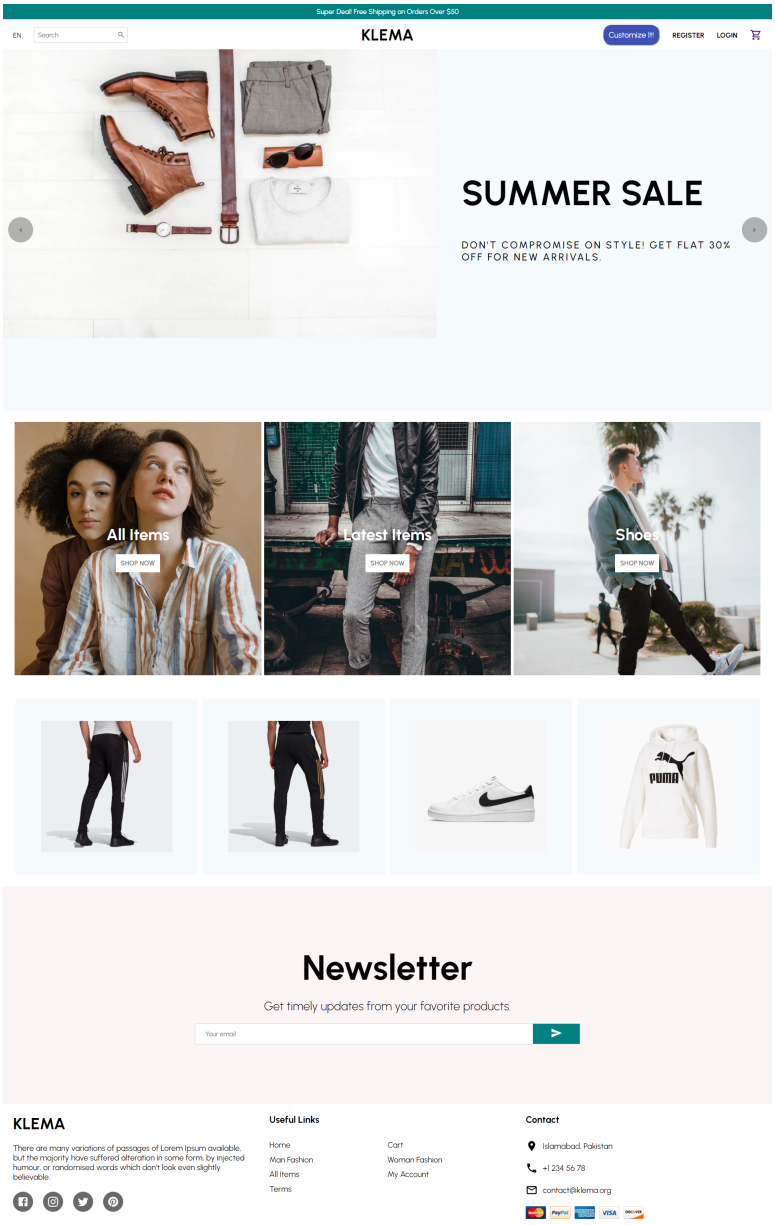
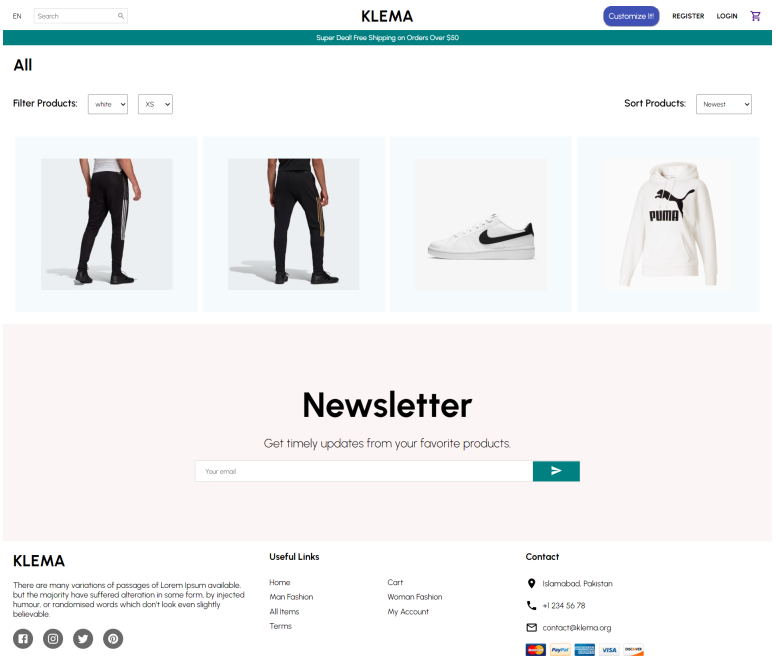


