A

PROJECT REPORT

ON

DEVELOPMENT OF AN E-COMMERCE APPLICATION FOR PRE-OWNED STUDENT ITEMS IN FUTA

BY

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CERTIFICATION

I hereby certify that the content of this report was carried out by OLUYALE PRAISE MONISOLA with the matriculation number CSC/17/2224 of the department of Computer Science, School of Computing, The Federal University of Akure, Nigeria.

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ABSTRACT

Students have traditionally relied on unofficial, frequently dispersed methods to purchase pre-owned goods from their peers in the busy centre of the university campus. Students have been navigating student-to-student commerce through word-of-mouth exchanges, Instagram posts, and WhatsApp adverts. Though ingenious, these techniques frequently fall short of expectations. Although traditional online markets like OLX and Jiji have helped close this gap, they might not be able to meet the particular requirements and tastes of the student population. This project encompasses of an application that links students with products not in use and student in dire need of these products. The application provides features that allows students to view products, upload products for sale, give out product for free, manage their sales inventory, categorize products for a more streamlined search. This application expands the market reach by acting as a middleman between buyers and sellers.

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CHAPTER ONE

INTRODUCTION

In the bustling hub of a university campus, students have long relied on informal, often scattered, methods to acquire pre-owned items from their peers. Word of mouth exchanges, Instagram posts, and WhatsApp advertisements have been the channels through which they navigate student-to-student commerce. However, these methods, while resourceful, often leave much to be desired. Traditional online marketplaces like Jiji or OLX have certainly stepped in to bridge this gap, but they may not cater to the unique needs and preferences of the student community. In addition to this, there is a pressing concern regarding security and the verification of products and sellers.

Moreover, the absence of a centralized point for students to sell, trade, or give away their unused items means that usable goods often end up being damaged and unused. This is not only an environmental concern but also a missed opportunity for students in need.

The Internet is becoming a part of everyday life; it is in this space that communication, purchases, and payment for various services are carried out. Young people are the most dynamic social group that has long mastered the Internet market with its advantages, namely, comparing prices, book products, and buy at discounts (Novgorodtseva, A. N et al., 2020).

Online shopping is the action of purchasing services and goods on the internet. It forms a huge part of everyone's lives in the technological savvy world that we are living in. Anything you require is just the click of a button away. Online shopping can be conducted over the internet or on an application (app) which can give consumers a more personalised experience. The people that are supposedly technologically inclined and knowledgeable about online shopping, are young adults or more specifically students. As most students are unemployed, funding is

scarce, but they still remain enthusiastic to shop, be it for food, clothing or other accessories (Singh, U., and Bharath, C. , 2021).

This project aims to improve the way students access and engage with pre-owned items on campus. By introducing an ecommerce marketplace application tailored to their needs, it not only enhances accessibility but also promotes sustainability by reducing waste in the environment. This innovation seeks to unite and empower students, offering them a digital haven where they can buy or sell items, fostering a stronger, more sustainable, and closely-knit campus community.

1.1 Background of Study

Pre-owned items, also known as second hand or used items, refer to goods that have been previously owned by someone else before being resold. These materials can encompass a wide range of products, from clothing and electronics to furniture and vehicles. Choosing pre-owned materials not only reduce wastes but also often offers cost- effective and sustainable alternatives to purchasing brand new items. By extending the lifespan of products and reducing the demand for new products, pre-owned items contributes to a more eco-friendly and economically prudent consumption pattern.

The pre-owned industry at large, has started to dominate online spaces, especially as the pandemic reshaped how the average consumer valued used products during times of low supply. Additionally, consumers are also reaping the benefits of resale, with new avenues opening for the average person to sell their used goods online. The other crucial motivator driving the pre-owned industry is the increased emphasis on promoting the circular economy through sustainable practices. Especially in the fashion industry, Gen Z and millennials are observing the initial environmental consequences of wastefulness and want to counter it. (Ohta, June 2022).

According to Hristova, Yulia. (2019), the introduction of new trading formats, the consumer behaviour of modern generations and development of social media, the Internet and environmental protection have led to a progressive rise of the second-hand goods market, especially in the last 40 years during which the purchase of these types of products became a worldwide phenomenon worth billions of dollars. For example, the global sales of second-hand apparel, shoes and clothing accessories are expected to increase from 24 billion USD in 2018 to 51 billion USD in 2023. The global market of second-hand cars has reached 10.2 billion units during the third trimester of 2018 while remaining traditionally larger than that of newer units. In 2017, the global market of pre-owned or used furniture comes to a sum of 29.3 billion USD and is predicted to keep growing with an annual rate of 6.4% until 2025. The tendency displayed in the resale market of mobile phones on a global scale has reached 19 billion USD in 2017 with a prospect of expanding to 44 billion in 2026. The dynamic development of the second-hand goods market raises the questions of what the reasons behind consumer interest in it might be and what kind of role and influence it holds over the industry of newly produced goods.

According to Ohta June (2022), the sale of pre-owned items fosters reuse in waste management. Reuse is the practice of using a material over and over again in it's current form. The essence of reuse is that it preserves some or all of the energy and materials that went into making an item. The pre-owned industry is experiencing massive growth, and online marketplaces are serving as a major driver of sales.

According to Umeokeke Amaka Chelsea (December, 2020) E-Commerce represents an economic movement of buying and selling goods and services through online platforms. They usually include a wide range of activities like retail stores, online payments etc. All these usually occur through three main transaction categories which includes business to business, business to customer and customer to customer. A subdivision of E-Commerce called Mobile

Commerce or M-Commerce represents the activities mentioned above like online payments which are easily performed using portable devices like phones, tables and smart watches. The increase in the usage of mobile devices in performing economic activities in online environments led to the development of E-Commerce.

E-commerce has helped businesses (especially those with a narrow reach like small businesses) gain access to and establish a wider market presence by providing cheaper and more efficient distribution channels for their products or services. E-commerce has changed the way people shop and consume products and services. More people are turning to their computers and smart devices to order goods, which can easily be delivered to their homes. As such, it has disrupted the retail landscape. (Bloomenthal, May 2023).

1.2 Motivation

Students often find themselves faced with a recurring challenge: the disposal of unused materials and personal belongings. These items, left neglected, are subjected to adverse weather conditions, leading to their eventual deterioration and wastage. This not only represents a loss of valuable resources but also contributes to environmental concerns related to sustainability and waste reduction.

Simultaneously, there exists a segment of the student population who are in dire need of these pre-owned items. Whether it's academic materials, clothing, electronics, or various other personal items, many students lack the financial means to purchase brand-new items, making pre-owned ones an essential option for their daily needs. However, the disconnect between those discarding items and those seeking them poses a significant challenge.

The minority population of students who are aware of the existence of pre-owned items within the campus community face substantial hurdles in locating these resources. The search process can be laborious, frustrating, and often fruitless.

Furthermore, the existing methods of buying and selling pre-owned items do not adequately cater to the unique requirements of the student population. Students often have specific needs, whether it's academic materials, specific types of clothing, or other items that are tailored to their campus life. Finding these specific items through traditional means can be a difficult task.

In light of these challenges, there is a clear and compelling need for a dedicated e-commerce application for students. This platform can not only provide students with a convenient and efficient means of accessing a wide array of pre-owned items but can also bridge the gap between those who have items to sell and those in need of them.

1.3 Objectives

The specific objectives of the project are to;

a. design an E-commerce mobile Application for pre-owned students items which will facilitate accessibility to pre-owned products and address waste management concerns;

b. implement (a).

1.4 Methodology

The development will commence with the design and implementation. The Information architecture will be meticulously planned to establish the flow and hierarchy of the application. Subsequently, the system design will be undertaken, incorporating user flow diagrams, flow charts, and use case diagrams to provide a comprehensive understanding of the application's functionality. The design phase will involve creating wireframes to visualize the interface. Moving forward, the implementation will necessitate the development of a robust front end, back end, and database. MySQL will be employed for database management, while the implementation will be executed using React.

1.5 Expected Contributions to Knowledge

Through this project, contributions will be made in various domains, including e-commerce, educational technology, user behaviour, sustainability, and economic impact, among others. It offers the opportunity to gain insights, generate data, and inform future projects and research in these areas. They are further explained below:

1. E-commerce in Educational Settings: The project can provide insights into the utilization of e-commerce platforms within educational institutions. It can shed light on how students and academic institutions can leverage e-commerce for the exchange of pre-owned items, contributing to a better understanding of e-commerce in an educational context.
2. User Behaviour: The application can serve as a valuable source of data for studying user behaviour in e-commerce settings. Researchers can analyse how students use and interact with the platform, which can lead to insights about user preferences, buying patterns, and decision-making processes in the context of pre-owned student items.
3. Sustainability: The project can contribute to discussions on sustainability by promoting the reuse and recycling of student items. This is particularly relevant in the context of environmental consciousness and the reduction of waste.
4. Educational Technology: By implementing the application within an educational institution, the project can contribute to the broader field of educational technology. It can demonstrate the potential of technology to enhance student experiences and address practical needs.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of pre-owned items

In today's consumer landscape, the increase in second-hand shopping is largely fuelled by the ever-expanding e-commerce sector. This growing trend is not only driven by market forces but is also deeply rooted in the numerous advantages it offers, such as the sustainable practice of recycling high-quality, pre-owned items and mitigating the issue of clothing waste. To fully appreciate this rapidly growing phenomenon, it's important to explore the historical evolution of the second-hand market, tracing its path to its current prominence.

The second-hand trade has quietly been present for centuries, majorly within the clothing industry. According to Ethitude (2017), second-hand trade began, among several European cities, between the Middle Ages and the beginning of the Renaissance in the fourteenth century. At that time, few people could afford new clothes given their exorbitant price. Each piece was unique, tailor-made and used for years or decades. The dresses were passed from mother to daughter as a legacy and masters could give their servants their worn clothes as a form of payment or currency.

In 1700, second-hand clothing stalls were scattered across London, in both the East and West End. They existed mainly to clothe the poor but also benefitted the emerging middle classes. The second-hand trade remained a central way for the poor to buy clothing, and it was at this point that it became associated solely with poverty. (Smezzina, 2020).

(The history of thrift shopping: Exploring the origins and evolution of the thrift industry, 2023) stated that it wasn't until the Great Depression of the 1930s that thrift shopping gained widespread popularity. During the Depression, many people were struggling to make ends meet, and buying new clothing was often out of reach. As a result, people turned to thrift stores

as a more affordable option. These stores were often run by charitable organizations and sold donated clothing and household items at a fraction of the cost of new items. In the decades that followed, second-hand stores continued to grow in popularity, and their inventory expanded beyond just clothing and household items. It was mentioned that today, a wide range of items can be found at thrift stores, including vintage and designer clothing, furniture, and electronics

2.2 Related Works

Guiot et al. (2010) researched the "Second-hand Shoppers' Motivation Scale," driven by the growing interest in alternative consumption channels and critiques of traditional retailing. Their objective was to propose a scale for understanding motives behind second-hand shopping, addressing a lack of research in this area. They used qualitative and quantitative studies with 708 participants in France, resulting in a reliable eight-factor scale covering motivations related to second-hand shopping. This research also identified four consumer segments, offering insights for both research and retailing. However, they acknowledged the study's limitation in fully representing all second-hand shoppers and suggested using more diverse criteria in future studies.

Vatrapu et al. (2014) delved into the "Design and Implementation of an E-Commerce Site for Online Shopping." The project's motivation stems from the need to respond swiftly to client demands in today's fast-paced business world and provide customers with the convenience of online shopping. The objective was to develop a user-friendly e-commerce store, allowing customers to buy clothes online, with features for product selection, shopping cart management, and a checkout process. The project employed ASP.NET technology, programming languages like C#, and a web server, enhancing user experience through data retrieval and interactive web pages. The result was a functional e-commerce platform for online shopping, albeit with limitations regarding customer data security and secure transactions.

