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TECHNOLOGY PARK MALAYSIA
CT049-6-3- PRJ

Final Year Project
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Abstract

The article discusses the increasing popularity of e-commerce during the Covid-19 pandemic and its benefits such as wider product range, convenience, and free shipping. Also highlights the issues face by the e-commerce company as well as customers. The inability to see and feel the products before purchasing them, leading to a high rate of product returns are major problems faced by e-commerce users as well as service providers. So, this article state that this problem can be solved by the use of augmented reality (AR) technology in e-commerce applications and illustrated the potential benefits of AR in e-commerce industry, including increased customer engagement, accurate product information, and a more immersive shopping experience. So, the article presents a project that aims to develop an AR-based e-commerce application that will provide an interactive and immersive shopping experience to customers, including a try-on feature. The objectives are to increase customer engagement and satisfaction, minimise return rate, and reduce hygiene issues. The core function of the application includes user registration, login, product catalog, reviews and ratings, and the try-on feature. There are various issues that are faced while carrying out the project which includes limited time, availability of data, and limited research on AR in e-commerce. The technical research for developing a web-based e-commerce application with augmented reality technology embedded in it has been carried out. So, the chosen programming languages are C# for the backend and Python to integrate AR if possible, with HTML, CSS, Bootstrap, and JavaScript for front-end development. The Agile methodology is chosen for system development due to its flexibility and iterative approach. The article concludes by discussing in the future enhancement that will be carried out in the project which include use of AR technology in e-commerce which provide the ability to virtually try on clothes. In addition, additional feature where customer can negotiate prices which will make the platform more interactive which might result in enhancing customer engagement.

Key Words: E-commerce, Augmented Reality, 3D Model, Flexible, Availability

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Use of AR in e-commerce

1. Introduction

In the era of digitalisation, there is no denying that majority of the people around the globe prefer to buy product or services via online. The main reason behind it is, buying product via online is easy and convenient and people are able to buy necessary stuffs from anywhere without visiting the brick-and-mortar stores with one click. It not only saves their time but also help them financially because instead of wasting their time and money while visiting physical stores they can utilise that on another important work. Moreover, on internet people have more choice and Currently, the online shopping is termed as e-commerce.

E-commerce also known as internet commerce refers to the process of purchasing and selling product and services via internet (Lutkevich, Chai, & Holak, 2022). Use of e-commerce has significantly rise due to the out break of covid-19 pandemic as people are relied more digital technology due to the restriction made by government to visit the stores physically. According to the statistics use of e-commerce has increased by 19% due to the outbreak of Covid-19 in 2020 (Statista. (2022). Latest research shows that around \$791.70 billion was spent by consumers on e-commerce in 2020. People are seems to be shift towards the use of e-commerce as it saves time and money. There are various offers that e-commerce company provide to the consumers but the main reason people prefer to via product via online stores is free shipping facility

The concept of online shopping was first introduced in 1979 by Michael Aldrich which was later named as e-commerce. Later on in 1995 Amazon was launched as a book selling platform which has currently become of the best e-commerce platform all over the world. By the innovation of Paypal in 1998 provide customer the flexibility to pay money online (Thomas, 2021). Currently due to the introduction of AI technology such as voice assistant, chatbots in online shopping platform it has even increased the customers engagement as it enhance customer experience by allowing people to search products easily. In addition to this the AI chatbot helps customers to make their purchasing decisions. Even e-commerce has also reduces the investment that need to be done while doing business compared to brick-and-mortar store and even provide the access to the customer world wide (Thomas, 2021).

Similarly, if we speak about the Augmented Reality it seems to be complicated and expensive so what exactly is augmented reality let me elaborate it. Augmented reality (AR) technology allows

users to view and interact with digital content in the context of the real world. It was first introduced in 1968 by a computer scientist Ivan Sutherland. Later on with the advancement of information technology augmented reality also get further advancement. In 1990 US Air Force used AR to train aircraft maintenance technicians. Currently, this technology has been applied to a wide range of industries, including e-commerce. Let me just give an example of the use of augmented reality in todays world. Currently various social media are seems to be utilising augmented reality such as snap chat, instagram and Facebook. Currently, AR technology has become more widely available and is used in a variety of applications, including education, entertainment, and marketing. In 2016, the AR game "Pokemon Go" becomes a global phenomenon (The Pokemon Company, 2016), introducing AR to a wider audience.

So the use of this technology could really help e-commerce sector to get new height of success in the business sector by allowing users to virtually try on products, visualize how products would look in their homes or offices, or access additional product information in a more interactive and immersive way which help them to chose the right product for them. Some potential benefits of an AR based e-commerce application include increased customer engagement, the ability to provide more detailed and accurate product information, and the potential to drive sales by making the shopping experience more immersive and enjoyable. As a result it helps to reduce the product return rate as well.

This article is also mainly focused on developing e-commerce application which provide the services of buying product and services through internet. It is web based application so to utilise its services ones must have an access to the internet connection in their smart phones or computing devices. To complete purchase customer need to add product in shopping cart and check out. This application also includes database which stores all the information related to product and customers. It is used to populate the website and process orders. There are two sides in this application, that is user and server side. User side of this application includes the User interface design where as server side includes complete working mechanism of the application. To design user side program in web based application HTML, CSS and Bootstrap is used where as to code server side various programming languages are used such as java, c sharp, php and python and many more. Similarly there are two type of users, one is customer who has got limited access to the functionalities where as another is admin who has got complete control over the application. Admin is able to add, delete and update products where as customer are

able to view product details and made a purchase. First of all, to carry out the activities customer need to register into the system with username and password along with their other basic details. Then he/she needs to log into the system which will allow them to buy products. Buying is only successful only after the checkout which can be done by doing payment using electronic wallets. There are various online shopping platform which currently serving people such as Amazon, Walmart, Alibaba, Daraz and many more.

1.1. Problem Statement

Although by the advancement of information technology e-commerce has also significantly developed over the few years but there are certain problems that e-commerce company and customer are encountering when using online shopping platform. Despite the convenience of shopping online, many customers have had negative experiences with e-commerce due to issues with the quality or condition of the products they receive. These problems can range from incorrect or defective items, to products that do not match the description or image provided on the website. This has led to customer dissatisfaction and may discourage them from using e-commerce platforms in the future. This is because, in online shopping platform customer are unable to feel the product where as in brick and mortar stores customer are able to try on the cloth, feel the fabric and view whether it suits and fit them or not. Hence, they are not able to pick the suitable product for them. So, during the covid1-19 period as well people choose physical stores to buy product rather than online stores by putting their lives on risk as they believe that product they buy through online stores are totally different than they appear on the e-commerce site. In addition to this, although there are the facilities of returning the product customer finds difficulties while returning the product as most often customer are unclear or confused about the return policies. Moreover, customers have to wait a long time for their refund to be processed, which is frustrating to them. Even me when I buy product via online stores and need to return the product I feel frustrated as I have to go through various steps to return the product. Not only this but also once I had to pay extra charges for returning the item and waited for more than two weeks to get my cash back. So, majority of people think that buying stuffs from online store is just waste of time and money. So, the use of augmented reality could really solve these issues in near future.

1.2. Rationale

E-commerce is a key industry that is constantly evolving and adapting to new technologies, and AR is one of the most promising technologies for enhancing the online shopping experience. This application is beneficial for both customer as well as business. For customer, augmented reality helps to create an interactive application. It allows users to virtually preview the product in their own environment and helps them to make correct decision before buying the product. For organisation, it can increase the revenue as it help them to enhance the customer engagement and increase in sales. In addition to this, as AR helps customer to make informed purchasing decision which results in reducing the return rate. Hence, it helps them to minimises the extra cost needed for repacking and shipping.

1.3. Potential Benefits

The use of augmented reality (AR) technology has the potential to completely transform the e-commerce sector by improving both the productivity of businesses and the online purchasing experience for consumers. Here are some concrete and abstract advantages of applying augmented reality to e-commerce applications:

1.3.1. Tangible benefits

- It allows customers to view the product in real world environment and make better decision before purchasing a product which leads towards the increment of customer satisfaction and decrement in return rate.
- Enhanced product demonstrations: AR can be used to show customers how a product functions or how to utilise it, which can be particularly helpful for complex or technical products.
- Increased sales: By providing customers with a more immersive shopping experience, firms may enjoy sales growth.

1.3.2. Intangible benefits

- Customer engagement: AR can make the online shopping experience more interactive and engaging, which can lead to increased customer loyalty.
- Increased brand awareness: AR can be used to create unique and memorable brand experiences, which can boost client loyalty.
- Improved customer experience: By providing customers with a more personalised and interactive shopping experience, businesses can improve overall customer satisfaction and loyalty.
- Competitive advantage: By using AR, businesses can set themselves apart from their rivals and stand out in a crowded market.

Overall, the usage of AR in e-commerce applications can provide both tangible and intangible benefits for businesses and customers alike. By enhancing the online shopping experience, increasing sales, and improving efficiency, AR has the potential to revolutionise the e-commerce industry.

1.4. Target Users

The target audience of this application are consumers who enjoy the convenience of being able to shop from the comfort of their own home, but who also want a more immersive and interactive shopping experience. Those who are interested in exploring the latest technology and trying out new ways to shop online.

1.5. Aim and Objectives

The main aim of this project is to motivate customer to use online shopping platform by providing better product experience as AR makes e-commerce application interactive and immersive.

The main objective of this project are:

1. To uplift the rate of customer engagement in online shopping platform by introducing augmented reality technology.
2. To gain customer trust and improve customer satisfaction and minimise return rate which help service provider financially by reducing shipping, restocking and repacking cost.
3. To develop an online shopping software with try on feature which enable people to virtually try on the products and helps in making right decision while buying products.
4. To reduce the hygiene issues as climate, germs and social distancing is one of the main concern in todays generation.

1.6. Deliverables

Augmented reality (AR)-based e-commerce applications are online shopping platforms that use AR technology to enhance the shopping experience for customers. With an AR-based e-commerce application, customers can use their smartphone or other device to see how a product would look in their home or on them before making a purchase. The application that I am going to build will help people to virtually try on the spectacles. For instance, if a customer is willing to buy a spectacles and there are variety of options but customer is unable to choose suitable one between them. Since, it is online platform customer will not be able to try those glasses physically and choose the one which looks good at them. So, implementation of AR technology could really help them to overcome such issues because they will be able to try on the glasses virtually through their smart phone camera. As soon as, customer choose the glass from the catalog it will appear on their face which can only be viewed on smart phone and they can make decision accordingly. Not only customer but also it will definitely help online retail company indirectly as it minimises the product return rate.

The core function of our e-commerce application are:

- Users are able to register into the system by providing the detail information .
- Users can login using username and password which they have registered previously.
- Those user with admin role will be able to view customer list, add , update and delete product.
- Customer can add reviews after buying products and provide the rating according to their satisfaction.
- Customer are able to try on the chosen product virtually with the help of their smart phone camera

1.7. Nature of Challenges

Developing a completely working project is a challenging task, and doing research before starting the project can create even more challenges. Developing AR application requires a strong understanding of AR technology and how to integrate it in functional application. During the research of the study one of the first issues that I have faced is during the technical research as I had to spend time researching the best tools and programming language for the development of my project. As student, I had limited time because as I skip preparation time which later on hit me hard and make me difficult to manage time. Also, I have other classes and assignments to complete in addition to this project, which make me difficult to balance time for academic work with the project. Another major challenge that occurs during the project was limited availability of the data, as AR technology is still relatively new to the people as most of the people are unfamiliar with it. This can make the data collected through surveys or questionnaires unreliable. Additionally, there is limited research available on the use of AR in e-commerce, which made it difficult for me to conduct a literature review on the topic.

1.8. Overview of this investigation report

An investigation report is a document that presents the findings of a research or investigation project.[Ossian, 2022]. The overview of each of the topic included in this report are briefly described below:

Introduction: This part of the report includes the topic of investigation and introduction of e-commerce and augmented reality along with their history. In addition to this, this part of the report also include other sub topic such as problem statement, aims and objectives, rational, and deliverable. Problem statement present a clear and concise statement of the problem or issue that the investigation is addressing. Aims and objectives outline the specific goals or objectives of the investigation, including what the researchers hope to achieve or learn through the study. Similarly, deliverable describes the main products or outcomes that the investigation is expected to produce.

Literature review: This section summarises the existing research and knowledge on the topic of the investigation, highlighting any relevant theories, studies, or findings related to the topic.

Technical Research: This section includes the programming languages, IDEs and operating system that I have chosen to develop my project.

System Development Methodology: In this section of report I have compared different types of methodology that are used to develop a project and have chosen one between them and provide the reason behind choosing the specific methodology.

Research Method: This section highlights the method that I have used to gather information such as questionnaire, interview, research and so on and description of each of the questions of the survey.

Requirement Validation: Here, all the data that are collected via survey are visualise and proper analysis is done.

Future Enhancement: This section highlights any implications or recommendations for future research or action and upgrade that can be done in near future.

Conclusion: This section summarises the main findings and conclusions of the investigation

2. Literature Review

To show that the chosen topic is relevant, there are various research done previously on similar topic which we can method here in this chapter of the research paper. There are various journal, book and article available on the internet to prove that the use of AR in e-commerce is really fruitful.

E-commerce has grown exponentially over few decades. There are various sites which are providing the facilities of online shopping. Some of the e-commerce giants are Amazon, Walmart, Shopify and many more. In case of Nepal Daraz is popular which is providing the services over few years. During the covid 19 period most of the people prefer to use online shopping platform to buy some goods rather than risking their lives by visiting the physical stores. Even people buy grocery stuffs to medicines via online platform or through phone calls. But most of the people seems to be unsatisfied about the product experience they are getting through online shopping. So, to enhance their product experience implementation of augmented reality technology could really help online retailer and attract more and more people in future.

According the research carried out by Uhm, J. P., Kim, S., Do, C. and Lee, H. W. use of AR technology has totally change the way people used to buy product via online stores. They have stated that the use of this technology could really help online retailers to reduce the product return rates and helps to boost the customer satisfaction. They also argue that the use of AR in online platform can lead to increased sales and customer satisfaction. However it is important to note that the effectiveness of AR may depend on the specific implementation and target audience [Uhm, Kim,Do,& Lee, 2022] .

According to Rendy Ridwan Hidayat¹ and Andar Bagus Sriworno user interface and user experience play key role in creating a strong connection between online shopping platform and the customers. They have stated that augment reality is a multiverse concept which gives a satisfactory experience to the customer by colliding digital world into real world in case of e-commerce platform.

Augmented reality is the future of e-commecce. It can personalised the shopping experience. With the help of AR technology customer can preview the product and find out whether that cloth will fit him/her or not. Hence, it helps them in better decision making while buying products. Beside this, it also improves the conversion rate and reduces the product return rate by enabling

consumers to choose the suitable product according to their needs. In his article he has stated that there are various e-commerce platform such as Alibaba , Amazon, Shopify, Sephora, etc who are implementing augmented reality at some extends [Wang, Rau, & Chen, 2017].

Recent research done by Taoufiki find out that majority of consumer prefer to use e-commerce platform with augmented reality to the e-commerce without augmented reality as it provide immersive experience to them. IKEA is one of the first company to implement AR technology in their application. With the help of this application customer can try product before they buy. They can view the items virtually on their surrounding and adjust where they want to place the item within their surrounding which is even 98% accurate. Especially, it has been useful for customers who are unable to visit a physical store and see the products in person. Similarly, in 2019 Nike has also launched an application called Nike Fit which helps customer to measure their feet and recommend them the correct size with variety of shoes. According to him, it has significantly reduces the return rate and increase customer engagement. In conclusion, AR could really boost the sales rate in near future as well as it creates a more enjoyable and memorable experience to the customer [Taoufiki, 2022].

Studies conducted by the University of North Caroline found that customers who used AR to virtually try on clothes were more likely to make a purchase than those who did not use AR. Similarly, a study by the Massachusetts Institute of Technology found that customer who used AR to interact with products in a virtual environment were more likely to report high levels of satisfaction with their shopping experience.

Augmented reality technology has been used in variety of industries including e-commerce, to enhance the customer experience and provide interactive and engaging content

Use of augmented reality in education

According to Mark Billinghurst augmented reality is an emerging technology which enable people to experience the virtual imagery into the real world environment. Kesim, M., & Ozarslan believes that the combination of augmented reality and education content helps to enhance the learning ability of the students and helps them to learn something quickly. According to them, since augmented reality technology has brought lots of positive impacts on robotics, military, manufacturing and many other fields than it can definitely bring some positive changes in education sector as well which not only makes learning activities more interactive but also helps

students to learn something quickly and easily. As a result it enhance students engagement towards study. Time prior to augmented reality technology, education was based on 2D view. But by the introduction of augmented reality students are able to view the images in 3D view . Not only this but also AR helps to provide the detail information of each and every parts of the image after one click.

Based on the research done by Bolek, De Jong, & Henssen, the use of augmented reality in education will really increase student motivation and engagement in study. According to them especially anatomy educator are searching for the technology that can make learning easy and interactive. They believe that with AR can offer a great experience for the medical student to learn anatomy more easily and quickly. With AR, complicated medical learning scenarios may be supported by a very realistic situated learning experience. In addition to this there is another major benefit that medical students can get by the use of AR technology is that AR gives user the chance to digitally disassemble and reassemble anatomical components in order to completely examine s structure's anatomy. So, in their perspective use of AR can really motivate more and more student to study anatomy in near future [Bolek, De Jong, & Henssen, 2021].

Overall, it appears that AR technology has the potential to enhance the e-commerce experience by providing interactive and engaging content and helping customer to make informed purchasing decisions.

3. Technical Research

3.1. Chosen Programming Language

There are various programming language such as python, c#, java, c, c++, javascript and so on that can be used for the development of a complete web based application. The best programming language for AR development will depend on a specific needs and requirements of the AR application as well as preference and expertise of the development team.

The application that I am going to built is web based e-commerce application with augmented reality technology embedded on it. The combination of C# and python would be a strong combination for developing the AR projects. So, I am planning to choose C# to develop a back-end of the application which includes API development, server side logic development and database interaction where as python will be used for the implementation of AR in the system. Similarly, the reason behind choosing C# for the backend and Python to integrate AR, I can take advantage of the strengths of each language. C# is powerful and efficient, making it well-suited for handling complex tasks and large amounts of data. Python, on the other hand, is more flexible and easier to learn, making it a good choice for the developer like me who are new to AR development. Overall, using C# for the backend and Python to integrate AR can allow you to create a more powerful and flexible AR application.

Another main point of choosing C# and python programming language for the development of our application is because I have a good knowledge of these two languages, as they were included in our previous course as well. In addition to this, I have also developed some of the application such as web based dynamic e-commerce application and e-learning application using c sharp previously. According to the technical research that I have carried out, there are several libraries available in python to integrate AR (augmented reality) functionality in e-commerce application among them most commonly used library is OpenCV which is a computer vision library that provide wide range of functionality for building AR applications, including image processing, object recognition, and augmented reality.

Since, I am going to develop a web application, the only option to develop front end design is HTML, CSS, Bootstrap and Javascript.

3.2. Chosen Interactive Development Environment (IDE)

An Integrated Development Environment (IDE) is a software application that provides a comprehensive environment for software development. It typically includes features such as a code editor, debugger, and build automation tools. This type of software make software development process easy and efficient (Amazon Web Services, 1978.).

There are different types of IDE available on the internet. Since, I have chosen C# and python programming language for the development of the project so, two commonly used IDEs for C# and Python development are Visual Studio and PyCharm, and choosing one between them depends upon the my expertise upon them and my preferences.

Visual Studio:

- Developed by Microsoft
- Available in paid and free versions and Open Source
- Supports a wide range of programming languages, including C# and Python
- Cross platform-IDE that is available for multiple operating system such as windows, android, google chrome os and linux.
- Comprehensive and feature-rich, with tools for code editing, debugging, testing, and deployment
- Large user base and a large ecosystem of plugins and extensions

PyCharm:

- Developed specifically for Python development
- Available in paid and free versions
- Cross platform-IDE that is available for multiple operating system such as windows, macOS, linux, and also available on web based IDE.
- Features include code completion, debugging, and support for version control systems
- Includes tools for scientific computing, web development, and data analysis
- Intuitive and user-friendly interface

Among above mention two IDE's I would like to choose visual studio for the development of my project. The main reason behind closing visual studio is because it is a comprehensive IDE that supports a wide range of other programming languages, including Python, JavaScript, and C++ where as PyCharm is specially developed for only python development. Beside this, another reason to choose visual studio is due to my familiarity with visual studio rather than PyCharm because I have develop various application using this IDE during my academic career. Moreover, visual studio is better than PyCharm in every aspect of application development.

3.3. Chosen Operating System

The chosen operating system to develop my project is Windows operating system. The reason behind closing this os is given bellow:

- As I am planning to develop an AR-based web application that integrates with other Windows technology that is Microsoft Azure for the deployment of the system over internet, then developing on Windows may be the most convenient option .
- Since, I use Mac OS it is difficult to do project on visual studio in this operating system so the other application that I have developed previously using visual studio is under Windows operating system. So, I am more familiar with the Windows operating system . So, I think that windows may be the most comfortable and efficient option for me.
- Visual Studio is a comprehensive IDE developed by Microsoft that is available on Windows, and it includes a wide range of tools and resources specifically designed for Windows development. This can make it easier to find support and resources for my project.

3.4. Summary

Overall, the suitable programming language that I have chosen to build my application are HTML, CSS, Bootstrap, Javascript, C# and python. Similarly, the chosen IDE is visual studio and operating system is Windows operating system. Similarly, to store data I will be using sql server and Microsoft Azure to deploy the system.

4. System Development Methodology

A system development methodology is a framework or set of guidelines that is used to plan, organise, and control the process of developing an information system efficiently. It provides a structured approach for defining and documenting the requirements, design, and implementation of the system [Hitachi].

Before beginning a project, we need to navigate the suitable methodology for our initiative. There are numerous system development methodologies available, and the most suitable one for a particular project will depend on the specific needs and goals of the project. Some common system development methodologies are shortly describe below:

4.1. Waterfall Methodology

Waterfall methodology is the oldest approach for the development of system in which system the processes are completed sequentially. As name implies on it, in this type of methodology once team complete one phase and move to another then the team cannot go back to previous phase and make changes . This type of method is suitable for those types of project whose requirements are fixed and no other changes are expected in the future. Following are the most common stages among all the project in waterfall methodology but the stages may vary according to the need of the project [Singh, 2022].

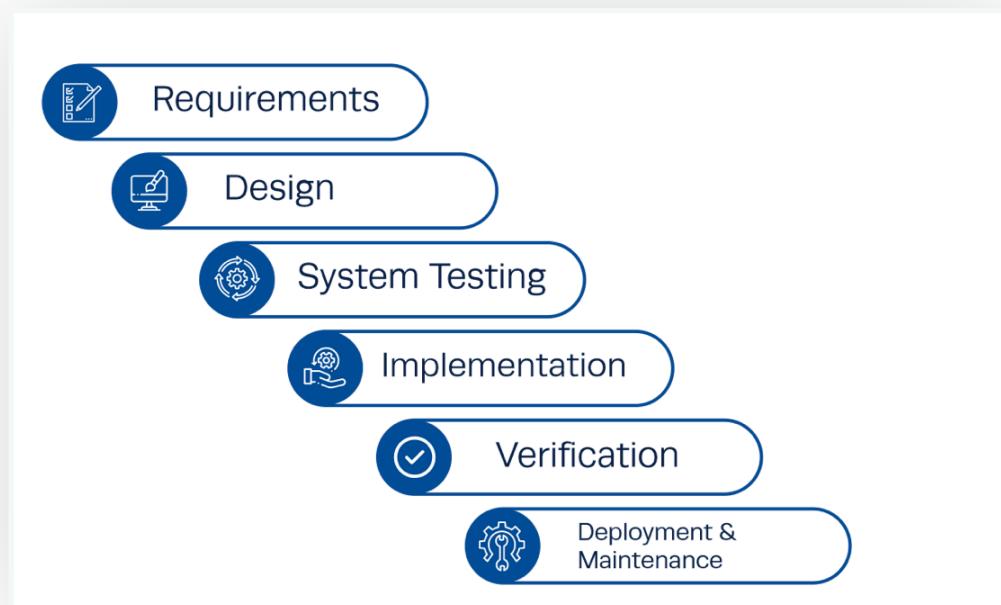


Figure 1: Waterfall Methodology (Singh, 2022)

4.2. Agile Methodology

Agile is a project management methodology that emphasizes adaptability, collaboration, and the ability to deliver working products or prototypes quickly. Compared to waterfall methodology it is flexible. While developing a software some choose waterfall mythology where as other choose agile. In this approaches requirements and solutions evolve through iteration. Change request are accepted in this type of development methodology. There are several types of agile methodology that development teams can use while developing a software such as ScrUm, Kannan, Extreme Programming and so on.

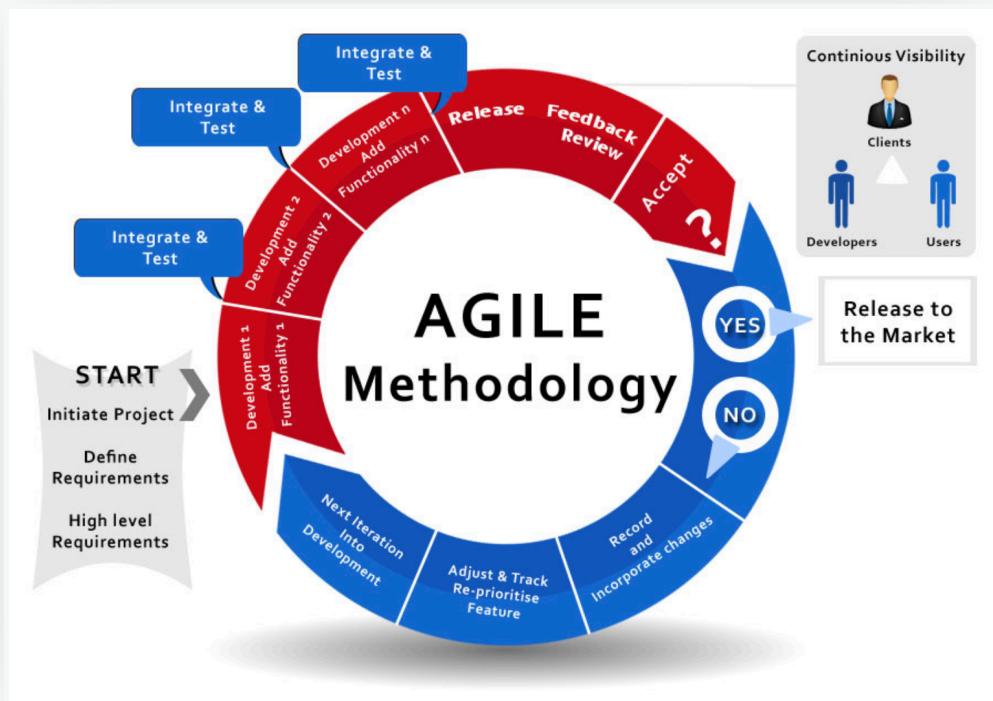


Figure 2: Agile Methodology (Floppy, 1970)

4.3. Chosen System Development Methodology

In case of my project, I prefer to use agile model over waterfall. In general, the Waterfall methodology is a linear, sequential approach that involves detailed planning and strict follow-through. This can be time-consuming, as it requires a lot of upfront planning and documentation where as I don't have enough time for the development of my project. On the other hand, the Agile methodology is a flexible, iterative approach that prioritizes rapid delivery and continuous

improvement. In agile methodology, we can even bring changes in our system during the period of development as well.