Figure 4.7: Sequence Diagram For Customization

4.6 GUI Design




EN
Search
KLEMA
Customize It!
REGISTER
LOGIN
Super Deal! Free Shipping on Orders Over $50
All
Filter Products:
white
XS
Sort Products:
Newest
Newsletter
Get timely updates from your favorite products.
Your email
KLEMA
There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don't look even slightly believable.
Useful Links
Home
Man Fashion
All Items
Terms
Cart
Woman Fashion
My Account
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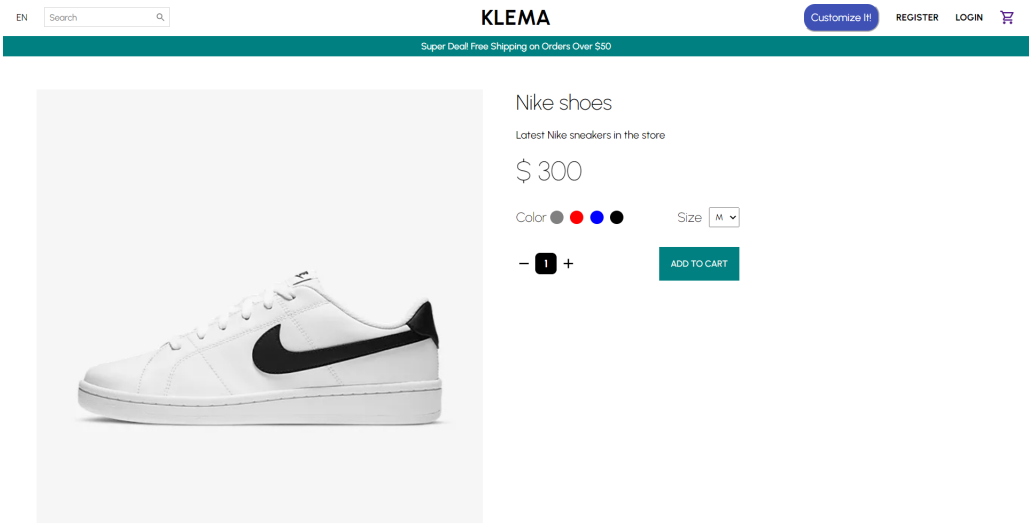
Islamabad, Pakistan
+1 234 56 78
contact@klema.org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KLEMA
Customize It!
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Super Deal! Free Shipping on Orders Over $50
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Latest Nike sneakers in the store
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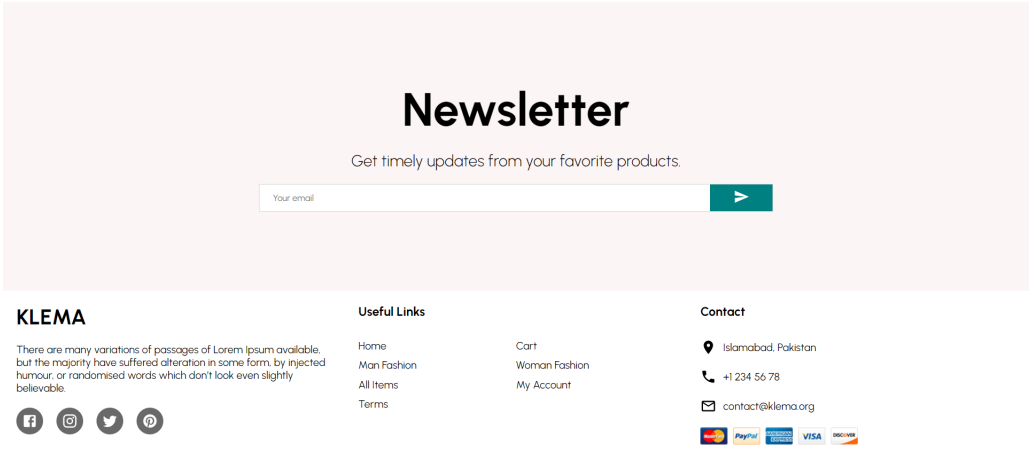
ADD TO CART