Correa et al. (2015) explored the motivations behind young people's consumption of second-hand clothing in Rio de Janeiro. The motivation for this study lies in recognizing the pivotal role of the fashion industry in the Brazilian economy, particularly in Rio de Janeiro, with a 2011 survey revealing a significant annual turnover in the fashion productive chain and a considerable number of people employed in the clothing industry. Despite this, there has been limited research and official statistics on a growing yet underexplored segment: the second-hand clothing market. This study aims to address this gap by analyzing the dynamics of changing values, meanings, and sociability within the context of second-hand clothing consumption in Rio de Janeiro, with a specific focus on consumer motivations for acquiring and using second-hand items. Employing an ethnographic approach, combining direct observation and in-depth interviews, the research was conducted over twelve months, primarily among young residents of Rio de Janeiro who purchase second-hand clothing from various sources. It draws on an anthropological perspective of consumption to understand the cultural significance of clothing and its communicative role in society, especially in the context of second-hand fashion.

In Yan's (2015) study, the primary objective was to explore the differentiation in psychographic characteristics between second-hand clothing shoppers and non-shoppers, with a particular focus on variables such as environmental consciousness, contamination perceptions, price sensitivity, and vintage clothing attitudes. The research, conducted among 152 college students, uncovered noteworthy disparities. Those engaged in second-hand clothing shopping exhibited heightened environmental awareness, a stronger sensitivity to pricing, a penchant for using pre-owned garments to convey a vintage aesthetic and promote eco-friendliness, and a belief in the diminished contamination of second-hand clothing compared to their non-shopping counterparts. The study's significant conclusion emphasized that, within the college student demographic, second-hand clothing shoppers' motivations encompassed not only economic

considerations but also a desire for distinctive self-expression and the cultivation of personal uniqueness. This research contributes to the understanding of second-hand clothing shopping behaviors, shedding light on an area that has seen limited exploration among college students.

In 2015, Turunen et al. addressed a gap in luxury consumption discussions by exploring the meaning of second-hand luxury possessions. Their study aimed to shed light on the significance of second-hand luxury in the context of fashion and accessories, offering a more comprehensive understanding of luxury consumption. They conducted interviews with Finnish women and analyzed fashion blogs, identifying five meaning themes associated with second-hand luxury possessions. This research bridged the gap between second-hand and luxury consumption, providing insights for luxury brand marketers and emphasizing the symbolic value and authenticity of second-hand luxury items, though it also recognized potential financial and reputational risks for consumers. The study uncovered five distinct meaning themes characterizing second-hand luxury possessions: "Sustainable Choice," "Real Deal," "Pre-loved Treasure," "Risk Investment," and "Unique Find." It emphasized that consumers can derive luxury experiences from second-hand luxury possessions, emphasizing their symbolic value and authenticity. Nonetheless, the research acknowledged that the concept of authenticity could also entail financial and reputational risks for consumers when acquiring previously-owned luxury items.

Abed et al. (2016) undertook a comprehensive investigation into the design and deployment of a secure e-commerce system. Their dual motivation was to overcome implementation obstacles, particularly security-related, and to offer practical solutions for data protection and privacy. They outlined the design of a user-friendly e-commerce website, complete with efficient data management. Their methodology included an in-depth analysis of security challenges such as DDoS attacks and SQL Injection, proposing a comprehensive suite of security solutions like firewalls, SSL, and intrusion detection. This research enhances

understanding of secure e-commerce systems and resulted in a successful e-commerce website implementation. Limitations acknowledged include the need for private networks, evolving software tools, cost barriers to Internet use, privacy concerns, and low awareness of e-commerce practices.

Yali Z. et al. (2017) explored the design and implementation of an online shopping mall system based on ASP.NET. The project methodology involved crafting a B/S network structure, B2C business model, and utilizing ASP.NET and ADO.NET technology. The integration of a mobile phone app is seen as a potential enhancement for the system. The research is fueled by the ambition to enhance the efficiency and convenience of online shopping, aligning with modern lifestyles and the global surge in internet-based commerce. The primary objective is to develop and implement an ASP.NET-based online shopping mall system that caters to consumer demands, particularly from younger generations, capitalizing on global internet trends and logistics technology to streamline trading processes, reduce operational costs, and elevate the user experience. Additionally, the study hints at the system's potential augmentation through the incorporation of a mobile phone app, promising added functionality and accessibility. Ultimately, the expected outcome is a fully functional system that enhances user experience, promotes efficiency, offers diverse payment options, and positions online shopping as a compelling choice.

Wei et al. (2018) investigated the Design and Implementation of an Online Shopping System based on the B/S Model, motivated by the recognition of internet technology's transformative role in enhancing convenience and network applications. Their study is rooted in leveraging the advantages of the B/S structure to simplify system development, maintenance, and usage, aiming to address the limitations of traditional shopping, including geographical and time constraints. The objective is to emphasize the advantages of internet technology, particularly in the context of e-commerce, and to develop an online shopping system using the B/S model

for streamlined development and enhanced user experience. The methodology involves B/S framework and Java, JSP technology for front shopping and backstage management, resulting in an efficient online shopping platform that caters to various business requirements. The research's outcomes include the development of an online shopping system using the B/S structure, integrating the MVC framework for network functionality and management, which not only provides relevant product information but also overcomes traditional shopping limitations

Chen et al. (2018) studied second-hand seller reputation in online markets: a text analytics framework. They focused on the critical issue of evaluating secondhand seller reputation in online markets, motivated by the economic and social significance of secondhand trading. The study aimed to provide a means for potential buyers to assess seller reputation on new-type secondhand e-commerce platforms. It introduced a novel text analytics framework, combining domain ontology and topic modeling to extract relevant features from product descriptions. The study's empirical analysis, focused on suit-dress sellers on the Xian Yu platform, showed that the ontology-based topic model was particularly effective in evaluating seller reputation. The research holds managerial implications by enabling more informed purchase decisions and contributes to the development of online secondhand markets, fostering transparency and buyer confidence.

Padmavathy et al. (2019) presented online second-hand shopping motivation-conceptualization, scale development, and validation. They delved into the motivation driving online second-hand shopping, addressing a research gap despite the increasing popularity of this market. The research aimed to conceptualize, develop, and validate a measurement scale for Online Second-Hand Shopping Motivation (OSSM) to understand the motivations of individuals engaging in this activity. Employing a hierarchical construct approach, the study identified three second-order factors of OSSM: economic motivation, convenience motivation,

and ideological motivation. The findings revealed the positive influence of OSSM on attitude and repurchase intention among online second-hand shoppers, emphasizing the importance of catering to these motivations. The study provides valuable insights for both online P2P second-hand firms and new goods e-retailers, enhancing their understanding of consumer behavior and strategies for the online second-hand market.

Tarai et al. (2020) examined consumer perception towards sale of second-hand clothes in the localities of Odisha, state of India. The perception of local people was examined, particularly in Bhubaneswar, Odisha, India, regarding the sale and purchase of second-hand clothes, aiming to underscore the environmental benefits of garment reuse and promote the second-hand clothing market. The research involved quantitative analysis through distributed online questionnaires to Bhubaneswar residents and qualitative interviews to gauge their perception of second-hand clothing. Findings indicated limited awareness about the environmental impact of textile waste, negative perceptions about purchasing second-hand clothes from others, often linked to concerns about hygiene and quality. However, participants were open to buying quality, hygienic second-hand garments, demonstrating potential for changing their mindset. The study's limitation was a relatively small sample size, suggesting the potential for more precise results with a larger sample.

Turunen et al. (2020) studied Selling second-hand luxury: Empowerment and enactment of social roles. The dynamics of selling second-hand luxury goods, driven by the need to explore the values and meanings attributed to this process was delved into. The study aimed to unravel how consumers selling pre-owned luxury items shape personal and social value in the context of luxury sales. Their objective was to investigate how luxury sellers alter the traditional power dynamics of the luxury market and examine the impact of selling luxury on the symbolic and personal value of the product, as well as consumers' social roles and perceived social value of luxury goods. The research conducted qualitative interviews with eighteen women who had

experience selling luxury branded items, shedding light on an underexplored aspect of luxury consumption literature. The study unveiled that selling luxury items transforms the conventional notions of luxury, empowering consumers and reshaping their social roles and status. It emphasizes the growth and influence of the second-hand luxury market on consumer attitudes and behaviours regarding luxury goods.

Alkhalfan et al. (2020) delved into the design and development of an e-commerce website for unused new goods shopping, motivated by the convenience and efficiency offered by online shopping. The study's objective was to create a platform for selling such goods, which customers couldn't return to their original stores, responding swiftly to customer needs. The methodology involved employing tools like Use Case diagrams, Functional Decomposition Diagrams, and Entity Relationship Diagrams to specify, document, and visualize software system artifacts. The system was constructed using the Unified Modeling Language (UML), ASP.NET, and Access. The study resulted in the design and implementation of an e-commerce website, offering customers immediate access to a variety of new and unused fashion and goods items. It addressed the need for swift and efficient customer access to products through an e-commerce platform.

Borusiak et al. (2020) delved into Towards Building Sustainable Consumption: A Study of Second-Hand Buying Intentions. They investigated promoting sustainable consumption by studying consumers' intentions to buy second-hand products and visit second-hand shops. Their motivation was rooted in the urgent need to foster sustainable consumer choices to combat resource depletion. The study utilized the extended Theory of Planned Behavior (TPB) and incorporated variables from the Norm Activation Model (NAM) to understand consumers' intentions and behaviors related to second-hand buying. Through an online survey involving 333 participants in Poland and Structural Equation Modeling (SEM) for analysis, the research revealed that attitudes supporting sustainable consumption, perceived behavioral control over

second-hand buying, and personal norms positively influence consumers' intention to engage in second-hand buying. However, subjective norms exhibited a negative relationship with consumers' intentions. Moreover, awareness of consequences and ascription of responsibility for environmental issues contributed positively to the formation of personal norms related to second-hand buying. The intention to buy second-hand products also positively correlated with the intention to visit second-hand shops.

Liu, Ying & Xi (2020) designed a Java-based business platform system with JSP technology and a MySql database, featuring a user forum for interaction. The research aimed to enhance campus e-commerce for college students, providing convenience, affordability, and item disposal solutions. It emphasized the importance of adapting e-commerce for universities. The result is a functional platform for efficient trade and an increased awareness of the need to meet modern campus e-commerce requirements.

Rita G. A. (2021) delved into measuring the determinants of e-customer experience and its consequences in the realm of pre-loved luxury fashion, driven by the need to understand the dynamics of this unique context. The objective of the study was to identify and quantify the factors influencing e-customer experience and demonstrate the critical role of web platform ease of use as a predictor. The research employed quantitative data collection, conducting a survey shared via social media and Amazon Mechanical Turk, resulting in 464 responses. The analysis utilized SmartPLS 3 and Structural Equation Modeling (SEM). The results affirmed that ease of use, customization, and web platform aesthetics positively impact e-customer experience in pre-loved luxury fashion platforms, with web platform ease of use emerging as the most influential predictor. Additionally, the study found that a heightened e-customer experience correlated with increased online customer satisfaction, loyalty, trust, and repurchase intention. This research contributes to the evolving literature on secondhand luxury fashion by

examining the determinants and consequences of e-customer experience in the pre-loved luxury fashion market, marking it as a pioneering study in this context.

Md. Rahman et al. (2022) aimed to streamline online shopping, especially for university students, through a business-to-customer e-commerce system. Their research was driven by the pervasive influence of e-commerce and the need for an efficient system architecture. The objective was to create a web-based platform emphasizing customer satisfaction and targeting university students. Their methodology encompassed requirements analysis, architecture design, implementation, and testing. The results yielded a user-friendly e-commerce system, focusing on university campus accessories, promoting accessibility, convenience, and contributing to the information and communication sector. The study highlighted the transformative role of e-commerce, especially during the COVID-19 pandemic, in maintaining social distancing and reducing infection risks.

