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Development of a mobile application for sales and marketing: a case of Raha beverages company limited

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**DEVELOPMENT OF A MOBILE APPLICATION FOR SALES AND
MARKETING: A CASE OF RAHA BEVERAGES COMPANY LIMITED**

Samwel Katwale

**A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Embedded and Mobile System of the Nelson Mandela African
Institution of Science and Technology**

Arusha, Tanzania

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ABSTRACT

Raha Beverage Company Limited is a wine-producing company based in Arusha Tanzania. It was experienced with the challenge of products advertisement to reach more customers. The problem extended to a lack of knowledge on market demand because there was no prior orders collection before product delivery, also the market demand fluctuation results in either less quantity delivery to wholesalers or delivery delay, causing wholesalers to stay out of stock for a while. Hence decreases customer satisfaction. The proposed RahaSales mobile application was designed to address and mitigate the encountered challenges by the company. The study showed that the mobile application would easily connect the company with their customers for instant communication and getting insights on the market ground. To reflect what was the exact puzzle to be solved; the data was collected from the sales representative and known customers through interviews, questionnaires, and observation. The mobile application was developed through the agile method known as scrum, and then the application was tested by both customers and sales representatives from the company to reflect what the application is required to do. The developed mobile application connects the supplier and wholesalers to enable them to share business information like market demand and product availability. According to the findings, mobile applications can be used to improve client loyalty as well as sales. From the developed application, I would like to recommend further studies to utilize the GPS locations collected from the customers to map all customers in the Google map for easy visualization of current customers and will help the company to determine where there is a gap in the market share and focus more in terms of advertisement and promotions.

DECLARATION

I, Samwel Katwale do hereby declare to the Senate of the Nelson Mandela African Institution of Science and Technology that this Project Report is my original work and that it has neither been submitted nor being currently submitted for degree award in any other institution.

Samwel Katwale



23/06/2022

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Date

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CERTIFICATION

The undersigned certify that have read and hereby recommend for acceptance by the Senate of the Nelson Mandela African Institution of Science and Technology, a project report titled "*Development of a Mobile Application for Sales and Marketing: A Case of Raha Beverages Company Limited*" in partial fulfillment of the requirements for the award of the degree of Master of Science in Embedded and Mobile Systems.

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Last but not least, I'd like to extend my gratefulness to my family for their unwavering support, prayers, and affection.

DEDICATION

This work is dedicated to my son Raguel Katwale.

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LIST OF ABBREVIATIONS AND SYMBOLS

API	Application Programming Interface
B2B	Business to Business
B2C	Business to Customer
CRM	Customer Relationship Management
DBMS	Database Management System
ERD	Entity Relationship Diagrams
FDD	Feature Driven Development
GET	HTTP Method used to request data from a specified resource
HAL	Hardware Abstraction Layer
HTTP	Hypertext Transfer Protocol
IDE	Integrated Development Environment
JDK	Java Development Kit
JRE	Java Runtime Environment
JSON	JavaScript Object Notation
M	Mandatory
MVC	Model – View – Model
PEOU	Perceived Ease of Use
PI	Primary Identifier
POST	HTTP Method used to send data to a server to create/update a resource
PU	Perceived Usefulness
RABEC	Raha Beverages Company Limited
REST	Representational State Transfer
SDK	Software Development Kit
SQL	Structured Query Language
TAM	Technology Acceptance Model

UAT	User Acceptance Testing
UI	User Interface
UML	Unified Modeling Language
URL	Uniform Resource Locator
WAMP	Windows, Apache, MySQL, and PHP
XML	Extensible Markup Language
XP	Extreme Programming

CHAPTER ONE

INTRODUCTION

1.1 Background of the Problem

Raha Beverages Company Limited (RABEC) previously known as Banana Investments Limited is an enterprise that started as a backyard manufacturer of banana wine in the early 1990s in Arusha, Tanzania. The initial plan was to make wine for personal use, but after it gained popularity among the locals, the focus turned to a wide range of banana-based alcoholic beverages that were manufactured in a well-organized and legally permissible manner. Raha, Raha Gold, Raha Poa, and Raha Pet are the company's four brands. Arusha, Kilimanjaro, Geita, Dar-es-Salaam, Shinyanga, Mara, Tanga, Coast, Manyara, Dodoma, Mwanza, Simiyu, Singida, and Mtwara are among the 14 regions where the products are common.

The current mode of products selling and delivery to wholesalers are based on weekly routine to different areas with unforeseen market demands that lead to delivering of less quantity of products as per market demands. Sometimes it requires resending trucks to meet the fluctuating market demand due to demands fluctuations. This leads to a waste of fuel which results in high running costs, time consumption, and sometimes unsatisfied customers due to waiting for the route schedule on their area if the sales are high in their area they have to be out of stock for more time.

Another challenge is on identifying new customers, keeping records on the customers' purchase trends, behavior on how customers use the company's utilities like (empty crates, empty bottles) and difficulty on reaching more customers as the current marketing is based on bar promotions, TV, radio and social media so this could hinder the company's plan to grow the banana market both domestically and internationally (especially to the Eastern, Central African countries). This new method of sales and marketing necessitates the addition of more task forces and is still inefficient due to manual interference throughout each phase.