Newsletter
Get timely updates from your favorite products.
Your email
KLEMA
There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don't look even slightly believable.
Useful Links
Home
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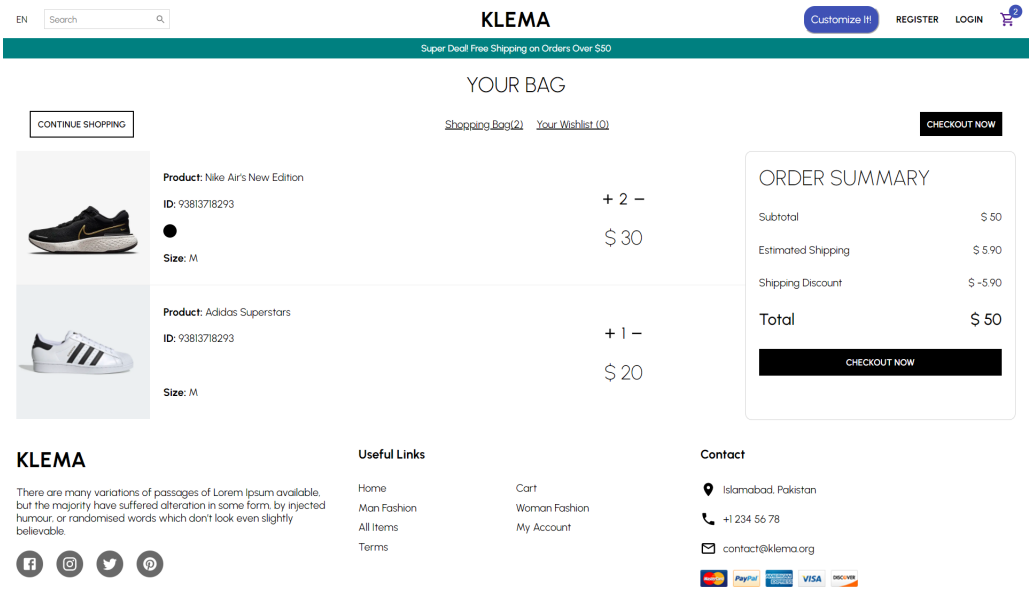
Islamabad, Pakistan
+1 234 56 78
contact@klema.org


EN
Search
KLEMA
Customize It!
REGISTER
LOGIN
Super Deal! Free Shipping on Orders Over $50
YOUR BAG
CONTINUE SHOPPING
Shopping Bag(2)
Your Wishlist (0)
CHECKOUT NOW
Product: Nike Air's New Edition
ID: 93813718293
Size: M
+ 2 −
$ 30
Product: Adidas Superstars
ID: 93813718293
Size: M
+ 1 −
$ 20
ORDER SUMMARY
Subtotal $ 50
Estimated Shipping $ 5.90
Shipping Discount $ -5.90
Total $ 50
CHECKOUT NOW
KLEMA
There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don't look even slightly believable.
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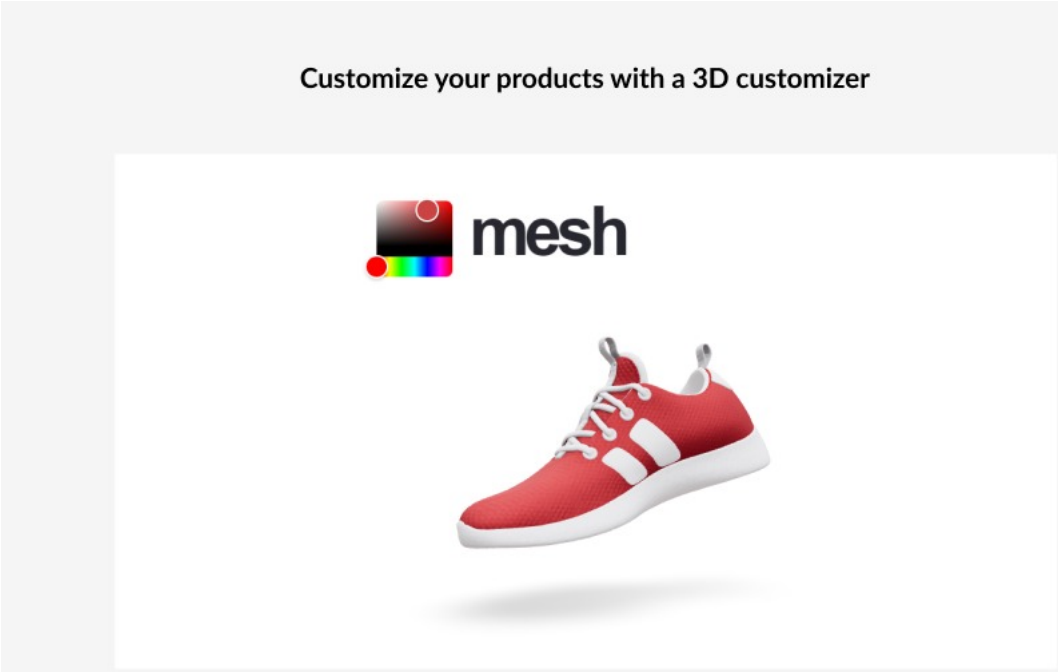
Customize your products with a 3D customizer
mesh