During the development of project under agile methodology first and foremost activity that need to be carried out is identifying the overall goals of the project and what will be included in the scope of work. Secondly, the project will be broken down into smaller manageable chunks called sprint. Then, those task which are more important are listed at the top so that we can complete most valuable work first. After the completion of each sprint I will review my product to certain group of people and gather feedback and identify the area of improvement. Hence, it will help me to continuously improve and become more efficient.

5. Research Methods

The initial phase of project development life cycle include requirement gathering. Conducting a requirement gathering activity before starting a project can help me to better understand the needs, attitudes, and behaviours of the people that I am trying to reach through my project. The main focus of this project is to develop a complete working e-commerce application which address the issues faced by customer and online service provider and find out the possible solution by adding suitable feature on it. So, I have gathered necessary information from the people who frequently use online platform to buy products. There are various method that can be applied to gather data for our project. Especially, there are two types of requirement gathering methods that is primary and secondary method. And choosing one between these two approaches depends up on the specific research carried out by the researcher.

First and foremost, I have used primary data collecting approach to gather the information from the targeted audience. I have chosen this approach because it is quick and inexpensive and I have to gather data from large sample population within short period of time and within limited budget available to me. Not only this but also, survey provide correct opinion of the people on certain topic. In addition to this, since survey is structured and standardised, same questions can be provided to larger number of people and it is easy to compare and analyse the data. So, to conduct survey I prepared certain question that need to be forwarded among certain sample population. After, I select certain sample population I forwarded the survey questions to them via mail and social media platform like instagram and messenger. And the responses are illustrated in analysis part of the research paper.

However, for basic knowledge there are negative sides of survey as well. For instance most of the people might misunderstand or misinterpret the questions.

Secondly, I have used interview as the data collecting tools to collect data from the delivery personal. Although, it is time consuming I have used this method as there are only few delivery person with whom I need to collect the information. Moreover, I have collected the data from the delivery personal of Fewa Online Stores, Daraz, Sasto Deal and Mero Deal.

Similarly, in case of secondary approach, I have reviewed the literatures and find out the possible solutions that can overcome the problems faced by customer and e-commerce company.

5.1. Design

The questions that are included in questionnaire are listed below with their justification:

Final Year Project Survey

Dear Participant,

Thank you for taking the time to participate in this survey. Your honest and thoughtful responses are greatly appreciated. Your input will help me to better understand the problem that you faced while using traditional e-commerce application and make improvements where needed. Please answer the questions as accurately and honestly as possible. Your responses will be kept confidential and will only be used for the purposes of this research.

Thank you for your contribution.

Sincerely,

Suraj Pandey, surazpandey101@gmail.com, NPI000051



surazpandey832@gmail.com (not shared) [Switch accounts](#)



Question 1:

How old are you? *

...

- 0-19 years
- 20-30 years
- 30-50 years
- above

This question helps to identify the age distribution of the survey respondent.

Question 2:

How often do you use e-commerce applications to make purchases? *

- Always
- Sometimes
- Rare
- Never
- previously but not now

This question helps to find out how frequently respondent use online platform to purchase goods and services. The purpose of asking this question is to gather data on the usage of e-commerce application which can be answered on a scale as provided on the option.

Question 3:

How likely are you to recommend an e-commerce application to a friend or family member? *

- Very likely
- Somewhat likely
- Neutral
- Somewhat unlikely
- Very unlikely

The main objective of asking this question in my survey is to identify the loyalty of customers towards e-commerce application. By analysing the responses to this question, we can get a sense of how well the e-commerce platform is meeting the needs and expectations of users, and whether or not they are likely to recommend it to others. This information can be valuable for us, as it can help us to identify areas for improvement and make changes to increase customer satisfaction and loyalty.

Question 4:

How satisfied are you with your overall experience using e-commerce applications? *

- Very Satisfied
- Somewhat satisfied
- Neutral
- Somewhat dissatisfied
- Option 5

Asking people about their satisfaction towards e-commerce application can be helpful to identify the pain points or issues that customer are encountering or how easy and enjoyable the shopping experience is for customers.

Question 5:

Have you ever experienced any problems when using an e-commerce application? *

- Yes
- No

The point of asking this question to the people is to find out the point of dissatisfaction or the issues that customer are currently facing while using e-commerce application.

Question 6:

If you answer is "yes" on previous question, please describe the problem you faced:

Long-answer text

The goal of this question is connected with previous question. Those respondent who are facing problems while using e-commerce application can provide their dissatisfaction or the problem they are currently facing in this question which can help online platform to improve on those section or help us to add the feature that can overcome the problem that are faced by majority of people. For instance, if most of the customers are facing problem in user interface then company can or the new developer can work on providing user friendly interface to the customer which will help customer to easily navigate the site. By tackling the issues company can enhance the customer satisfaction towards their application and improve the loyalty.

Question 7:

What are the differences that you get while buying product via online stores and physical stores?

Long-answer text

The main aim of this question is to understand the preference and experience of people when purchasing good via different channels. This information can help businesses understand the advantages and disadvantages of shopping online versus in physical stores from the perspective of the customer. For example, a business may find that convenience and selection are important factors for customers when shopping online, while the ability to touch and try on products is more important when shopping in physical stores. This information can help businesses tailor their offerings and shopping experiences to better meet the needs and preferences of their customers.

Question 8:

Have you ever return the product that you bought via online stores? If 'Yes' How long did it take for you to receive a refund or replacement product?

- The refund or replacement was processed within a few days.
- The refund or replacement took a week or longer.
- I am still waiting for the refund or replacement.

Answer of this question helps developer to understand the issues that customer are facing while returning the product and find out the solution to overcome this issues or reduce the return rate. For instance, most common reason for returning the product by the customer bought via online is due to the poor product view and lack of sufficient product description. So, they can implement the new technology such as Augmented Reality to preview the proper product demonstration to the customer so that they can preview product before they buy and make better decision before buying a product which could minimises the chances of returning the product. Thus, it can help to solve the issue of getting back the money after the product is returned to the company.

Question 9:

How important do you think the ability to visualise products before making a purchase to you when shopping online? *

- Very important
- Somewhat important
- Neutral
- Not very importnat
- Not important at all

This question is necessary to ask in survey to identify the whether people prefer to use online shopping platform that provide the facility to try the product virtually which could help customer to make better decision.

Question 10:

Have you ever used an augmented reality (AR) application?

Yes

No

The reason behind asking this question is to find out whether people are aware about the importance of augmented reality and usefulness of it or not.

Question 11:

Which AR based application have you used so far?

Short-answer text
.....

The main goal of asking this question is to identify the people knowledge regarding augmented reality.

Question 12:

Overall, how satisfied are you with the interactivity of the AR application? *

- Very satisfied
- Somewhat satisfied
- Somewhat frustrated
- Very frustrated

This question helps me to identify the people satisfaction towards using AR based application and find out whether they enjoy using such application.

Question 13:

Are there any features that you would like to see in e-commerce applications in the future?
If so, please mention them: *

Long-answer text

The point of asking this question is to determine the people preference features which we can add in our application in near future. It will also help me to find out the answer of topic ‘future enhancement’.

6. Requirement Validations

After the preparation of the questionnaire, those questions were distributed to certain group of people via various social media platform and email. Questionnaire form was created with the help of google form which is easy to use and provide accurate responses. Then those responses are analysed as follows:

6.1. Data Analysis

The criteria of minimal responses was 20 but the responses that I have received 30 responses which meet my requirements. Then the collected data are visualised in the form of pie chart and bar graph. So, the data analysis of my survey questions are listed below in sequential order:

Question 1: How old are you?

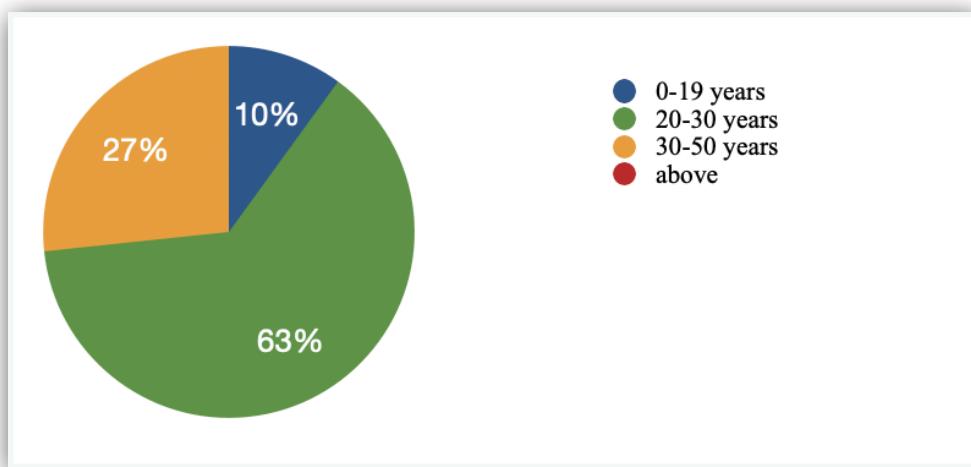
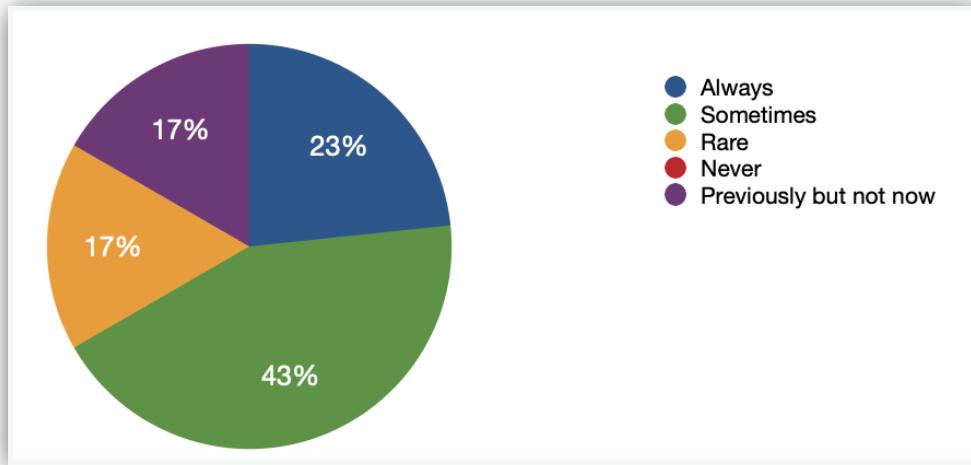
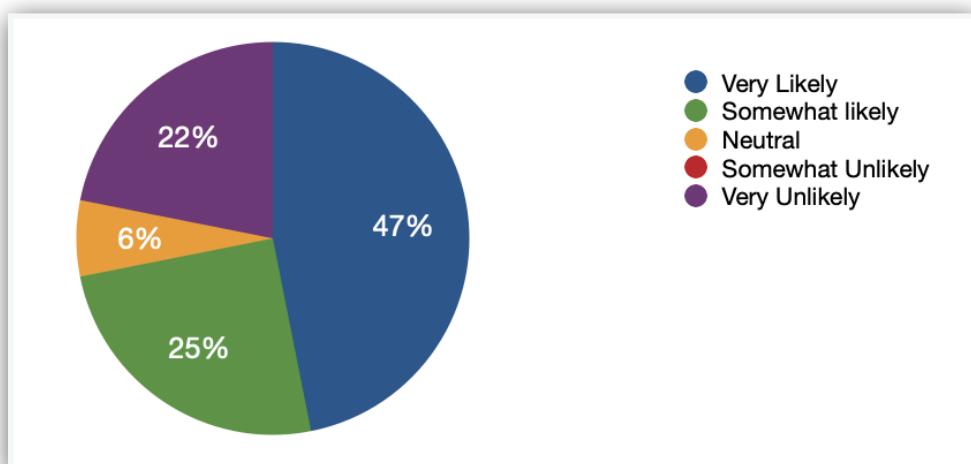


Figure 3: Result of Question 1

Above mentioned pie chart represents the distribution of different age group people who has responded to the survey. It shows that the largest proportion of people who have respond to my survey falls under 20-30 years where as no people above have responded to the questionnaire . Second highest group of people who have provided their opinion falls under the age group of 30-50 years which is followed by the teen age group which is few in numbers.

Question 2: How often do you use e-commerce applications to make purchases?*Figure 4: Result of Question 2*

Above illustrated pie chart represents the how often respondent use e-commerce to buy product and services. There are very few respondent who shop online most of the time that is only 23% of people among 30 respondent whereas there are certain respondent who have stop using online shopping platform but used to buy product previously. Also, from above analysis we can say that almost all people are well known about such kinds of platform and have used at least one time to purchase goods via online stores. Similarly, 43% of people use e-commerce application sometimes whereas 17% of responded used to buy product and rarely via online platform.

Question3: How likely are you to recommend an e-commerce application to a friend or family member?*Figure 5: Result of Question 3*

According to the pie chart, almost half of the respondent are likely to recommend an e-commerce application to their friends and family which seems they are satisfied with the services and the product they get via online platform which is about 47% which is huge in number. It also depends up on the what types of e-commerce application they are using. Similarly, there are some responded who does not like to recommend such application to their friends and family that is 22% of people among 30 respondent. So, we can assume that they must be quite unsatisfied with the online platform. Similarly, 6% of people seems to be neutral and 25% of people answers somewhat likely. So, from above mentioned data we can conclude that there are most of the people who are satisfied with the service provided by the e-commerce company.

Question 4: How satisfied are you with your overall experience using e-commerce applications?

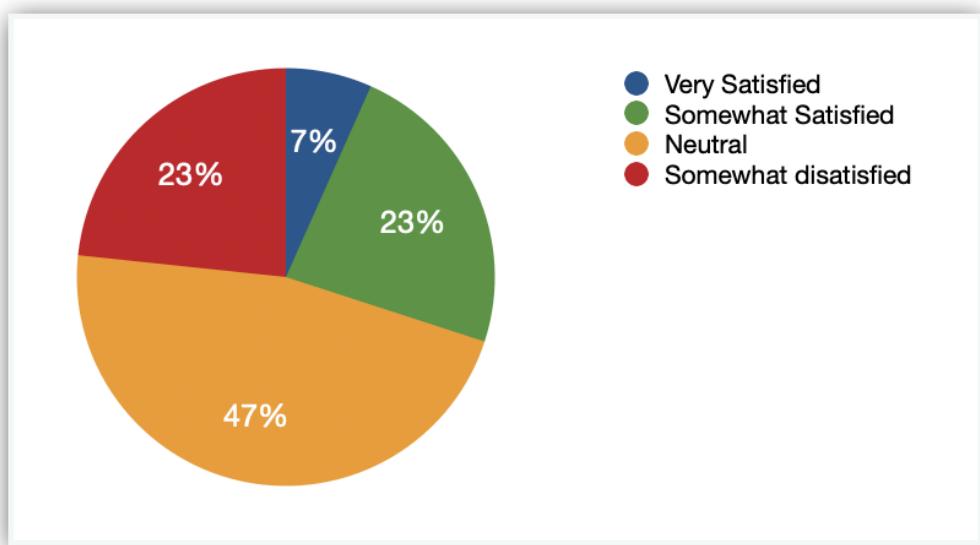


Figure 6: Result of Question 4

Above given pie chart represents the distribution of responded who are satisfied with online shopping platform while buying products. Most of the people have stayed neutral among 30 respondent which is 47%. Followed by 23% of people who are dissatisfied with the product they get via online stores whereas same amount of the have voted on somewhat satisfaction. And around 7% of responded seems to be fully satisfied with the product and services they get via online shopping platform. So, from above data we can conclude that almost 30% of peopler satisfied with the experience they get while using e-commerce applications.

Question 5: Have you ever experienced any problems when using an e-commerce application?

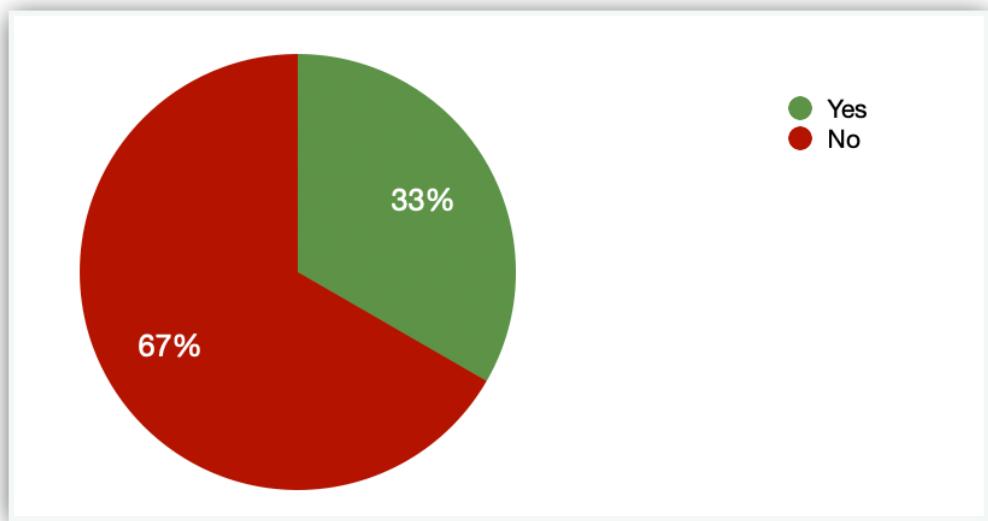


Figure 7: Result of Question 5

Above given pie chart demonstrate the number of respondent who has experienced issues while using e-commerce application. Almost two third of people among respondent chooses yes over no which is 67%. Whereas rest of the 33% people haven't experienced any kinds of problems. Those, 33% people might be among those who rarely use e-commerce application.

Question 6: If you answer is "yes" on previous question, please describe the problem you faced?

Those person who have answer 'Yes' to above question have responded to this question. Most of the people have answer regarding the poor product experience they get via online stores and poor product demonstration due to which they feel difficulty while making decision . Even most of them have said that the product that they view on the site and the product delivered to them are totally different and doest not suits them.

Question 7: What are the differences that you get while buying product via online stores and physical stores?

The most common responses on above mention question are as follows:

- Vast differences, while buying product via physical store, we can feel the product and try on and choose the suitable one but it is not possible via online stores
- Quality is quite different
- Are not according as shown
- Online stores often have a larger selection of products than physical stores

Question 8: Have you ever return the product that you bought via online stores? If 'Yes' How long did it take for you to receive a refund or replacement product?

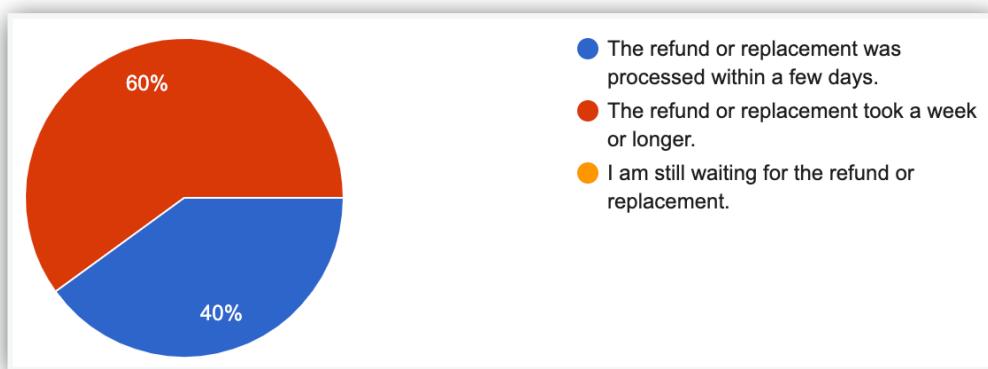


Figure 8: Result of Question 8

Most of the people have experienced problem while returning the product. According to the given pie chart about 60% of people has to wait more than a week where as about 40% people have received the refund within a few days. The return procedure might also depends upon the service provider. So, this issue can be addressed by the implementation of AR technology by minimising the return rate by helping people to make better decision before buying a product which eventually solves the problem faced while receiving refund or replacement of the product.

Question 9: How important do you think the ability to visualise products before making a purchase to you when shopping online?

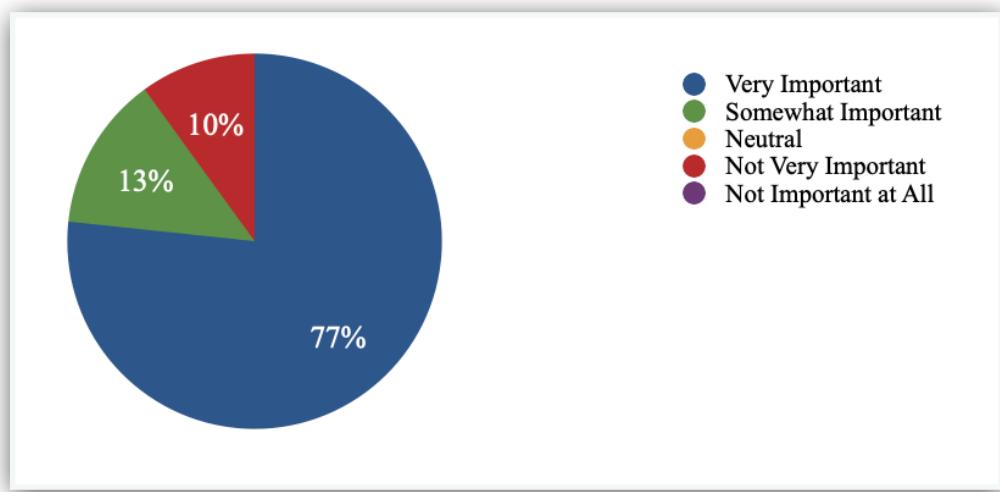


Figure 9: Result of Question 9

The pie chart represents the people opinion about the importance of implementation of try on feature in e-commerce application. According to the result shown above, about 77% of people have vote as very important where as few have even voted as not important. In my opinion those who voted to not very important they might be unknown about the how try on feature will help customer while buying product via online stores. Hence, to implement this feature in e-commerce we need to integrate AR technology.

Question 10: Have you ever used an augmented reality (AR) application?

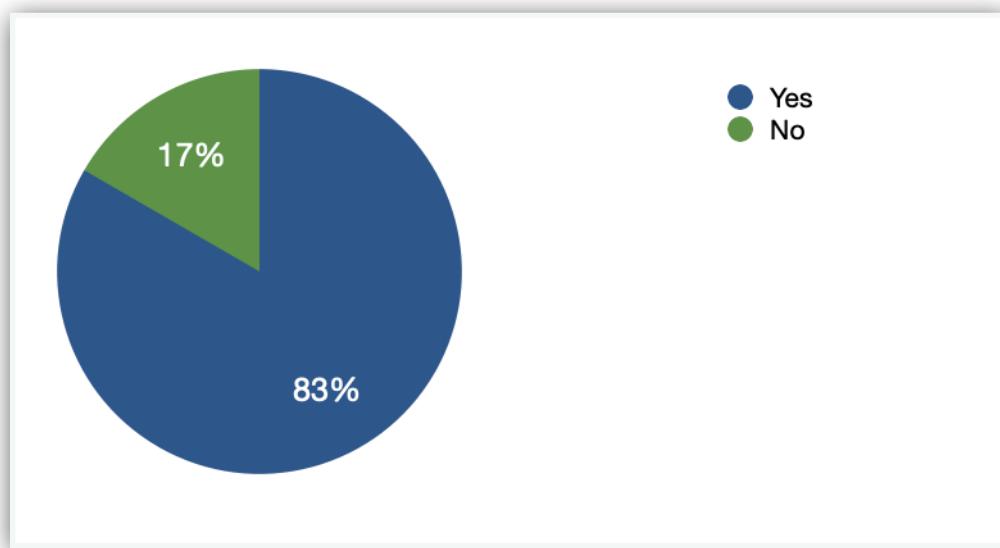


Figure 10: Result of Question 10

Above given pie chart shows the percentage of respondent who have used ar application. According to above mentioned pie chart most of the respondent have used ar application that might be either online shopping application or any other application like snap chat, instagram, etc.

Question 11: Which AR based application have you used so far?

According to the answer provided by the respondent most of the people have used social media platform such as snapchat and instagram where as very few have used google lens. So, those who use ar application might have good knowledge regarding how augmented reality works and how it can help customer and online shopping stores.

Question 12: Overall, how satisfied are you with the interactivity of the AR application?

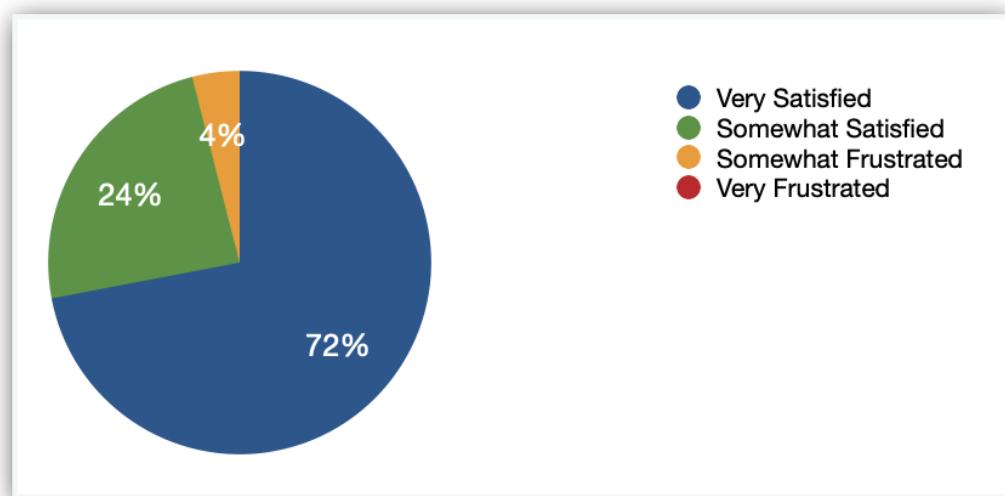


Figure 11: Result of Question 12

The pie chart in the figure describe the satisfaction level of respondent about the interactivity of the ar application that they are using. According to 65% of respondent who have used ar application are very satisfied with where as 3% of respondent are some what frustrated while using ar application.

Question 13: Are there any features that you would like to see in e-commerce applications in the future? If so, please mention them:

After analysing current e-commerce application most of the people have recommended to implement try on feature which will help them to visualise the online product in their own environment. Some have responded saying to implement AI to enhance shopping experience. Some have asked there must be good product demonstration which will help people to view product and preview how the specific product functions which will help them to make better decision before buying the product.