The RahaSales mobile application will help the customer to interact directly with the company through placing orders, tracking their orders, managing sales, and keeping their selling trends. In other ways, it will help the company to easily identify the market demands before delivery of the product to the market and forecast the upcoming sales and hence help in effective production planning. Also, it will simplify the record-keeping on several customers and their location, buying trends, and customer behaviors. Therefore it enhances customer satisfaction due to easy access and faster products delivery.

1.2 Statement of the Problem

The company's sales representatives were oblivious of market demands that make it difficult in planning the appropriate route for products distribution and the number of items to be delivered to wholesalers due to lack of business-to-business interaction tool, also suffered from decentralized sales information (Desai *et al.*, 2014).

Therefore, this project developed the RahaSales mobile Application that will help wholesalers on placing orders, track their orders, manage sales and keep their selling trends. On the other hand, it will help Raha Beverages Company to manage products distributions, demands to forecast, and record-keeping on several customers and their location and buying trends. This will lead to reduce running costs and increase customer satisfaction due to faster products delivery.

1.3 Rationale of the Study

Smartphones have become massive repositories of information on consumer tastes and desires, according to recent studies. This means that thanks to the features provided by mobile apps, advertisers, sellers, and marketers can be far more precise with their advertising and marketing strategies, and can deliver more relevant messages to various types of groups or individuals (Johnston, 2021). Customers are seeking more personalized and detail-rich content, and they can provide more information about themselves than they have in the past (RetailMeNot, 2015). They expect better-targeted promotional material from sellers as a thank you.

As a result, sellers will incorporate these findings into the creation and evolution of their mobile marketing strategies. Sellers will take advantage of a new channel to meet consumers by using mobile devices and mobile apps. Ström *et al.* (2014) found that mobile devices can combine phone functionality, information search, and interaction while shopping. Furthermore, since a consumer's mobile device is still with them, it serves as a portal to a partnership between the buyer and the seller, making it an ideal complement to distance selling and physical retailing.

Today, with most of their smartphones, people can access the Internet at any time and from any place. And smartphones could receive and send information. Therefore, it becomes the best choice for marketers to choose a mobile platform to deliver and receive information from customers. The sales and marketing mobile application is targeted to solve most of the challenges encountered by RABEC on managing sales and product distribution, this application will play a part in consolidating customer relationships, faster products delivery, and reducing running costs.

1.4 Objectives of the Study

1.4.1 Main Objective

The main objective of this project is to create products' sales and marketing mobile application for Raha Beverages Company Limited.

1.4.2 Specific Objectives

- (i) To identify system requirements for sales and marketing mobile application for Raha Beverages Company Limited.
- (ii) To develop a sales and marketing mobile application for Raha Beverages Company Limited.
- (iii) To validate and deploy the mobile Application for sales and marketing of Raha Beverages Company Limited.

1.5 Research Questions

- (i) What are the system requirements for sales and marketing mobile application for Raha Beverages Company Limited?
- (ii) How to develop a sales and marketing mobile application?
- (iii) How to validate a mobile application for sales and marketing?

1.6 Significance of the Study

The project is necessary because it will be used to improve consumer loyalty. After all, mobile apps enable companies to connect directly with their customers via in-app purchases, deals, advertisements, and alerts sent to their phones through mobile apps. Since more people are using their smartphones, it will improve business connectivity to potential customers. A seller may use a mobile app to submit promotional offers and discount updates to all its customers at the same time. Also, the mobile app will act as a source of data and information about customers' behavioral patterns and preferences that enable sellers to make critical decisions based on information gathered. This has the potential to increase revenue while also enhancing the customer experience.

1.7 Delineation of the Study

The study assumed that the customer routes are pre-determined by the sales representative, hence

the wholesalers (Customers) choose their closest route for products delivery, and also the main customers are only wholesalers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Sales and Marketing Methods used by Raha Beverages Company Limited

Raha Beverages have used a variety of distribution and marketing methods since 1990, including bar promotions, Television and radio advertisements, social media advertisements, local visiting of the wholesalers and distributors of the products to the wholesaler before the order collections, the distribution of the products is done through scheduling customer route and path by per weekly bases. Sales and marketing are two closely and conjointly working functions of the company. Before we proceed, let's get aware of what sales and marketing functions stand for in business. The salesperson is a team of individual who sells goods or services to other entities (B2B) or customers (B2C). The other function, marketing is the activities that focus on promoting the buying or selling of the product or service (Okwara & Ben, 2019). Therefore, it is clear how related this to functions are and they both focus on the customer relationship, brand awareness, and revenue collection of the company. Furthermore, these functions need to work closely with each other to facilitate the strategy creation and its execution. The disconnection between sales and marketing will affect the business performance while an improved relationship will better the sales performance (Okwara & Ben, 2019).