4.7 Database Design

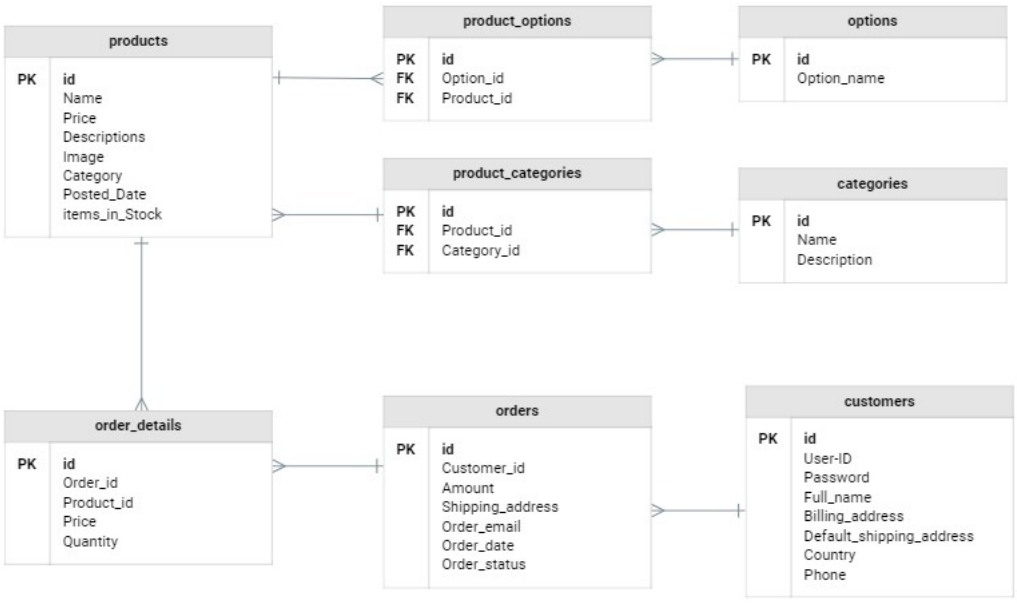

Figure 4.8: Entity Relation Diagram of Database Design

4.8 External Interfaces

The term external systems refers to any systems that are not part of the project being worked on. It's important to note that this system's electronic interfaces with other systems and/or subsystems will be discussed in this section.

Chapter 5

System Implementation

This chapter explains the platform's development process in detail. Other computer systems are also included, such as a technical specification, algorithm as a software program, and other components of software. This project's system implementation also includes a description of the tools and technologies employed. Here is the project's implementation plan.

5.1 Architecture and Component Integration

The 3D configuration items will integrate with the React Three Fiber.js library. The geometrical scene layout for the model will be integrated using the Three Fiber.js library and geometric sequence code. This is the main scene where the model will be displayed. A file extension with .glb extension is to be used product models. This will help to make any 3D model object convert into simple compressed file for the React framework, that can later be integrated into the project. This is the only way to integrate the models into the project. This does not mean that an individual needs to have any sort of special software or hardware requirements to view such products on the platform, as they will be rendered.