6.2. Summary

In conclusion, from the data recorded above have clarified that most of the people who currently use e-commerce application and those who used to buy previously have recommended to implement try on feature and enhance product demonstration, which is only possible by the implementation of augmented reality. Hence, it proves that there is high demand of an online shopping platform that help customer to visualise the product virtually and helps them to make better decision

7. System Architecture

In computer science the system architecture refers to the design and organisation of the various components of a system to achieve its intended purpose. It is like a blueprint or plan that outlines how a system should be designed and built, including its hardware, software, and communication components, and how they interact with each other (System architecture, 2022). Software architecture includes various aspects such as design, technology, human factors, and business objectives. It outlines the qualities and features that are important for a good software system, and provides a framework for modifying and improving the system over time. The technology used in the software is carefully selected and integrated to create a suitable environment for the system to operate in (Software system architecture, 2021). Therefore, without system architecture it is almost impossible for us to develop a system as it identify the database structure as well as the functionality that system includes and the flow of data within the system. Various system architecture that I have designed which helped me to develop a complete project are illustrate below with short description:

7.1. Use Case Diagram

Use case diagram is one of the basic and most important system architecture requirements which contributes in the development of fully functional application or software. It is define as the pictorial representation of functional requirement of the system which can be understood by the people outside IT field as well. It helps to identify how the system works and how users can interact with the system that I have engineered to achieve their goal (About Jennifer Gaskin , 2023). So we can say that the main purpose of this architecture is to capture the functional requirements of a system and provide a high-level overview of its behavior. It is also used to outline how actors (such as, users or other systems) interact with the system to achieve a specific goal or objective.

In case of the e-commerce application this diagram illustrate how a user interacts with the system to browse and purchase products. The diagram show the different actors involved (like, the user and third party company used for payment), the different use cases (for instance, login, view product, adding products to cart, making a purchase), and the relationships between them. This diagram could help to identify any potential issues or gaps in the system's functionality and

ensure that all user requirements are met. The use case diagram of e-commerce application is illustrate below:

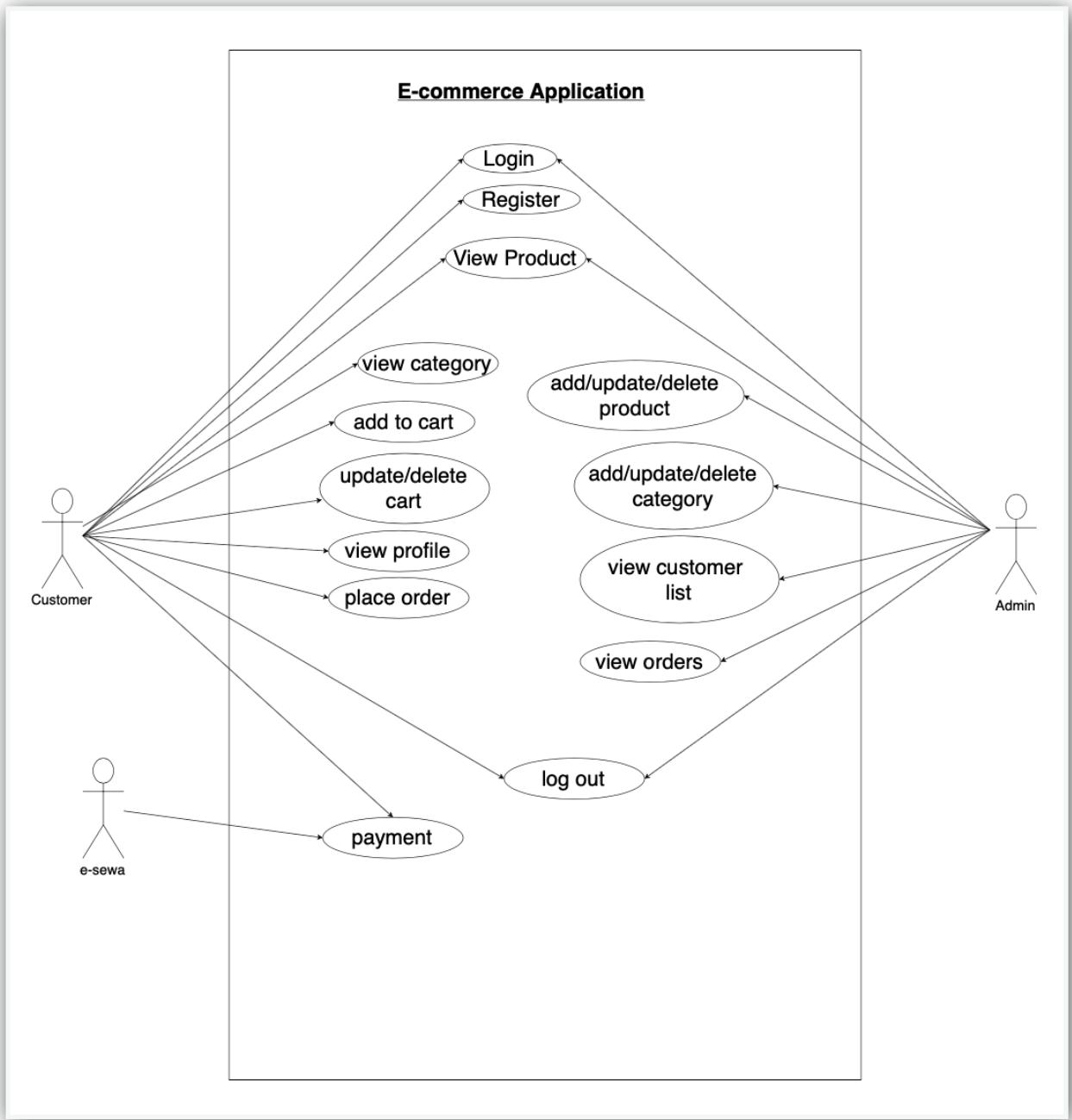


Figure 12: Use Case Diagram of E-commerce application

Use case diagram includes three main components that is actor, use cases and relationship. Actors works as an external entities that interact with the system they can be person, business or event other system. In case of the system that I have develop there are mainly three different actors that is customer, admin and the third party company that provide payment facilities. Similarly, another component is use case which are represented by oval shape. In case of given diagram oval shape represents the task or the activities that user can perform to interact with the

system (About Jennifer Gaskin , 2023). According to above diagram, the use cases of the system includes login, register, view products, adding product to the cart, make payment and so on. Third and last components used in use case is relationship which are represented by line. This lines helps us to identify task that actor of the system can perform. For instance, in above diagram customer can login, register, view products, view categories, add product into the cart, update and delete cart, view profile and place order where as admin are bounded by additional functionalities like add, delete and update product, add, delete and update category, view entire customer list and order list. In addition to this, third party system are only associated with the payment service.

7.1.1. Use Case Specification

Registration

Use case name	Registration
Summary	Customer create an account to buy products.
Actor	Customer
Pre-conditions	If customer has not registered previously .
Main Sequence	<p>Step 1: must click login/signup button at the navigational bar.</p> <p>Step 2: user must fill the form with valid information like full name, email, username, contact, password.</p> <p>Step 3: must check terms and conditions .</p> <p>Step 4: Must click register button at the button.</p> <p>Step 5: popup message appears with “account created successfully”.</p> <p>Step 6: user get redirected to login page.</p>
Alternative Sequence	<p>Step 1: if any field is left blank</p> <ol style="list-style-type: none"> 1. Every field must be filled. 2. Fill the field which are left blank.
Post Condition	<p>Customers details are security saved into database .</p> <p>User can log into the system with the username and password.</p>

Table 01: Registration user case specification

Login

Use case name	Login
Summary	Customer log into the system and are able to make purchase
Actor	Customer
Pre-conditions	Customer must have created an account previously
Main Sequence	<p>Step 1: must click login/signup button at the navigation bar</p> <p>Step 2: User must enter valid username and password</p> <p>Step 3: Must click login button .</p> <p>Step 4: redirected to the home page.</p>
Alternative Sequence	<p>Step 2: if any field is left blank</p> <ol style="list-style-type: none"> 1. Every field must be filled 2. Fill the field which are left blank <p>Step 2: If username or password incorrect</p> <ol style="list-style-type: none"> 1. Receive error message with “Username or password is incorrect please enter correct username and password” 2. Repeat Step 2.
Post Condition	Users are redirected to the home page.

Table 02 : Login user case specification

View Product and category

Use case name	View Product and view category
Summary	Customer and admin can view the available products.
Actor	Customer, admin
Pre-conditions	Admin must have logged into the system with valid username and password
Main Sequence	<p>Step 1: User must select either home page or product page of the system.</p> <p>Step 2: System retrieve the products from database and displays on the screen.</p>
Alternative Sequence	
Post Condition	If user click add to cart button then they are redirected to login page if not logged into the system

Table 03: View Product and Category use case specification

Add to cart

Use case name	Add to cart
Summary	Customer visit the web application and add necessary product into their cart
Actor	Customer
Pre-conditions	Customer must have registered account and logged into the system with valid username and password
Main Sequence	<p>Step 1: Must click login/signup button at the navigation bar.</p> <p>Step 2: Enter valid username and password and click ‘Login’ button.</p> <p>Step 3: Customer selects the necessary product from product catalog which he/she wants to buy.</p> <p>Step 4: Must click ‘Add to Cart’ button .</p> <p>Step 5: Can view their add product by clicking cart icon at the navigational bar .</p>
Alternative Sequence	<p>Step 3: if customer click ‘Add to Cart’ button with out signing</p> <ol style="list-style-type: none"> 1. Redirected to login page 2. Enter valid username and password and log into the system to make purchase <p>Step 2: If username or password incorrect</p> <ol style="list-style-type: none"> 1. Receive error message with “Username or password is incorrect please enter correct username and password” 2. Repeat Step 2.
Post Condition	Item added to the cart

Table 04 : Add to Cart use case specification

Update/delete cart

Use case name	Update/Delete product from cart
Summary	Customer modify or delete the added product to their cart as per their requirements
Actor	Customer
Pre-conditions	Customer must have registered account and logged into the system with valid username and password and must have added product to their cart.
Main Sequence	<p>Step 1: Can view their add product by clicking cart icon at the navigational bar</p> <p>Step 2: System retrieve product from cart table of that specific customer and displays on cart</p> <p>Step 6: Can edit the product information like quantity from the cart</p> <p>Step 7: Customer can delete the product from cart by clicking on ‘Delete icon’</p>
Alternative Sequence	<p>Step 2: if product not found Message “No product added to the cart”</p>
Post Condition	Items added to the cart are successfully updated or deleted from the cart.

Table 05: Update and Delete Product from Cart Use Case Specification

View Profile

Use case name	View Profile
Summary	Customer can view their profile information
Actor	Customer
Pre-conditions	Customer must have registered account and logged into the system with valid username and password.
Main Sequence	Step 1: Must click login/signup button at the navigation bar. Step 2: Enter valid username and password and click ‘Login’ button. Step 3: Click username at the navigational bar Step 4: View their information and can edit if necessary
Alternative Sequence	Step 3: if customer click ‘Delete icon’ 1. Popup message is shown with “product deleted successfully”
Post Condition	Items added to the cart are successfully updated or deleted from the cart.

Table 06: View Profile Use Case Specification

Place order

Use case name	Place order
Summary	Customer can successfully place an order by clicking ‘check out’ button only after doing payment via online payment gateway.
Actor	Customer and Paypal/esewa
Pre-conditions	Customer must have registered account and logged into the system with valid username and password and must have added product
Main Sequence	<p>Step 1: Click cart icon at the navigational bar</p> <p>Step 2: View the product they have added to the cart</p> <p>Step 3: Provide valid payment information</p> <p>Step 4: third party payment service provider check the informations</p> <p>Step 5: If informations are correct order is placed</p>
Alternative Sequence	<p>Step 3:</p> <ol style="list-style-type: none"> 1. Popup message is shown with “Payment informations are incorrect please provide valid informations.” 2. Repeat step 3
Post Condition	Order added successfully.

Table 07: Check Out Use Case Specification

Logout

Use case name	Logout
Summary	Customer or admin can logout from the system
Actor	Customer and admin
Pre-conditions	Customer or admin logged into the system with valid username and password
Main Sequence	<p>Step 1: Must click logout button at the navigation bar.</p> <p>Step 2: Logged out successfully</p>
Alternative Sequence	
Post Condition	Customer and is no longer logged into the system

Table 08: Logout Use Case Specification

Add/delete/update product

Use case name	Add/Delete/Update product
Summary	Admin can add, delete and update product
Actor	Admin
Pre-conditions	Admin must logged into the system with valid username and password
Main Sequence	<p>Step 1: Must click login button at the navigational bar</p> <p>Step 2: Admin must fill the form with valid information</p> <p>Step 3: Must click ‘Login’ button</p> <p>Step 4: Redirected to admin dashboard</p> <p>Step 5: Click ‘Product’ option at the sidebar</p> <p>Step 6: Admin will see view product button and Add product button</p> <p>Step 7: After clicking ‘Add product’ button then a form will appear to add product into the database</p> <p>Step 8: Admin must click ‘View Product’ button</p> <p>Step 9: System retrieve product information from database</p> <p>Step 10: Displays product information at the screen</p> <p>Step 11: Must click edit icon to modify the product information</p> <p>Step 12: Must click delete icon to delete the product from the database</p>
Alternative Sequence	<p>Step 3: If username or password are incorrect</p> <ol style="list-style-type: none"> 1. Message “username and password are incorrect please provide valid information” 2. Repeat step 2
Post Condition	Admin successfully viewed, modified and delete the product from the database

Table 09: Add, Update, and Delete Product Use Case Specification

Add/delete/update category

Use case name	Add/Delete/Update category
Summary	Admin can add, delete and update category
Actor	Admin
Pre-conditions	Admin must logged into the system with valid username and password
Main Sequence	<p>Step 1: Must click login button at the navigational bar</p> <p>Step 2: Admin must fill the form with valid information</p> <p>Step 3: Must click ‘Login’ button</p> <p>Step 4: Redirected to admin dashboard</p> <p>Step 5: Click ‘category’ option at the sidebar</p> <p>Step 6: Admin will see view category button and Add category button</p> <p>Step 7: After clicking ‘Add category’ button then a form will appear to add category into the database</p> <p>Step 8: Admin must click ‘View category’ button</p> <p>Step 9: System retrieve category information from database</p> <p>Step 10: Displays category information at the screen</p> <p>Step 11: Must click edit icon to modify the category information</p> <p>Step 12: Must click delete icon to delete the category from the database</p>
Alternative Sequence	<p>Step 3: If username or password are incorrect</p> <ol style="list-style-type: none"> 1. Message “username and password are incorrect please provide valid information” 2. Repeat step 2
Post Condition	Customer successfully viewed, modified and delete the category from the database

Table 10: Add, Update, and Delete Category Use Case Specification

View Customer

Use case name	View Customer list
Summary	Admin can view the register customer in the database
Actor	Admin
Pre-conditions	Admin must logged into the system with valid username and password
Main Sequence	<p>Step 1: Click ‘customer’ option at the sidebar</p> <p>Step 2: System admin will see view customer button</p> <p>Step 3: After clicking ‘view’ button ,system retrieve users information from database and displayed users in tabulated form</p>
Alternative Sequence	-
Post Condition	Admin view the customer list in tabulated formate

Table 11: View Customer list Use Case Specification

View Orders

Use case name	View orders
Summary	Admin can view the order list
Actor	Admin
Pre-conditions	Admin must logged into the system with valid username and password
Main Sequence	<p>Step 1: Click ‘Order management’ option at the sidebar</p> <p>Step 2: After clicking ‘order management’ button ,system will retrieve orders information from database and display on the screen in tabulated formate</p>
Alternative Sequence	-
Post Condition	Admin view the orders list in tabulated formate

Table 12: View Order List Use Case Specification

7.2. Activity Diagram

Another important behavioural diagram in system architecture is activity diagram which illustrate the flow of work or the activities within the system. Here, various dynamic aspects of the system are captured and visualise and represent them by using activity diagram (Walker, 2023). Let me just give a simple example, when a student wants to apply for a scholarship then he/she will interact with scholarship in-charge and provides all the detail information and after analysing all the information in-charge will decide whether to provide scholarship to the particular student or not. So, the total procedure that will be carried out to provide the scholarship to that student are represented in activity diagram. So, in software engineering, activity diagrams are commonly used to model and analyse the behavior of a software system or a business process. So, the activities that are represented in use case diagram are presented in which order they need to be performed. For instance, there is an add to cart activity that a customer can perform so to perform that task he/she need to perform various steps like first of all user need to login into the system and brows the product they want to buy and after browsing the product they can only add the product by clicking on add to cart button. So, the graphical representation of the steps that customer perform is represented in activity diagram.

7.2.1. System Activity Diagram

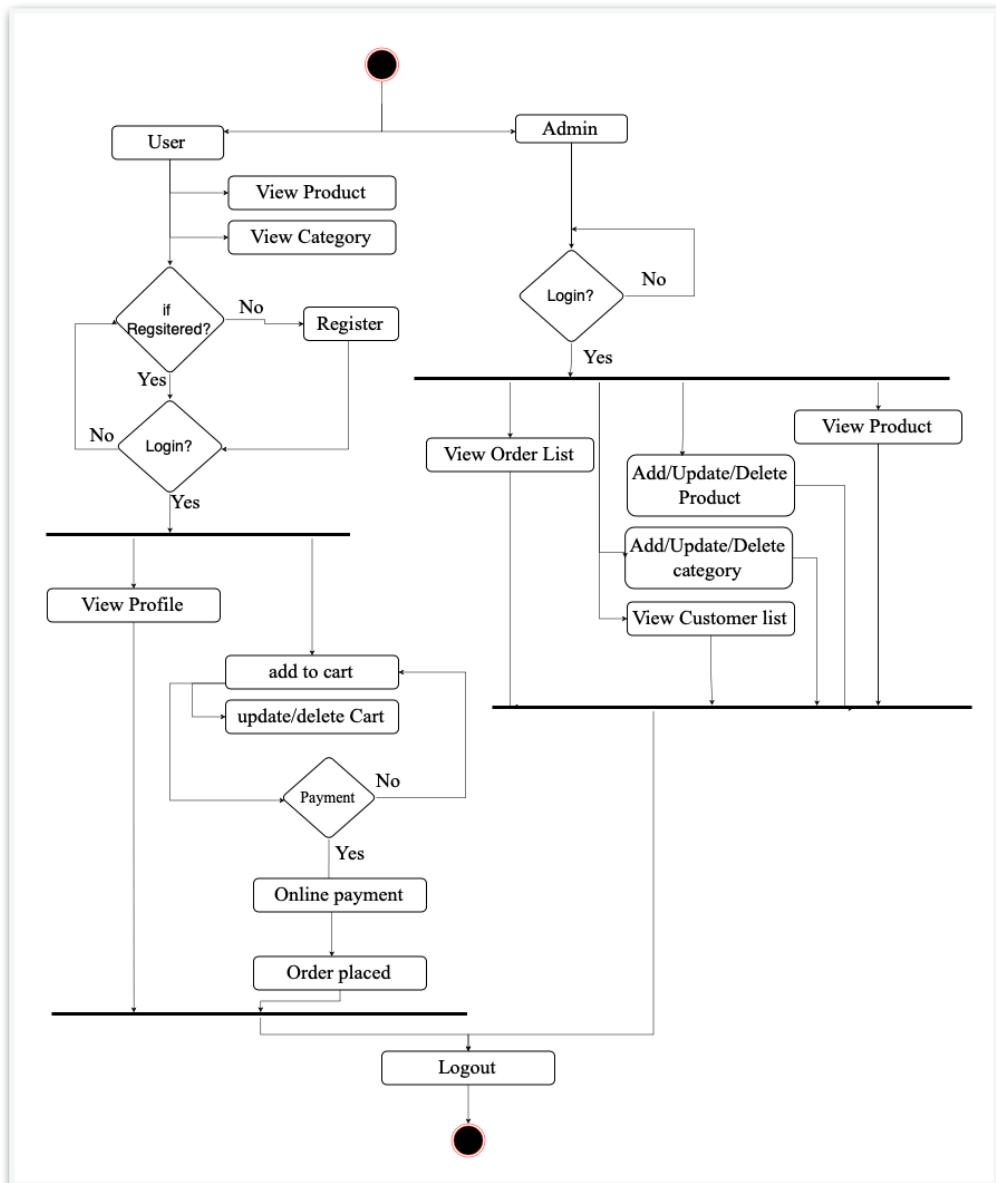


Figure 13: E-commerce Application's Activity Diagram

Above mentioned diagram is the activity diagram of the e-commerce application that I have developed in this project. It illustrates the various activities that users can perform and the steps that we need to carry out to perform the each and every tasks. According to the diagram, users can view product and categories even without registration but they need to logged into the system in order to perform the activities like view profile, add product to the cart and so on. Similarly, admin must logged into the system to get access to the functionality that they can perform. In addition to this, according to the figure above the order are only placed only after customer do payment. There is not an option of cash on delivery so it is compulsory to each and

every customer to do payment online in order to make purchase. This diagram also illustrate both user and admin login activity as well.

7.3. Sequence Diagram

Beside use case and activity diagram another most important UML diagram that need to be drawn while working under software development project is sequence diagram. A sequence diagram is like a story that shows how different objects in a system works together to get something done. It shows the order of events and messages that they send to each other. It demonstrate the logic of the system and how various component interact with each other to fulfil the needs of the users (Infinity, 2022). So, in case of my system, there are mainly three components that is frontend , web api and database. Customer and admin interact with frontend and all the backend process of the system are carried out by web api so that customer can interact with database in smooth way. So, the sequence diagram of e-commerce application is illustrate below:

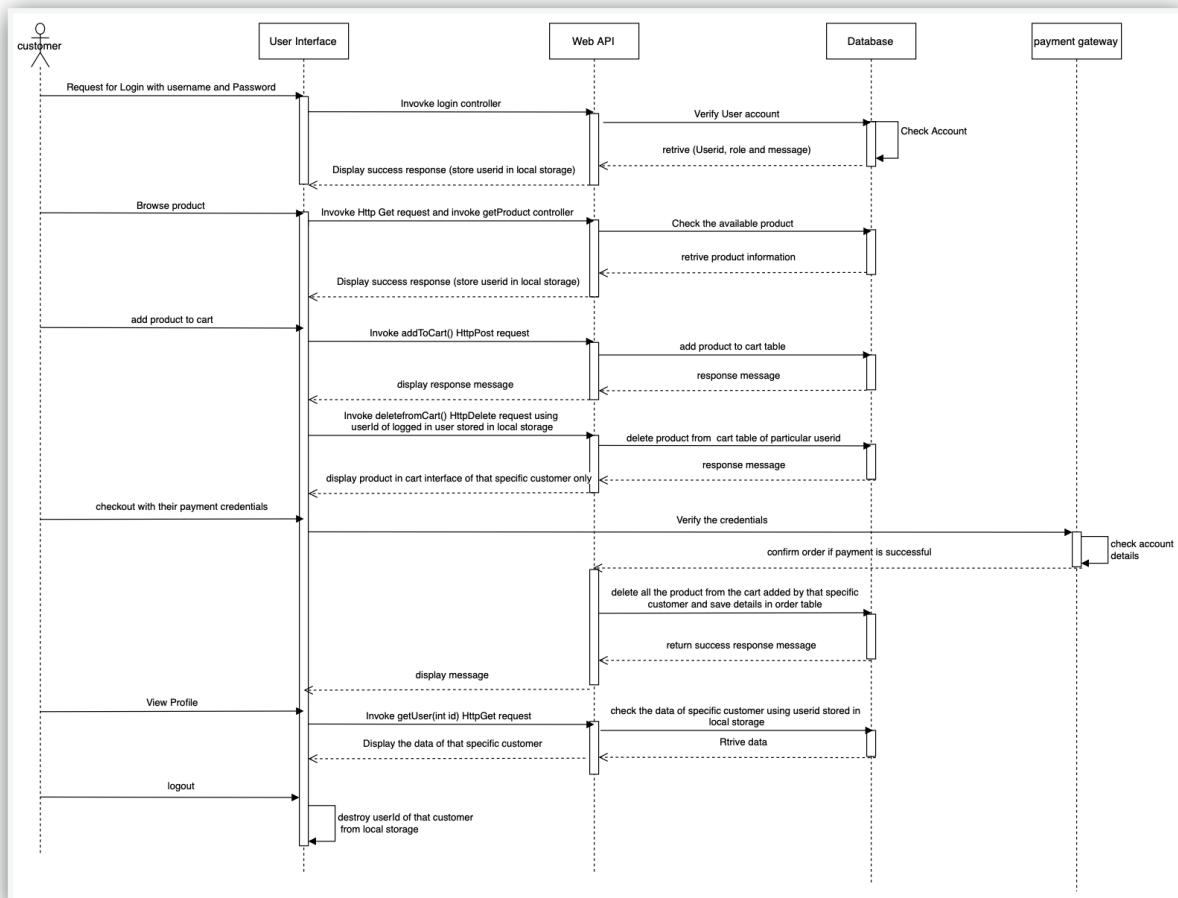


Figure 14: Sequence diagram of e-commerce application for customer's activities

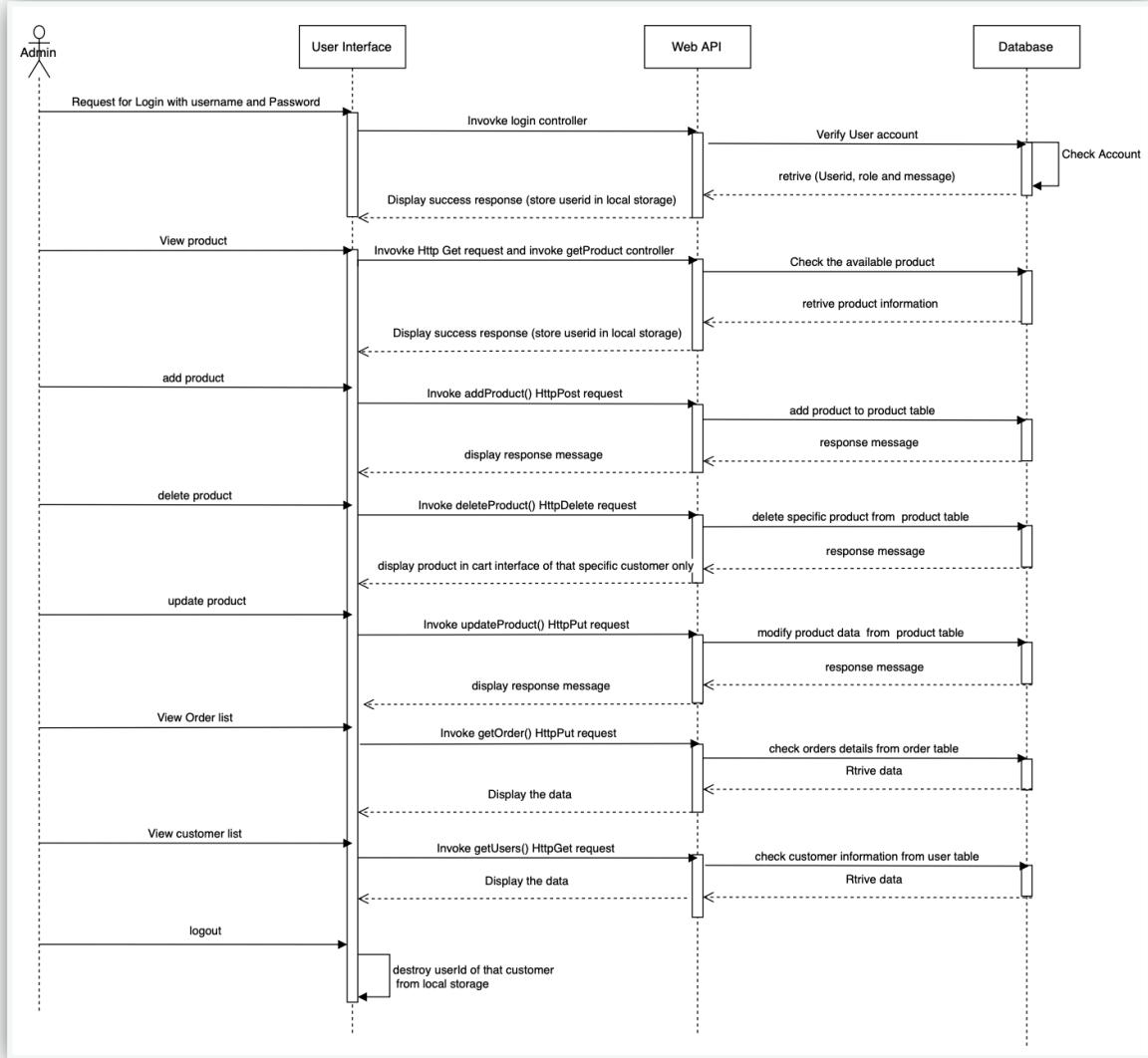


Figure 15: Sequence diagram of e-commerce application for admin's activities

Above given diagrams illustrate the working mechanism of the e-commerce application. The main purpose of drawing a sequence diagram of software is to visualize the interactions between components in a system and to understand how they work together to achieve a particular function or task. It helps in identifying potential problems, bottlenecks, or inefficiencies in the system's design and can be used as a blueprint for implementing and testing the system. Sequence diagrams are especially useful in designing and documenting complex systems where multiple components interact with each other, such as in e-commerce applications, financial systems, or communication protocols.