2.2 Sales Performance

Sales success has been described in a variety of ways by various scholars. It is described by Anderson and Oliver (1987) as a criterion for evaluating salespeople both what they do for the company (sales consequences) and what they do for themselves (sales behaviors) (Zallocco *et al.*, 2009). The sales outcomes could be measured in terms of generation of revenue, new accounts, profitability, market share, sales units, etc. while sales behaviors comprise of selling skills like teamwork, selling practices such as time management and territory management include adaptive selling and effective communication, making sales calls based on these definitions, etc. Managers are responsible to ensure that performance targets are met by the salesperson. To achieve this, managers need clear information from the market that helps them to make a decision. The effective and efficient way to measure performance and reach an unbiased decision is to have the on-ground data within the centralized data source that could clearly show the sales trends and customers' feedback.

2.3 Customer Satisfaction and Loyalty

The company produces and sells products/services to the community, hence having a connection with people who are potential users of products and services. People are part of the companies; people could make the business dream into reality. As a result, it's important to comprehend the cognitive and emotional interactions that affect any brand image through accessing their level of emotional relevance, rather than assuming perfect rationality (Adamashvili & Fiore, 2017). Marketing is a tool used to instill high levels of trust in customers, as they must gain trust in the business before making a purchasing decision, particularly in the B2B market. Every company strives to deliver products in the market that customers look for, the challenge arises when there is a difference between customer expectations and the quality of delivered products. This may lead to loss of customers if the quality is lower than the expectation. To get clear customer expectations, the company needs to establish closer interaction with customers to get their insight about what they want. The mobile application currently proved a high impact between customer-salesperson interactions and feedback on the product or service used.

2.4 Online Marketing

Online marketing is used to boost industrial advancement through faster reaching globally dispersed customers to maximize sales. Online marketing comes with many approaches depending on the scale and capability of the business. It comprises social media advertisement, website advertisement, blogs advertisement, mobile application content delivery, customer interaction, etc. for the customer engagement in the website advertisement could be measured in clicks and attitudes (Lockett, 2018). The customer attitude toward the advertised product could be negative or positive. The customer attitude helps the business to adjust to a better way of product distribution (reachability), customer care, and quality of products. Online marketing has proved an easy way of reaching users and collecting users' emotions.

Among the online marketing methods, a mobile application is the best choice for the business that needs to integrate sales and marketing in a single platform and achieve high sales performance. The mobile application offers the best way for customers' interaction and feedback, easy product purchase, customer loyalty, and easy content access anywhere at any time.

2.5 Ways a Mobile Application Can Boosts Sales

Entrepreneurs employed a lot of advertisements, brochures, catalogs, and flyers to enhance their sales a few years ago. You don't need any of them nowadays. With the widespread use of

smartphones, a single mobile application may now serve as a catalog, newspaper, brochure, salesperson, and even a pay register. There are a variety of strategies to enhance sales using a mobile application.

2.5.1 Faster Sales

The best ideas are often the most basic. With only one click, you can find what you're looking for. Do not know which option to select? Additional click enables users to swiftly obtain assistance and guidance, after which you can simply click to place an order and pay. What could be more appropriate for your client? Your goods are sold in three clicks, and your consumer is satisfied.

2.5.2 Improved Service

Your consumers will be able to order, purchase, or make reservations anytime they want, from anywhere on the earth (Titova, 2016). Nothing is handier than having their item delivered directly to their home location. Our lives are fast-paced, and your potential consumers are always looking for methods to save time, so take full advantage of this chance!

2.5.3 Keep your Customers Informed

It is usually preferable for customers to have access to all pertinent information regarding the items and services you offer. Use the app to send out information, special deals, and new goods for sale to your customers. Not only on a retailer's website, but also in its stores, mobile applications enhance sales, buy volume, and the range of things sold. Retail app users purchase 33% more frequently, buy 34% more things, and spend 37% more than non-app users, according to the study's authors (Smith, 2019).

2.6 Related Works

A literature review of similar related studies on sales, distribution, and marketing systems and mobile applications was performed. The related systems and applications are classified as inventory management systems and online shopping systems, according to the study.

2.6.1 KiKUU online Shopping Mall

KiKUU become an African digital shopping centre that offers over 400 000 new fashion pieces through its KiKUU APP (Kikuu, 2018). Africans from Tanzania, Ghana, Cameroon, DR Congo, Uganda, Rwanda, Senegal and use KiKUU to shop for low-cost products from China. It provides

free shipping and delivery on all products, and you can compare prices from different sellers to find the best deal, new arrivals updates weekly, talk with the seller directly using the provided contacts, allow the customer to track his/her order with automatic shipment notifications, and deliver the products to the nearest local office. So KiKUU collects the customers' addresses for delivery to the nearest local office of the respective country. Also after delivery of products, a customer could confirm to receive the order and give feedback on the service provided and the satisfaction of the received product as compared to what was ordered.

The strength point of kikuu is on good business-customer interaction, such as instant messaging customer care, Affordable prices, and cheap shipping fees. On the other side, some flows make customers hesitate to shop via kikuu, especially the late delivery as predicted due to a variety of issues, including the scarcity of the commodity ordered. Kikuu offers a shopping platform for retailers to interact with customers but there is no direct contact between customer and retailer but with Kikuu customer care.