5.2 Tools/Technologies

The Merchandise with 3D configuration is developed on React.js. To make this project reusable and efficient and light weight several tool, techniques and libraries of java script have been used.

The list is as followed:

- Vs code

- React.js
- Node.js
- NPM Package Installer
- Fiber Three.js
- Redux Toolkit
- MongoDB Database
- Browser
- Postman API Tester
- Stripe Payment Method
- Blender

5.2.1 React.js

The front-end JavaScript library React.js is the most widely used for creating Web apps. Developed by Facebook, React.js is a free and open source JavaScript toolkit for creating single-page web apps. In online and mobile app development, it's utilised to handle the view-layer management. User Interface components may also be created using React. Because of it's simplicity, testablity, performance and the data binding effectiveness helped and convinced to make this project on React.js. As it is also compatible with the core libraries of the java script, making it a lot easier to integrate multiple libraries in a single project.

5.2.2 React Redux-Toolkit

Using "actions", which are events, Redux is a paradigm and framework for keeping and updating an application's state. Your application's state is maintained in a single location, with rules ensuring that the information may only be changed in a predictable way. As a result, it's simple to see when, why, and how the platform's state changes, and how the logic reacts to those changes, thanks to Redux's patterns and capabilities. Redux promotes the platform to perform as intended.. In this case, Redux came in handy since it helped manage the enormous quantities of platform state that were required in several locations across the app due to the platform's many complicated queries and features that needed to be connected. Over time, the platform is often modified. In terms of constructing Redux logic, Redux-toolkit is the most popular way, since it offers packages and functions that are regarded to be required for building a React Redux project. With this toolkit, most

Redux jobs are simplified, frequent coding errors are avoided, and the platform is simpler to use for administrators as well as end users.

5.2.3 Model Integration

Three.js is a library that makes it easier to create 3D graphics int he browser or your project, it uses a canvas and a WebGL pack to display the 3D models and animations. React three fiber.js is a React renderer for three.js on the web , it is a boost to the speed at which a 3D model(s) and animations were created. It is very efficient as it allowed to make the platform's components reusable, reduced time spent on binding events and rendering loops. Allowed the components to be build upon hooks and props.

Once the library is set, a 3D model was created using Blender 3D tool for creating a 3D model. This realistic model was then rendered layer after layer so it could easily be integrated into the project and rendered. After the rendered model is completed a .gltfx extension file is then compressed into a .glb file using the dracon compression method of the three fiber.js library. A high quality image is to be used in order to keep it's rendered layers intact. Without proper compression method and file extension, the model would not work. Once the integration is made after that came the part to make the 3D model become realistic through a virtual scene environment. This was set up by using complex geometrical functions that enabled it to work in a realistic scene like 3D environment. The 3D model could be seen and used by every angle in 360 degrees. Furthermore, with the help of a color picker created for the 3D model the user is able to customize the product as they wish and place an order.

5.2.4 Stripe payment method

Numerous businesses all across the globe depend on Stripe, a multi-billion dollar global internet payment processor. In order to accept online credit card payments and deposit the funds straight into one's bank account, one may use Stripe. Because Stripe fulfils the strictest security requirements, it is safe to use Each and every transaction is secured by an SSL (Security Socket Layer). During the payment processing, all of your information, as well as the information of your contributors, is delivered securely. In terms of payment processing security, Stripe has achieved PCI Service Provider Level 1, the highest level possible. Your contributors' personal information is safe and secure, so you can rest easy. Stripe's state-of-the-art data centre securely stores all encrypted payment card details. Donor data is safeguarded in this way because of its security and integrity. As this is a prototype, it was necessary to utilise Stripe on various platforms for testing. Stripe's interoperability with the project and its security features were tested using a test account.

5.2.5 MongoDB Database

Internet applications built using MongoDB are extremely available and scalable. It's a popular choice for agile development teams because of its flexible schema approach. You don't have to waste time setting up a database while using MongoDB, which has drivers for almost every major programming language.