7.4. Database Diagram

Database diagram is the pictorial demonstration of tables and their relationship. A well designed database diagram helps us in many ways and one of the most important is that it helps in reduction of excessive memory useable as its main aim is to reduce the data redundancy and organise data in proper manners into table which maintain data consistency and integrity(Osman, 2022). It helps developer, designer and stakeholders to understand the database structure of their project and the relationship between the tables and reduce the duplication of data by performing necessary normalisation of the tables.

There are various tools available on the internet which can be used to design database diagrams. The tool that I have used is lucid chart. Following are the various database diagram that I have developed to identify the database structure of my project:

7.4.1. Entity Relationship Diagram (ERD)

Entity Relationship Diagram is the most commonly used database diagram that is used for identifying the entities their attributes and relationship which Later on helps to find out the necessary tables that need to be created with their column for any project (Er diagrams in DBMS,2023). Before design entity relationship diagram it is important to understand the scenario of the project which includes the use case diagram that outlines the necessary entities of the system. Let us consider the scenario of e-commerce application with the help fo use case diagram as mentioned above where there are two users in the system one is customer and another admin. Customer can perform various activities like view product, view category, add product to cart, do payment and confirm order whereas admin is bounded with additional activities like add, delete and update product, view customer list, view orders, and so on. So, the necessary entities of this project are users, product, cart, order and so on. Therefore , before drawing ERD we need to identify the entities , their attributes and relationship between the entities (Entity relationship diagram (ERD), 2022). So the entities, attributes and relationship of the e-commerce application are illustrate below:

Entities and Attributes:

- users: Attributes could include user id, full name, address, email, phone number, username, password.
- Products: Attributes could include product id, product name, description, summary, marked price, selling price, product image, quantity in stock.
- Category: Attribute includes category id, category name, created at.
- Order: Attributes could include order id, date/time, user id, sub total, discount, grand total price, shipping id.
- Shipping address: Attributes could include shipment id, street, country, shipped date.
- Cart: Attributed could include cart id, product id, product name, user id, quantity, price,

Relationships:

- A user can add many product to a cart, but a cart is only associated with only one user.
- A user can make many orders, but each order belongs to one user.
- Order can contain only one shipping address, but a shipping address might associate with many orders.
- An order can contain many products, and a product can appear in many orders, creating a many-to-many relationship. To resolve this, an intermediary table is needed to track which products are included in which orders.
- A category can have many product, but a specific product is associated with only one category.

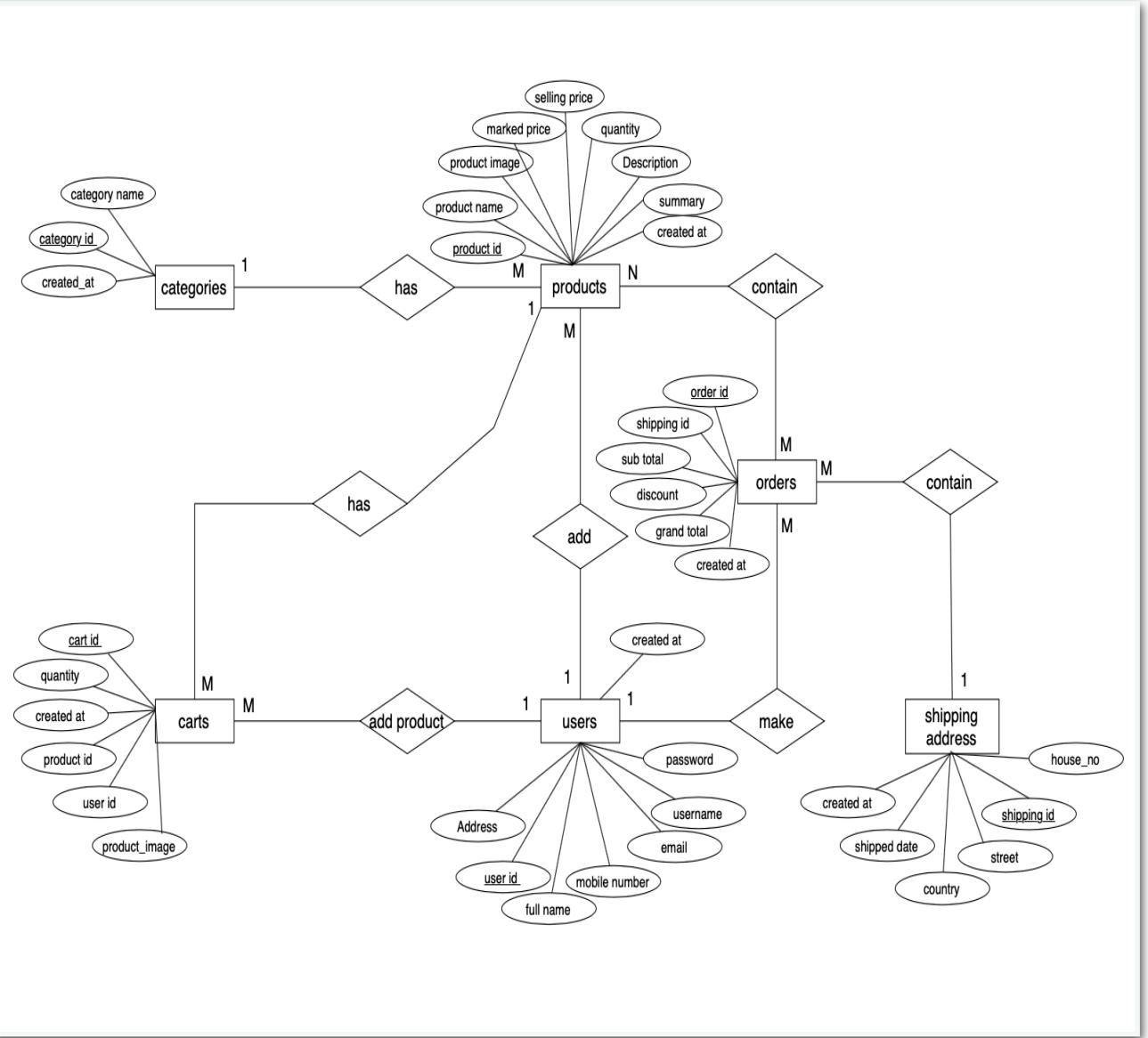


Figure 16: Entity Relationship Diagram of E-commerce application

7.4.2. Database Schema

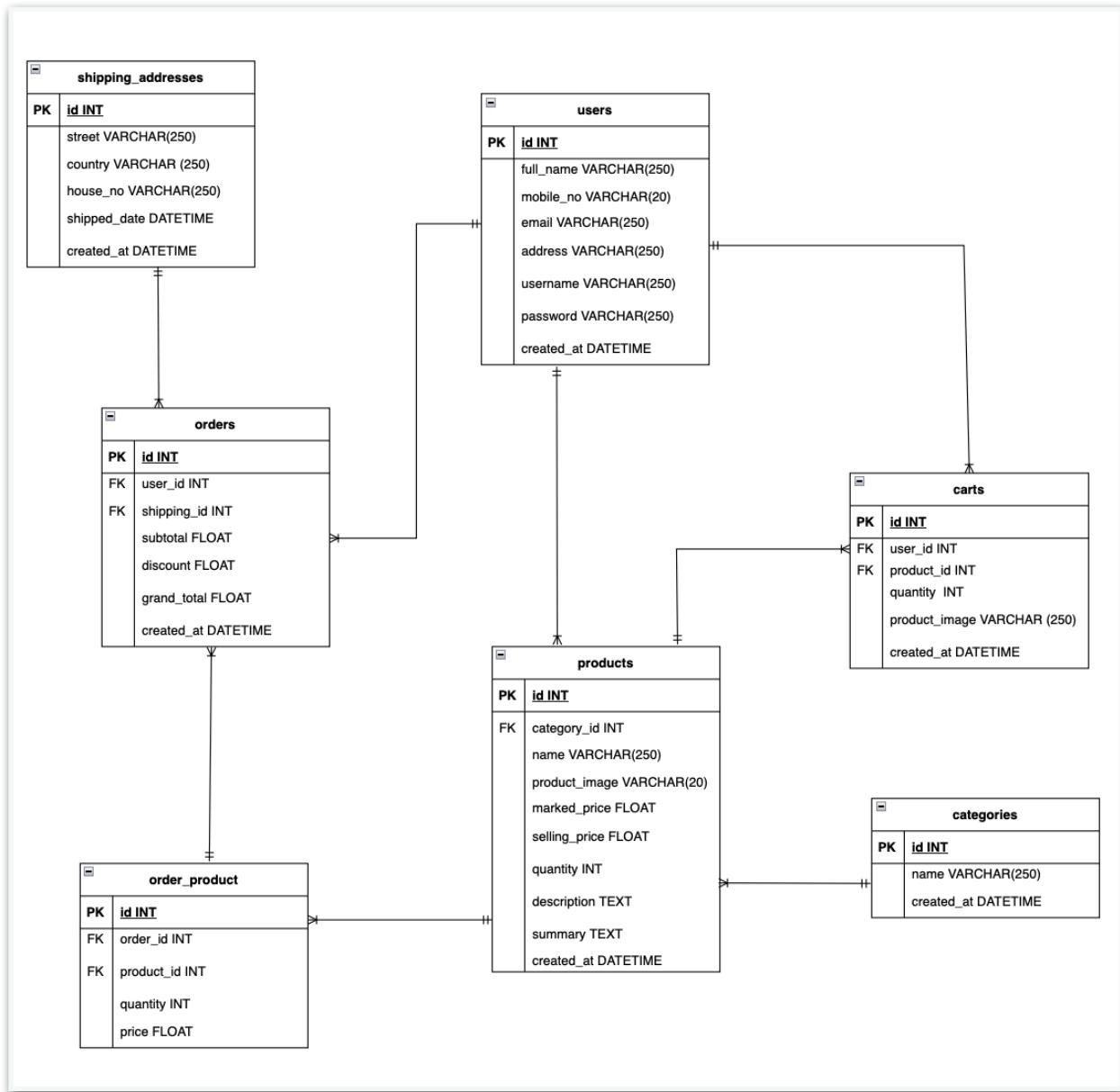


Figure 17: Database schema of E-commerce application

A database schema is a blueprint or a plan for how a database is structured. Database schema help us to identify the tables, columns, relationships, and constraints such as foreign key, primary key, not null, check constraints and so on which make up the database (ThoughtSpot, 2023). In simple words, a database schema is like a map that shows how different pieces of information are related to each other in a database. Just like a map helps us to navigate and find our ways around a city, in the same way a database schema also helps us to organise and find information within a database. The importance of a database schema lies in its ability to ensure data integrity, accuracy, and consistency. By defining the structure of the database, the schema helps to avoid

data duplication, inconsistencies, and errors that can arise when data is stored in an unstructured manner. For database designers, a database schema is a critical tool that helps them to plan, design, and implement a database system. It provides a common language for communication between database developers and stakeholders, and serves as a reference point for testing, maintenance, and troubleshooting (IBM, 2023). So, due to all these reason I have develop a database schema which could help me a lot while designing database in mysql.

7.4.3. Database Table Structure

Users Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each user in the database.
full name	VARCHAR(250)	-	The full name of the user, with a maximum length of 250 characters.
mobile_no	VARCHAR(250)	-	The mobile phone number of the user, with a maximum length of 250 characters.
email	VARCHAR(250)	-	The email address of the user, with a maximum length of 250 characters.
address	VARCHAR(250)	-	The address of the user, with a maximum length of 250 characters.
username	VARCHAR(250)	-	The username chosen by the user, with a maximum length of 250 characters.
password	VARCHAR(250)	-	The password chosen by the user, with a maximum length of 250 characters.
created_at	DATETIME	-	The date and time when the user record was created in the database.

Table 13: Database Users Table Structure

Product Table

Column Name	Data Type	Constraints	Description
id	INT	P R I M A R Y KEY	A unique identifier for each product in the database.
category_id	INT	F O R E I G N KEY	The ID of the category to which the product belongs.
name	VARCHAR(250)	-	The name of the product, with a maximum length of 250 characters.
product_image	VARCHAR(250)	-	The path or URL of the image associated with the product.
marked_price	FLOAT	-	The original price of the product.
selling_price	FLOAT	-	The discounted price of the product.
quantity	INT	-	The number of items available in stock for the product.
description	TEXT	-	A detailed description of the product.
summary	TEXT	-	A brief summary of the product.
created_at	DATETIME	-	The date and time when the product record was created in the database.

Table 14: Database Product Table Structure

Orders Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each order in the database.
user_id	INT	FOREIGN KEY	The ID of the user who placed the order.
shipping_id	INT	FOREIGN KEY	The ID of the shipping information associated with the order.
subtotal	FLOAT	-	The total cost of the items in the order, before any discounts.
discount_price	FLOAT	-	The total discount amount applied to the order.
grand_total	FLOAT	-	The total cost of the order, after discounts and taxes are applied.
created_at	DATETIME	-	The date and time when the order was created in the database.

Table 15: Database Order Table Structure

Order_product Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each order-product relationship in the database.
order_id	INT	FOREIGN KEY	The ID of the order that this product is associated with.
product_id	INT	FOREIGN KEY	The ID of the product that was ordered.
price	FLOAT	-	The price at which the product was sold in this order.
quantity	INT	-	The quantity of the product that was ordered.

Table 16: Database Order_Product Table Structure

Category Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each category in the database.
name	VARCHAR(250)	-	The name of the category.
created_at	DATETIME	-	The date and time when the category was created in the database.

Table 17: Database Category Table Structure

Carts Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each cart item in the database.
user_id	INT	FOREIGN KEY	The ID of the user who added the product to their cart.
product_id	INT	FOREIGN KEY	The ID of the product that was added to the cart.
quantity	INT	-	The quantity of the product that was added to the cart.
product_image	VARCHAR(250)	-	The path or URL of the image associated with the product that was added to cart.
created_at	DATETIME	-	The date and time when the cart item was added to the database.

Table 18: Database Cart Table Structure

Shipping_addresses Table

Column Name	Data Type	Constraints	Description
id	INT	PRIMARY KEY	A unique identifier for each shipping address in the database.
street	VARCHAR(250)	-	The street name and number of the shipping address.
country	VARCHAR(250)	-	The country of the shipping address.
house_no	VARCHAR(250)	-	The house or apartment number of the shipping address.
shipped_date	DATETIME	-	The date and time when the shipping address was used for a successful delivery.
created_at	DATETIME	-	The date and time when the shipping address was added to the database.

Table 19: Database Shipping Address Table Structure

7.5. Wireframe

A wireframe is a visual representation of a user interface design that shows the layout of the different elements on a page or screen (What are wireframes?, 2022). It is a simple, low-fidelity design that outlines the basic structure and functionality of an interface without getting into details such as colors, fonts, or images. So, some of the wireframes of the e-commerce application that I have developed in this project are:

7.5.1. Home Page

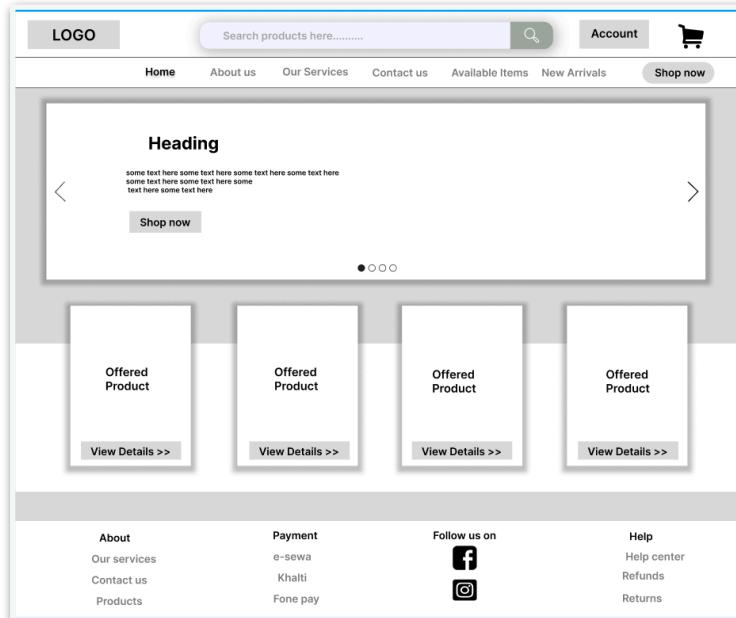


Figure 18: Home Page

This is the landing page of e-commerce application. As soon as customer opens the application the first page on that appears is home page of the website. This page also provide the highlight of the web application. With the help of this wireframe we will be able to design the actual user interface design of the home of the application.

7.5.2. About us Page

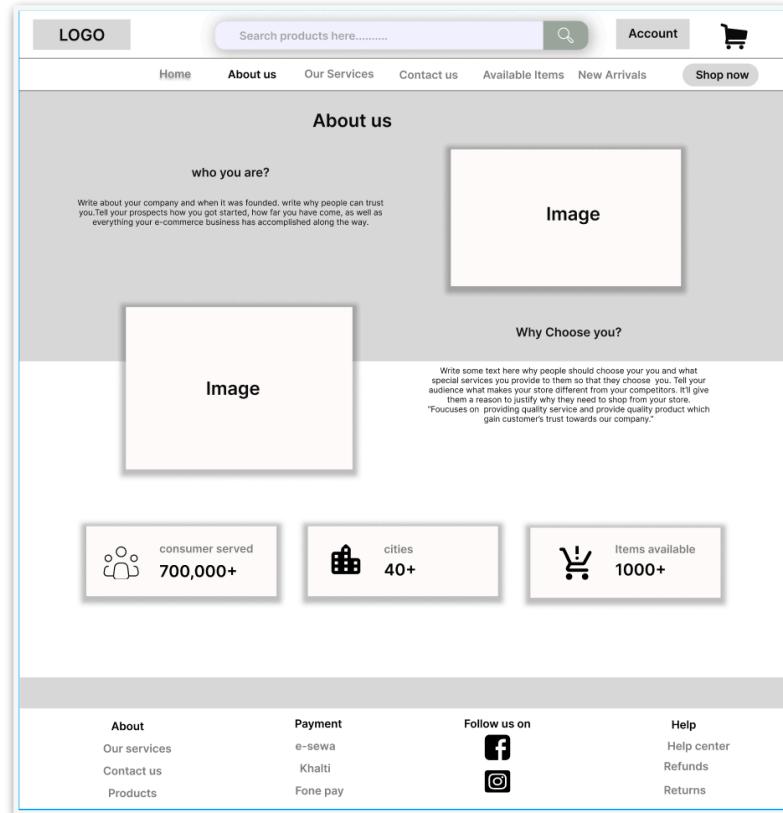


Figure 19: About Us Page

It is the layout and structure of the About Us page of e-commerce web application. It typically includes the basic elements that should be included on the page, such as the company's logo, a brief introduction to the company, the company's mission statement or values, and any other relevant information about the company's history or background. The wireframe helps to organise this information in a clear and easy-to-understand way. With the help of this wireframe it will be easier for me to design user interface design as it defines the skeleton of the page.

7.5.3. Our Services Page

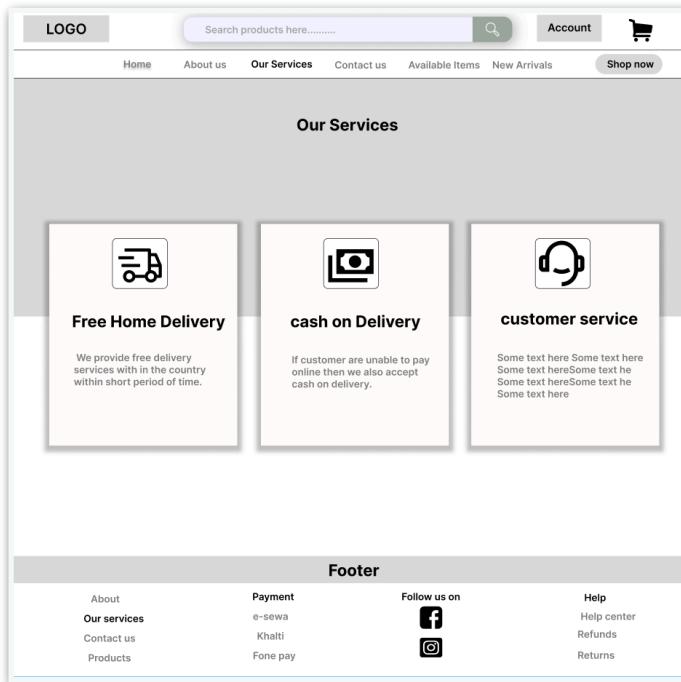


Figure 20: Our Services Page

The given diagram is the skeleton of ‘Our Services Page’ which illustrate the list of the services offered by the service provider company. The wireframe will later useful while designing actual user interface design that customer will view on their display.

7.5.4. Contact Us Page

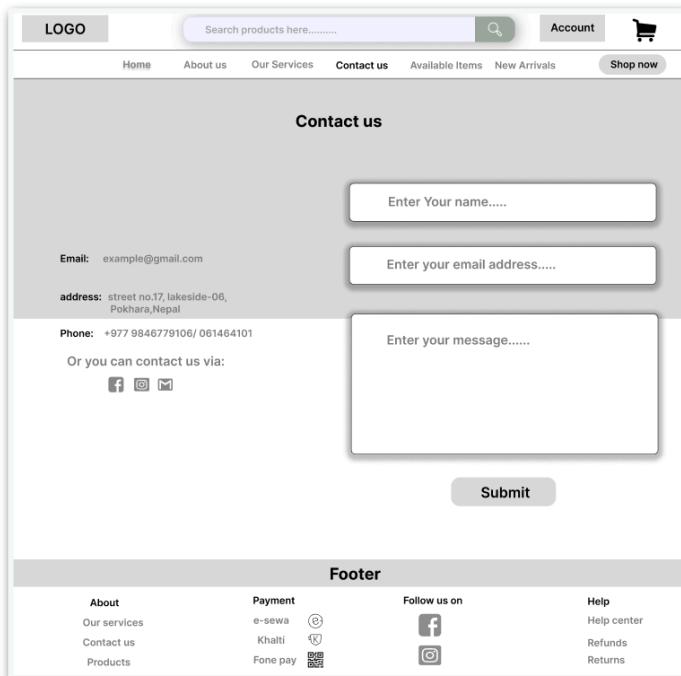


Figure 21: Contact Us Page

This is the wireframe of the contact us page. It includes key components such as the page title, contact form or fields, and company contact information. The wireframe helps ensure that the page is organised in a clear and concise manner, making it easy for users to find the information they need and to contact the company.

7.5.5. Available Items Page

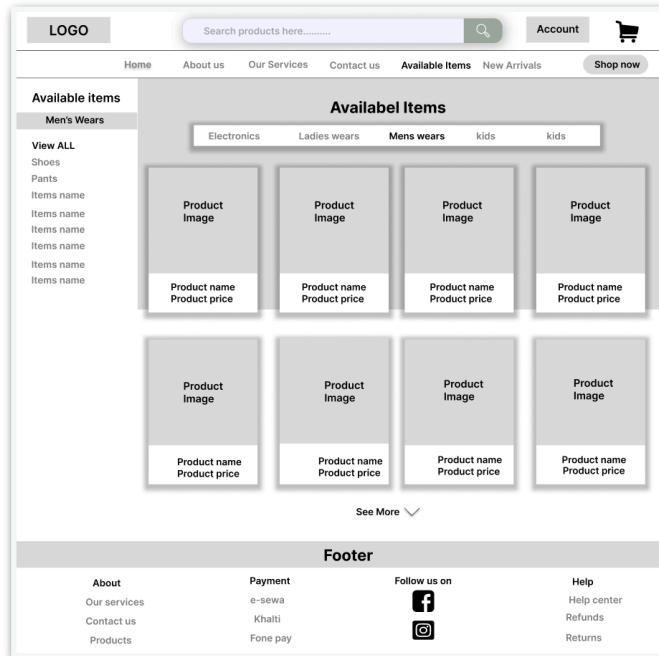


Figure 22: Available Items Page

Above given diagram is the wireframe of available items of that displays the available items which are for sales. It typically includes the page title or heading, a search or filter function to help users find specific items, a list or grid view of the available items, images and descriptions of each item, pricing information, and options for adding items to a cart or making a purchase. The wireframe helps to organize this information in a user-friendly way, making it easy for users to browse and find the items they are interested

7.5.6. New Arrivals Page

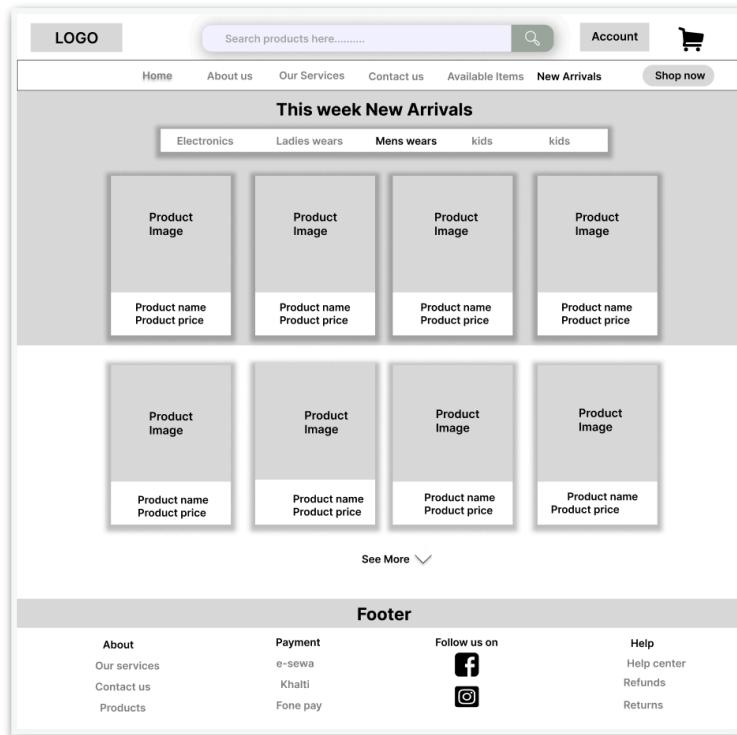


Figure 23: New Arrivals Page

This is the wireframe of newly arrival items. It is similar to available items page which displays the product information which are newly added to the database. Overall, the New Arrivals page wireframe aims to showcase the latest products or items available for sale, enticing users to make a purchase and keeping them up-to-date on the company's offerings.