2.6.2 ZARA Inditex

The Inditex group, which owns Zara, is the world's largest clothing retailer. Zara oversees up to 20 clothing lines a year as of 2017. Stores usually position orders twice a week and receive shipments twice per week (Ferdows, 2003). Orders should be received by 3 p.m. on Wednesdays and before 6 p.m. on Saturdays in Spain and southern Europe, and by 3 p.m. on Tuesdays and Fridays in the rest of the marketplace. If a store fails to meet its deadline, it will be forced to wait: Most products are only in stores for two weeks or less, and Zara avoids overproduction by maintaining production levels down early in the season and adapting quickly to demands and emerging changes later in the season. Zara uses the received order to control the production plan as per demands. Information from the market help Zara supply chain to react and forecast more precisely the market demands. Zara ensures greater Power over all aspects of the supply chain, distribution, and promotion, as well as the ability for consumers to provide reviews.

Zara's brain is their operation centre in Spain, where they monitor all that happens in their stores in real-time and receive regular updates from store managers with input from customers (Danziger, 2018). This valuable information is used to identify fashion patterns that will influence the design of new lines and changes to existing ones. It can take up to 15 days for items to hit the shelves after they are designed. Hence customers receive their orders from the nearest store after the items are delivered.

One of the reasons Zara is so successful is because they consistently listen to their customers while

creating new designs i.e high customer interaction (Duoyan, 2021). Zara's consumer research capabilities provide them a competitive advantage since they can adjust to each culture and area to meet the demands of their customers. On the other hand, Zara does not enable customer stock management and there is no capability for customer rating.

2.6.3 Zoho Customer Relationship Management

Zoho is a customer relationship management (CRM) platform that allows organizations of all sizes to handle their marketing, sales, inventory needs, and customer care in one place. It includes features including lead scoring, lead and deal management, email marketing, sales forecasting, analytics for users, and social media marketing. It's perfect for expanding businesses seeking an all-in-one CRM system that's scalable (Ila0, 2021).

Its greatest assets are its reporting, lead and contact management features, and email marketing. The disadvantages of Zoho are that most plans have a restricted file storage allowance; just the corporate plan has a 5Gb of storage allotment.

2.6.4 Jiji Tanzania

Jiji is a leading online marketplace based in Nigeria that serves as a location for buyers and registered sellers to meet and exchange products and services. It organizes things in groups of comparable commodities to make it easier for buyers to buy them. Jiji was founded in 2014 and operated as a blog until fall 2015, providing users with diverse information such as technology, news, lifestyle, entertainment, and business (John, 2021). As of 2017, it deals with a wide range of products, including anything from household appliances to food, pets, and toys. According to statistics, it hosted over 800 000 advertisements in 2018, attracting over 160 000 sellers and 7 million unique users per month.

Jiji has been operating in five African nations since 2019: Nigeria, Kenya, Ghana, Uganda, and Tanzania, and it has its corporate website dedicated to the brand's primary accomplishments and goals. Jiji has recently classified advertising, which allows users to interact with others to further their careers as well as seek employment openings. The bad side of Jiji is the product visibility scramble with other sellers and as a seller, you are unable to alter and rebrand the software to make it more recognized to customers. This is extremely detrimental to any future-targeting firm.

2.7 Why Sales and Marketing Application?

The mobile application intends to integrate the sales and marketing functions so that they could work closely and efficiently. It ensures easy accessibility of data and information for decision-making on the sales trend, customer's behavior; evaluate the quality of the delivered service to the customer through customer feedback. The application also will integrate the business social media into one page for easy real-time content access by customers.

The proposed mobile application will use a Google navigation route to direct the sales representative to the wholesaler's destination through the provided customer location (Geolocation) in the profile settings and route optimization to minimize distribution expenses, save time and ensure hassle less for new goods distributor.

The application will help a sales representative to know the wholesaler stock status without physically visiting them. The proposed mobile application also will help businesses to receive customer orders and determine the required quantity of goods to be delivered to the market, which will make the selling activity more effective. Furthermore, the mobile application will help managers to trace the sales performance. The summarized sales statistics will show the sales trend and customer feedback on the products and delivered services.

On the other side, a wholesaler could be able to create orders, make follow-up on the orders, give feedback on the products and customer service and receive a more customized promotion and update on their mobile device.

2.8 Theoretical Literature Review

2.8.1 Model-View-Controller

The Model-View-Controller (MVC) architectural pattern divides an application into three logical components: model, view, and controller as shown in Fig. 1. Each of these components is designed to handle specific aspects of application development (Singh, 2020).