5.2.6 Postman API

Postman is an API testing tool that was used to verify the platform's REST API's functionality, sustainability, and compatibility with the MongoDB database. Using a graphical user interface, it acts as an HTTP client and generates a variety of response kinds that can then be tested. Collections and the development of environments using a user-friendly graphical interface are included in the latter category. With Agile practises in mind, Postman can help speed up testing.

5.2.7 Blender

Free and open source 3D computer graphics program, Blender is used to create animated films, visual effects, art, 3D-printed models; motion graphics; interactive 3D apps; virtual reality; and, a few years back in the past, games. 3D models for this project were created using Blender. Layer by layer, each scene was produced before the model as a whole was reconstructed to make sure it worked properly.

5.3 System Work Flow

This project works on the simply methodology of interaction with daily use of web application. Users will be able to use it over the internet just as they use regular websites.

The project works as follows:

1. User visits the website.
2. Given two options, whether to register, login or free roam on the website to check it out.
3. On the landing page user gets to see the eye-catchy view and general information of the website such as latest announcements, promotions, merchandise etc.
4. Also get the option to directly go on the product customization page to customize the 3D model.
5. Rather they could also opt to scroll through the regular articles shown on the website.If they choose not to go for the customization portion.

6. After selecting the product(s) they would go to the checkout page.
7. From there they would be prompted to login or register if they have not done it already.
8. After the checkout they will be guided to the payment page where they would fill up the payment form and upon successful completion an order completion page would be shown.
9. All the data would be stored in the database at the admin panel. Admin panel would contain order details revenue generated, charts etc.
10. At admin panel, admin is enable to add, delete, modify user details, order details.
11. Same process will be ensured for the 3D customized product, that will be confirmed and ordered by the user.

application

Chapter 6

System Testing and Evaluation

In this chapter we have tested and evaluated the project. Before finally delivering the project, it should be passed through critical assessment, as it reveals its deficiencies, which as a result guarantees the quality of the project. Evaluation and testing of the project perform a vital role in identifying its strengths and weakness. To evaluate this project's compliance with the requirements which were conducted in system testing. For this purpose, different testing techniques were applied on the web platform. As every project has some limitations, to explore them some test cases were applied on the project as well. Meticulous software testing ensures the reliability, robustness, and high performance of the software operations. The following testing techniques were applied on the project.

6.1 Graphical User Interface Testing

Evaluate the design and functionality of the web platform. The GUI should be easy to understand and use as well as it should work properly. The intended functionality of each control on the screen should execute properly. In this web platform all the controls work properly. It properly represents the purpose of the buttons graphically and textually. The font used is readable and the pictures used are clear, properly aligned the icons as well. Used the right size and color for the buttons, so that user can click the desired button without any problem. Made it simpler for the user to try the product on virtually, by avoiding complicated nested menus and clearly representing the purpose of the controls. It was assured that the web platform can easily be used by anyone of any age.

6.2 Usability Testing

For testing the usability of the platform, the actual user of the platform is required to perform a task. This is a method which is used to analyses whether the user completes the required task quickly and easily without getting confused. By usability testing it can be evaluated:

- That how much time is required by the web platform to perform a specific task.
- Whether the web platform is correctly performing the task it is intended to.
- Whether the user is satisfied with the output
- Whether the user can easily do the task

For testing the usability of the web platform is evaluated by the intended target audience, these users tried different products through the web platform and it was observed that how user-friendly this platform is.

- **Easy to Use:** The web platform is easy to understand and use, as clear information about functionality is displayed on each control which makes it easy for the user to accomplish the task. Moreover, the platform can be used by everyone even with minimal technical knowledge without guidance. The platform has no waiting time.
- **User experience:** It is essential for a platform to provide its users a pleasant user experience. If you want your user to get an amazing experience when using the platform or an application, you should use eye catchy colors and the graphics, which should give impressive look and feel of the platform along with their actual meaning.
- **Easy to understand:** It was preferred using graphical items on the web platform to represent the functionality of the control, which makes it easier for the user to understand and use it, as the success of the software immensely depends on how the platform interacts with the user.