Giri et al. (2022) embarked on the development of a campus second-hand buy and sell application to address students' resource management challenges, minimize wastage, and enhance economic efficiency. Their motivation was fueled by the desire to create a user-friendly platform tailored to students, offering easy access to second-hand items, promoting sustainability, and reducing electronic waste. The project aimed to facilitate students in recognizing the value of pre-owned goods, saving both time and resources, and fostering trust within the student community by connecting them directly. The project's methodology encompassed technical, operational, and economic feasibility studies, ensuring a comprehensive analysis of its viability. The outcome was the creation of a student-centric online buy and sell platform for second-hand items, which bypassed expensive intermediaries and encouraged efficient resource utilization. It also fostered a trusted environment for transactions among college students.

Loos (2022) addressed the need for specific provisions in second-hand goods sales to bolster sustainability, driven by shifting perceptions of pre-owned items. Traditional biases against second-hand goods have softened, partly due to sustainability initiatives and thriving online platforms. The study evaluated the current legal framework and regulations within the context of evolving consumer attitudes and sustainability objectives using a legal analysis approach. It analyzed relevant directives, including the 2019 Sale of Goods Directive (SGD) and the Consumer Sales Directive (CSD), while referencing existing literature and case studies. The paper contributes to understanding the legal aspects of second-hand sales and their sustainability implications, proposing tailored conformity assessments, distinctions for refurbished items, default rules for commercial guarantees, and greater alignment between consumer-to-consumer (C2C) and business-to-consumer (B2C) contracts. However, it acknowledged limitations, such as the absence of empirical evidence supporting the influence of specific provisions and potential consumer hesitance due to reduced seller liability.

Xu et al. (2022) explored the significance of narrative information in the context of online secondhand shopping, driven by the industry's growth and the need for effective product presentation. The study aimed to clarify how narrative information affects consumers' perceived persuasiveness of secondhand product details, focusing on its impact and boundary conditions. Three experiments were conducted to evaluate this impact, emphasizing the importance of providing usage-based attributes. The experiments involved presenting participants with different scenarios and manipulating whether the secondhand products were for self-use or not for self-use. Participants' perceptions of persuasiveness were assessed through various measurements. Mediation and moderation analyses were conducted to explore the underlying mechanisms and boundary conditions of the effect of narrative information. The study offers valuable guidance to sellers on presenting information effectively while considering product usage. Results showed that narrative information increases perceived

persuasiveness for products intended for self-use but decreases it for those not intended for self-use. Reactance was identified as a mediating factor in this effect.

The study conducted by Suresh et al. (2022) addresses the issue of inadequate availability of study materials in current systems. Its objective is to develop a website that enables students to purchase university-based textbooks and past question papers. The system allows returns, offers future purchase discounts, and collects undamaged returned books, ultimately resolving stock availability problems. The methodology involves website development for buying and selling study materials, with PHP for the front-end and MySQL for the back-end. Notably, the system facilitates both returns and delivery of items. This proposed system provides valuable contributions to students, offering cost-effective access to study materials. It eliminates stock availability challenges prevalent in existing systems, guaranteeing a dependable supply of study materials while delivering a seamless user experience.

Liu et al. (2022) propose a business model for "Best4u.com," an online platform for second-hand transactions. They aim to simplify online second-hand shopping while promoting sustainable consumption (Sustainable Development Goal 12). Using design thinking and various tools, they address customer concerns and validate the model through a survey. The methodology involves applying design thinking to identify issues and propose solutions, using tools like the Business Model Canvas, Value Proposition Canvas, and Environment Map. A survey of potential customers validates the proposed business model, addressing concerns like delayed delivery and fraudulent products. Their contribution is a validated business model for "Best4u.com," aiming to streamline online second-hand shopping. Survey results show potential customers are interested if issues like delayed delivery and fraud are resolved.

Yoonjae et al. (2022) explore technology-based strategies in the online second-hand resale industry. Their study aims to understand these strategies, their impact on users, and areas for

improvement. They use a mixed-method approach, combining quantitative data collection, case studies, surveys, and expert interviews. The study provides insights into how features promoting safe transactions, user-friendly design, and individual compatibility influence users' adoption of online resale platforms. High-tech features have a limited impact. The research emphasizes shared culture and sustainable consumption values, contributing to sustainability in the retail industry. This study sheds light on the ongoing digitalization of the online secondhand resale industry, with a focus on users' perceptions of usefulness, ease-of-use, and enjoyment.

Kawulur et al. (2022) explore the purchase intentions of Generation Z regarding online second-hand shopping. Their aim is to identify the motivating factors that drive Generation Z to make such purchases. The methodology involves questionnaires administered to individuals aged 18 to 26years. Data analysis employs Multiple Linear Regression Analysis and SPSS software to process the collected data. The study contributes to the knowledge of business owners by highlighting the importance of focusing on convenience, shopping speed, product information, and selection in order to appeal to the spending preferences of the future generation. A limitation of the study is the need for further validation of the findings through additional research.

Wang et al. (2023) delve into the influencing factors of online second-hand C2C trading platforms, motivated by the recent surge in second-hand goods circulation due to COVID-19. The study aims to enhance these platforms' efficiency and performance by identifying key factors. They construct a questionnaire, analyse variables related to information, communication, service, and user characteristics using a binary discrete probit model. The study provides insights into these influencing factors, such as information acquisition, communication, consultation, service, and user characteristics. It offers measures and suggestions for improving platform efficiency and performance. However, it's important to

note that the study's findings may not be universally applicable to all C2C online second-hand trading platforms, and further research could explore these factors more comprehensively.

Hedge et al. (2023) delve into The Impact of Thrift Stores. International Journal of Innovative Research in Technology. The paper explores the impact of thrift stores, particularly Goodwill Industries, on sustainable fashion practices, given the fashion industry's significant contribution to environmental degradation and waste. Thrift stores are seen as a solution to fast fashion, promoting the reuse and recycling of clothing. Using a case study approach with qualitative and quantitative data, the study finds that Goodwill plays a crucial role in diverting textiles from landfills and encouraging sustainable consumption. The benefits of thrifting are highlighted, such as decreasing waste, creating a unique wardrobe, obtaining premium brands affordably, and supporting the community. The research aims to investigate the extent to which thrift stores contribute to sustainability, identifying challenges they face, and opportunities to enhance sustainable fashion practices. While the findings indicate the positive role of Goodwill in promoting sustainability, the study points to the need for increased awareness and education among consumers about fast fashion's environmental impact and improving sustainably-produced clothing availability. Further promotional efforts and business models could strengthen sustainable fashion practices in thrift stores.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.1 Introduction

The intricate phases of the application development design and implementation process are thoroughly explored in this section. The design phase aims to create a detailed model of the system, providing guidance for the subsequent implementation. This chapter encompasses various aspects, including information architecture, user flow diagrams, use case diagrams, wireframes, functional and non-functional requirements, specifications for software tools, as well as the selection of implementation tools and programming languages essential for the development of the final application

3.2 System Specification

3.2.1 Functional Requirement

The Functional Requirements Specification (FRS) serves as a detailed and structured document outlining the functionalities and features that a software system, application, or product is expected to deliver. It plays a critical role in the software development lifecycle by providing a comprehensive roadmap for designers, developers, and stakeholders. In essence, it articulates the specific behaviours, features, and interactions expected from the software. It details user interactions, system responses, and any external dependencies that influence the system's functionality. By clearly defining the functional requirements, the FRS acts as a guiding document throughout the development process, aiding in the creation of software that aligns with the project's goals and user expectations.

It serves as a reference point for developers to understand the expected behaviour of the system and for stakeholders to validate that the final product meets their business needs. Ultimately,

the FRS contributes to the successful development of software that not only meets functional specifications but also satisfies the broader objectives and requirements of the project.

The application encompasses the specifications listed below:

1. User Registration and Authentication: Elevating the user registration and authentication process by incorporating a resilient system that enables individuals to sign up using their email addresses. Implement a secure authentication procedure, potentially involving email verification, to safeguard user accounts against unauthorized access. This robust system not only facilitates a seamless registration experience but also adds an extra layer of security by verifying the authenticity of user identities. The inclusion of email verification serves as a protective measure, ensuring that only legitimate users gain access to the platform, thereby fortifying the overall security framework and user confidence.
2. User Profile: The User Profiles functionality entails empowering users to establish comprehensive profiles enriched with vital information, including their name, profile picture, contact and order details. This feature is designed to not only offer a personalized and engaging user experience but also to foster a sense of transparency and reliability within the community. To further fortify trust, a verification process specifically tailored for sellers is implemented. This verification process seeks to confirm the authenticity of sellers, ensuring that they are legitimate participants in the platform and promoting a secure environment for buyers and fellow users. By combining detailed user profiles with a robust verification mechanism, the platform aims to enhance the overall credibility and trustworthiness of its user base.
3. Search: Improve the browsing experience by integrating a robust search functionality, enabling users to swiftly locate items of interest. The implementation of this advanced search feature is geared towards providing users with a seamless and efficient means to

explore the platform's offerings. By incorporating a sophisticated search mechanism, the goal is to enhance user satisfaction by facilitating quick and precise access to the diverse array of items available on the platform. This improvement in search capability contributes significantly to the overall usability and user-friendliness of the application.

4. Product Listing: Optimizing the process of listing products by enabling sellers to create thorough and detailed product listings. This involves the implementation of features that empower sellers to upload photos, define product names, categorize items, provide detailed descriptions, specify conditions and set accurate and suitable prices. The aim is to streamline the product listing experience for sellers, ensuring that they can effectively showcase their items with rich and pertinent information. By incorporating these features, the platform enhances the clarity and completeness of product listings, ultimately contributing to a more informed and satisfying experience for both sellers and potential buyers.
5. Delivery Location: Refine the delivery process by implementing features that enable sellers to precisely specify delivery details, particularly within designated campus locations, thereby bolstering security measures. This functionality allows sellers to choose specific delivery points on the campus, ensuring a secure and organized delivery process. Additionally, enhance transparency by incorporating clear and detailed information about these delivery locations, providing both buyers and sellers with a comprehensive understanding of where transactions will take place. This emphasis on accurate delivery location specifications and transparent information contributes to a heightened sense of security and trust within the platform.
6. Inventory Management: Empower sellers through the provision of a user-friendly interface designed for efficient inventory management. Implement features that allow sellers to mark items as sold, remove listings, update product details, and track item

availability, including a convenient view of sold items. This comprehensive inventory management system aims to streamline the seller's experience, providing them with the tools needed to effectively organize and monitor their listed items. The ability to mark items as sold, remove listings, and update details ensures that the inventory remains accurate and up-to-date. Additionally, the feature allowing sellers to track item availability by reviewing sold items contributes to a more informed and responsive approach to managing their product offerings.

7. Security Features: Giving paramount importance to user data security by incorporating encryption protocols, secure login mechanisms, and conducting regular security audits. Integrate measures aimed at safeguarding sensitive information, particularly payment details. These security features collectively form a robust protective infrastructure, ensuring the confidentiality and integrity of user data. By emphasizing encryption, secure login processes, and ongoing security assessments, the platform takes a proactive stance against potential vulnerabilities, fostering a secure digital environment for users.
8. Account Settings: Enabling users to tailor their experience through the implementation of account settings. Provide a user-friendly interface that allows individuals to customize various aspects of their accounts, including preferences, password changes, and other personalization features. This functionality aims to empower users with control over their interaction with the platform, enhancing their overall experience. By offering flexibility in account settings, users can adapt the platform to align with their preferences, ensuring a personalized and user-centric engagement. This inclusive approach to account customization contributes to user satisfaction and loyalty within the platform.