7.5.7. Product Details Page

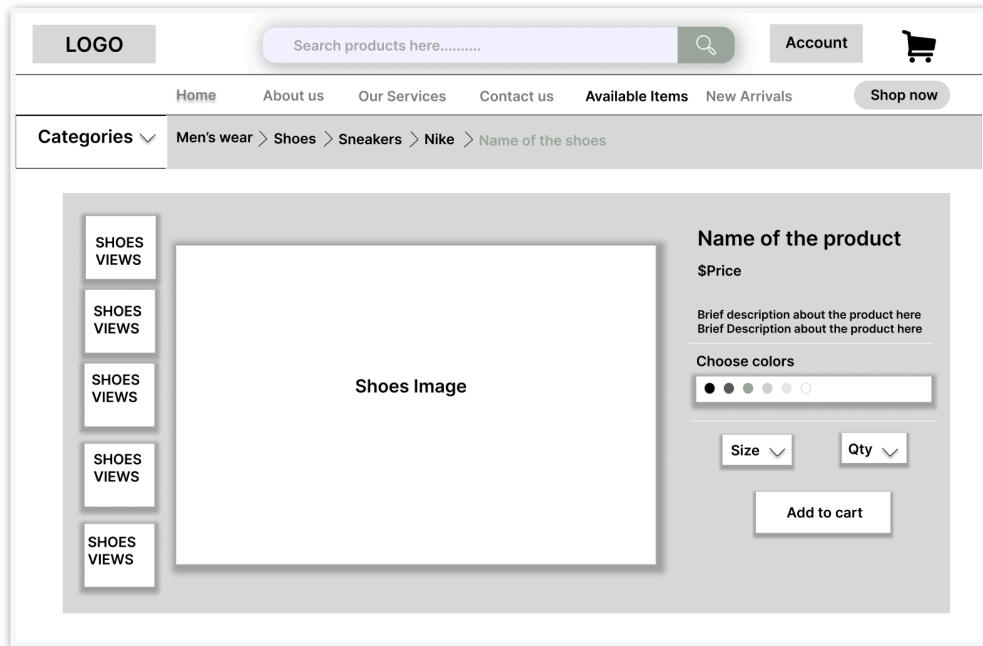


Figure 24: Product Details Page

It is the layout of product details page which displays the detail information of the specific product. As soon as customer clicks product from product catalog he/she is redirected to this page. This page describe where product image, pricing information, a description of the product, user reviews or ratings, and options for adding the product to a cart or making a purchase need to be displayed. This diagram helps designer to organise this information in a user-friendly way, making it easy for users to learn more about the product and make an informed purchasing decision.

8. Project Plan

8.1. Project Milestone

S.N	Task	Start Date	End Date	Duration
1.0	System Architecture	12/15/2022	01/02/2023	18 days
1.1	Use Case Diagram	12/15/2022	12/17/2022	2 day
1.2	System Activity Diagram	01/17/2023	01/21/2023	4 days
1.3	Sequence Diagram	01/21/2023	01/27/2023	6 days
1.4	Entity Relationship Diagram (ERD)	01/27/2023	01/01/2023	5 days
1.5	Database Schema	01/01/2023	01/02/2023	1 day
1.6	Database Table Structure	01/04/2023	01/07/2023	3 days
2.0	Wireframe and front end design	01/07/2023	01/27/2023	20 days
2.1	Home Page	01/07/2023	01/09/2023	2 days
2.2	About Us Page	01/09/2023	01/11/2023	2 days
2.3	Our Services Page	01/11/2023	01/13/2023	2 days
2.4	Contact Us Page	01/13/2023	01/15/2023	2 days
2.5	Available Items Page	01/15/2023	01/17/2023	2 days
2.6	New Arrivals Page	01/17/2023	01/19/2023	2 days
2.7	Product Details Page	01/19/2023	01/21/2023	2 days
2.8	Admin Panel design	01/21/2023	01/27/2023	6 days
3.0	Create Test Plan	02/01/2023	02/03/2023	2 days
4.0	Back end Coding	02/03/2023	03/03/2023	30 days
5.0	Testing	03/05/2023	03/08/2023	3 days
5.1	Unit Testing	03/08/2023	03/10/2023	2 days
5.1	User Acceptance Testing	03/10/2023	03/11/2023	1 day
6.0	Documentation	03/13/2023	03/18/2023	5 days

Table 20: Project Plan Milestone

8.2. Test Plan

8.2.1. Login

Test ID	Test Objective	Test Steps	Test Data	Expected Result	Result
T001	Verify that the login page is accessible	1. Open the application 2. Navigate to the login page	Application URL	The login page is displayed	
T002	Verify that form validation is working correctly	1. Press login button	Blank username and password field	Form validation with message Username and Password is mandatory	
T003	Verify that valid user credentials are accepted and the user is logged in	1. Enter valid username and password 2. Click the login button	Valid username and password	The user is redirected to the home page and logged in	
T004	Verify that invalid user credentials are rejected and the user is not logged in	1. Enter invalid username and password 2. Click the login button	Invalid username and password	An error message is displayed, and the user is not logged in	
T005	Verify that the "Logout" button works correctly	1. Click on the "Logout" button	N/A	The user is logged out and redirected to the login page	

Table 21: Login Test Plan

8.2.2. Registration

Test ID	Test Scenario	Test Steps	Test Data	Expected Results	Pass/fail
T006	Registration with valid data	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Enter valid data in all the required fields. 3. Click on the Register button. 	Valid data for all the required fields.	User is registered successfully and redirected to the login page with a success message.	
T008	Registration with invalid data	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Enter invalid data in any of the required fields. 3. Click on the Register button. 	Invalid data in any of the required fields.	User is not registered and an error message is displayed to the user.	
T009	Registration without filling all the required fields	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Leave any of the required fields blank. 3. Click on the Register button. 	Leave any of the required fields blank.	User is not registered and an error message is displayed to the user.	

Table 22: Registration Test Plan

8.2.3. View Product

Test Objective: To verify that the product can be viewed by the user on the website.

Test ID	Test Description	Test Steps	Expected Result	Pass/ Fail
T010	Verify that user can view 3D product details	1. Navigate to the product page	The all the products details (image, description, price, etc.) are displayed to the user	
T011	Verify that user can search for products	1. Navigate to the product page 2. Enter a search term in the search 3. Click on the search button	The product(s) related to the search term are displayed to the user	
T012	Verify that user can add products to cart	1. Navigate to the product page 2. Click on "Add to Cart" icon on the cart	The product is added to the user's cart	

Table 23: View Product Test Plan

8.2.4. View, Update, Delete Cart item and check out

Objective: To ensure the functionality of viewing, updating, deleting items in the cart and checkout button

Test ID	Test Description	Test Steps	Expected Result	Pass/ Fail
T013	View Cart	<ol style="list-style-type: none"> Click on Cart icon. The cart page should display all items added to the cart. Verify that the product name, price, and quantity are displayed correctly. 	All items added to the cart should be displayed correctly.	
T014	Update Cart	<ol style="list-style-type: none"> Click on the "Edit" button next to the product customer want to update. Change the quantity of the product Click on the "Update" button. Verify that the quantity of the product has been updated correctly. 	The quantity of the product should be updated correctly.	
T015	Delete from Cart	<ol style="list-style-type: none"> Click on the "Delete" button next to the product customer wants to remove from the cart. Verify that a confirmation message is displayed. Verify that the product has been removed from the cart. 	The product should be removed from the cart.	
T016	Cart Empty Message	<ol style="list-style-type: none"> Remove all items from the cart. Verify that the "Your cart is empty" message is displayed. Refresh the page Verify that the message is still displayed. 	The "cart is empty" message should be displayed when there are no items in the cart.	
T017	Verify invalid card informations	<ol style="list-style-type: none"> Click "check out" button 	The "Enter correct card information before check out"	
T018	Check out without filling all the required fields	<ol style="list-style-type: none"> Leave any of the required fields blank. Click on the check out button. 	User is not registered and an error message is displayed to the user.	
T019	Checkout with valid information and all the field correctly filed	<ol style="list-style-type: none"> Click "check out" button 	Show popup message with "Order successfully placed"	

Table 24: View, Update, Delete art item and Check out Test Plan

8.2.5. View, Update and Delete Product from Database by Admin

Objective: To ensure the functionality of viewing, updating, deleting product

Test ID	Test Description	Test Steps	Expected Results	Pass/Fail
T020	Verify that the admin can view all products in the database	1. Login as admin 2. Navigate to product management page 3. Click on "View Products"	All products from database are displayed	
T021	Verify that the admin can update a product's details in the database	1. Login as admin 2. Navigate to product management page 3. Select a product to update 4. Modify the product's details 5. Click on "Update"	The product's details are updated in the database and popup message displays "product successfully updated"	
T022	Verify that the admin can delete a product from the database	1. Login as admin 2. Navigate to product management page 3. Select a product to delete 4. Click on "Delete"	The product is removed from the database and shows popup message with "product deleted successfully"	
T023	Verify that the admin cannot delete a product that is currently in a customer's cart	1. Login as admin 2. Navigate to product management page 3. Select a product that is currently in a customer's cart 4. Click on "Delete"	An error message is displayed indicating that the product cannot be deleted because it is currently in a customer's cart	

Table 25: View, Update,Delete Product Test Plan

8.2.6. View, Update and Delete category from Database by Admin

Objective: To ensure the functionality of viewing, updating, deleting product

Test ID	Test Description	Test Steps	Expected Results	Pass/Fail
T024	Verify that the admin can view all category from the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Click on "View category" 	All category from database are displayed	
T025	Verify that the admin can update a category in the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category to update 4. Modify the category details 5. Click on "Update" 	The category's details are updated in the database and popup message displays "category successfully updated"	
T026	Verify that the admin can delete a category from the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category to delete 4. Click on "Delete" 	The product is removed from the database and shows popup message with "category deleted successfully"	
T027	Verify that the admin cannot delete a category whose product is currently in a customer's cart	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category whose product is currently in a customer's cart 4. Click on "Delete" 	An error message is displayed indicating that the category cannot be deleted because it is currently in a customer's cart	

Table 26 : View, Update and Delete Category Test Plan

9. Implementation

9.1. User Interface Design of Webpages

9.1.1. Login

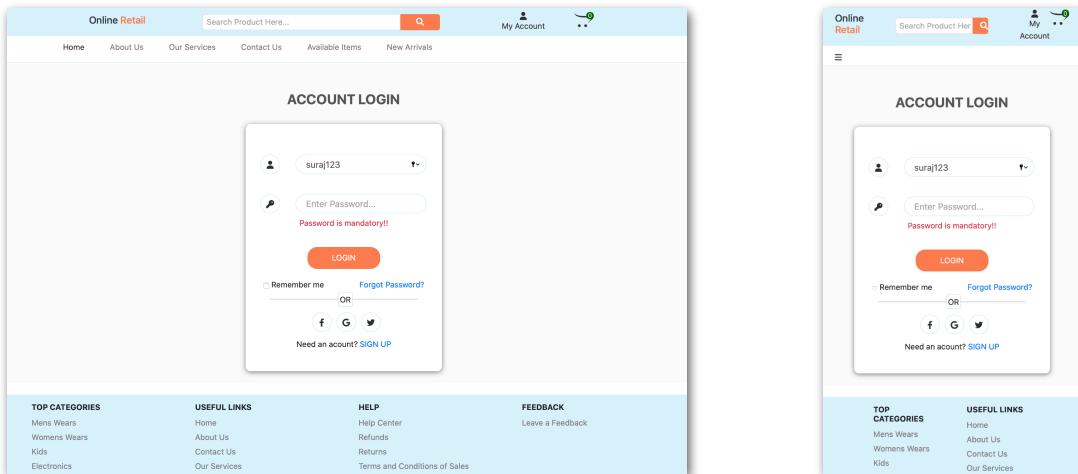


Figure 25: Login Form with error message

If customer or admin miss to provide informations in the required fill then a message is shows as shown in the given figure. In the figure above after providing the username I clicked login button. As soon as I clicked login button a message “Password is mandatory” is shown which is called form validation. But if the user provide valid username and password he/she are directed to Home page.

9.1.2. Product

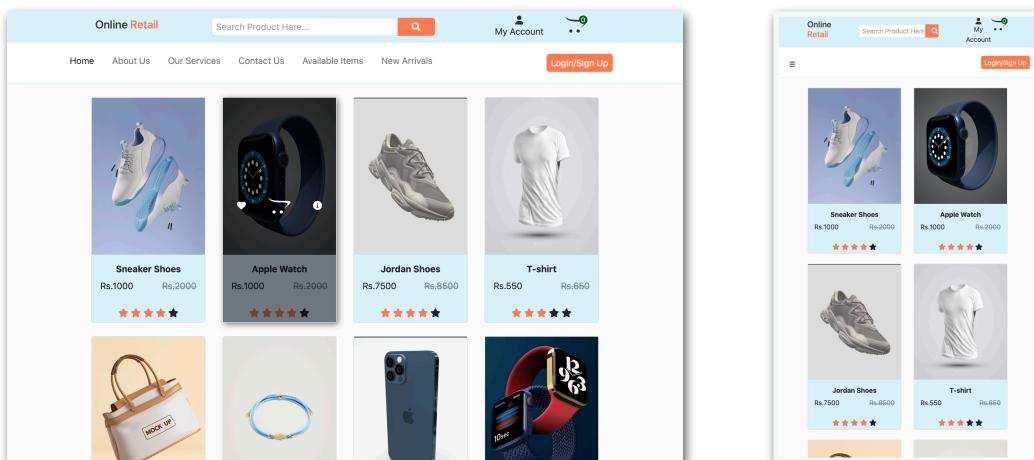


Figure 26: 3D view demonstration of products in product page

Above illustrated screenshots are the desktop and mobile view of product page of the e-commerce application. This page demonstrate the products after retrieving from the database. The 3d model product helps to provide customers an immersive shopping experience as they can visualise the product from all the side. The page typically features a high-quality 3D rendering of the product that can be rotated and viewed from all angles.

9.1.3. Product Details

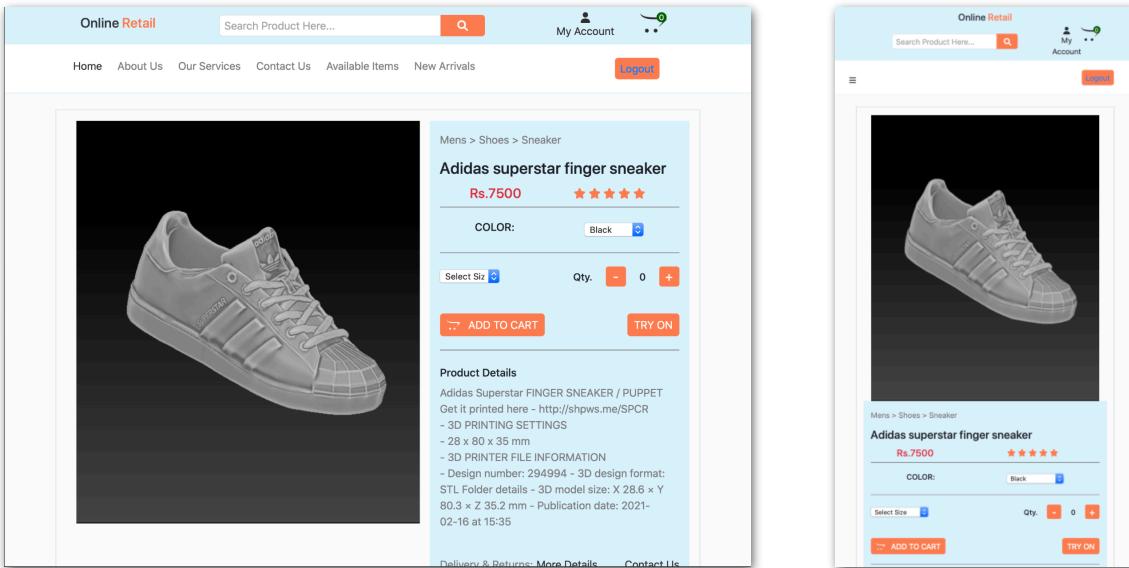


Figure 27: User Interface design of Product Details page

The product details page in an AR implemented e-commerce application provides customers with a more immersive shopping experience by allowing them to visualise the product in their physical environment. Currently, only spectacles can be visualise. The page typically includes a product image, name, price, and description, as well as a button to launch the AR experience. Once the AR experience is launched, customers can use their smartphone or tablet camera to place a 3D model of the product in their real-world environment.

9.1.4. About us

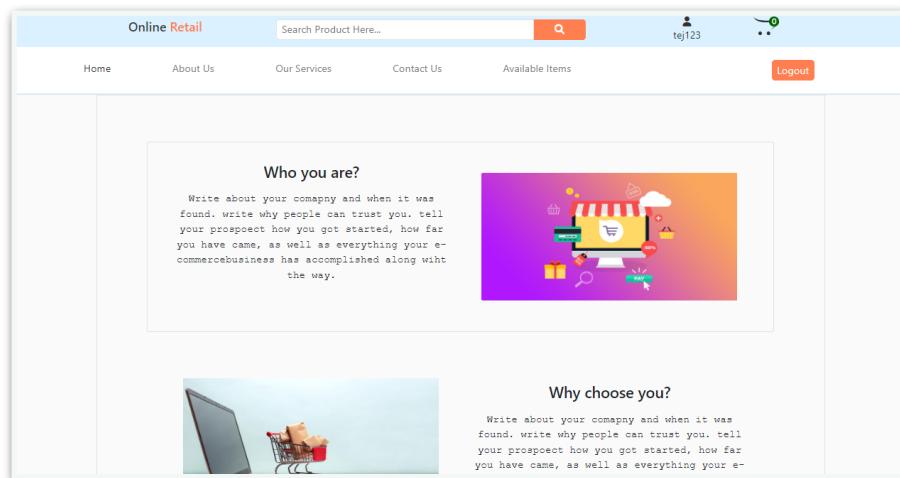


Figure 28: About Us Page Interface Design

Above given diagram is the about us page of e-commerce application. The About Us page is a crucial part of a website. It provides information about the company's history and services, including their mission statement, values, and location. The page also features the team members and contact information. The purpose of this page is to help customers understand the company's identity and build trust by being transparent about who they are and what they stand for.

9.1.5. Our Services

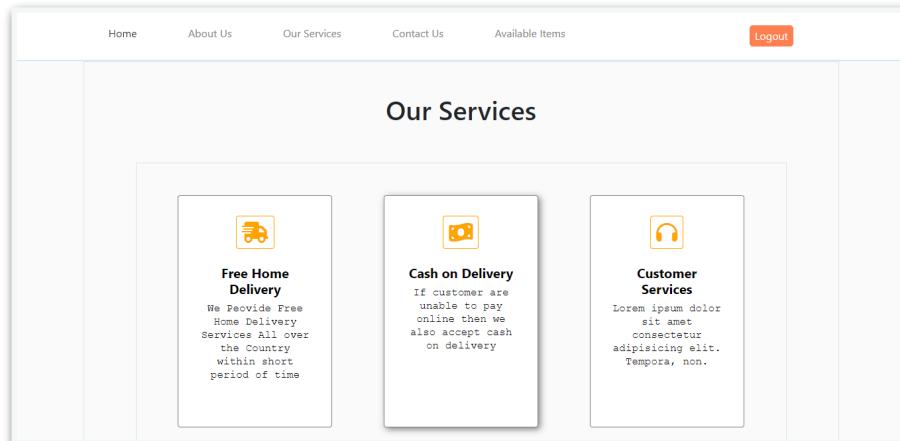


Figure 29: Our Services Page

This is the static our services page of e-commerce application. This page includes the detail information of the services provided by the e-commerce company. The page typically includes a list of the company's services, along with descriptions and pricing information.

9.1.6. Profile

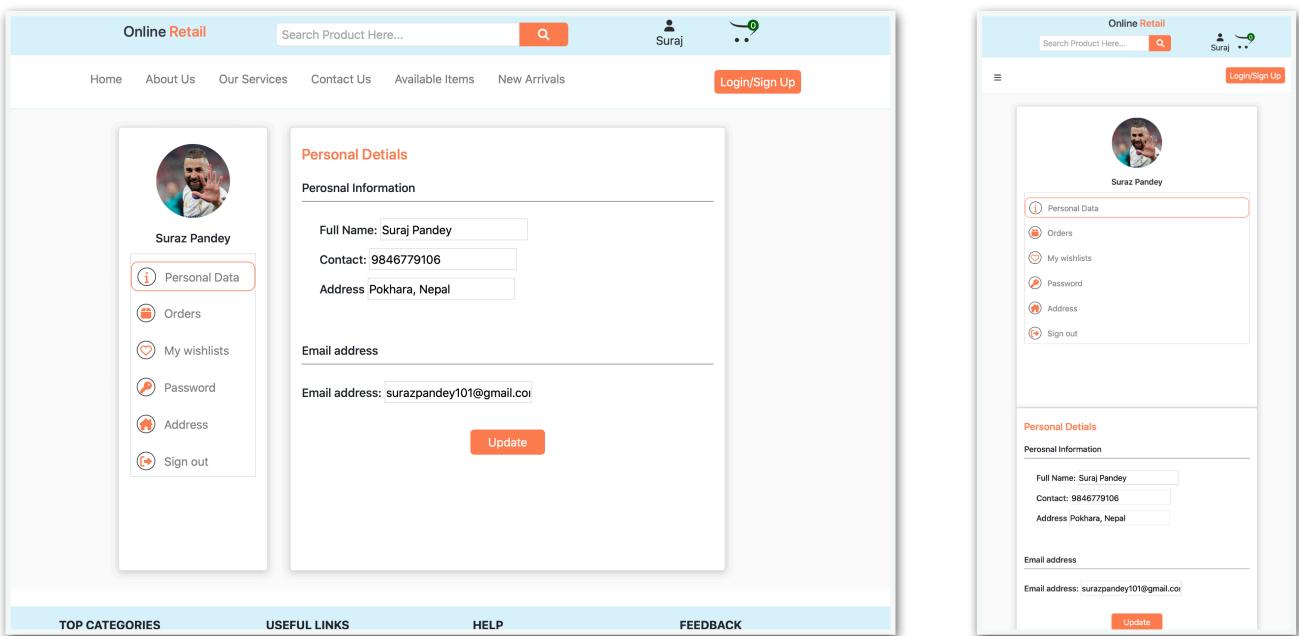


Figure 30: View Profile Page

This is the page that appears after clicking account icon at the navigational car only if customer is logged in. In this page the detail information of the logged user is displayed and users are able to edit their profile too. They can view orders, manage password and so on.

9.1.7. Admin Panel

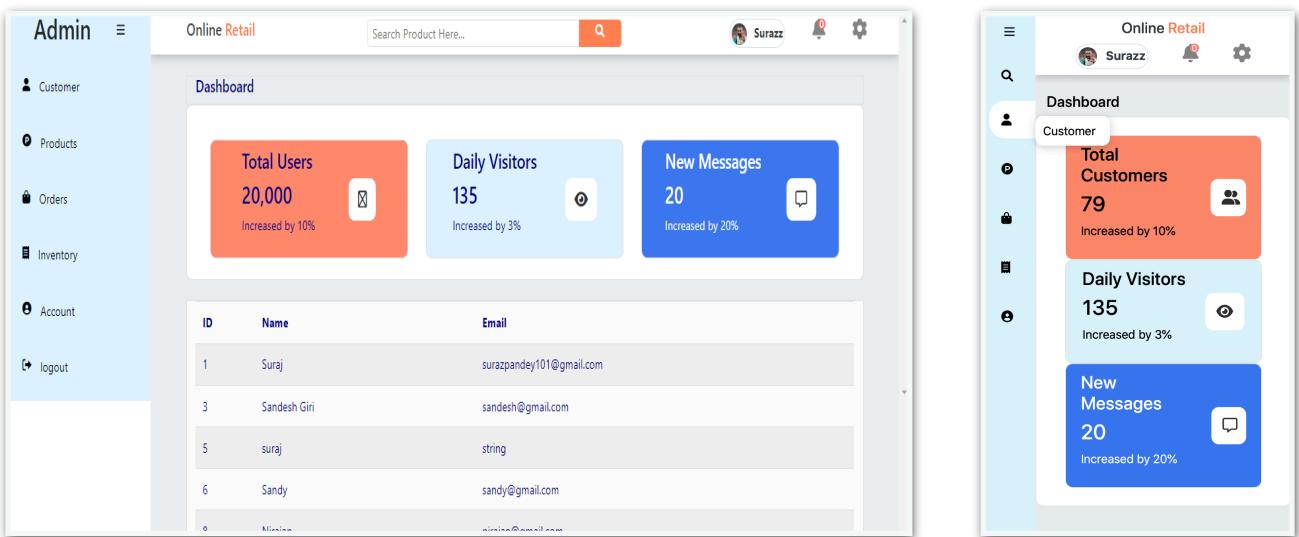


Figure 31: View customer list Admin Panel

This is the admin dashboard of the e-commerce application where all the activities that admin is given access are performed such as customer management, product management, order

management, and so on. After user enter username and password and hit login button in login form server reads data from the database and send message to the front end. So, if the message contain the role with ‘Admin’ this dashboard appears. In above figure list of the users registered into the database are illustrated on tabulated formate and the delete and update access are also not given to the admin in this context.

ID	Name	Image	Quantity	Action
8	shoes		4	Delete Edit
9	FOOTBALL BOOTS		3	Delete Edit
13	Futsal boots		3	Delete Edit
14	shirt		2	Delete Edit

Figure 32: Product Management Page of Admin Panel

The Product Management page in an e-commerce application's admin panel is where the store's administrator can manage the products available on the website. It includes a list of all products with descriptions, prices, and images. From this page, the administrator can add, edit, or delete products, update information and manage inventory levels. They can also create promotions and assign products to categories. The goal of the Product Management page is to give the administrator full control over the product offerings, ensuring accuracy and relevancy for customers, resulting in a more successful and efficient e-commerce platform.