6.3 Software Performance Testing

Performance testing is the testing used to examine the performance the platform under various workloads. Performance testing basically measures the scalability, reliability, resource usage, stability, and speed of the platform. the only time required by the platform is when it is configuring the 3D model on the web page. Th platform has minimum response time which in return lessens the wait time. It loads fast. It requires less CPU and memory usage on the device it is installed. It requires the following to execute properly:

- A PC or laptop

- Minimum RAM and Processor requirements
- An internet connection

6.4 Compatibility Testing

Compatibility testing is the testing used to examine compatibility of the platform with other devices i.e., the devices on which the platform will be running and used. It basically determines which kind of hardware, software and operating system does the software requires to execute. If the system does not support any well known browser with the developer option it might struggle to work with proper functionality. The tasks that platform will perform are listed below:

- Access the product catalogues.
- Select a product.
- Customize a product model as per their choice.
- Selected product variation will be stored in the database as a complete order with all the details.
- Place order.
- Get payment details.
- Prompt the user upon successful completion of order.

6.5 Exception Handling

To examine whether the platform responds when an exception occurs. Exception handling was done on the platform to make the interaction of the user and the platform smooth. For example in the areas where user is required to add some input, and if the user do not add any input an error dialog box, guiding the user, pops up, which helps the user without confusing the user. Overall, there are less chances of error occurrence in our platform, therefore exception handling was not required excessively.

6.6 Load Testing

Load testing comes under performance testing, it is a non-functional type of testing. It is used to examine how the platform will perform under different kinds of loads. It is used to determine the capacity and speed of the platform. The platform was tested by using it

simultaneously on three to four devices and it works fine, did not notice any scalability issues The platform handled the load of user without increasing the response time. It is important to remove any bottlenecks from the system and increase its reliability.

6.7 Security Testing

This is most important kind of testing and is used to find the vulnerabilities in the system. Security testing is mainly required for the web platforms or applications which have confidential data of the user and in our case our platform does not-contain any kind of confidential data of the user.

6.8 Installation testing

Installation testing is applied to test whether the platform has installed successfully in all the devices, with all the features and to determine whether the platform works as it is expected to work. The preconditions which are required to install the software requires a storage, a device with Windows or Mac operating system, along with Node.js and NPM package installer. Platform was tested by installing it in various systems, the platform is installed and executed successfully after the above conditions are fulfilled.

6.9 Test Cases

All the functions were tested and these test cases show the results of web platform testing.

6.9.1 Test Case 1 : Create Account

When the user visit the web platform for the first time. It allow help user to create account of the platform. Below table 6.1 and 6.2 shows the results of the test.

Table 6.1: Test Case : 1 Create Account

Test Case	1
Function to be tested	Create the user
Initial state	User visit to the web platform for the first time and create his account on platform
Input	User input the username and password
Expected Output	Account should be created and login page should show
Output	Account is created and login page is shown
Status	Pass

Table 6.2: Test Case : 2 Create Account

Test Case	2
Function to be tested	Create the user
Initial state	User visit to the web platform for the first time and create his account on platform
Input	User input the username and password
Expected Output	Account should be created and login page should show
Output	Account not created and user asked to register himself again
Status	Fail

6.9.2 Test Case 3 : Login

When the user enter user name and password. It will allow user to access the functionality of platform fully. Below table 6.3 and 6.4 shows the test result

Table 6.3: Test Case : 3 Logged in User

Test Case	3
Function to be tested	Login
Initial state	User visit the web platform and login page appears
Input	User input the login credentials
Expected Output	User should be directed to the homepage.
Output	User has logged in and homepage is show
Status	Pass

Table 6.4: Test Case : 4 Logged in User

Test Case	4
Function to be tested	Login
Initial state	User visit the web platform and login page appears
Input	User input the login credentials
Expected Output	User should be directed to the homepage.
Output	User failed to logged in and asked to enter credentials again
Status	Fail

6.9.3 Test Case 5 : Cart

When the user add the product cart . That product will be added to User cart and the bill according to the amount the product in cart will be showed at cart page. Below table 6.5 and 6.6 shows the test result

Table 6.5: Test Case : 5 Cart

Test Case	5
Function to be tested	Cart
Initial state	User add the click add to cart on the product display page
Input	User select the product and quantity of product
Expected Output	Product will be added to cart and amount of order bill will be showed based on price and quantity of product
Output	Product added to cart and amount of bill displayed
Status	Pass