3.2.2 Non-functional Requirement

The Non-Functional Requirements Specification (NFRS) is a comprehensive document that delineates the criteria and constraints beyond the functional aspects, which are crucial for the successful development and deployment of a software system. Unlike functional requirements that focus on what a system should do, non-functional requirements delve into how a system should perform. These encompass a wide array of characteristics such as performance, security, reliability, usability, and scalability, among others.

The Non-Functional Requirements Specification outlines the performance expectations, operational parameters, and overall quality attributes that the system must adhere to. This document serves as a guiding framework for the development team, ensuring that the software not only meets user expectations in terms of functionality but also complies with critical non-functional considerations. For example, it may specify response times, system availability, data encryption standards, or user interface responsiveness.

In essence, the Non-Functional Requirements Specification is a critical component in shaping the holistic user experience and system performance. It provides a comprehensive understanding of the operational parameters and quality attributes that are fundamental to the success of the software project. By detailing these non-functional considerations, the NFRS facilitates effective communication between stakeholders and the development team, ensuring that the software not only works as intended but also meets the broader criteria for performance, security, and usability.

The application encompasses the following non-functional requirements:

1. Response Time: The application responds to user interactions within a specified time frame, ensuring a smooth and efficient user experience.

2. Scalability: The application is able to handle an increasing number of users and transactions without significant degradation in performance.
3. Data Encryption: Ensure that sensitive information, such as user data and payment details, is encrypted to protect against unauthorized access.
4. Authentication and Authorization: Implement robust authentication and authorization mechanisms to control access to different parts of the application.
5. 24/7 Uptime: Ensure that the e-commerce application is available for use 24/7, providing uninterrupted service to users regardless of the time of usage. This continuous availability is critical to meet the diverse and potentially global user base's expectations and needs.

3.3 Information Architecture

Anna Fitzgerald (September,2022) emphasized that making information easy for visitors to find is more than just good website navigation, but about the entire structure of the site: what information displays on the homepage, where the product catalogue is, how users access it.

Information architecture, an important aspect in the digital landscape, serves as the strategic blueprint for organizing and structuring information within systems, websites, and applications. This discipline encompasses the thoughtful arrangement of data, content, and functionality, ensuring seamless navigation and user interaction. As a guiding framework, information architecture not only shapes the hierarchical structure but also influences the user experience, promoting clarity, accessibility, and efficiency.

The information architecture of the mobile application, illustrating the hierarchy, navigation, and other elements, is presented below.

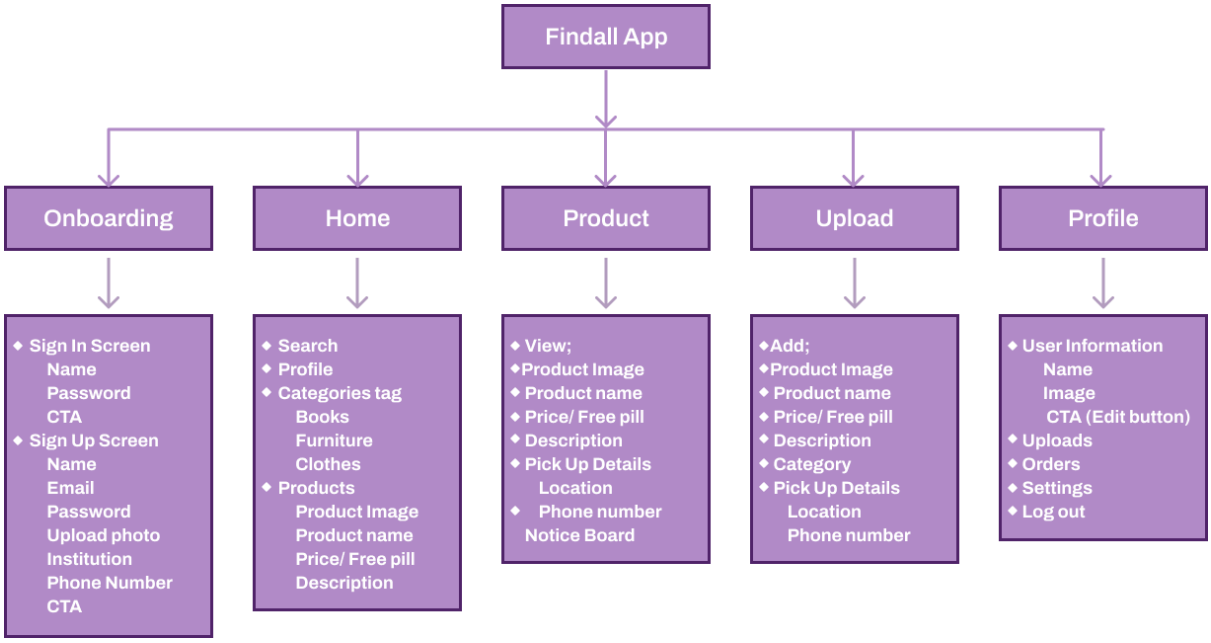


Figure 3.1: System Information Architecture

3.4 User Flow

Navigating the digital landscape is a dynamic journey marked by intentional steps and interactions, collectively encapsulated as the user flow. User flow embodies the seamless progression of users through a system, application, or website, outlining the pathways and decision points that define their experience. This comprehensive roadmap guides individuals from their initial entry point through various stages to their ultimate destination, whether it be acquiring information, completing tasks, or finalizing transactions. By understanding and optimizing the user flow, designers and developers can craft digital environments that not only meet user needs but also cultivate intuitive, engaging, and efficient experiences within the ever-evolving realm of digital interaction. Below is the user flow for both the buying and selling perspectives. Below, the user flow for both sellers and buyers are outlined.

3.4.1 User Flow for Buyer

The buyer initiates the process by registering and establishing a profile, after which they explore product details and access the seller's contact information. Subsequently, the buyer initiates contact with the seller, who engages in communication and negotiation with potential

buyers. Once a sale is confirmed, sellers coordinate shipping or meet-ups for delivery. The buyer then makes a cash payment to the seller and concludes the transaction by receiving the delivery.

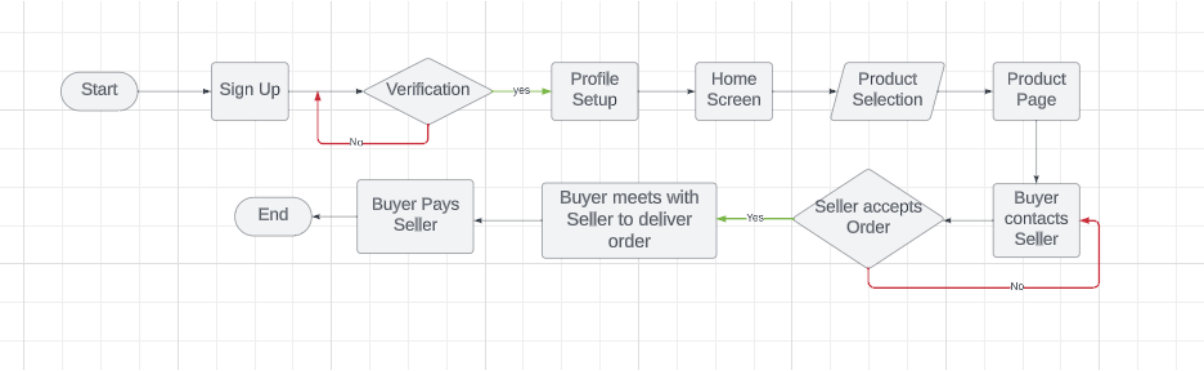


Figure 3.2: User Flow Diagram for Buyer

3.4.2 User Flow for Seller

Sellers commence the process by registering and establishing a profile, then proceed to upload their products, including photos, names, categories, descriptions, and prices. After previewing and publishing their listings, sellers interact with potential buyers through communication and negotiation. Upon confirming a sale, sellers organize shipping or meet-ups, mark transactions as complete, and effectively manage their inventory.

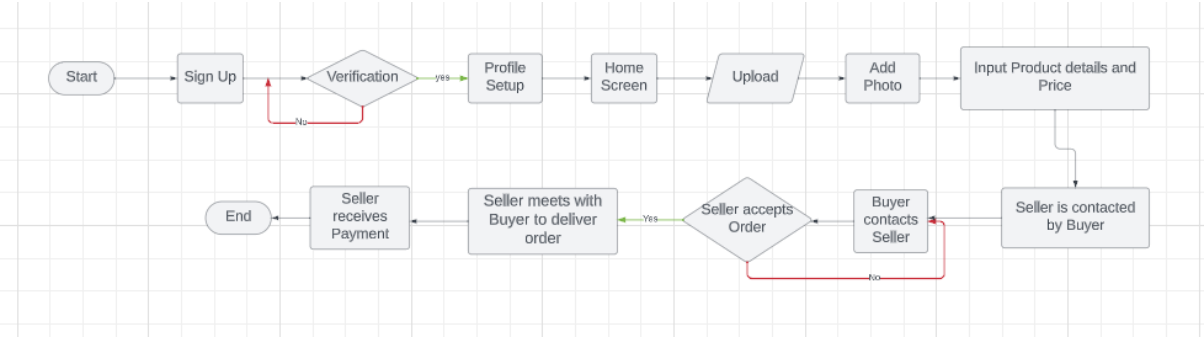


Figure 3.3: User Flow Diagram for Buyer

3.5 Wireframing

Wireframing is a fundamental step in the process of designing digital interfaces, serving as a visual blueprint or skeletal framework for websites, applications, or other digital products. It is

a low-fidelity representation that outlines the basic structure, layout, and key elements of a user interface without delving into detailed design elements or visual aesthetics. Wireframes act as a guide for designers, developers, and stakeholders to understand the fundamental layout and functionality of a digital product before investing time and resources into higher-fidelity design elements.

The primary purpose of wireframing is to establish a clear and functional information architecture, emphasizing the placement of essential elements and user interactions. By focusing on the arrangement of elements rather than detailed design aspects, wireframes facilitate collaboration and early-stage feedback, allowing teams to iterate on the structure and flow of a digital interface. Wireframing is an integral part of the design process, enabling teams to align on the core features and user journey, ultimately contributing to the creation of user-friendly and effective digital experiences.

3.5.1 Paper Wireframe

A paper wireframe is a low-fidelity, hand-drawn representation of a user interface, typically created on plain paper using pencils or pens. It serves as an initial visual blueprint for the layout and key components of a digital product, such as a website or mobile application. The process involves outlining the basic structure, sketching individual elements, and annotating functionalities. Paper wireframes provide a quick and flexible means of exploring design possibilities and iterating on the overall structure before moving to digital design tools. This method allows designers and stakeholders to collaboratively test ideas, gather feedback, and make informed decisions about the user interface's fundamental architecture and flow

The paper wireframes for the application are provided below:

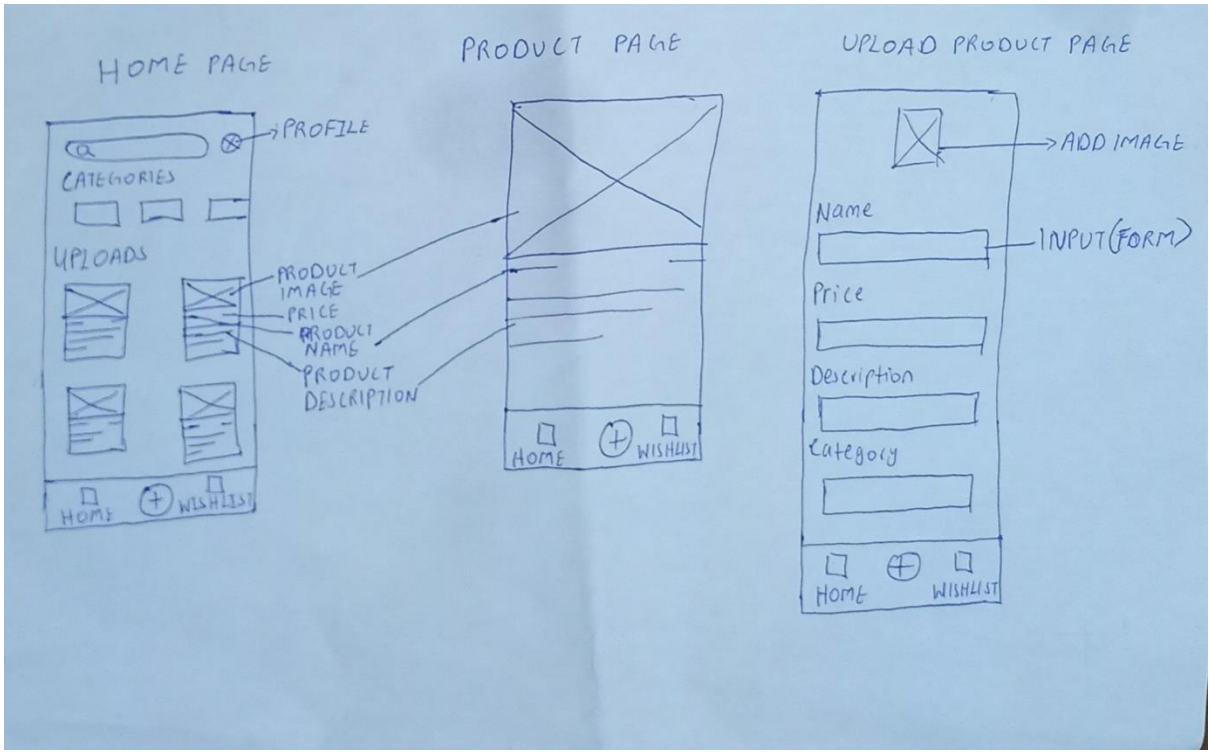


Figure 3.4: Paper Wireframe for Home, Product and Upload Screens

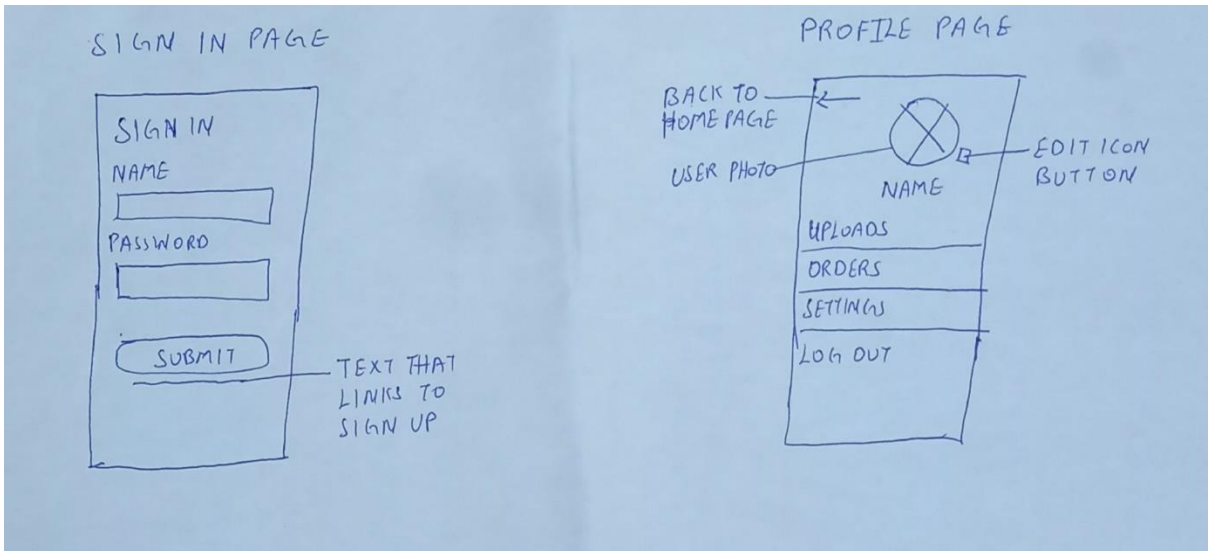


Figure 3.5: Paper Wireframe for Sign-In and Profile Screens

3.6 UI design

UI design, short for User Interface design, is the process of crafting visually appealing and user-friendly interfaces for digital products, focusing on the overall look, feel, and interaction.

It involves creating layouts, selecting colour schemes, choosing typography, and designing icons and other visual elements to enhance the user experience. UI designers consider the principles of usability, accessibility, and consistency to ensure that the interface is intuitive and efficient for users. The design process often begins with wireframing, where the basic structure is outlined, followed by the creation of high-fidelity mock ups that showcase the final visual appearance. UI design is integral to creating engaging and effective digital experiences, contributing to the success of websites, mobile apps, and other interactive platforms.

3.6.1 Figma Design Tool

Figma is a versatile and collaborative cloud-based design tool that excels in UI design. Offering a seamless blend of design, prototyping, and collaboration features, Figma allows designers to create and iterate on user interfaces in real-time. With an intuitive interface and robust design capabilities, Figma facilitates the creation of high-fidelity prototypes and responsive designs, making it a preferred choice for UI designers. Moreover, it’s cloud-based platform eliminates version control issues, providing a centralized space for design assets and ensuring accessibility from anywhere, anytime.

The UI design screens for the application are provided below:

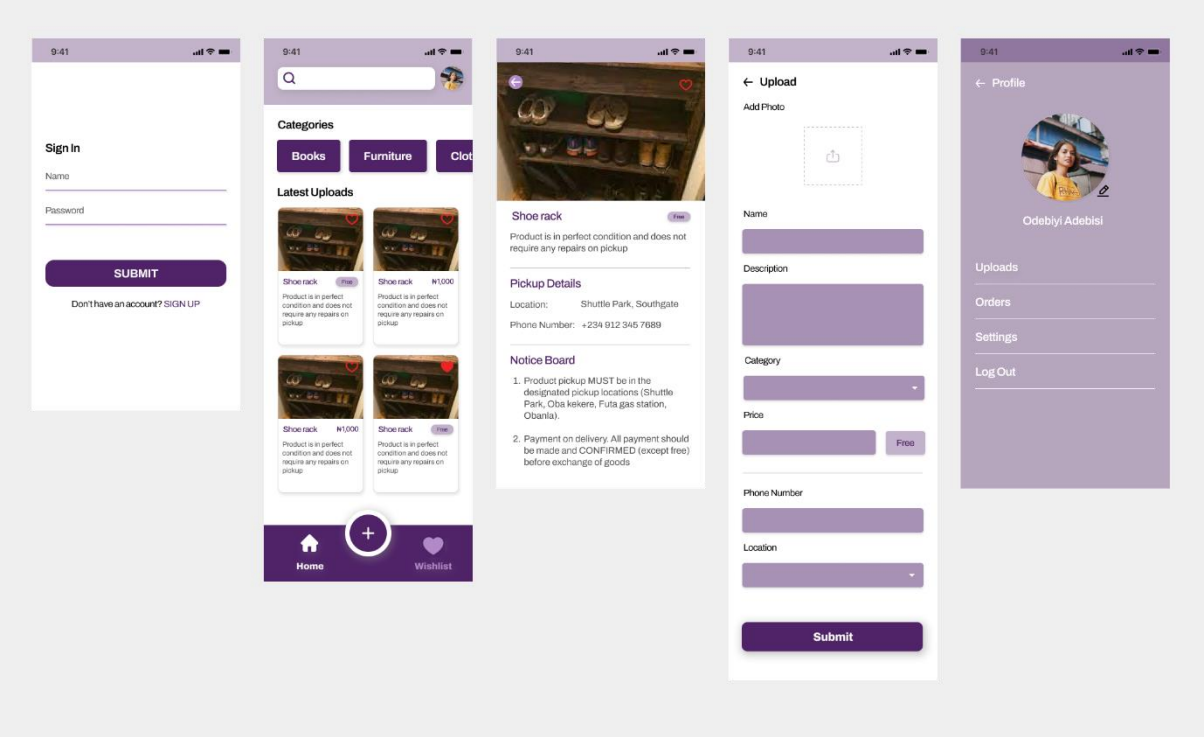


Figure 3.6: UI design of Sign-In, Home, Product, Upload and Profile Screen

3.7 Software Tools

3.7.1 Node.js and npm:

Node.js and npm together form a robust ecosystem for server-side JavaScript development. Node.js provides the runtime environment, while npm simplifies the process of managing dependencies, fostering collaboration, and enhancing the scalability of Node.js applications.

1. Node.js:

   Node.js is a powerful, open-source, server-side JavaScript runtime environment built on the V8 JavaScript engine from Google Chrome. Its main purpose is to enable developers to execute JavaScript code on the server side, outside the confines of a web browser. This capability is crucial for building scalable and high-performance network applications. Node.js uses an event-driven, non-blocking I/O model, making it well-suited for applications that demand real-time communication and efficient handling of a large number of simultaneous connections.

2. npm (Node Package Manager):

   npm, short for Node Package Manager, is the default package manager for Node.js. It plays a pivotal role in simplifying the process of managing dependencies, sharing code, and integrating third-party libraries and tools into a Node.js project. npm provides a centralized repository of packages, making it easy for developers to discover, install, and use a wide range of modules.

3.7.2 React Native

React Native is an open-source framework developed by Facebook for building cross-platform mobile applications using JavaScript and React. It allows developers to use a single codebase to create native-like mobile apps that can run on both iOS and Android devices. The primary goal of React Native is to provide a seamless and efficient development experience while maintaining the performance and look-and-feel of native applications.

React Native empowers developers to create powerful and performant mobile applications with a focus on efficiency and code reuse. Its adoption has grown significantly, and it continues to be a popular choice for businesses and developers seeking a streamlined approach to cross-platform mobile app development.

Key Features and Concepts of React Native:

I. Cross-Platform Development: React Native enables the development of cross-platform mobile applications, meaning developers can use the same codebase to create apps for both iOS and Android platforms. This approach significantly reduces development time and effort.

II. Component-Based Architecture: React Native follows a component-based architecture similar to React, where the UI is built using reusable components. This modular approach enhances code maintainability and reusability.

III. JavaScript and React Knowledge: Developers with knowledge of JavaScript and React can easily transition to React Native. The framework leverages these familiar technologies, making it accessible to a broad community of developers.

IV. Native-Like Performance: React Native bridges the gap between web and mobile development by allowing developers to use React components that are translated to native views. This provides a native-like performance experience to users.

V. Hot Reloading: React Native supports hot reloading, allowing developers to see the immediate impact of code changes during development. This feature accelerates the development process and enhances productivity.

VI. Native Modules and Libraries: For functionality not covered by React Native's core components, developers can use native modules and libraries. This allows integration with native code when required, providing flexibility and access to native device features.

VII. React Navigation: React Navigation is a popular library used in React Native for handling navigation between different screens in a mobile app. It provides a smooth and customizable navigation experience.

VIII. Community and Ecosystem: React Native has a vibrant and active community. This community contributes to a vast ecosystem of libraries, tools, and resources, further enhancing the capabilities and functionality available to developers.

IX. Expo Go: Expo Go is a set of tools and services built around React Native to accelerate the development process. It includes features like a development server, cloud-based builds, and an Expo Go Client app for testing on physical devices.

3.7.3 Expo Go

Expo Go revolutionizes React Native development by offering a streamlined and accessible framework. Its Managed Workflow provides an expedited development process, making it an excellent choice for projects where simplicity and speed are paramount. Expo Go's pre-configured tools, unified development environment, and continuous updates contribute to its popularity among React Native developers.

Expo Go is a comprehensive, free, and open-source framework designed to simplify the process of building React Native applications. Tailored to enhance the development workflow, Expo Go provides developers with a suite of pre-configured tools and services, significantly reducing the complexities associated with native development setups. Expo Go's goal is to streamline the development process, making it more accessible for developers to create cross-platform mobile applications with React Native.