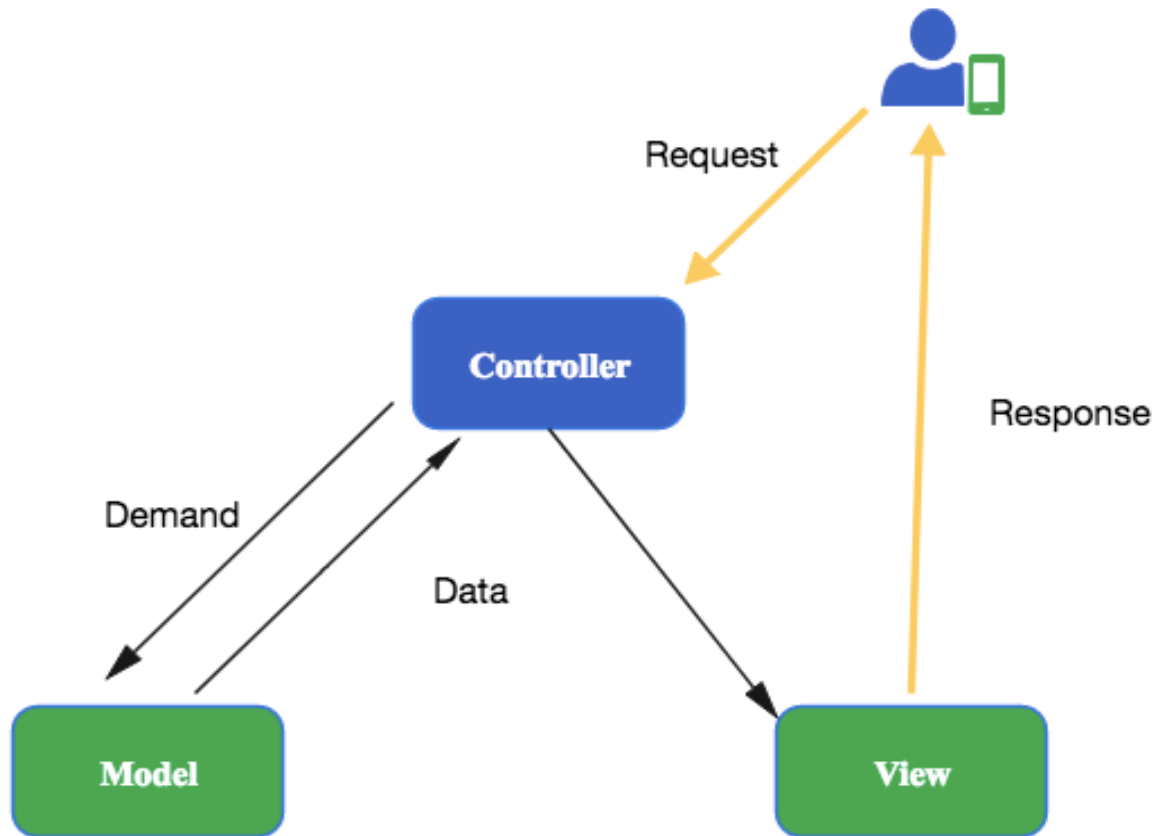


Figure 1: The Model-View-Controller Pattern (Pop & Samuel, 2014)

The three levels of MVC Model:

(i) Model

All data-related functionality that the user engages with is represented by the Model component. This might be the data being transmitted between the View and Controller components or any other data related to business logic.

(ii) View

All of the application's UI functionality is handled by the View component. The Customer view, for example, will comprise all of the UI components that the final user interacts with, such as Text View, Edit Text, Button, and so on.

(iii) Controller

Controllers serve as a link between the Model and View components, processing all business logic and incoming requests, manipulating data using the Model, and interacting with Views to produce the final output. The Customer controller, for example, will handle all interactions and inputs from the Customer View and use the Customer Model to update the database.

2.8.2 Technology Acceptance Model

Users can be certain that the correct system was built by validating the system. The developed system was validated through user acceptance testing. During the validation process, the Technology Acceptance Model (TAM) was used, which was considered the most popular and widely used theory for defining an individual's acceptance of information systems, which was defined by two major variables: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) (Lee *et al.*, 2003) as shown on Fig. 2, which are influenced by the external variable like design features and UX, In most cases the UX influence more the attitude toward the use of the system (Weng, 2018).

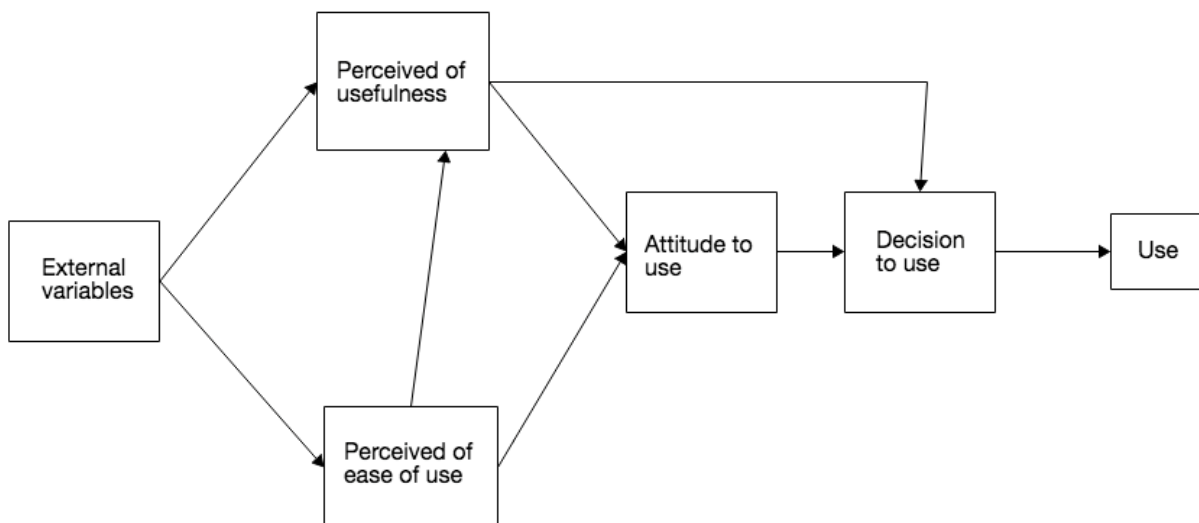


Figure 2: Technology Acceptance Model (Alambaigi & Ahangari, 2016)