9.2. Code Implementation

9.2.1. Sample Code of Web API Controller

```
[HttpPost]
//[Route("putUser")]

0 references
public string putUser(User usr)
{
    UserResponse ur = new UserResponse();
    string message = ur.registerUser(usr);
    return message;
}
```

Figure 33: Sample of HttpPost controller

This is the api helps to put users details into the database. This controller invoke the ‘registerUser’ method of ‘UserResponse’ class which stores the code to insert data into the database. Similar to this there are HttpPost method to store product information into the database. I have used JQuery Ajax method to get access to this code.

```
[HttpGet]
// [Route("Getusers")]
0 references
public List<User> Getusers()
{
    UserResponse ur = new UserResponse();

    List<User> obj = ur.getUsers();

    return obj;
}

[HttpGet("{id}")]
// [Route("Getuser/{id}")]
0 references
public List<User> Getuser(int id)
{
    UserResponse ur = new UserResponse();
    List<User> obj = ur.getUser(id);
    return obj;
}
```

Figure 34: Sample of HttpGet Controller

In above given figure we can view HttpGet method. In this figure one controller is used to get all the users from the database whereas another method is used to retrieve the data of specific user from the database .

```
//Delete user api
[HttpDelete("{id}")]
// [Route("delete/{id}")]

0 references
public string delete(int id)
{
    UserResponse ur = new UserResponse();
    //ur.getUser(id);
    string message = ur.deleteUser( id);

    return message;
}
```

Figure 35: Sample of HttpPut Controller

This is the example of Web API which used to update the data in the database. This api invokes the method storing the code that is used to update the information of the specific users whose is is passed as a parameter.

```
[HttpPost("{id}")]
// [Route("update/{id}")]
0 references
public string update( User usr,int id)
{
    UserResponse ur = new UserResponse();
    string message = ur.updateusers(usr, id);

    return message;
}
```

Figure 36: Sample of HttpDelete Controller

This is the example of Web API which used to delete the data in the database. As shown in the given figure, this controller invoke the method storing the code that will help to delete information of specific users whose id is passed as a parameter from the database.

9.2.2. Sample Code of Model class

```
using System.ComponentModel.DataAnnotations;
using System.ComponentModel.DataAnnotations.Schema;

namespace onlinerentailapi.Models
{
    20 references
    public class User
    {

        public int id { get; set; }
        4 references
        public string name { get; set; }
        [Required]
        7 references
        public string username { get; set; }
        4 references
        public string password { get; set; }
        4 references
        public string email { get; set; }
        2 references
        public long contact_no { get; set; }
        4 references
        public string type { get; set; }
        4 references
        public string profile_img { get; set; }
        2 references
        public DateTime created_at { get; set; }
        2 references
        public DateTime updated_at { get; set; }

        // public IFormFile files { get; set; }
    }
}
```

Figure 37: Sample of User Model class

9.2.3. Sample Code of ADO.Net code

ADO.NET is a programming framework used to connect to and work with databases. It allows developers to create applications that can retrieve and store data in databases, such as SQL Server or Oracle. The server that have used is mysql. The framework includes classes and methods that enable the creation of database connections, the execution of SQL commands, and the management of data transactions.

```
//method to insert
1 reference
public string registerUser(User usr)
{
    string image = usr.profile_img;
    string fileName = Path.GetFileName(image);
    string filePath = "/wwwroot/uploads/" + fileName;
    SqlCommand cmd = new SqlCommand("insert into [user]
        (name,username,password,email,contact_no,type,profile_img,created_at,updated_at) values(@name, @username,
        @password, @email, @contact_no, @type,@profile_img, @created_at, @updated_at)", con);

    cmd.Parameters.AddWithValue("@name", usr.name);
    cmd.Parameters.AddWithValue("@username", usr.username);
    cmd.Parameters.AddWithValue("@password", usr.password);
    cmd.Parameters.AddWithValue("@email", usr.email);
    cmd.Parameters.AddWithValue("@contact_no", usr.contact_no);
    cmd.Parameters.AddWithValue("@type", usr.type);
    cmd.Parameters.AddWithValue("@profile_img", filePath);
    cmd.Parameters.AddWithValue("@created_at ", usr.created_at);
    cmd.Parameters.AddWithValue("@updated_at", usr.updated_at);
    con.Open();
    int i = cmd.ExecuteNonQuery();
    con.Close();

    if (i > 0)
    {
        return "Data inserted succesfully into the database!!";
    }
    else
    {
        return "Unable to insert data into database!! something has gone WRONG!!";
    }
}
```

Figure 38: Code to Insert Registered Users into Database

Given example is the actual c# code that is used to insert user's details into a database called users. This ADO.NET typically involves creating a connection to the database, creating an SQL query that inserts the user's information into the appropriate table, and then executing the query. The user's information, such as name, email address, and password, is obtained from the registration form and then passed as parameters to the SQL query. Once the query is executed, the user's information is stored in the database for future use. The purpose of this code is to store user information securely and reliably, ensuring that it is readily available for use in other parts of the application.

```

[HttpPost]
[Route("Login")]
public IActionResult login(Login login)
{
    SqlConnection con = new SqlConnection("Data Source=DESKTOP-IR1C47V\SQLEXPRESS;Initial Catalog=Online_retail;Integrated Security=True");
    string username = login.username;
    string password = login.password;

    con.Open();
    SqlCommand cmd = new SqlCommand("select * from [user] where username='" + username + "' and password = '" + password + "'", con);
    cmd.Parameters.AddWithValue("@username", username);
    cmd.Parameters.AddWithValue("@password", password);
    SqlDataReader dr = cmd.ExecuteReader();
    if (dr.HasRows)
    {
        while (dr.Read())
        {
            var user = new User
            {
                id = Convert.ToInt32(dr.GetValue(0).ToString()),
                username = dr.GetValue(1).ToString()
            };
            return Ok(new
            {
                userId = user.id,
                role = "customer"
            });
        }
    }
    else
    {
        if (username == "admin" && password == "admin")
        {
            return Ok(new
            {
                role = "admin"
            });
        }
        else
        {
            return Ok(new
            {
                role = "invalid"
            });
        }
    }
    return Ok(new
    {
        role = "invalid"
    });
}

```

Figure 39: Login code

The ADO.NET login code for an e-commerce application involves reading user information from a database. If a user with a matching username and password is found in the database, the code returns the user's ID and role as a customer. If the username and password are set as admin, the code sets the role to admin by default. If the username and password are incorrect, the code returns an error message stating that the login is invalid.

To accomplish this, the code creates a connection to the database and runs a SQL query to retrieve user information. The query uses parameters for the username and password entered by the user in the login form. If the query returns a row with matching credentials, the user's ID and role are returned. If the query returns no results or an error occurs, an error message is returned. The purpose of this code is to authenticate users and grant them appropriate access to the e-commerce application based on their role.

```

10 references
public class UserResponse
{
}

    SqlConnection con = new SqlConnection("Data Source=DESKTOP-IR1C47V\SQLEXPRESS;Initial Catalog=Online_retail;Integrated Security=True");

    //methods to get all user details from database
    public List<User> getUsers()
    {
        List<User> listuser = new List<User>();
        SqlCommand cmd = new SqlCommand("select * from [user]", con);
        con.Open();

        SqlDataReader dr = cmd.ExecuteReader();
        while (dr.Read())
        {
            User user = new User();
            user.id = Convert.ToInt32(dr.GetValue(0).ToString());
            user.name = dr.GetValue(1).ToString();
            user.username = dr.GetValue(2).ToString();
            user.password = dr.GetValue(3).ToString();
            user.email = dr.GetValue(4).ToString();
            //user.contact_no = Convert.ToInt32(dr.GetValue(5).ToString());
            user.type = dr.GetValue(6).ToString();
            user.profile_img = dr.GetValue(7).ToString();
            //user.created_at = dr.GetDateTime(8);
            // user.updated_at = dr.GetDateTime(9);
            listuser.Add(user);
        }
        con.Close();
        return listuser;
    }
}

```

Figure 40: Code to Retrieve all the Registered Users From Database

The ADO.NET code to get all users from a database involves creating a connection to the database and executing an SQL query to retrieve user information. The query returns a list of users with their respective details as meted in user model class. The code then transforms this list into JSON format, which is a lightweight data interchange format used to transmit data between a client and a server. The purpose of this code is to retrieve user information from the database and make it available to the admin panel to display the results.

```

[HttpPost]
[Route("addtocart")]
public string addtocart([FromForm] AddToCart at)
{
    DateTime date = DateTime.Now;
    int productId = at.productId;
    int userId = at.userId;
    string sql = "SELECT id, selling_price, product_image FROM [product] WHERE id =@ProductId";
    using (SqlCommand cmd = new SqlCommand(sql, con))
    {
        cmd.Parameters.AddWithValue("@productId", productId);
        cmd.Open();
        using (SqlDataReader reader = cmd.ExecuteReader())
        {
            if (reader.Read())
            {
                //Extract the product information from the data reader
                string productName = reader.GetValue(0).ToString();
                float productPrice = Convert.ToInt32(reader.GetValue(1).ToString());
                string productImage = reader.GetValue(2).ToString();
                reader.Close();
                //Insert the product
                string insert = "INSERT INTO [cart] (cart_id, product_id, quantity, price_created_at,updated_at , productImage,productName ) VALUES (@userId, @productId, @Quantity, @price, @created_at, @updated_at , @productImage,@productName)";
                SqlCommand insertCommand = new SqlCommand(insert, con);
                insertCommand.Parameters.AddWithValue("@userId", userId);
                insertCommand.Parameters.AddWithValue("@productId", productId);
                insertCommand.Parameters.AddWithValue("@Quantity", 1);
                insertCommand.Parameters.AddWithValue("@price", productPrice);
                insertCommand.Parameters.AddWithValue("@created_at", date.ToString("yyyy-MM-dd"));
                insertCommand.Parameters.AddWithValue("@updated_at", date.ToString("yyyy-MM-dd"));
                insertCommand.Parameters.AddWithValue("@productImage", productImage);
                insertCommand.Parameters.AddWithValue("@productName", productName);
                int i = insertCommand.ExecuteNonQuery();
                con.Close();
                if (i > 0)
                {
                    return "Data inserted successfully into the database!!";
                }
                else
                {
                    return "Unable to insert data into database!! something has gone WRONG!!";
                }
            }
        }
    }
}

```

Figure 41: Code to Add Product into Database

This is the code that is used to add a product to the cart table into the database. First of all in this code product informations are retrieve from the product table using the product ID as a

parameter. Once the information is retrieved and stored in local variables, the code then inserts this data into the cart table in the database. The purpose of this code is to enable the e-commerce application to add products to a user's cart. By retrieving the product information from the product table, the application can ensure that the product being added is valid and exists in the database. Storing the product data in the cart table allows the application to keep track of which products are in a user's cart and retrieve this information as needed.

9.2.3. Sample code of JQuery Ajax Call

```
$('.registerBtn').on('click',function(e)
{
  e.preventDefault();
  alert("button-clicked");

  // $("#Result").html("button clicked")
  var Name=$('#txtName').val();
  var Username=$('#txtUsername').val();
  var Password=$('#txtPassword').val();
  var Email= $('#txtEmail').val();
  var Contact_no=$('#txtContact').val();
  var Type="user";
  var Profile_img="image";
  var Created_at="2022-11-16T06:26:21.123Z";
  var Updated_at="2022-11-16T06:26:21.123Z";

  var jsonData ={
    name:Name,
    username:Username,
    password:Password,
    email:Email,
    contact_no:Contact_no,
    type:Type,
    profile_img:Profile_img,
    created_at:Created_at,
    updated_at:Updated_at
  };

  $.ajax({
    type:'POST',
    url:'https://localhost:7086/api/user',
    contentType:'application/json',
    dataType:'text',
    data:JSON.stringify(jsonData),
    success:function(response)
    {
      alert (response);
      $('#txtName').val("");
      $('#txtUsername').val("");
      $('#txtPassword').val("");
      $('#txtEmail').val("");
      $('#txtContact').val("");

      return;
    },
    error:function(error)
    {
      alert("error");
      return;
    }
  });
});
```

Figure 42: JQuery Ajax Post Request

The AJAX code uses the `$.ajax()` method with a POST request type to send form data to the API endpoint. The data from the form is serialised into a JSON formate that can be sent as a POST request to the API endpoint. The purpose of this code is to allow users to submit form data to the server without having to reload the entire page. This provides a smoother user experience and allows for more dynamic web applications.



```
$('#customer').click(function() {
    $.ajax({
        type: 'GET',
        url: "https://localhost:7086/api/user",
        dataType: 'json',
        success: function(data) {
            console.log(data);
            var table = $("<table>").addClass("table table-striped");
            var header = $("<thead>").append("<tr><th>ID</th><th>Name</th><th>Email</th></tr>");
            table.append(header);
            var tbody = $("<tbody>");
            for (i = 0; i < data.length; i++) {
                var row = $("<tr>");
                row.append("<td>" + data[i]["id"] + "</td>");
                row.append("<td>" + data[i]["name"] + "</td>");
                row.append("<td>" + data[i]["email"] + "</td>");
                tbody.append(row);
            }
            table.append(tbody);
            $("#Result").html(table);
        },
        error: function(error) {
            alert(error);
        }
    });
});
```

Figure 43: JQuery Ajax Get Request

The AJAX code uses the `$.ajax()` method with a GET request type to retrieve data from the API endpoint. The API endpoint retrieves the data from the database and sends it back in a format that can be easily parsed by the frontend user interface. The purpose of this code is to allow the frontend user interface to interact with the backend database and retrieve data in real-time without the need for the page to be reloaded.

9.2.4. Sample Code of Three.js code to display 3D model

```

$.ajax({
    type:'Get',
    url:"https://localhost:7086/api/product",
    dataType:'json',
    success:function(data)
    {
        console.log(data);

        // var table = $(<table>).append("<tr><td> ID </td><td> NAME </td><td> EMAIL </td><td> Image</td></tr>");
        for(i=0;i<data.length;i++)
        {

            $("main-content").append("<div class='product-card col-lg-3 col-md-4 col-sm-6 mt-4'><div class='card'><div id='overlay'><div class='box'>" +
                "<ul class='d-flex justify-content-around align-items-center'>" +
                "<li><a href='ProductDetails.html?id=" + data[i]['id'] + "'><i class='fa-brands fa-openCart'></i></a><a href='ProductDetails.html?id=" + data[i]['id'] + "'><i class='fa-regular fa-circle-info information'></i></a></li></ul></div><div class='product-image'>" +
                "<img alt='myCanvas' src='myCanvas'" + data[i]['name'] + ".png'></div><div class='product-content container pt-3'><div class='product-name'><h6>" +
                data[i]['name'] + "</h6></div><div class='price d-flex justify-content-between align-items-center'><p class='id'>" +
                data[i]['id'] + "</p><del>" + data[i]['original_price'] + "</del><div><span>M&lt;sup>RS</sup></span><del>" + data[i]['original_price'] + "</del></div><div><span>Rs</span>" + data[i]['marked_price'] + "</span></div></div><div class='rating pt-2 text-center'><i class='fa-solid fa-star checked'></i>" +
                "<i class='fa-solid fa-star'></i><i class='fa-solid fa-star'></i><i class='fa-solid fa-star'></i><i class='fa-solid fa-star'></i></div></div>" +
                "</div></div>");

            $("myCanvas").each(function(index) {
                var scene = new THREE.Scene();
                var camera = new THREE.PerspectiveCamera(90, canvasWidth/canvasHeight, 1, 1000);
                var light = new THREE.DirectionalLight(0xffffff, 1);
                // var ambient = new THREE.AmbientLight("#85b2cd");
                light.position.set(0.1, 0.1, 0.1);
                scene.add(light);
                // scene.add(ambient);
                var renderer = new THREE.WebGLRenderer({canvas:canvas});
                renderer.setSize(canvasWidth, canvasHeight);

                var camera = new THREE.PerspectiveCamera(90, canvasWidth/canvasHeight, 1, 1000);
                camera.rotation.y = 45/180*Math.PI;
                camera.position.x=-800;
                camera.position.z=0;
                camera.position.y = 100;
                const loader = new THREE.GLTFLoader();
                loader.load([data[i]['product_image']], function(gltf){

                    scene.add(gltf.scene);
                    renderer.render(scene, camera);
                });

                function animate(){
                    requestAnimationFrame(animate);
                    renderer.render(scene, camera);
                }

                animate();
            });
        }
    }
});

var count = 0;
$('.cart-btn').click(function()
{
    count = count+1;
    $('.count').text(count);
    var productId = $(this).data('productId');
    var userId = localStorage.getItem("userId");

    var userId = localStorage.getItem("userId");

    $.ajax({
        url: "https://localhost:7086/api/product/addtocart",
        method: "POST",
        data: {
            productId: productId,
            userId: userId
        },
        success: function(response) {
            alert(response);
            // Do something with the response
        },
        error: function(jqXHR, textStatus, errorThrown) {
            alert(errorThrown);
            // Handle the error
        }
    });

    if(count == 5)
    {
        alert("Cart Full");
    }
});

```

Figure 44: Three Js Code to Display 3D Model

The jQuery AJAX code requests a HttpGet API that retrieves product details from a database and displays them in a product catalog in a 3D format using Three.js code. The AJAX code uses the `$.get()` method to retrieve data from the HttpGet API endpoint. The retrieved data includes product details such as name, image, and price. This data is then used to create a 3D model of the product using the Three.js library. The purpose of this code is to provide a visually appealing product catalog for users to browse through. By retrieving product details from a database using an API endpoint, the application can ensure that the product information is up-to-date and accurate. Displaying the products in a 3D format using Three.js allows users to view products from different angles and get a better understanding of the product's design and features.

10. System Validation

10.1. Unit Testing Result

10.1.1. Login

Test ID	Test Objective	Test Steps	Test Data	Expected Result	Result
T001	Verify that the login page is accessible	1. Open the application 2. Navigate to the login page	Application URL	The login page is displayed	PASS
T002	Verify that form validation is working correctly	1. Press login button	Blank username and password field	Form validation with message Username and Password is mandatory	PASS
T003	Verify that valid user credentials are accepted and the user is logged in	1. Enter valid username and password 2. Click the login button	Valid username and password	The user is redirected to the home page and logged in	PASS
T004	Verify that invalid user credentials are rejected and the user is not logged in	1. Enter invalid username and password 2. Click the login button	Invalid username and password	An error message is displayed, and the user is not logged in	PASS
T005	Verify that the "Logout" button works correctly	1. Click on the "Logout" button	N/A	The user is logged out and redirected to the login page	PASS

Table 27: Login Unit Testing

10.1.2. Registration

Test ID	Test Scenario	Test Steps	Test Data	Expected Results	Pass/fail
T006	Registration with valid data	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Enter valid data in all the required fields. 3. Click on the Register button. 	Valid data for all the required fields.	User is registered successfully and redirected to the login page with a success message.	PASS
T008	Registration with invalid data	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Enter invalid data in any of the required fields. 3. Click on the Register button. 	Invalid data in any of the required fields.	User is not registered and an error message is displayed to the user.	PASS
T009	Registration without filling all the required fields	<ol style="list-style-type: none"> 1. Click on the Register button. 2. Leave any of the required fields blank. 3. Click on the Register button. 	Leave any of the required fields blank.	User is not registered and an error message is displayed to the user.	PASS

Table 28: Registration Unit Testing

10.1.3. View Product

Test Objective: To verify that the product can be viewed by the user on the website.

Test ID	Test Description	Test Steps	Expected Result	Pass/ Fail
T010	Verify that user can view 3D product details	1. Navigate to the product page	The all the products details (image, description, price, etc.) are displayed to the user	PASS
T011	Verify that user can search for products	1. Navigate to the product page 2. Enter a search term in the search 3. Click on the search button	The product(s) related to the search term are displayed to the user	PASS
T012	Verify that user can add products to cart	1. Navigate to the product page 2. Click on "Add to Cart" icon on the cart	The product is added to the user's cart	PASS

Table 29: View Product Unit Testing

10.1.4. View, Update, Delete Cart item and check out

Test ID	Test Description	Test Steps	Expected Result	Pass/Fail
T013	View Cart	<ol style="list-style-type: none"> Click on Cart icon. The cart page should display all items added to the cart. Verify that the product name, price, and quantity are displayed correctly. 	All items added to the cart should be displayed correctly.	PASS
T014	Update Cart	<ol style="list-style-type: none"> Click on the "Edit" button next to the product customer want to update. Change the quantity of the product Click on the "Update" button. Verify that the quantity of the product has been updated correctly. 	The quantity of the product should be updated correctly.	PASS
T015	Delete from Cart	<ol style="list-style-type: none"> Click on the "Delete" button next to the product customer wants to remove from the cart. Verify that a confirmation message is displayed. Verify that the product has been removed from the cart. 	The product should be removed from the cart.	PASS
T016	Cart Empty Message	<ol style="list-style-type: none"> Remove all items from the cart. Verify that the "Your cart is empty" message is displayed. Refresh the page Verify that the message is still displayed. 	The "cart is empty" message should be displayed when there are no items in the cart.	PASS
T017	Verify invalid card informations	<ol style="list-style-type: none"> Click "check out" button 	The "Enter correct card information before check out"	PASS
T018	Check out without filling all the required fields	<ol style="list-style-type: none"> Leave any of the required fields blank. Click on the check out button. 	User is not registered and an error message is displayed to the user.	PASS
T019	Checkout with valid information and all the field correctly filed	<ol style="list-style-type: none"> Click "check out" button 	Show popup message with "Order successfully placed"	PASS

Table 30: View, Update and Delete Item from Cart Unit Testing

10.1.5. View, Update and Delete Product

Test ID	Test Description	Test Steps	Expected Results	Pass/Fail
T020	Verify that the admin can view all products in the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to product management page 3. Click on "View Products" 	All products from database are displayed	PASS
T021	Verify that the admin can update a product's details in the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to product management page 3. Select a product to update 4. Modify the product's details 5. Click on "Update" 	The product's details are updated in the database and popup message displays "product successfully updated"	PASS
T022	Verify that the admin can delete a product from the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to product management page 3. Select a product to delete 4. Click on "Delete" 	The product is removed from the database and shows popup message with "product deleted successfully"	PASS
T023	Verify that the admin cannot delete a product that is currently in a customer's cart	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to product management page 3. Select a product that is currently in a customer's cart 4. Click on "Delete" 	An error message is displayed indicating that the product cannot be deleted because it is currently in a customer's cart	PASS

Table 31: View, Update and Delete Product Unit Testing

10.1.6. View, Update and Delete category

Test ID	Test Description	Test Steps	Expected Results	Pass/Fail
T024	Verify that the admin can view all category from the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Click on "View category" 	All category from database are displayed	PASS
T025	Verify that the admin can update a category in the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category to update 4. Modify the category details 5. Click on "Update" 	The category's details are updated in the database and popup message displays "category successfully updated"	PASS
T026	Verify that the admin can delete a category from the database	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category to delete 4. Click on "Delete" 	The product is removed from the database and shows popup message with "category deleted successfully"	PASS
T027	Verify that the admin cannot delete a category whose product is currently in a customer's cart	<ol style="list-style-type: none"> 1. Login as admin 2. Navigate to category management page 3. Select a category whose product is currently in a customer's cart 4. Click on "Delete" 	An error message is displayed indicating that the category cannot be deleted because it is currently in a customer's cart	PASS

Table 32: View, Update and Delete Category Unit Testing

10.2. User Acceptance Testing Results

User Acceptance Testing (UAT) is a type of testing that verifies whether the software or system meets the requirements and expectations of the end-users. It is the final phase of testing that involves a group of real users who test the software in a real-world scenario. The purpose of UAT is to ensure that the software or system is functioning as expected and is suitable for release. In case of my project I have selected three different users one who frequently visits e-commerce site and make purchase, one who visits once a week and one who rarely visits the sites. So to carry out the user acceptance testing I prepared certain questions and prepare a form and forwarded to them via email to collect the repines from them.Following is the responses that I have received from the tester:

User 1: Rare Visitor

Name: Bishal Pandey

Occupation: Student.

Date: 2023/04/03

Project: E-commerce application with AR technology

Please test the following features of our e-commerce application and provide your feedback. Your responses will help us improve our application and ensure that it meets your needs.

	0	1	2	3	4	5
How satisfied are you with the overall user experience of our e-commerce application?					✓	
How easy was it for you to view and interact with the 3D models of the products using the AR feature in the e-commerce application?			✓			
How helpful was the AR feature in making a purchasing decision for the products?				✓		
How is the User Interface Design of the application?					✓	
How good is the application performance wise?						✓
Comment:	I encountered some issues with the AR feature not working properly on my device.					
				
Signature of Tester	Signature of Developer					

User 2: Frequent Visitor

Name: Kishor Thapa

Occupation: Chief

Date: 2023/04/03

Project: E-commerce application with AR technology

Please test the following features of our e-commerce application and provide your feedback. Your responses will help us improve our application and ensure that it meets your needs.

	0	1	2	3	4	5
How satisfied are you with the overall user experience of our e-commerce application?						<input checked="" type="checkbox"/>
How easy was it for you to view and interact with the 3D models of the products using the AR feature in the e-commerce application?					<input checked="" type="checkbox"/>	
How helpful was the AR feature in making a purchasing decision for the products?					<input checked="" type="checkbox"/>	
How is the User Interface Design of the application?						<input checked="" type="checkbox"/>
How good is the application performance wise?						<input checked="" type="checkbox"/>
Comment:	<ul style="list-style-type: none">The overall design and layout of the website was visually appealing and easy to navigate.The 3D models of the products were really impressive and made it easy to visualise them before making a purchase and happy to experience such functionalities which I had not experienced previously.					
						
..... Signature of Tester Signature of Developer					

User 3: Visits Online Shopping Platform once a week

Name: Shulav Gaire

Occupation: Student.

Date: 2023/04/03

Project: E-commerce application with AR technology

Please test the following features of our e-commerce application and provide your feedback. Your responses will help us improve our application and ensure that it meets your needs.

	0	1	2	3	4	5
How satisfied are you with the overall user experience of our e-commerce application?					<input checked="" type="checkbox"/>	
How easy was it for you to view and interact with the 3D models of the products using the AR feature in the e-commerce application?					<input checked="" type="checkbox"/>	
How helpful was the AR feature in making a purchasing decision for the products?					<input checked="" type="checkbox"/>	
How is the User Interface Design of the application?						<input checked="" type="checkbox"/>
How good is the application performance wise?						<input checked="" type="checkbox"/>
Comment:	It would be helpful to have a more detailed FAQ section or customer support chat option for any questions or issues that arise.					
						
..... Signature of Tester Signature of Developer					

10.3. Summary

In the summary of the testing phase of a e-commerce application development project involves testing the application for bugs and ensuring that it meets the functional requirements and specifications. The testing phase usually involves different types of testing, including unit testing, integration testing, system testing, and acceptance testing. But the testing that I have carried out is unit testing. The results of the testing phase should be documented and any bugs or issues found during testing should be fixed before the application is released to the end-users and luckily I was able to fix those issues and complete the project on time . Additionally, the testing phase also include user acceptance testing, where the end-users test the application and provide feedback on its usability and functionality which was carried out among three different users that is those who frequently buys product and services online, those who buys product Once a week and those who rarely visits the site.

11. Conclusion and Critical Evaluation

11.1. Critical Evaluation

The project that is being developed is web based e-commerce application. According to my perspective, the development of a web-based e-commerce application can be a better choice compared to a mobile application for several reasons. Firstly, a web-based e-commerce application can be accessed from any device with an internet connection, making it more accessible to a wider audience. In contrast, mobile applications are restricted to specific mobile operating systems and devices, which limits their accessibility. Secondly, developing a web-based e-commerce application is generally more cost-effective than developing a mobile application because you don't need to create separate versions for different mobile platforms. Thirdly, maintaining a web-based e-commerce application is easier than maintaining a mobile application because changes can be made quickly and easily without requiring users to download a new version of the app. Fourthly, a web-based e-commerce application can be optimized for search engines, making it easier for potential customers to find it. Mobile applications are generally not as easily discoverable through search engines. Finally, web-based e-commerce applications provide a consistent user experience across different devices, while mobile applications may need to be customized for different screen sizes and resolutions. While mobile

applications can be beneficial for certain types of e-commerce businesses, web-based e-commerce applications offer a wider range of benefits and may be the better choice for many businesses.