Managed Workflow and Bare Workflow:

Expo Go supports two main workflows: the Managed Workflow and the Bare Workflow. The Managed Workflow, often referred to as the "Expo way," is particularly beneficial for rapid development. It allows Expo Go to handle various aspects of the build and deployment process, offering a streamlined experience without requiring developers to set up native development environments.

Expo Go and Physical Device Linking:

Expo Go simplifies the process of linking physical devices to the development code during the testing phase. Expo's approach to device linking involves the following steps:

i. Expo Client App: Developers install the Expo Client app on their physical devices. The Expo Client app serves as a development tool that allows developers to preview and test their applications directly on the device.

ii. QR Code Scanning: Expo Go generates a QR code that represents the current state of the application. Developers use the Expo Go Client app to scan this QR code, establishing a connection between the physical device and the Expo Go development server.

iii. Live Updates: With the physical device linked to Expo Go, developers can experience live updates as they make changes to the code. This real-time connection streamlines the development and testing process.

3.7.4 MongoDB (Database)

According to (Alexander S. Gillis, n.d), MongoDB is an open source NoSQL database management program. NoSQL (Not only SQL) is used as an alternative to traditional relational databases. NoSQL databases are quite useful for working with large sets of distributed data. MongoDB is a tool that can manage document-oriented information, store or retrieve information.

MongoDB is used for high-volume data storage, helping organizations store large amounts of data while still performing rapidly. Organizations also use MongoDB for its ad-hoc queries, indexing, load balancing, aggregation, server-side JavaScript execution and other features

Instead of using tables and rows as in relational databases, as a NoSQL database, the MongoDB architecture is made up of collections and documents. Documents are made up of key-value pairs. MongoDB's basic unit of data. Collections, the equivalent of SQL tables, contain document sets. MongoDB offers support for many programming languages, such as C, C++, C#, Go, Java, Python, Ruby and Swift.

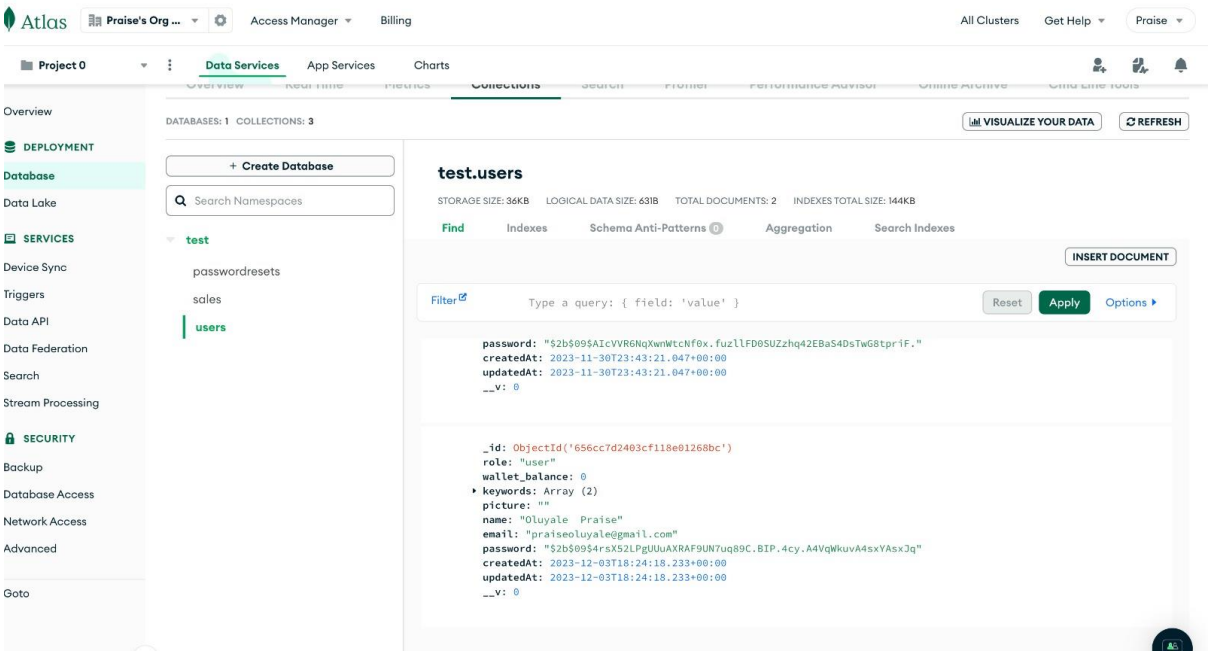


Figure 3.7: MongoDB user database

3.7.5 Visual Studio Code (IDE)

Visual Studio is a comprehensive integrated development environment (IDE) developed by Microsoft. It provides a robust and feature-rich environment for software development, supporting a wide range of programming languages, frameworks, and platforms. Visual Studio is widely used by developers for building applications ranging from desktop and web applications to mobile and cloud-based solutions.

Key Features of Visual Studio IDE:

I. Multi-Language Support: Visual Studio supports a multitude of programming languages, including C#, C++, Python, JavaScript, TypeScript, and more. This versatility makes it a preferred choice for developers working on diverse projects.

II. Code Editor and IntelliSense: The code editor in Visual Studio offers advanced features such as syntax highlighting, code completion, and IntelliSense. IntelliSense provides real-time suggestions and auto-completions, enhancing coding efficiency.

III. Debugging Tools: Visual Studio provides powerful debugging tools that help developers identify and fix issues in their code. Features like breakpoints, watch windows, and step-by-step debugging contribute to a seamless debugging experience.

IV. Integrated Version Control: Visual Studio integrates with popular version control systems like Git, allowing developers to manage source code versions directly from the IDE. This ensures collaboration and code integrity within development teams.

V. Extensibility and Plugins: The IDE supports a wide range of extensions and plugins, allowing developers to customize their development environment based on their preferences and project requirements.

VI. Project Templates and Wizards: Visual Studio offers a variety of project templates and wizards that streamline the creation of new projects. This accelerates the development process by providing a foundation for different types of applications.

VII. Cross-Platform Development: Visual Studio supports cross-platform development, enabling developers to build applications for Windows, macOS, Linux, iOS, Android, and more. This flexibility is crucial for modern application development.

VIII. Performance Profiling: The IDE includes performance profiling tools that help developers analyse and optimize the performance of their applications. This is essential for delivering high-performance software.

IX. Integrated Development for Web and Cloud: Visual Studio provides tools for web development, including support for ASP.NET, HTML, CSS, and JavaScript. Additionally, it offers features for cloud development, making it suitable for building scalable and robust cloud-based applications.

CHAPTER FOUR

SYSTEM IMPLEMENTATION RESULT AND TEST

Implementing this application was divided into two sides, the client and the server side. The client side contains the mobile application code with all the components and screens. The server side contains the backend code, tests and the database. The software tools used are React Native for cross-platform development, MongoDB for the database, and Node.js for server-side implementation.

This chapter provides a detailed examination of the implementation process, outlining the individual screen, their functionalities. Also the testing methodologies.

4.1 Client-side

The Client-side code contains the components that were used to build the application screen, like the ActionButton, Button, Card, Form, Header, NotFound to list a few. It also contains the assets which contains the font and images. The screens that make us the application which users can view and interact with is also included in the client side. Screens like the Home, Sign-Up, Sign-In, Profile, Product screens.

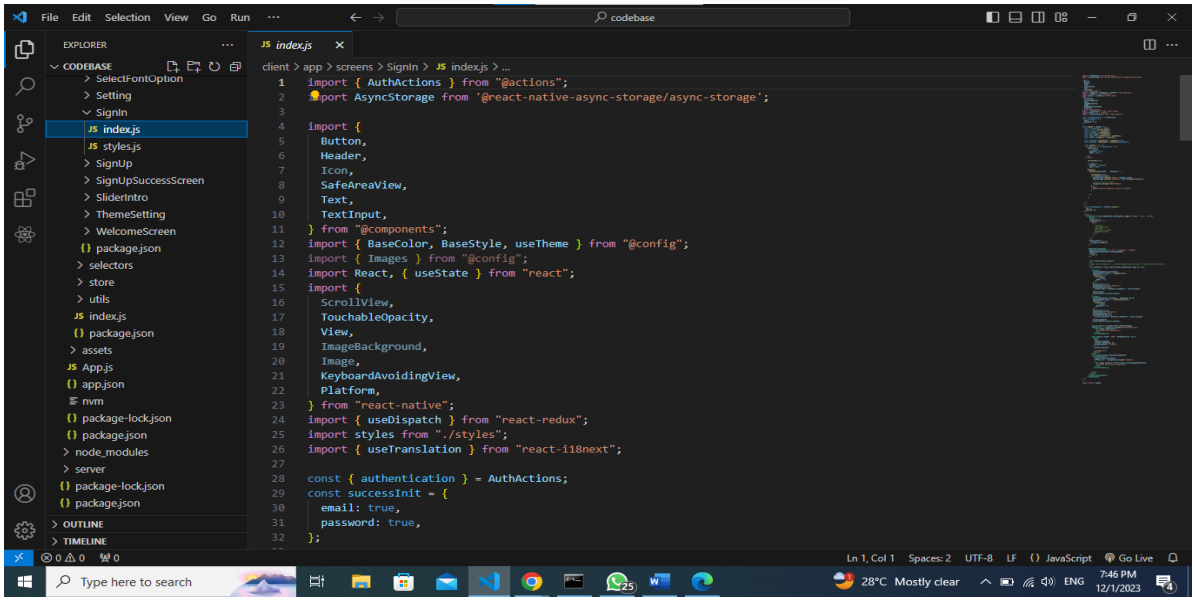


Figure 4.1: Client-side Sign-In Screen development code on Visual Studio Code

4.1.1 Welcome Screens

This are the initial screen the users see and interact with after launching the application. It is a screen that welcomes the users and has a cation of what the application is about. It also contains the ‘Proceed’ button that navigates the users to the next welcome screen where users can choose to either sign-in, if they have registered before or Sign-up, to register.

Below is an image of the application’s Welcome screen. This image provides a visual representation of the layout and key components typically found on a Welcome screen.

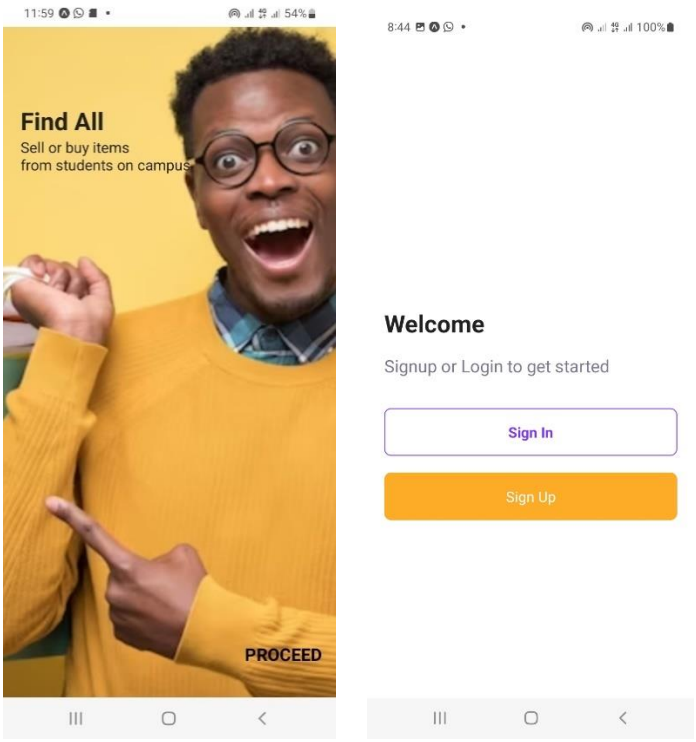


Figure 4.2: Welcome Screens

4.1.2 Sign-In and Sign-Up Screen

The Sign-In screen serves as the initial point of interaction after the Welcome screen, enabling registered users to access the application's functionalities by providing valid credentials, including a registered username and password. Upon successful authentication, existing users are granted entry to the app's features, while invalid inputs necessitate rectification and resubmission of accurate information. For first-time users, an intuitive (Sign-Up) text link

found below the submit CTA (call-to-action) button seamlessly guides them to the Sign-Up page, where essential details are input, validated, and stored to ensure a smooth onboarding process. After signing-Up, a modal screen comes up to confirm successful registration.