The focus of the literature review was to learn about the current features and services offered by mobile applications for online shopping and CRM for business–customer interaction, as well as how they benefit both sellers and buyers. It has been seen from the different mobile applications that most features are for the platform to just connect the seller and the buyer for exchanging goods but not maintaining an intact relationship for the next purchase. Also in the case of CRM, the

service offered are quite good but from the point of business competition, the business data privacy was given more priority which makes it difficult for the Raha Beverages Company to adopt the third-party mobile application or CRM. Most of the mobile applications the delivery feature haven't incorporated Google navigation map for easy products delivery once the customer purchase through the online platform. The other missing feature on most of the platforms is the capability of the buyer to manage his/her inventory through the supplier's platform which was the recommended feature from Raha Beverages Company Limited.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Area of the Study

A field survey was conducted at Raha Beverages Company Limited Arusha, Tanzania, to determine the overall situation regarding the process from production, marketing customer orders collection, products distribution, and business feedback. This activity was done for gathering system development requirements. The groups involved in this activity were the sales and marketing department and the production department.

The research was conducted at the Raha Beverages Company in the Arusha region of Tanzania, which is the country's fourth-largest city (Worldometer, 2020). Arusha city, Karatu, Meru, Monduli, and Ngorongoro, Arusha rural, Longido are the names of the five districts: Arusha city, Arusha rural, Karatu, Longido, Meru, Monduli, and Ngorongoro. Based on the 2012 census, the region's estimated population for 2019 was 2 051 900, up from 1 694 310 in 2012 (City population, 2020).

3.2 Research Methods

This study used a convergent parallel design, a mixed-methods approach, to get a comprehensive grasp of the subject. Demir and Pismek (2018) defined the research method as qualitative and quantitative. A convergent parallel design means that the researcher conducts both quantitative and qualitative portions of the research at the same time, weights the techniques equally, analyzes the two separately and interprets the results jointly (Razali *et al.*, 2019). This approach allows us to collect both quantitative and qualitative data and combine them to answer our question (Shorten & Smith, 2017). The quantitative data allows for generalization based on the statistical behavior of the obtained data, whilst the qualitative narrative data allows for the participants' perspectives to be gained. The majority views or acceptability of the suggested features of the proposed RahaSales mobile application was generalized in this study using the number of respondents prejudiced on the specific feature. The qualitative narrative, on the other hand, was required to get the user's perspective, which led to a straightforward assessment of user requirements.

3.3 Sample Size and Sampling Procedures

A total of 73 wholesalers were interviewed for the study. Wholesalers were included in the requirement elicitation process to obtain information on how they intend to use the application and

what features it should have to alleviate difficulties with product acquisition from the company. During the research, we discovered that wholesalers' responses were consistent with their responses to questions on how they obtain items from a firm that follows a weekly supply schedule. A total of 73 wholesalers were randomly chosen from a pool of 730 in the research area (Arusha region) who account for 10% of the target population. The purposive sampling was used to select production manager for the interview to get the information that is from the production unit and should be included in the system development as he was aware of the production flow and market demand, also the same sampling technique was used to select sales manager to explore the information used to interact with customers and the challenges uncounted (Omona, 2013). Also, a random purposive sampling scheme was used to select one sales representative for interview from three sales representatives who were more involved with customers among the others.

3.4 Methods of Data Collection

The method of collecting, measuring, and analyzing detailed perceptions to analyze using normative validated techniques is well-known as data collection. This is the early stage in requirements engineering process definitions (Suaib, 2014). Data collection is a process that is used to understand a problem and its application domain. Any new application requires this process to develop the correct application. To capture correct system requirements, it needs intensive interaction between stakeholders and analysts. During data collection, the following activities were conducted:

- (i) Knowledge of the general area where the system is applied.
- (ii) Detailed investigation of user needs.
- (iii) Interaction of system with its external environment.
- (iv) Defining the constraints for system development.
- (v) The basic customer issue for which the device would be used must be understood in detail.

To achieve the above goals, some data collection techniques were used to ensure the collection of clear requirements for the application (Kabir, 2016). The suggested techniques were:

- (i) Interview
- (ii) Questionnaire
- (iii) Observations

- (iv) Focus groups
- (v) Prototyping
- (vi) Brainstorming

Structured and semi-structured interviews, questionnaires, observation, and brainstorming had been employed to gather both qualitative and quantitative data.