Strength

Unique features: The integration of AR technology and the 3D view of the products with a try-on feature is a unique and innovative feature that may set the project apart from other e-commerce applications in the market. Although, it is not new in online shopping platform as it has been already implemented by IEKA and Nike but in context of Nepal it is unique as other e-commerce applications such as Daraz, Sasto Deals, Hamro Bazaar and so on who are still away from integrating this technology. So, the implementation of AR in our system could really bring some benefits to the online shopper and such feature could really increase the engagement of more and more people and encourage them to buy product via online shopping platform.

Enhanced user experience: With the use of AR technology, the e-commerce application could provide users with a more immersive and interactive experience, allowing them to visualise the products in a more realistic way and try them on virtually. This can lead to higher user engagement, satisfaction, and ultimately, increased sales.

Competitive advantage: By integrating AR technology, the project can gain a competitive advantage over other e-commerce applications that do not offer such features. This can attract more customers, increase brand recognition, and establish a strong market position.

Potential for growth: The integration of AR technology in e-commerce is a relatively new concept, and the market for such applications is still growing. By being an early adopter of this technology, the project has the potential to grow and expand as the market matures.

Limitations

- **Limited accuracy:** The accuracy of virtual try-on is dependent on various factors such as the quality of the camera, lighting, and the user's movements. These factors can cause inaccuracies in the virtual representation of the item, making it difficult for the user to make an informed purchase decision.
- **Limited options:** Virtual try-on in our system is currently limited to certain types of items, such as spectacles, and watches. For other products, such as clothes, shoes, furniture or appliances, the virtual representation is not integrated.
- **Limited availability:** Not all e-commerce platforms offer AR-based virtual try-on features. This can limit the user's ability to try on items virtually, forcing them to rely on traditional product images and descriptions.
- **Technical requirements:** Virtual try-on features require specific hardware and software to function properly, which may not be available to all users. This can limit the accessibility of this application to certain segments of the population.
- **Time limitation:** Implementing AR-based virtual try-on features is very time-consuming developer need to have knowledge in various sectors such as 3D model, , which makes difficult for developer to develop this project within short period of time.

11.2. Future Enhancement

Currently, the system implements the augmented reality to try on spectacles, caps and watch so in future this system can be enhanced which allow customer to virtually try on the clothes and recommend the size and the color that suits on them. In addition to this, AR can be used to provide more interactive and immersive demonstration of the products, allowing customers to see how products works. Let me just give and example, let's say that e-commerce store sells electronic gadgets such as smartwatch. With the helps of AR technology, customer should be able to navigate through the watch's menu and settings, see how different features and functions work and compare them with other similar product of different brand and choose the one which is suitable for them. This would give customer a much clear idea of how to use product and what it can do than they could get from simply looking at product image or reading a product description and review done by the other users. Hence, it makes application more interactive and enhance customer engagement towards online shopping. In addition to this, another important feature that can be implemented in e-commerce platform which helps to make it more interactive is bargaining or negotiation feature. With the help of this feature customer should be able to negotiate a lower price for the product then they appears on the site which provide them the experience of buying product as if they are purchasing visiting the physical store. The negotiation process will continue until the customer accepts the price offered by the seller or until one party decide to walk away from the negotiation. As a result it would increase the chances of customer returning to the platform where they feel they have the ability to negotiate prices.

11.3. Conclusion

After looking into it carefully, we found out that it's possible to create an online shopping app with augmented reality, and it would be really useful in the future. In conclusion, the development of an e-commerce system integrated with AR technology has been successfully accomplished. The project involved various stages, including system architecture design, user interface design, test planning, unit testing, and user acceptance testing. The system architecture was designed to accommodate the complex functionalities of an e-commerce platform and integrate AR technology seamlessly. The user interface was designed to be intuitive and user-friendly, providing a seamless shopping experience for customers. The test plan was conducted to ensure that the system met the expected requirements and that all functionalities were working correctly. The unit testing and user acceptance testing were carried out to ensure that the system is bug-free, efficient, and met the user's needs. Furthermore, the critical analysis conducted provided valuable insights into the system's strengths, weaknesses, opportunities, and threats. The system's success in integrating AR technology could open up new possibilities for e-commerce platforms, providing customers with a more immersive and personalised shopping experience.

Overall, the development of this e-commerce system integrated with AR technology has proven to be a valuable addition to the e-commerce industry, providing a new dimension of customer experience and setting a new standard for e-commerce platforms.rephrase it in very simple words.

References

1. About Jennifer Gaskin A veteran of newsrooms and agencies, & Gaskin, A. (2023, February 02). Everything you need to know about use case diagram. Retrieved March 20, 2023, from <https://venngage.com/blog/use-case-diagram/>
2. Agile vs. waterfall: Pros & cons, use cases, & more. (n.d.). Retrieved January 8, 2023, from <https://www.glasscubes.com/agile-vs-waterfall/>
3. Amazon Web Services. (1978). What is an IDE? Retrieved from <https://aws.amazon.com/what-is/ide/>
4. Arghashi, V., & Yuksel, C. A. (2022). Interactivity, Inspiration, and Perceived Usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services*, 64, 102756.
5. Bölek, K. A., De Jong, G., & Henssen, D. (2021). The effectiveness of the use of augmented reality in anatomy education: a systematic review and meta-analysis. *Scientific reports*, 11(1), 1-10.
6. Contributor, T. (2020, July 24). What is a use case diagram? Retrieved March 18, 2023, from <https://www.techtarget.com/whatis/definition/use-case-diagram>
7. Entity relationship diagram (ERD). (2022, April 12). Retrieved March 23, 2023, from <https://www.smartdraw.com/entity-relationship-diagram/>
8. Er diagrams in DBMS: Entity relationship diagram model. (2023, February 02). Retrieved March 23, 2023, from <https://www.simplilearn.com/tutorials/sql-tutorial/er-diagram-in-dbms>
9. Hidayat, R. R., & Sriworno, A. B. (2015). Brand Development Strategy Of Micro Scale Shoe Industries Based On Augmented Reality For Smartphone Application. *Jurnal Sosioteknologi*, 14(1), 89-97.
10. Hitachi, L. (n.d.). System development methodology : Hitachi. Retrieved January 8, 2023, from https://www.hitachi.com/rd/glossary/s/system_development_methodology.html#:~:text=It%20is%20a%20methodology%20for,according%20to%20viewpoint%20available.

11. Infinity, B. (2022, November 17). Sequence diagrams in software engineering. Retrieved March 24, 2023, from <https://www.boardinfinity.com/blog/learn-about-sequence-diagram-in-software-engineering/>
12. Kesim, M., & Ozarslan, Y. (2012). Augmented reality in education: current technologies and the potential for education. *Procedia-social and behavioral sciences*, 47, 297-302.
13. Lutkevich, B., Chai, W., & Holak, B. (2022, June 13). What is e-commerce? definition and meaning. Retrieved January 7, 2023, from <https://www.techtarget.com/searchcio/definition/e-commerce>
14. Nagy, A. S., Bittner, B., Monica Tuegeh, O. D., & Tumiwa, J. R. (2022). Augmented reality improving consumer choice confidence during COVID-19. *Issues In Information Systems*, 23(2).
15. N., R. (2022, December 07). What is a database schema? A quick guide with examples. Retrieved March 24, 2023, from <https://www.hostinger.com/tutorials/database-schema>
16. Osman, J. (2022, October 19). Database Design Diagram full guide and Tools. Retrieved March 23, 2023, from <https://appmaster.io/blog/database-design-diagram-full-guide>
17. Ossian. (2022, October 13). What is investigation report and how to write one. Retrieved January 8, 2023, from <https://datamyte.com/investigation-report/>
18. Statista. (2022). eCommerce Report 2021. Available online from" <https://www.statista.com/study/42335/ecommerce-report/> (accessed March 7, 2022).
19. Sung, Y., & Kim, D. (2018). The effects of augmented reality on consumer emotions and behaviors in the fashion industry. *Sustainability*, 10(4), 1082.
20. System architecture - detailed explanation. (2022, June 17). Retrieved March 20, 2023, from <https://www.interviewbit.com/blog/system-architecture/>
21. Singh, R. (2022, December 14). Waterfall methodology. Retrieved January 8, 2023, from <https://www.projectmanagement.ie/blog/waterfall-methodology/>
22. Software system architecture: Advantages of software architecture. (2021, August 24). Retrieved March 15, 2023, from <https://www.educba.com/software-system-architecture/>

23. Taoufiki, S. (2022, February 10). Augmented reality in e-commerce : How ar boosts online shopping ? Retrieved January 1, 2023, from <https://mbamci.com/augmented-reality-in-e-commerce-how-ar-boosts-online-shopping/>
24. Thomas, J. (2021, August 12). The history of online shopping. Retrieved January 7, 2023, from <https://purple.ai/blogs/the-history-of-online-shopping/>
25. ThoughtSpot, T. (2023, April 07). What is a database schema and why does it matter? Retrieved March 24, 2023, from <https://www.thoughtspot.com/data-trends/data-modeling/database-schema>
26. Uhm, J. P., Kim, S., Do, C., & Lee, H. W. (2022). How augmented reality (AR) experience affects purchase intention in sport E-commerce: Roles of perceived diagnosticity, psychological distance, and perceived risks. *Journal of Retailing and Consumer Services*, 67, 103027.
27. Walker, A. (2023, February 25). Activity diagram in UML: Symbol, components & example. Retrieved March 23, 2023, from <https://www.guru99.com/uml-activity-diagram.html>
28. Wang, Y., Rau, P. L. P., & Chen, C. C. (2017). Augmented reality in e-commerce: A review and future directions. *Electronic Commerce Research and Applications*, 22, 1-14.
29. What are wireframes?: Wireframing Academy: Balsamiq. (2022, May 22). Retrieved March 24, 2023, from <https://balsamiq.com/learn/articles/what-are-wireframes/>
30. What is Agile Methodology in project management? (n.d.). Retrieved January 8, 2023, from <https://www.wrike.com/project-management-guide/faq/what-is-agile-methodology-in-project-management/>
31. What is a database schema? (2023). Retrieved March 23, 2023, from <https://www.ibm.com/topics/database-schema>
32. What is a database schema? (2023). Retrieved March 24, 2023, from <https://www.ibm.com/topics/database-schema>

APPENDICES

Project Proposal Form



DRAFT PROJECT PROPOSAL FORM

Office Record	Receipt
Date Received:	Student name:
Received by whom:	Student number:
	Received by:
	Date:

Proposal ID:

Supervisor: MR. ANUP ADHIKARI

Student Name: Suraj Pandey

Student No: NPI000051

Email Address: surazpandey101@gmail.com

Programme Name: Final Year Project (FYP)

Title of project: web based e-commerce application

Please record which module(s) your topic is related to:

Investigation module

Introduction

In the age of digitalization, online shopping, also known as e-commerce, has become increasingly popular due to its convenience and cost-saving benefits. The COVID-19 pandemic has further accelerated this trend, with e-commerce use increasing by 19% in 2020. E-commerce has evolved from its early days in 1979 to now include innovations such as AI chatbots and augmented reality technology. E-commerce applications typically consist of user and server-side components and allow customers to purchase products after registering and logging in. Payment is made using electronic wallets. Major e-commerce platforms include Amazon, Walmart, and Alibaba.

In this era where every one are busy, online shopping saves time and money and also provides consumers with more options and a wider range of products. Even, the introduction of AI technology, such as voice assistants and chatbots, has enhanced the customer experience by allowing for easy product searches and helping customers make purchasing decisions.

Augmented reality, in particular, has the potential to revolutionise e-commerce by allowing users to interact with digital content in a real-world context. AR technology has been applied to a wide range of industries, including e-commerce. AR can help consumers virtually try on products and visualise how they would look in their homes or offices. This technology can increase customer engagement, provide more accurate product information, and make the shopping experience more immersive and enjoyable.

The project is based on the development of web based e-commerce applications which requires an internet connection to access. The user interface is design includes HTML, CSS, and Bootstrap, while the server side involves programming languages like C Sharp and Python. There are two types of users in the system: customers and administrators. Customers have limited access to the system and can only view products and make purchases. Administrators have complete control over the application and can add, delete, and update products. Customers must register and log into the system before making purchases. Payment can be made through electronic wallets.

Overall, e-commerce has become a popular and convenient method for buying and selling products and services. The introduction of AR and AI technology has enhanced the customer

experience and provided more accurate product information. So, the e-commerce applications that I am planning to build include both user and server-side programming and two types of users: customers and administrators.

Problem Statement

- E-commerce has transformed shopping but the lack of physical interaction with products has led to issues with quality, incorrect choices, and costly returns.
- Complex return policies and slow refunds have added to customer frustration.
- The inability to see how products look or fit before purchasing has led to an inadequate shopping experience.
- Customers still prefer brick and mortar stores, especially during times of uncertainty such as the COVID-19 pandemic.
- These challenges lead to customer dissatisfaction and ultimately reduce the potential of e-commerce as a market for both consumers and businesses, resulting in lower sales.
- There is a need for innovative solutions that can provide customers with a satisfactory shopping experience and reduce their concerns about buying products online.

Project Aims and Objectives

The main aim of this project is to motivate customer to use online shopping platform by providing better product experience as AR makes e-commerce application interactive and immersive.

The main objective of this project are:

1. To uplift the rate of customer engagement in online shopping platform by introducing augmented reality technology.
2. To gain customer trust and improve customer satisfaction and minimise return rate which help service provider financially by reducing shipping, restocking and repacking cost.

3. To develop an online shopping software with try on feature which enable people to virtually try on the products and helps in making right decision while buying products.
4. To reduce the hygiene issues as climate, germs and social distancing is one of the main concern in todays generation.

Literature Review

To show that the chosen topic is relevant, there are various research done previously on similar topic which we can method here in this chapter of the research paper. There are various journal, book and article available on the internet to prove that the use of AR in e-commerce is really fruitful.

E-commerce has grown exponentially over few decades. There are various sites which are providing the facilities of online shopping. Some of the e-commerce giants are Amazon, Walmart, Shopify and many more. In case of Nepal Daraz is popular which is providing the services over few years. During the covid 19 period most of the people prefer to use online shopping platform to buy some goods rather than risking their lives by visiting the physical stores. Even people buy grocery stuffs to medicines via online platform or through phone calls. But most of the people seems to be unsatisfied about the product experience they are getting through online shopping. So, to enhance their product experience implementation of augmented reality technology could really help online retailer and attract more and more people in future.

According the research carried out by Uhm, J. P., Kim, S., Do, C. and Lee, H. W. use of AR technology has totally change the way people used to buy product via online stores. They have stated that the use of this technology could really help online retailers to reduce the product return rates and helps to boost the customer satisfaction. They also argue that the use of AR in online platform can lead to increased sales and customer satisfaction. However it is important to note that the effectiveness of AR may depend on the specific implementation and target audience [Uhm, Kim,Do,& Lee, 2022] .

According to Rendy Ridwan Hidayat1 and Andar Bagus Sriwarno user interface and user experience play key role in creating a strong connection between online shopping platform and

the customers. They have stated that augment reality is a multiverse concept which gives a satisfactory experience to the customer by colliding digital world into real world in case of e-commerce platform.

Augmented reality is the future of ~~e-commecce~~. It can personalised the shopping experience. With the help of AR technology customer can preview the product and find out whether that cloth will fit him/her or not. Hence, it helps them in better decision making while buying products. Beside this, it also improves the conversion rate and reduces the product return rate by enabling consumers to choose the suitable product according to their needs. In his article he has stated that there are various e-commerce platform such as Alibaba , Amazon, Shopify, Sephora, etc who are implementing augmented reality at some extends [Wang, ~~Rau~~, & Chen, 2017].

Recent research done by Taoufiki find out that majority of consumer prefer to use e-commerce platform with augmented reality to the e-commerce without augmented reality as it provide immersive experience to them. IKEA is one of the first company to implement AR technology in their application. With the help of this application customer can try product before they buy. They can view the items virtually on their surrounding and adjust where they want to place the item within their surrounding which is even 98% accurate. Especially, it has been useful for customers who are unable to visit a physical store and see the products in person. Similarly, in 2019 Nike has also launched an application called Nike Fit which helps customer to measure their feet and recommend them the correct size with variety of shoes. According to him, it has significantly reduces the return rate and increase customer engagement. In conclusion, AR could really boost the sales rate in near future as well as it creates a more enjoyable and memorable experience to the customer [Taoufiki, 2022].

Studies conducted by the University of North Caroline found that customers who used AR to virtually try on clothes were more likely to make a purchase than those who did not use AR. Similarly, a study by the Massachusetts Institute of Technology found that customer who used AR to interact with products in a virtual environment were more likely to report high levels of satisfaction with their shopping experience.

Augmented reality technology has been used in variety of industries including e-commerce, to enhance the customer experience and provide interactive and engaging content

Overall, it appears that AR technology has the potential to enhance the e-commerce experience by providing interactive and engaging content and helping customer to make informed purchasing decisions.

Deliverables

The task that admin and customer can perform are:

Admin:

- Login
- Register
- Manage customer (Add, update, view)
- Manage product (Add, update, view, delete)
- View reports

Customer:

- Register
- Login
- View Product
- Add to cart and purchase
- View Profile and update information
- Change Password

Future Enhancement

- The system can be enhanced to allow virtual try-on of clothes and provide interactive demonstrations of products using AR technology.
- Bargaining or negotiation feature can be implemented in the e-commerce platform to increase customer engagement and make it feel like a physical store experience.

References

- Arghashi, V., & Yuksel, C. A. (2022). Interactivity, Inspiration, and Perceived Usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services*, 64, 102756.
- Bölek, K. A., De Jong, G., & Henssen, D. (2021). The effectiveness of the use of augmented reality in anatomy education: a systematic review and meta-analysis. *Scientific reports*, 11(1), 1-10.
- Hidayat, R. R., & Sriwarno, A. B. (2015). Brand Development Strategy Of Micro Scale Shoe Industries Based On Augmented Reality For Smartphone Application. *Jurnal Sosioteknologi*, 14(1), 89-97.
- Hitachi, L. (n.d.). System development methodology : Hitachi. Retrieved January 8, 2023, from https://www.hitachi.com/rd/glossary/s/system_development_methodology.html#:~:text=It%20is%20a%20methodology%20for,according%20to%20viewpoint%E2%80%94are%20available.
- Kesim, M., & Ozarslan, Y. (2012). Augmented reality in education: current technologies and the potential for education. *Procedia-social and behavioral sciences*, 47, 297-302.
- Lutkevich, B., Chai, W., & Holak, B. (2022, June 13). What is e-commerce? definition and meaning. Retrieved January 7, 2023, from <https://www.techtarget.com/searchcio/definition/e-commerce>
- Nagy, A. S., Bittner, B., Monica Tugeh, O. D., & Tumiwa, J. R. (2022). Augmented reality improving consumer choice confidence during COVID-19. *Issues In Information Systems*, 23(2).
- Ossian. (2022, October 13). What is investigation report and how to write one. Retrieved January 8, 2023, from <https://datamyte.com/investigation-report/>

Project Specification Form

Project Specification Form

STUDENT ID : NPI000051

INTAKE ID : NP3f2009IT

STUDENT NAME : Suraj ~~Pande~~

Project Title

Web Based E-commerce Application

Brief description on project background. (i.e., problem context, rationale, description problem area, nature of challenge)

Problem Context

E-commerce has revolutionised the way people shop by providing them with the convenience of buying products online. However, the lack of physical interaction with the product before purchasing has lead to issues with product quality, incorrect choices, and costly returns. Additionally, the complexity of return policies and slow refund processing has added to customer frustration. Current e-commerce platform does not allow customers to see how products look or fit on them before purchasing, leading to an inadequate shopping experience. As a result, many customers still prefer brick and mortar stores to online shopping, especially during times of uncertainty such as the COVID-19 pandemic. These challenges has lead to customer dissatisfaction and ultimately reduce the potential of e-commerce as a market for both consumers and businesses. Thus, it has lead to lower sales and customer dissatisfaction. Therefore, there is a need to find innovative solutions that can provide customers with a satisfactory shopping experience and reduce their concerns about buying products online.

Rationale

The rationale of the report is to explore the potential benefits of implementing augmented reality (AR) technology in the e-commerce industry. The report aims to highlight how AR can enhance the online shopping experience for customers, increase customer engagement, and ultimately boost sales for businesses. The report also addresses the challenges faced by the e-commerce industry, such as the lack of physical interaction with products and the resulting customer dissatisfaction, and how AR can address these challenges. The report aims to provide insights into the potential of AR technology to revolutionize the e-commerce industry and improve the overall shopping experience for customers.

Tangible Benefits:

- AR allows customers to view products in their environment before purchasing, improving decision-making and reducing return rates.
- AR enhances product demonstrations, especially for complex or technical products.
- AR provides a more immersive shopping experience, which can increase sales.

Intangible Benefits:

- AR increases customer engagement and loyalty.
- AR boosts brand awareness through unique experiences.
- AR improves customer experience and satisfaction.
- AR provides a competitive advantage in a crowded market.

Nature of Challenge

Creating a working AR project is hard work, and researching beforehand adds more challenges. Understanding AR technology and integrating it into a functional application is crucial. During my research, I encountered problems with finding the best tools and programming language. Being a student, I had limited time and had trouble managing my time between classes, assignments, and the project. Another challenge was the limited availability of data as AR technology is still new to people, making surveys or questionnaires unreliable. Moreover, there is limited research on the use of AR in e-commerce, making it difficult for me to do a literature review.

Brief description of project objectives. (i.e. scope of proposal and deliverables)

The scope of developing an e-commerce application is vast and includes designing and building an online platform that allows businesses to sell their products or services to customers over the internet. This involves developing a user-friendly interface for customers to browse products, adding features such as shopping carts and secure payment gateways for transactions, and creating a system for businesses to manage their inventory and sales. Additionally, the scope can also include integrating advanced technologies such as augmented reality and artificial intelligence to enhance the online shopping experience and improve customer satisfaction.

Hardware

The minimum hardware requirements to develop web based e-commerce application in ASP.NET are mentioned below

- Processor – 64-bit processor.
- Random Access Memory (RAM) – 4 GB RAM and
- Keyboard & Mouse
- Router (RJ45 / Wireless Fidelity (Wi-Fi))

Software

The minimum software requirements for the development and execution of the project are as follows:

Code Editor and Database Management System (DBMS)

- Microsoft Visual Studio (version 2017 or later)
- MySQL database management system
- MySql Management Studio
- **Server-Side Scripting, Web Server and File Transfer Protocol (FTP) Software**
- Microsoft IIS
- FileZilla FTP Server 0.9.37

Documentation and Planning

- Apple Pages
- Apple Keynote
- Google Drive

In order to carry out the deliverables, the preliminary list of books and web pages I will study are as follows.

Books

- "Pro ASP.NET Core MVC 2" by Adam Freeman
- Beginning ASP.NET E-Commerce in C#: From Novice to Professional" by Cristian Darie and Karli Watson
- "ASP.NET Core in Action" by Andrew Lock
- "Pro ASP.NET Web API: HTTP Web Services in ASP.NET" by Tugberk Ugurlu, Alexander Zeitler, and Ali Kheyrollahi
- "ASP.NET Web API 2: Building a REST Service from Start to Finish" by Jamie Kurtz and Brian Wortman
- "ADO.NET and System.XML v. 2.0 - The Beta Version" by Alex Homer, David Sussman, and Brian Francis
- "Building Web Applications with Visual Studio 2017: Using .NET Core and Modern JavaScript Frameworks" by Philip Japikse, Kevin Grossnicklaus, and Ben Dewey
- "Professional Ajax" by Nicholas C. Zakas, Jeremy McPeak, and Joe Fawcett

Online Resources

- Microsoft. (n.d.). ADO.NET overview. Retrieved from <https://learn.microsoft.com/en-us/dotnet/framework/data/adonet/ado-net-overview>
- Microsoft. (2012). ASP.NET Web API: Build RESTful web applications and services on the .NET framework. Retrieved from [https://learn.microsoft.com/en-us/previous-versions/aspnet/hh833994\(v=vs.108\)](https://learn.microsoft.com/en-us/previous-versions/aspnet/hh833994(v=vs.108))
- W3Schools. (n.d.). Learn HTML, CSS, JavaScript and more - W3Schools. Retrieved from <https://www.w3schools.com>
- Udemy. (n.d.). Udemy online courses & classes | learn on your schedule. Retrieved from <https://www.udemy.com>
- Khan, S. (2019, June 05). Call ASP.NET Core Web API using jQuery AJAX. ASPSnippets. Retrieved from <https://www.aspsnippets.com/Articles/Call-ASPNet-Core-Web-API-using-jQuery-AJAX.aspx>

Development Plan

The development plan for the project will follow the Agile methodology due to its flexibility and ability to handle changes during the development process.. The first step in the development plan will be to identify the overall goals of the project and what will be included in the scope of work. This will involve defining the objectives of the project and the requirements for the system.

After identifying the project goals, the project will be broken down into smaller manageable chunks called sprints. These sprints will focus on completing the most valuable work first, as identified by a priority list. Each sprint will have a set of tasks to complete and will have a specific timeframe for completion.

The order of development for the e-commerce application can be as follows:

- Interface Design: The design of the user interface will be one of the first stages of development. This involves creating wireframes, mockups or prototypes that define the layout, user flow and functionality of the application.
- Prototyping: After the interface design, prototypes can be developed to test the basic functionality of the system. The prototypes will be tested by users, and their feedback will be used to improve the design of the application.
- Database Design: Once the interface and basic functionality are defined, the next step is to design the database. This involves defining the database schema, identifying data relationships, and creating a data model.
- Front End Development: The next stage is front-end development, which involves building the client-side user interface using HTML, CSS, and JavaScript. The focus here is on creating a user interface that is visually appealing, intuitive to use, and responsive to different devices and screen sizes.
- Backend Coding: After the front-end development, the back-end coding will be done. This involves writing the code for server-side functionality, such as data processing and storage, authentication, and security.

- Reviewing: After each sprint, a review will be conducted to evaluate the progress made, identify areas of improvement, and gather feedback from stakeholders. This helps to ensure that the project is on track and that the development process is aligned with project goals.
- Testing: Finally, testing will be done to ensure that the application is stable, secure, and performs as expected. Testing will include unit tests, integration tests, acceptance tests, and user acceptance testing.

It is important to note that under the Agile methodology, the development process is iterative, and each stage can be revisited and improved upon as necessary, even after the product has been released. This flexibility and adaptability are some of the main benefits of Agile methodology. During the development process, the continuous review of the product after the completion of each sprint will take place. This review will involve gathering feedback from a certain group of people and identifying areas of improvement. This feedback will be used to make adjustments and improve the product, making it more efficient.

Overall, the development plan for the project will follow the Agile methodology, which is a flexible and iterative approach that prioritizes rapid delivery and continuous improvement. By following this methodology, the project team will be able to deliver a high-quality product that meets the project goals and requirements.