Below is an image of the application's Sign-In and Sign-Up screen. This image provides a visual representation of the layout and key components typically found on a sign-In and Sign-Up screen.

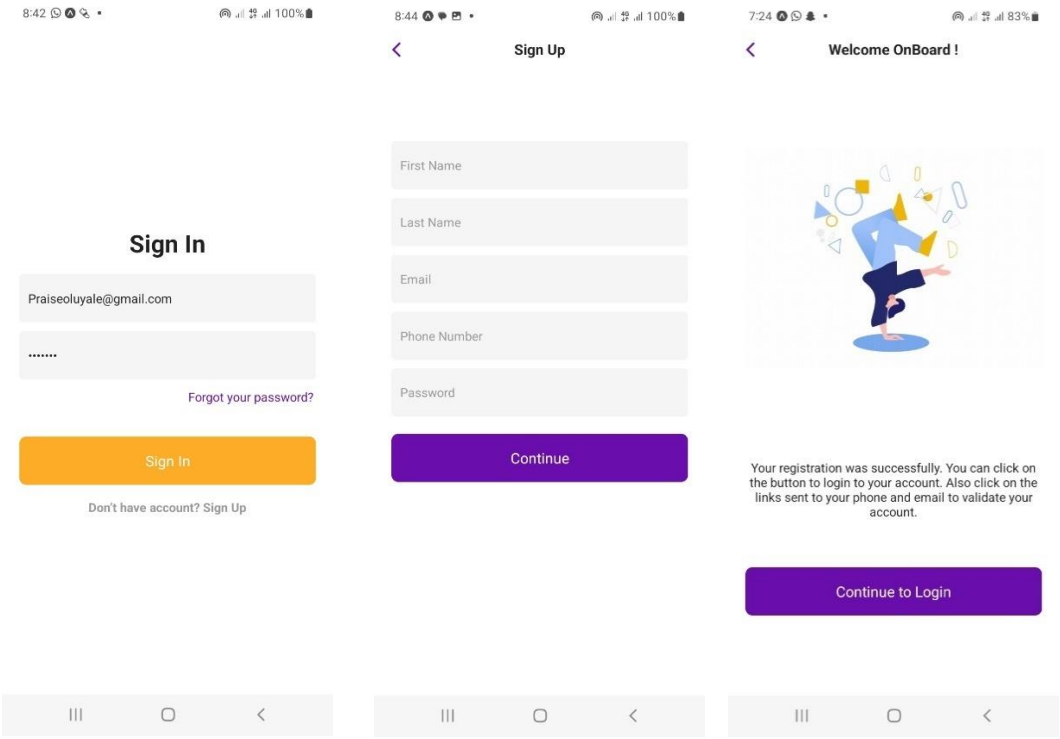


Figure 4.3 Sign-In and Sign-Up Screens

4.1.3 Home Screen

The homepage acts as the app's main entrance, a central hub that smoothly connects users to various screens, such as the user profiles, product, and category screens. With a user-friendly navigation system, it offers quick access to different parts of the app. The incorporation of category tags that link to the category screen simplifies product searches, providing users with a more organized, streamlined search and efficient user experience. Additionally, a function that allows users to like products, this serves as a form of feedback to the seller. The homepage

also visualizes recommended products, offering users a curated selection of recently added items, enhancing the overall exploration and discovery process.

Below is an image of the application's Home screen. This image provides a visual representation of the layout and key components typically found on a Home screen.

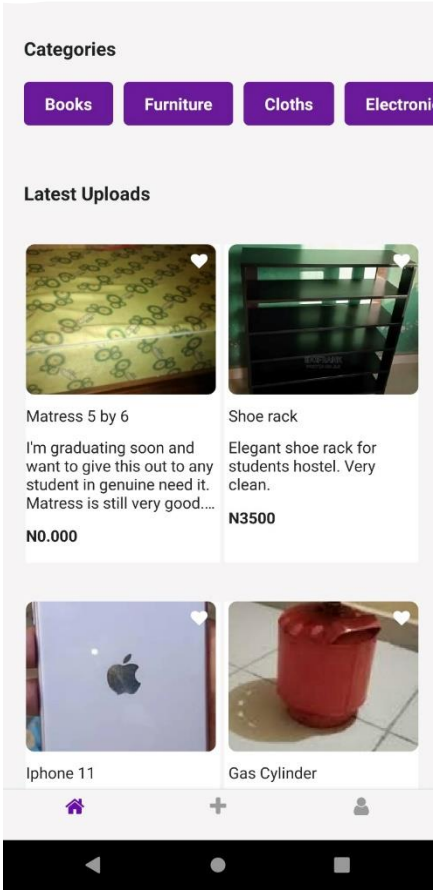


Figure 4.4: Home Screen

4.1.4 Product Screen

The product page serves as the ultimate destination when a particular product is selected, presenting essential details such as the product's image, name, description, and pricing information. If the product is available at no cost, a 'Free' tag replaces the price. Additionally, the page provides pickup details, including the seller's contact information and location. A

clearly displayed notice board outlines the purchase rules, ensuring transparent and informed transactions.

Below is an image of the application's Product screen. This image provides a visual representation of the layout and key components typically found on a Product screen.

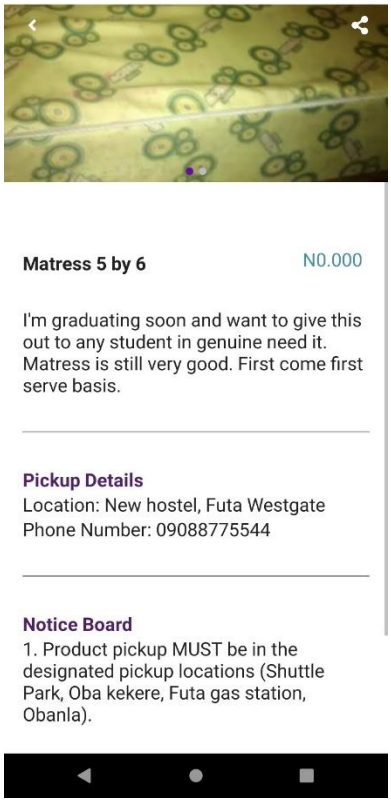


Figure 4.5: Product Screen

4.1.5 Category Screen

The category screen displays an extensive collection of items within the selected category, allowing users to seamlessly browse through a wide assortment of products, encompassing books, clothes, electronics, furniture, and more. This purposeful categorization streamlines user navigation, presenting a focused and organized selection tailored to specific interests. Also, the integration of a search feature further empowers users to effortlessly locate particular types of products within the chosen category.

4.1.6 Upload Screen

The upload screen functions as a portal for sellers to add their products, enabling prospective buyers to browse and purchase them. Sellers are guided to upload a product image along with essential details such as the product name, description, pricing information, or an indication if the item is available for free. Additionally, sellers specify the product category and location, ensuring comprehensive details that will be displayed on the product page. This provides potential buyers with a clear and informative representation of the listed items.

Below is an image of the application's Upload screen. This image provides a visual representation of the layout and key components typically found on an Upload screen.

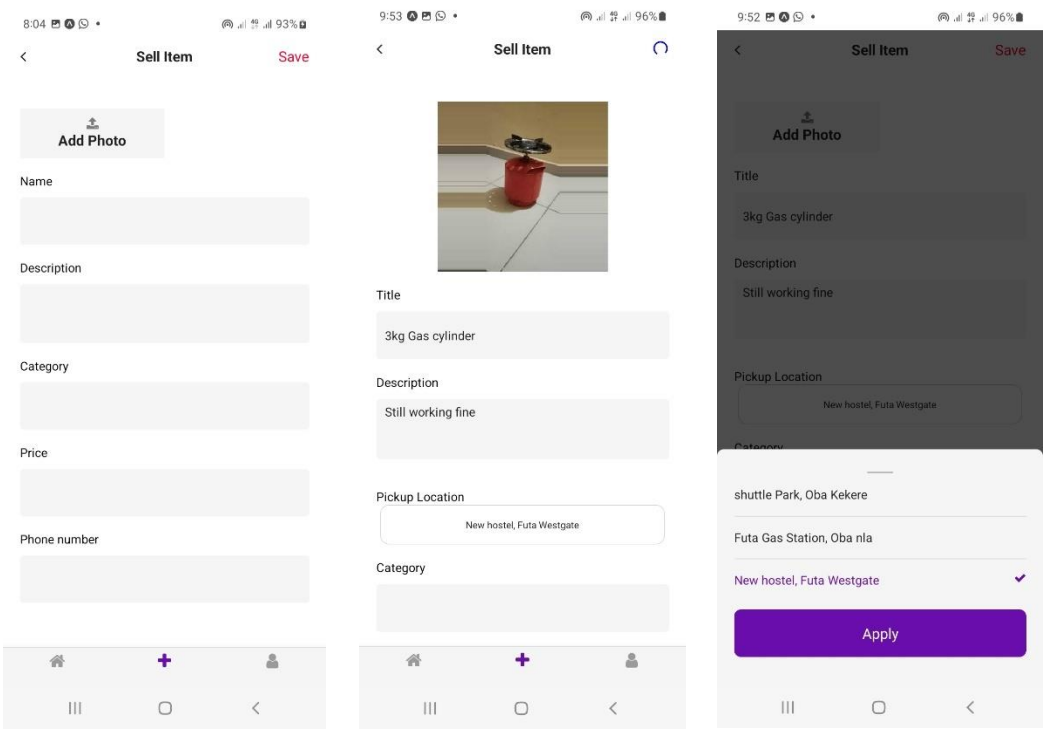


Figure 4.6: Upload Screens

4.1.7 Profile Screen

The Profile screen displays user photo and name with an edit button users can use to edit their name and image. It also has navigations to the uploads screen, where the list of products uploaded are displayed with their status whether "is pending", which is for products that has

not been purchased or “sold”, for those that has been successfully sold. Users can also add pending product to sold in this tab so that already sold items won’t be on display for users to view. It also navigates to the orders screen, where all successful purchases are displayed. Also, the settings option to modify application features and the log out option to log out of the app.

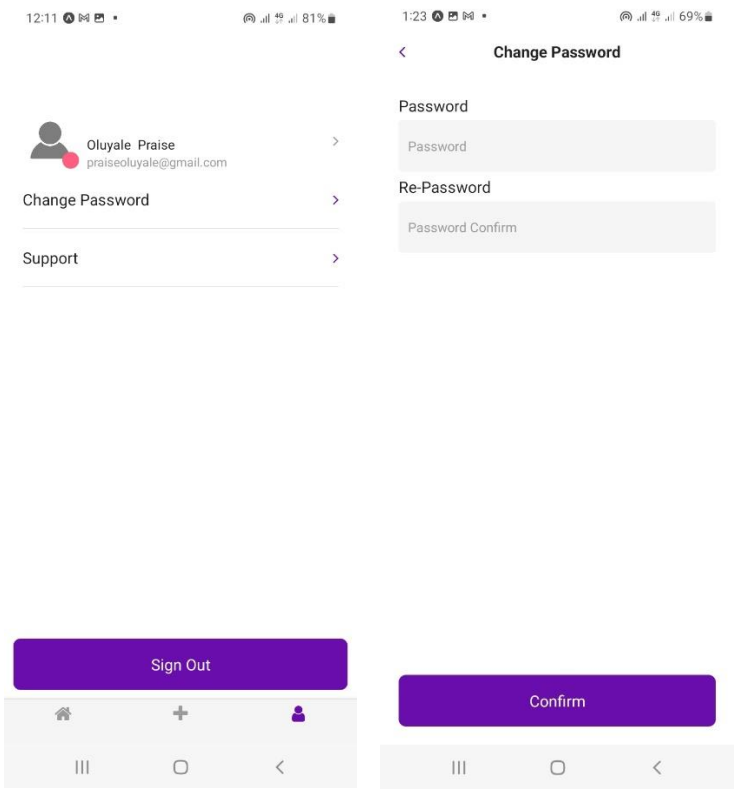


Figure 4.7: Profile and password reset Screen

4.2 Server side

The server side contains the backend of the application which takes care of the functionality of the application. It also manages database integration with MongoDB. It also contains different APIs which handles user sign-in authentication, the reset password feature, updates and manage sales and user status. There are Unit tests to verify the correctness of these components, and there are also services in place to manage the interaction with the MongoDB database.