3.4.1 Interviews

Sales representatives, production managers, sales managers, and wholesalers were interviewed in structured and semi-structured interviews to learn their thoughts on the use of a mobile application platform for sales and marketing management.

(i) Interview for Sales Representatives

In structured and semi-structured interviews as shown in Chapter 4, section 4.2.2 (ii), sales executives, production managers, sales managers, and wholesalers were asked their opinions on the use of a mobile application platform for sales and marketing management.

(ii) Production Manager Interview

The structured and semi-structured interviews with the production manager were conducted to obtain information about the capacity of production as compared to the market demand as it could affect the process of sales and marketing in terms of customer loyalty and market shared competition as shown in Chapter 4, section 4.2.1.

(iii) Interview for the Wholesalers

Some wholesalers were also questioned (in structured and semi-structured interviews) about their attitudes toward mobile applications and the feasibility of using one for order placing and business communication as shown in Appendix 1.

3.4.2 Observation

The study also included product distribution observation from Raha Beverages Company to wholesalers, product promotion, and sales reporting and inventory management used by the company. The observations showed that the number of products to the market is always assumed, and sometimes it doesn't match the market demands, another observation shows that there is no

track of the purchased order, and reporting is done through WhatsApp which was also decentralized data (data were scattered).

3.5 Technique for Data Analysis

Because of their simplicity and availability of numerous data analysis repositories, the survey text data was analyzed using Narrative Analysis. This is because the narrative analysis is a more comprehensive and diverse tool. It aids researchers in not only gaining a better grasp of their topic but also in determining why people behave and respond the way they do. Furthermore, To illustrate the results, pie charts were employed. Because pie charts show and communicate data in a straightforward graphical way, they were chosen. This strategy made use of the Microsoft Excel utility, which has the availability of various data analysis libraries. Chapter 4 discusses the findings of the data analysis.

3.6 System Development Methodology

A software development methodology is a framework that provides the best way to manage a software development project, which helps to address different issues like which feature to select and include in the current version of the project, to determine the expected time of the software release, how to distribute tasks to team members and how each code of the software is tested. There is no single methodology that fits all situations. Even the greatly rejected waterfall model is appropriate to some projects or organizations. In software development project management every organization uses different ways that fit the project at hand and could differ on the next project depending on the situation, available resources, development environment, and the complexity of the project. The choice of the appropriate project management method could contribute much to the successful result when measured in terms of cost, time, the robustness of software, meeting deadlines, client satisfaction, or minimizing the possibility of project failure. Hence the development methodology for any project should be chosen wisely to make it successful.

Most of the umbrellas for the software development model are plan-driven development and agile development, each has advantages and disadvantages depending on the nature of the project (Young, 2013).

Plan-driven software development is focused on distinct development stages in which the performance of the previous stage is required for the next stage to occur, so the development phase is planned ahead of time and calculated against it. The waterfall model, which consists of five stages of development: system analysis, system design, system development, and testing, system

implementation, and operations, system maintenance, is an example of the most common plan-driven approach. In this well-organized system, each stage of the project development needs to be completed in sequence (Andrei *et al.*, 2019).

Advantages of plan-driven specifically waterfall, linear nature makes it easy to understand and manage. The waterfall method could be appropriately used in a mission-critical or safety-critical project with a clear objective and stable requirements. Also, the waterfall method could help the less experienced project managers and project teams due to its clear flow.

Disadvantages of the plan-driven for example waterfall method, because of its rigid structure, it is sluggish and expensive (doesn't embrace changes), complete steps are not easy to modify, and tight control. In practice most of the project requirements are not stable, they change with business change and technology changes. This is the drawback that makes developers explore other development methods (Van Casteren, 2017).

Agile is the software development framework that follows the development processes: Gathering specifications, analysis, design, coding, checking, and delivering partially implemented applications in iterations while receiving input from customers (Sharma *et al.*, 2012). The priority is customer satisfaction and radically reduces software delivery time. In agile methodologies, Scrum, Feature Driven Development (FDD), and Extreme Programming (XP), requirements gathering, design, and implementation are inter-leaved. To ensure customer satisfaction, the software is developed with stakeholders interested in version specification and evaluation in a sequence of versions/increments, and new versions are regularly delivered for evaluation and feedback.

Advantages of using agile methods that attract many developers in many projects (Usmani *et al.*, 2017) are:

- (i) Ability to adapt to the changing requirements due to its nature of inter-leaving requirements gathering, design, and implementation.
- (ii) Minimize development costs as changes are anticipated and could be accommodated with minimum cost.
- (iii) Iterative release of the software improves the efficiency as it allows the team to find and fix defects early during development.

- (iv) The benefits of the software are realized earlier by the user with frequent gradual improvements.
- (v) The strong emphasis on testing as the software is written.
- (vi) It allows the project to be decomposed into manageable modules and be implemented in increments.

The disadvantage of agile methods is not suitable for a project with many dispersed developers, long-lasting software e.g. decades, or projects that emphasize conscientious documentation and well-documented design and testing.