Success Criteria:

The main purpose of e-commerce applications is to facilitate online buying and selling of products or services. These applications provide an online platform for businesses to showcase their products and services to a global audience and allow customers to browse, compare, and purchase products from the comfort of their homes. To ensure that the application is stable, secure, and performs as expected, the evaluation and test plan will be conducted which includes unit tests, integration tests, usability tests, and user acceptance testing.

Unit Testing:

In unit testing, individual components of the e-commerce application are tested to ensure they function correctly. The focus of unit testing is on small, isolated parts of the application, such as individual functions or modules. The main things that will be tested during unit testing of an e-commerce application are:

- Data validation and error handling
- Calculation and processing of orders and payments
- Display of products and their details
- Interaction with the database
- Functionality of individual components such as shopping cart, checkout, etc.

Integration Testing:

In integration testing, the individual components of the e-commerce application are tested in combination to ensure they work together as intended. The goal of integration testing is to identify any issues that arise when different parts of the application are combined. The main things that will be tested during integration testing of an e-commerce application are:

- Communication between different components of the application
- Data exchange between components
- Compatibility of different components with each other

- Integration with third-party services such as payment gateways, shipping providers, etc.

Usability Testing:

In usability testing, the e-commerce application is tested to ensure it is easy to use and understand for its intended users. The focus of usability testing is on the user interface, navigation, and overall user experience. The main things that will be tested during usability testing of an e-commerce application are:

- Navigation and layout of the application
- Ease of finding products and information
- Clarity of product descriptions and pricing
- Ease of use of shopping cart and checkout process
- Speed and performance of the application

User Acceptance Testing:

In user acceptance testing, the e-commerce application is tested by its intended users to ensure it meets their needs and requirements. The goal of user acceptance testing is to validate that the application meets the user's expectations and is ready for launch. The main things that will be tested during user acceptance testing of an e-commerce application are:

- Overall functionality of the application
- Accuracy of product information and pricing
- Security and privacy of user data
- Ease of use and navigation
- Ability to process orders and payments correctly.

References

- Arghashi, V., & Yuksel, C. A. (2022). Interactivity, Inspiration, and Perceived Usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services*, 64, 102756.
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- Kesim, M., & Ozarslan, Y. (2012). Augmented reality in education: current technologies and the potential for education. *Procedia-social and behavioral sciences*, 47, 297-302.
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IR Log Sheet



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2022/08/02 Meeting No: 04

Project Title: Web-based e-commerce Intake: NPESF20209IT

Supervisor's name: Anup Adhikari Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Review of Projects goals and objectives, scope, potential solutions.
2. Discussion about literature review and guidance on research
3. Discussion about the find
4. Discussion regarding the similar project

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussed about project goals and objectives
2. Research about literature review and similar articles.
3. Discussed about key findings and insights.
4. Reviewed similar system and discussed about PPF

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Prepare Methodology
2. Do more analysis on similar projects.
- 3.
- 4.
- 5.



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2022/08/10 Meeting No: 02

Project Title: Web-based e-commerce Intake: NP13F220927

Supervisor's name: Anup Adhikari Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion of about data collection methodology and analysis .
2. Discussion of project development software
3. Discussion about the algorithm that can be used .
- 4.
- 5.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Methodology discussion
2. Discussion of Project Development Software tool .
3. Chosing framework and programming language
4. Discussion on PAF
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Approach the Sampling Techniques .
- 2.
- 3.
- 4.
- 5.



Project Log Sheet-Supervisory Session

Notes on use of project log sheet:

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Student's Name: Suraj Pandey Date: 2022/08/28 Meeting No: 03

Project Title: Web-based e-commerce Intake: NP13F2209ST

Supervisor's name: Anup Adhikari Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion about the sampling approach, size & selection criteria
2. Discussion of data collection process including any
3. data collection methods to be used.
4. Discussion of data analysis techniques.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Snowball Sampling chosen.
- 2.
- 3.
- 4.
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Work on Evaluation Matrix.
- 2.
- 3.
- 4.
- 5.



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2022/09/17 Meeting No: 04

Project Title: Web-based e-commerce Intake: NPI3F2091T

Supervisor's name: Anup Adhikari Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion of the business logic behind the project
2. including any underlying rules, assumption and constraints.
3. Discussion about the performance metrics that can
4. utilized to evaluate the success of a project

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussion about project business logic.
2. Discussion of performance metrics to project evaluation
- 3.
- 4.
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Identifying listing techniques
2. Work on Timeline
- 3.
- 4.
- 5.



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2022/10/21 Meeting No: 05

Project Title: Web-based e-commerce Intake: NP13F2209IT

Supervisor's name: Anup Ashikori Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion of the user acceptance testing process
2. quality of the deliverables.
3. Discussion of the project timeline
- 4.
- 5.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussion about acceptance testing along with other testing techniques
- 2.
3. Discussed about project timeline.
- 4.
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Prepare for the report
- 2.
- 3.
- 4.
- 5.

FYP Log Sheet



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 20/22/2021 Meeting No: 06

Project Title: Web based e-commerce Intake: NP13F2208IT

Supervisor's name: Mr. Anup Adhikari

Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion Regarding System architecture.
2. Discussion regarding the framework used
3. And the progress of the project till now.
- 4.
- 5.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussed about progress.
2. Discussed about the frameworks
3. Discussed about the required diagrams
4. that is system architecture,

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Work on integration AR in my e-commerce.
2. study on Three.js in order to visualise
3. 3D product in per product page.
- 4.
- 5.



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2023/01/28 Meeting No: 07

Project Title: Web based E-commerce Intake: NPI3F2208 IT

Supervisor's name: Mr. Anup Adhikari

Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussion about the Payment Gateway
2. Integration
3. Discussion about order management
4. Implementation with add to cart functionality
- 5.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussed about the payment
2. Discussed about cart management
3. Discussed about order management
4. Discussed about Testing plan
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Do critical evaluation of the project
2. Testing techniques used
- 3.
- 4.
- 5.



Project Log Sheet-Supervisory Session

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Student's Name: Suraj Pandey Date: 2023/03/13 Meeting No: 08

Project Title: Web based e-commerce Intake: NPI3F2208IT

Supervisor's name: Mr. Anup Adhikari

Supervisor's signature:

Items for discussion (noted by student before mandatory supervisory meeting):

1. Discussions regarding the testing techniques
2. Discussions regarding future enhancement
3. Discussions regarding documentation
- 4.
- 5.

Record Of discussion (noted by student during mandatory supervisory meeting):

1. Discussed about the project progress
2. Discussed about test plan and testing techniques
3. Discussion about preparation of documentation
- 4.
- 5.

Action List (to be attempted or completed by student by the next mandatory supervisory meeting):

1. Prepare for Documentation.
- 2.
- 3.
- 4.
- 5.

Ethics Form

Office Record	Receipt – Fast-Track Ethical Approval
Date Received:	
Received by whom:	

Student name: number: *Suraj Pandey*
number : NP100051
 Received by: *Anup Adlikar*
 Date: *2022/08/28*

**ACADEMIC RESEARCH ETHICS
DISCLAIMER**

Declaration about ethical issues and implications of research project/assignment proposals to be included on project/assignment application forms

Project/Assignment Title:

Web Based E-commerce Application

The following declaration should be made in cases where research project/assignment applicants for a particular/assignment and the supervisor(s)/lecturer(s) for the project/assignment conclude that it is not necessary to apply for ethical approval for the research project/assignment.

We confirm that the University's guidelines for ethical approval have been consulted and that all ethical issues and implications in relation to the above project/assignment have been considered. We confirm that ethical approval need not be sought.

Suraj Pandey
 Name of Research Project Applicant

Suraj
 Signature

2022/08/28
 Date

Anup Adlikar
 Name of Research Project Supervisor/ 2nd

Anup Adlikar
 Signature

2022/08/28
 Date Marker

Office Record	Receipt – Fast-Track Ethical Approval
Date Received:	Student 'Suraj' Pandey name:
Received by whom:	Student Anup Adhikari number: Received by: Anup Adhikari Date: 202108/28

**APU
FAST-TRACK ETHICAL APPROVAL FORM (STUDENTS)**

Tick one box: TAUGHT POSTGRADUATE project UNDERGRADUATE project

- TAUGHT POSTGRADUATE MODULE assignment
 TAUGHT UNDERGRADUATE MODULE assignment

Title of Specialism on which enrolled: B.Sc. IT(Hons)

Tick one box: Full-Time Study or Part-Time Study

Title of project: Web based e-commerce application

Name of student researcher: Suraj Pandey

Name of supervisor/ MR. Anup Adhikari

Student Researchers- please note that certain professional organizations have ethical guidelines that you may need to consult when completing this form.

Supervisors/Module Tutors - please seek guidance from the Chair of the APU Research Ethics Committee if you are uncertain about any ethical issue arising from this application.

		YES	NO	N/A
1	Will you describe the main procedures to participants in advance, so that they are informed about what to expect?	✓		
2	Will you tell participants that their participation is voluntary?	✓		
3	Will you obtain written consent for participation?	✓		
4	If the research is observational, will you ask participants for their consent to being observed?	✓		
5	Will you tell participants that they may withdraw from the research at any time and for any reason?	✓		
6	With questionnaires and interviews will you give participants the option of omitting questions they do not want to answer?	✓		

7	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	<input checked="" type="checkbox"/>		
8	Will you give participants the opportunity to be debriefed i.e. to find out more about the study and its results?	<input checked="" type="checkbox"/>		

If you have ticked **No** to any of Q1-8 you should complete the full Ethics Approval Form.

		YES	NO	N/A
9	Will your project deliberately mislead participants in any way?		<input checked="" type="checkbox"/>	
10	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?		<input checked="" type="checkbox"/>	
11	Is the nature of the research such that contentious or sensitive issues might be involved?		<input checked="" type="checkbox"/>	

If you have ticked **Yes** to 9, 10 or 11 you should complete the full Ethics Approval Form. In relation to question 10 this should include details of what you will tell participants to do if they should experience any problems (e.g. who they can contact for help). You may also need to consider risk assessment issues.

		YES	NO	N/A
12	Does your project involve work with animals?		<input checked="" type="checkbox"/>	
13	Do participants fall into any of the following special groups? Note that you may also need to obtain satisfactory Criminal Records Bureau clearance (or equivalent)	Children (under 18 years of age) People with communication or learning difficulties Patients People in custody People who could be regarded as vulnerable People engaged in illegal activities (eg drug taking)		<input checked="" type="checkbox"/>
14	Does the project involve external funding or external collaboration where the funding body or external collaborative partner requires the University to provide evidence that the project had been subject to ethical scrutiny?		<input checked="" type="checkbox"/>	

If you have ticked **Yes** to 12, 13 or 14 you should complete the full Ethics Approval Form. There is an obligation on student and supervisor to bring to the attention of the APU Research Ethics Committee any issues with ethical implications not clearly covered by the above checklist.

STUDENT RESEARCHER

Provide in the boxes below (plus any other appended details) information required in support of your application.
THEN SIGN THE FORM.

Please Tick Boxes

I consider that this project has no significant ethical implications requiring a full ethics submission to the APU Research Ethics Committee.	<input checked="" type="checkbox"/>
Give a brief description of participants and procedure (methods, tests used etc) in up to 150 words.	
<p>For the evaluation and testing of the proposed web based e-commerce application, participants will be selected from a diverse group of users, including individuals with varying levels of technical expertise and users who have a need for the services provided by the platform. The participants will be selected based on their willingness to test the system and provide feedback.</p> <p>The procedure for testing the system will include a combination of unit testing, integration testing, and usability testing. Unit testing will involve testing individual modules of the system, such as user registration and login, data validation and error handling and payment processing, to ensure they function as expected. Integration testing will involve combining the individual units into the final product and testing how different modules interact with each other and how they work in conjunction with the database. Usability testing will involve evaluating the satisfaction level of the end-users by testing the system using actual input, simulating how real users use the system.</p> <p>The methods used in the testing process will include manual testing, automated testing, and user feedback. The manual testing will be done by the development team, while the automated testing will be done using test automation tools. User feedback will be collected through questionnaires and interviews to evaluate the system's performance and usability.</p> <p>In summary, the evaluation and testing of the proposed web based e-commerce application will involve a diverse group of users selected based on their willingness to test the system and provide feedback. The testing procedure will include unit testing, integration testing, usability testing, and user acceptance testing. The methods used in the testing process will include manual testing, automated testing, and user feedback.</p>	
I also confirm that:	
ii) All key documents e.g. consent form, information sheet, questionnaire/interviewware appended to this application.	<input checked="" type="checkbox"/>
Or	
ii) Any key documents e.g. consent form, information sheet, questionnaire/interview schedules which need to be finalised following initial investigations will be submitted for approval by the project supervisor/module leader before they are used in primary data collection.	<input checked="" type="checkbox"/>

Signed 
(Student Researcher)

Name: Suraj Pandey Date: 2022/08/28

Please note that any variation to that contained within this document that in any way affects ethical issues of the stated research requires the appending of new ethical details. New ethical consent may need to be sought.

**SUPERVISOR/MODULE TUTOR
PLEASE CONFIRM THE FOLLOWING:**

Please Tick Box	
I consider that this project has no significant ethical implications requiring a full ethics submission to the APU Research Ethics Committee	<input checked="" type="checkbox"/>
i) I have checked and approved the key documents required for this proposal (e.g. consent form, information sheet, questionnaire, interview schedule)	<input type="checkbox"/>
Or	
ii) I have checked and approved draft documents required for this proposal which provide a basis for the preliminary investigations which will inform the main research study. I have informed the student researcher that finalised and additional documents (e.g. consent form, information sheet, questionnaire, interview schedule) must be submitted for approval by me before they are used for primary data collection.	<input checked="" type="checkbox"/>

SUPERVISOR AND SECOND ACADEMIC SIGNATORY

STATEMENT OF ETHICAL APPROVAL (please delete as appropriate)

- 1) THIS PROJECT HAS BEEN CONSIDERED USING AGREED APIIT/SU PROCEDURES AND IS NOW APPROVED
- 2) THIS PROJECT HAS BEEN APPROVED IN PRINCIPLE AS INVOLVING NO SIGNIFICANT ETHICAL IMPLICATIONS, BUT FINAL APPROVAL FOR DATA COLLECTION IS SUBJECT TO THE SUBMISSION OF KEY DOCUMENTS FOR APPROVAL BY SUPERVISOR (see Appendix A)

Signed...  Print Name... Anup Adhikari Date... 2022/08/28
(Supervisor/2nd Marker)

Signed... Print Name... Date...
(Second Academic Signatory)

Office Record	Receipt – Appendix A (Fast-Track Ethics Form)
Date Received:	Student name:
Received by whom:	Suraj Pandey Student number: NPI000051
	Received by: Anup Adhikari
	Date: 2022/08/28

APPENDIX A

AUTHORISATION FOR USE OF KEY DOCUMENTS

Completion of Appendix A is required when for good reasons key documents are not available when a fast track application is approved by the supervisor/module leader and second academic signatory.

I have now checked and approved all the key documents associated with this proposal e.g. consent form, information sheet, questionnaire, interview schedule

Title of project: Web based e-commerce application

Name of student researcher Suraj Pandey

Student ID:NPI000051

Intake: NPI3F2009ST

Signed.....  Print Name..... Anup Adhikari Date.....
(Supervisor/2nd Marker)

Library Form

Declaration of Final Year Project CONFIDENTIALITY

Author's full name: Suraj Pandey

Project title : Web Based E-commerce Application Integrating AR Technology

I declare that this thesis is classified as:

- CONFIDENTIAL
- RESTRICTED
- OPEN ACCESS

I acknowledged that Asia Pacific University of Technology & Innovation (APU) reserves the right as follows:

1. The report is the property of Asia Pacific University of Technology & Innovation (APU).
 2. The Library of Asia Pacific University of Technology & Innovation (APU) has the right to make copies for the purpose of research only.
 3. The Library has the right to make copies of the thesis for academic exchange.
-

Author's Signature:

Date: 20 March 2023

Supervisor's Name: Mr. Anup Adhikari

Date: 20 March 2023

Signature:

Gantt Chart

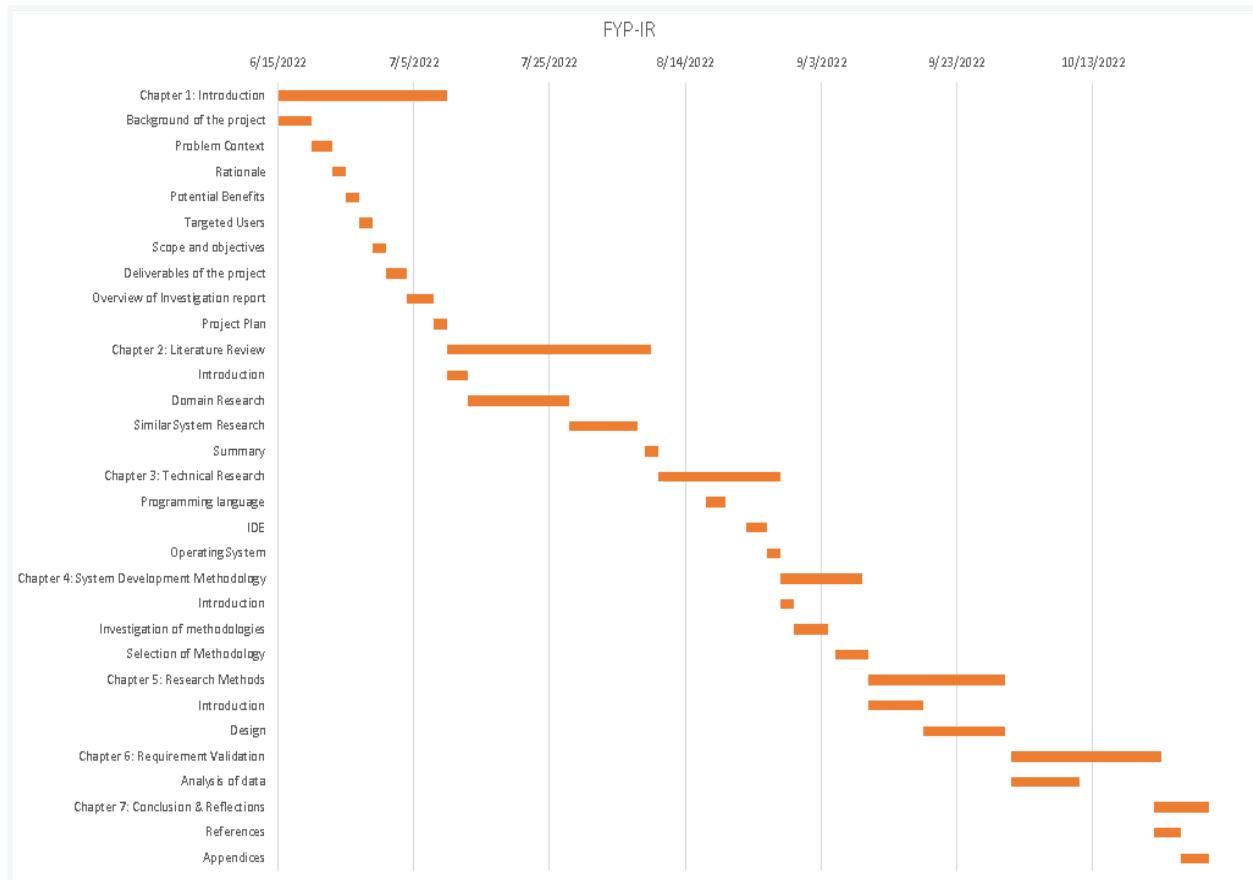
IR Timeline

Task ID	Task	Start Date	End Date	Duration
PA-T-1	Chapter 1: Introduction	15/06/2022	10/07/2022	25 Days
PA-T-1-1	Background of the project	15/06/2022	20/06/2022	5
PA-T-1-2	Problem Context	20/06/2022	23/06/2022	3
PA-T-1-3	Rationale	23/06/2022	25/06/2022	2
PA-T-1-4	Potential Benefits	25/06/2022	27/06/2022	2
PA-T-1-5	Targeted Users	27/06/2022	29/06/2022	2
PA-T-1-6	Scope and objectives	29/06/2022	01/07/2022	2
PA-T-1-7	Deliverables of the project	01/07/2022	04/07/2022	3
PA-T-1-8	Overview of Investigation report	04/07/2022	08/07/2022	4
PA-T-1-9	Project Plan	08/07/2022	10/07/2022	2
PA-T-2	Chapter 2: Literature Review	10/07/2022	10/08/2022	30 Days
PA-T-2-1	Introduction	10/07/2022	13/07/2022	3
PA-T-2-3	Literature review	28/07/2022	08/08/2022	15
PA-T-2-4	Summary	08/08/2022	10/08/2022	2
PA-T-3	Chapter 3: Technical Research	10/08/2022	28/08/2022	18 Days
PA-T-3-1	Programming language	17/08/2022	20/08/2022	3
PA-T-3-2	IDE	23/08/2022	26/08/2022	3
PA-T-3-3	Operating System	26/08/2022	28/08/2022	2
PA-T-4	Chapter 4: System Development Methodology	28/08/2022	10/09/2022	12 Days
PA-T-4-1	Introduction	28/08/2022	30/08/2022	2
PA-T-4-2	Investigation of methodologies	30/08/2022	05/09/2022	5
PA-T-4-3	Selection of Methodology	05/09/2022	10/09/2022	5
PA-T-5	Chapter 5: Research Methods	10/09/2022	01/10/2022	20 Days
PA-T-5-1	Introduction	10/09/2022	18/09/2022	8
PA-T-5-2	Design	18/09/2022	30/09/2022	12
PA-T-6	Chapter 6: Requirement Validation	01/10/2022	22/10/2022	22 Days
PA-T-6-1	Analysis of data	01/10/2022	22/10/2022	10
PA-T-7	Chapter 7: Conclusion & Reflections	22/10/2022	30/10/2022	8 Days
PA-T-7-1	References	22/10/2022	26/10/2022	4
PA-T-7-2	Appendices	26/10/2022	30/10/2022	4

FYP Timeline

S.N	Task	Start Date	End Date	Duration
1.0	System Architecture	12/15/2022	01/02/2023	18 days
1.1	Use Case Diagram	12/15/2022	12/17/2022	2 day
1.2	System Activity Diagram	01/17/2023	01/21/2023	4 days
1.3	Sequence Diagram	01/21/2023	01/27/2023	6 days
1.4	Entity Relationship Diagram (ERD)	01/27/2023	01/01/2023	5 days
1.5	Database Schema	01/01/2023	01/02/2023	1 day
1.6	Database Table Structure	01/04/2023	01/07/2023	3 days
2.0	Wireframe and front end design	01/07/2023	01/27/2023	20 days
2.1	Home Page	01/07/2023	01/09/2023	2 days
2.2	About Us Page	01/09/2023	01/11/2023	2 days
2.3	Our Services Page	01/11/2023	01/13/2023	2 days
2.4	Contact Us Page	01/13/2023	01/15/2023	2 days
2.5	Available Items Page	01/15/2023	01/17/2023	2 days
2.6	New Arrivals Page	01/17/2023	01/19/2023	2 days
2.7	Product Details Page	01/19/2023	01/21/2023	2 days
2.8	Admin Panel design	01/21/2023	01/27/2023	6 days
3.0	Create Test Plan	02/01/2023	02/03/2023	2 days
4.0	Back end Coding	02/03/2023	03/03/2023	30 days
5.0	Testing	03/05/2023	03/08/2023	3 days
5.1	Unit Testing	03/08/2023	03/10/2023	2 days
5.1	User Acceptance Testing	03/10/2023	03/11/2023	1 day
6.0	Documentation	03/13/2023	03/18/2023	5 days

IR Gantt chart



Final Year Project Gantt chart

ID	Task Name	Start	Finish	Duration	Dec 2022		Jan 2023				Feb 2023				Mar 2023		
					18/12	25/12	1/1	8/1	15/1	22/1	29/1	5/2	12/2	19/2	26/2	3/3	12/3
1	1.0 System Architecture	15/12/2022	01/01/2023	18d													
2	1.1 Use Case diagram	15/12/2022	16/12/2022	2d													
3	1.2 System Activity Diagram	17/12/2022	20/12/2022	4d													
4	1.3 Sequence diagram	21/12/2022	26/12/2022	6d													
5	1.4 Entity Relationship Diagram (ERD)	27/12/2022	31/12/2022	5d													
6	1.5 Database Schema	01/01/2023	01/01/2023	1d													
7	1.5 Database Table structure	02/01/2023	04/01/2023	3d													
8	2.0 Wireframe and front end design	05/01/2023	24/01/2023	20d													
9	2.1 Wireframe	05/01/2023	09/01/2023	5d													
10	2.2 Front End	10/01/2023	24/01/2023	15d													
11	3.0 Create Test Plan	01/02/2023	02/02/2023	2d													
12	4.0 Back end Coding	03/02/2023	04/03/2023	30d													
13	5.0 Testing	05/03/2023	07/03/2023	3d													
14	5.1 Unit testing	05/03/2023	06/03/2023	2d													
15	5.2 User acceptance testing	07/03/2023	07/03/2023	1d													
16	6.0 Documentation	13/03/2023	17/03/2023	5d													

The poster features a collage of various logos and images related to technology and commerce. At the top left is the logo for Infomax College of IT & Management. Next to it is the Asia Pacific University of Technology & Innovation (A.P.U.) logo. Below these are two large images: one showing a person holding a smartphone displaying an AR interface, and another showing a computer monitor with the word "E-COMMERCE". A large orange diagonal shape runs from the top right towards the bottom left. The central text area contains the title "E-commerce Application with AR", supervisor information ("SUPERVISOR: ANUP ADHIKARI"), and presenter information ("PRESENTER: SURAJ PANDEY"). Below the title is a section titled "ABSTRACT" which describes the project's goal of improving customer engagement and satisfaction through AR technology. The "OBJECTIVES" section lists four goals: uplift customer engagement, improve customer satisfaction, help to make right decision, and reduce return rate. The "PROBLEM STATEMENT" section lists three challenges: poor product experience, poor customer satisfaction, and increased return rate. The "Similar System" section shows logos for IKEA and NIKE, along with images of mobile phones displaying AR interfaces for product placement. The "FRAMEWORK" section shows logos for Python, C, HTML5, CSS3, JS, MySQL, and Microsoft Visual Studio.

COLLEGE OF IT & MANAGEMENT

A.P.U.
ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION

E-commerce Application with AR

SUPERVISOR: ANUP ADHIKARI
PRESENTER: SURAJ PANDEY

ABSTRACT

The project is based on the development of web based e-commerce application integrating Augmented Reality. The aim of developing this application is to uplift the customer experience and increase the engagement of more and more customer towards online shopping. So, in this application AR allow customer to virtually try on the product in their on environment which could help them to make better decission before making purchase.

OBJECTIVES

- Uplift customer engagment
- improve customer satisfaction
- Help to make right decision
- Reduce return rate

PROBLEM STATEMENT

- Poor Product Experience
- Poor Customer Satisfaction
- Increased Return Rate

Similar System

IKEA and Nike logos are displayed above images of mobile phones showing AR interfaces for placing furniture and shoes respectively.

FRAMEWORK

Logos for Python, C, HTML5, CSS3, JS, MySQL, and Microsoft Visual Studio are shown.

!!THE END!!