Table 6.6: Test Case : 6 Cart

Test Case	6
Function to be tested	Cart
Initial state	User add the click add to cart on the product display page
Input	User select the product and quantity of product
Expected Output	Product will be added to cart and amount of order bill will be showed based on price and quantity of product
Output	Product is not added to Cart
Status	Fail

6.9.4 Test Case 7 : Customization Tool

When the user click on customize the product product the customization tool will be displayed of that product . Below table 6.7 and 6.8 shows the test result

Table 6.7: Test Case : 7 Customization Tool

Test Case	7
Function to be tested	Customization Tool
Initial state	User click the customize button on product
Input	User click the customize the product button
Expected Output	Page for product Customization will be displayed to user
Output	Customization page displayed to user
Status	Pass

Table 6.8: Test Case : 8 Customization Tool

Test Case	8
Function to be tested	Customization Tool
Initial state	User click the customize button on product
Input	User click the customize the product button
Expected Output	Page for product Customization will be displayed to user
Output	Customization page doesn't displayed to user
Status	Fail

6.9.5 Test Case 9 : Payment

When the user click to pay in the cart page payment form will be displayed to user and it will authenticate the card information and proceed the payment. Below table 6.9 and 6.10 shows the test result

Table 6.9: Test Case : 9 Payment

Test Case	9
Function to be tested	Payment
Initial state	User click the Pay button in cart page
Input	user give to information of his/her bank card
Expected Output	Error will be displayed if user enter wrong information or Proceed the payment if bank card information is valid
Output	Payment made Successfully
Status	Pass

Table 6.10: Test Case : 10 Payment

Test Case	10
Function to be tested	Payment
Initial state	User click the Pay button in cart page
Input	user give to information of his/her bank card
Expected Output	Error will be displayed if user enter wrong information or Proceed the payment if bank card information is valid
Output	Payment Failed
Status	Fail

Chapter 7

Conclusions

7.1 Introduction

Using 3D virtualization, configuration of products/models, difficulties encountered during the project's development, and future plans to enhance 3D configuration stores will be described in this chapter.

7.2 Project Contribution

Web platform 'Merchandise Store with 3D Configuration' has successfully met its goals of creating a design platform that will help increase the awareness of diverse businesses. In addition, interactive apps will be developed for a number of additional platforms so that consumers may conduct surveys of their own stuff from the comfort of their own homes or from anywhere else. Using an interactive approach, this online platform creates apps for clients.

The goals and scope of the project are clearly stated from the outset. Then, the project implementation's tasks and timetable were meticulously planned to prevent a project delay issue, if necessary. The web platform interfaces were designed and built next, once the project requirements were gathered. To ensure that everything worked to its full potential, the last stages of development focused on fine-tuning all of the interfaces. This web platform was thoroughly tested after the end of the project's development and installation. Due to a shortage of buyer time, this online platform helps to solve some of the problems related to the lack of visual appeal in a product, such as the absence of information about the product's model or a picture of it. For example, a user may purchase a pair of shoes from the comfort of their own home by contacting the business. It was concluded that the project's goals and objectives had been accomplished and exceeded in their entirety.

7.3 Problems and Limitation

Limitations must be imposed in order for a program or online platform to function properly. Only a few issues have been discovered throughout the process of achieving the goals and targets.The problem occurs during the development of the web platform as the followings:

1. Since the web platform is an internet based platform, user cannot access it without any internet connection.
2. Since the product models are in a virtual environment on your system some users might find it tricky to use it but it has been kept as simple as possible by doing user experience research.
3. Lacking knowledge in this field also made the project development very difficult since the tutorials and learning material for the method is limited.
4. Adding more models to the platform without enough knowledge of the technology will prove to be very hard.

7.4 Conclusion

Merchandise Store with 3D Configuration focuses on helping the users to easily buy a product(s) at home while looking and customizing the 3D visual object, but also focuses on improving the ROI of the web platform owner.

Web platforms may be expanded into more robust systems that allow offline usage, thus enhancing the brand name of a firm that is preparing to enter the 4th industrial revolution. Finally, the creators have reason to believe that their online platform will find a home in the commercial world and provide a satisfying user experience. Consequently, the online platform can provide customers the best option or proposal while allowing them to provide input for future platform improvements.

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