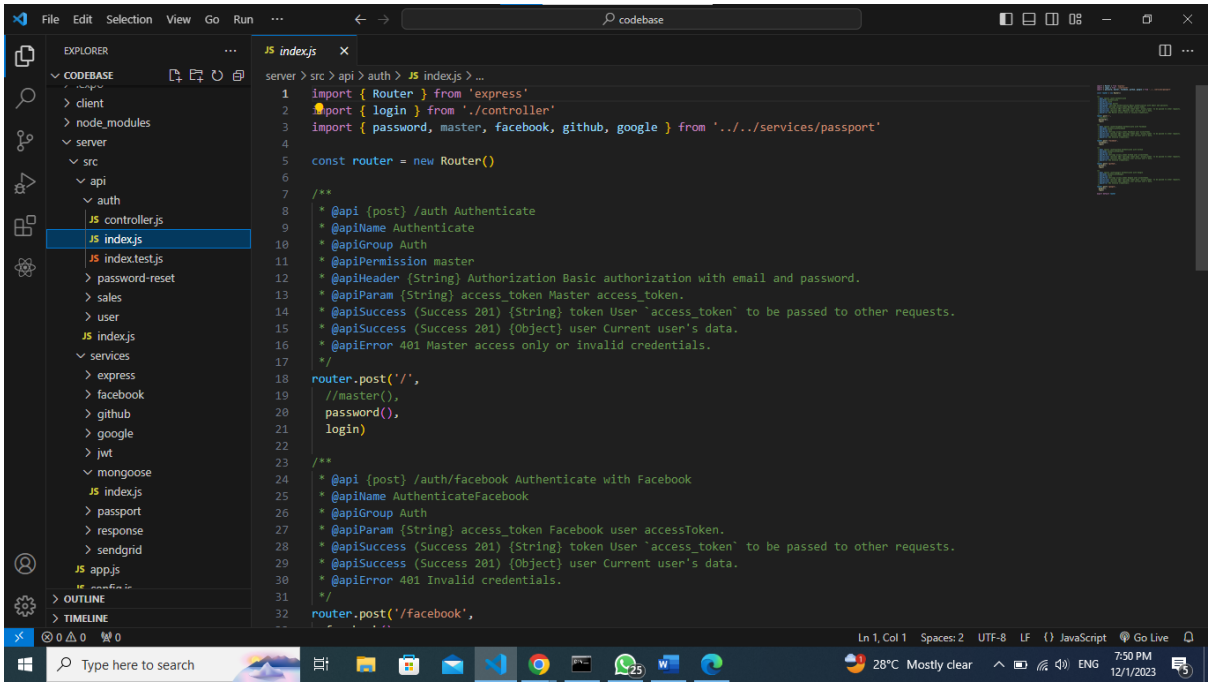


Figure 4.8: Server Side auth Screen development code on Visual Studio Code

4.3 System Testing

(Kinza Yasar, n.d) mentioned that System testing, also referred to as *system-level* testing or system integration testing, is the process in which a quality assurance (QA) team evaluates how the various components of an application interact together in the full, integrated system or application.

System testing, for example, might check that every kind of user input produces the intended output across the application. System testing is the third level of testing in the software development process. It's typically performed before acceptance testing and after integration testing.

System testing is imperative for interconnected systems because any system or software defect can cause extreme complications for the consumers. For example, in 2014, Nissan had to recall over 1 million cars due to a defect in the airbag sensor detectors.

With system testing, a QA team determines whether a test case corresponds to each of an application's most crucial requirements and user stories.

4.3.1 Unit Testing

Unit testing is a type of software testing that focuses on individual units or components of a software system. The purpose of unit testing is to validate that each unit of the software works as intended and meets the requirements. Unit testing is typically performed by developers, and it is performed early in the development process before the code is integrated and tested as a whole system.

Unit tests are automated and are run each time the code is changed to ensure that new code does not break existing functionality. Unit tests are designed to validate the smallest possible unit of code, such as a function or a method, and test it in isolation from the rest of the system. This allows developers to quickly identify and fix any issues early in the development process, improving the overall quality of the software and reducing the time required for later testing.

Below is a unit test done at the server side. This code sets up an in-memory MongoDB server for testing, connects to it using Mongoose, configures some global variables, and ensures that the database is cleaned after each test.

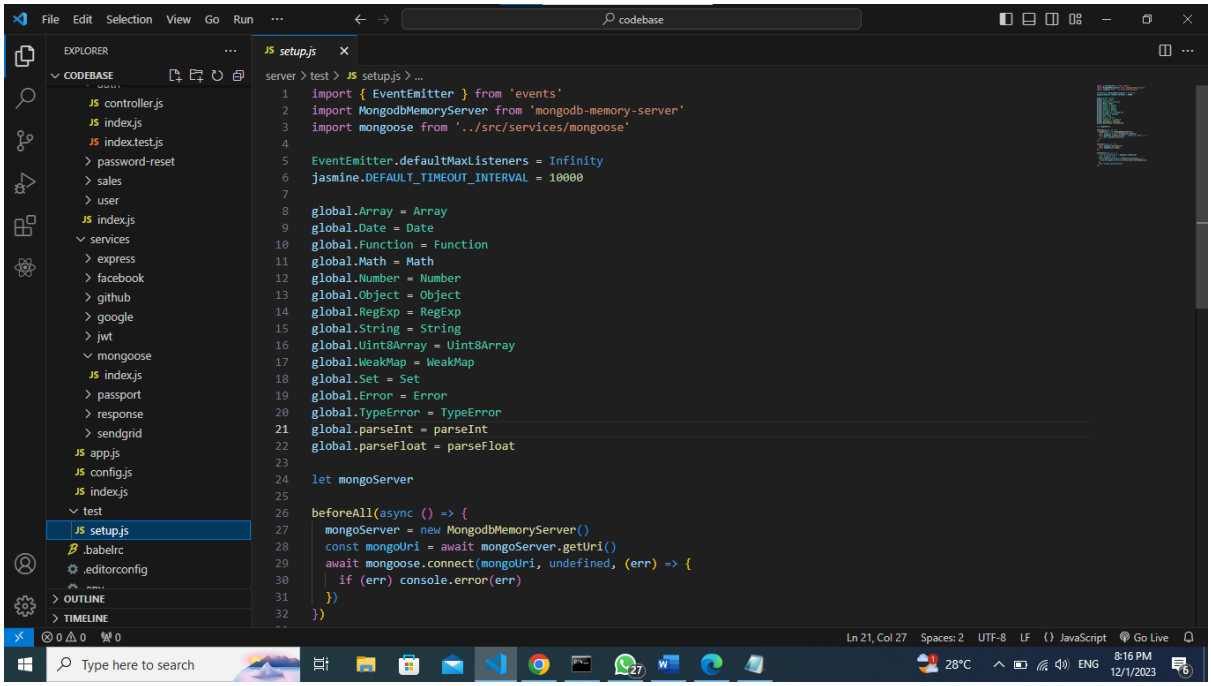
Code Explanation:

It starts by importing the EventEmitter class from the 'events' module, the MongodbMemoryServer class from 'mongodb-memory-server' module, and the mongoose object from a custom module located at '../src/services/mongoose'.

It then configures by setting the maximum number of listeners for the EventEmitter to infinity, which means there is no limit on the number of listeners. It also sets the default timeout interval for Jasmine tests to 10,000 milliseconds.

Furthermore, it extends the global scope with some built-in objects like Array, Date, Function, Math, Number, Object, RegExp, String, Uint8Array, WeakMap, Set, Error, TypeError, parseInt, and parseFloat. This is typically done to make these objects available globally during testing.

It then sets up the MongoDB. In the beforeAll hook, it creates an instance of MongodbMemoryServer and gets its URI. This allows the testing environment to run a MongoDB server in memory. It then connects to the in-memory MongoDB server using mongoose.connect. In the afterAll hook, it disconnects from the MongoDB server and stops the in-memory server. In the afterEach hook, it deletes all documents in each collection of the MongoDB database. This ensures a clean slate before each test is run.



MongoDB database setup test code on Visual Studio Code

4.3.2 Test Cases

(Coursera, n.d) states that Test cases are instructions for testers to follow to ensure programs are functioning properly. They describe how the software should work in normal, abnormal, or error operating conditions. Test case writing converts user requirements into a set of test

conditions and descriptions that indicate how a system is functioning. In an automated test script, more than one test case can combine to form a test suite.

Functionality test cases:

These are the most basic and obvious test cases to write. They ensure that each feature of your system works correctly. Below are the functional tests for the application.

Table 4.1: Sign-In Test Case

Test Case ID	Test Case	Expected Result	Actual Result	Status
1	Valid Username Valid Password	Sign-In Success	Sign-In Success	Passed
2	Valid Username Invalid Password	Sign-In Failure	Sign-In Failure	Passed
3	Invalid Username Valid Password	Sign-In Failure	Sign-In Failure	Passed
4	Invalid Username Invalid Password	Sign-In Failure	Sign-In Failure	Passed

Table 4.2 Sign-Up Test Case

Test Case ID	Input Value	Test Case	Conditions Being Checked	Status
1	Name	Empty	Name must not be empty	Passed
2	Password	Empty	Enter Valid Password	Passed
3	Email	Empty	Enter Valid Email	Passed

4	Contact Number	Empty	Contact Number must not be empty	Passed

Table 4.3 Upload Test Case

Test Case ID	Input Value	Test Case	Conditions Being Checked	Status
1	Add Image	Browse	Please browse image	Passed
2	Product Name	Null	Product Name must not be empty	Passed
3	Product Description	Null	Product Description must not be empty	Passed
4	Product Price	Null	Product Price must not be empty	Passed
5	Product Category	Select	Please select product category	Passed
6	Pick Up Location	Select	Please select location	Passed

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Developing this mobile application for students, using The Federal University of Technology, Akure (FUTA) as a location will bridge the gap between students with products not in use and student in dire need of these products. This application serves as the middle ground linking sellers with buyers also increasing the market reach.

It has solved the problem of traditional method of student sellers reaching buyers through word of mouth, WhatsApp statuses, Instagram pages which limits prospective buyers to people in contact with the seller by expanding the market reach to all students in the school. It also solves the security problem as pick up locations are within the school premises.

There are some areas of improvement which could not be implemented due to some technical reasons. Which include linking the student email to the application. This will ensure that only registered student of the university will be able to Sign-Up and register to have access to the application.

5.2 Recommendation

In light of developing this application, the following are recommended

1. A Web-based platform can be developed to complement the mobile application
2. Educational resources or guidelines for both buyers and sellers to promote responsible and informed transactions should be provided, especially for student users who may be new to e-commerce.
3. Further development that supports integration with university systems for email verification to ensure that users are valid students from recognized institutions.

4. Provision of secure payment options, possibly integrating with trusted payment gateways, to enhance the overall transaction security for both buyers and sellers.
5. Awareness-raising and seminars on trash management and pre-owned goods sales.

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