Specifying all the requirements at once is very difficult and is not possible to limit the requirement changes during the development process. The proposed project is neither safety nor mission-critical. The requirements are not clear at the very beginning. Therefore agile methods are more effective than plan-driven methods.

Extreme programming (XP) and Scrum are the two most common agile methods (CollabNet VersionOne, 2020). The XP is the agile method that focuses on producing higher quality software and customer satisfaction therefore emphasizes maximum customer interaction during development who is responsible for features specification and evaluation, this customer is also part of the team and hence should represent the stakeholder. The project was divided into several short development cycles. It embraces and implements customer modifications or expectations at any point during the development life cycle. The XP introduced effective development practices like pair programming to avoid error, a thorough code analysis, refactoring, and an open workspace to ensure the quality of developed software (Sharma *et al.*, 2012). Some of the drawbacks of XP (Kukhnavevets, 2018) are firstly is not supportive for separate geographically located programmers, secondly, it focuses more on code rather than design, this may be an obstacle because good design is very important on mobile applications. Which may help to attract more users. And thirdly the main challenge is its nature to an On-site customer, who is responsible to stay with a developing team throughout the development time to provide requirements and prioritization of increments. In practice, it's difficult to find an idle customer who will be present 100% with the development team.

Scrum is an incremental and iterative popular agile method, which ensures high productivity for software development. It follows the incremental software development process. Scrum divide the entire project into small series of iteration known as sprint and the maximum duration of each

sprint is 30 days (Sharma *et al.*, 2012). The first phase is requirement collection from the customer but does not expect to capture the entire requirements from the user/customer at this early stage. Customers can change the requirement in the middle of development, can add new features, remove old ones, or upgrade existing ones. The next step is to prioritize the specifications that have been obtained from the requirement list (product backlog). At this point, the sprint is properly planned, including the number of sprints needed to produce the program, the product backlog requirements to be introduced in each sprint, and the sprint duration. The sprint backlog is the list of scheduled requirements for each sprint. Every day, a sprint meeting is held to track how much work has been completed and to receive feedback from the developing team. The requirements that are not implemented are scheduled for to next sprint. Every complete sprint gives the working increment of the software for customer evaluation and feedback, hence developer-customer interaction is maintained throughout the development time. Several advantages convince developers to choose Scrum over other methods, like at any stage in Scrum changes can be absorbed to make the product better (Usmani *et al.*, 2017) based on customer feedback. Testing is very easier since it is done concurrently in every phase so defects are corrected as soon as they arise. It ensures effective utilization of time and money; complex projects are split into manageable sprints, higher productivity, and enable fast release of the usable product to customers. As we know nothing is perfect, Scrum also has some disadvantages in some situations. If developers are not committed or not cooperative, there is a great chance of project failure. Daily meetings sometimes frustrate team members and if happen one member According to the descriptions above and considering the nature of the proposed project, the Scrum method seems to be appropriate. Therefore, the project was implemented using the Scrum method according to the steps highlighted in Fig. 3.

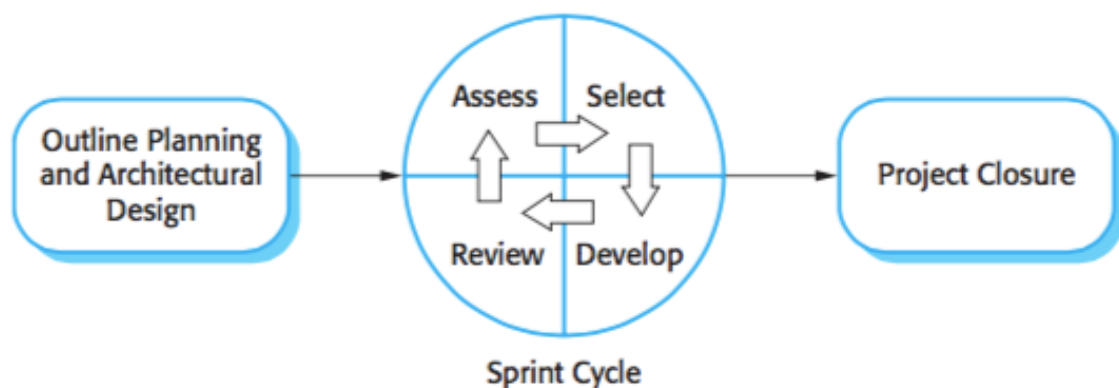


Figure 3 Scrum Sprint Cycle (Wesley, 2011)

3.7 Data Requirements

Data requirement is the section that specifies the set of data that is used to design input and output data for an Application. In this study, the crucial data needed to register users is the login details. This necessary set of data was required to be as simple as possible to minimize user hassle on the registration and login. The designed set includes an email address/mobile phone number which was required to follow the format of an email address or phone, products quantity entered by the user should be integer values, and password was designed to contain at least 8 alphanumeric characters for making it strong and not easy to guess.

3.8 Package Overview

The developed android application was using Volley library (similar to AsyncTask) that creates a background thread efficiently to link to the web service and send/receive data from the database. The AndroidRestService processes the request from the Android Application and updates/queries the specified database and then returns the response/data. As shown in Fig. 4, Volley handles the returned response/data before updating the Android application's main thread.

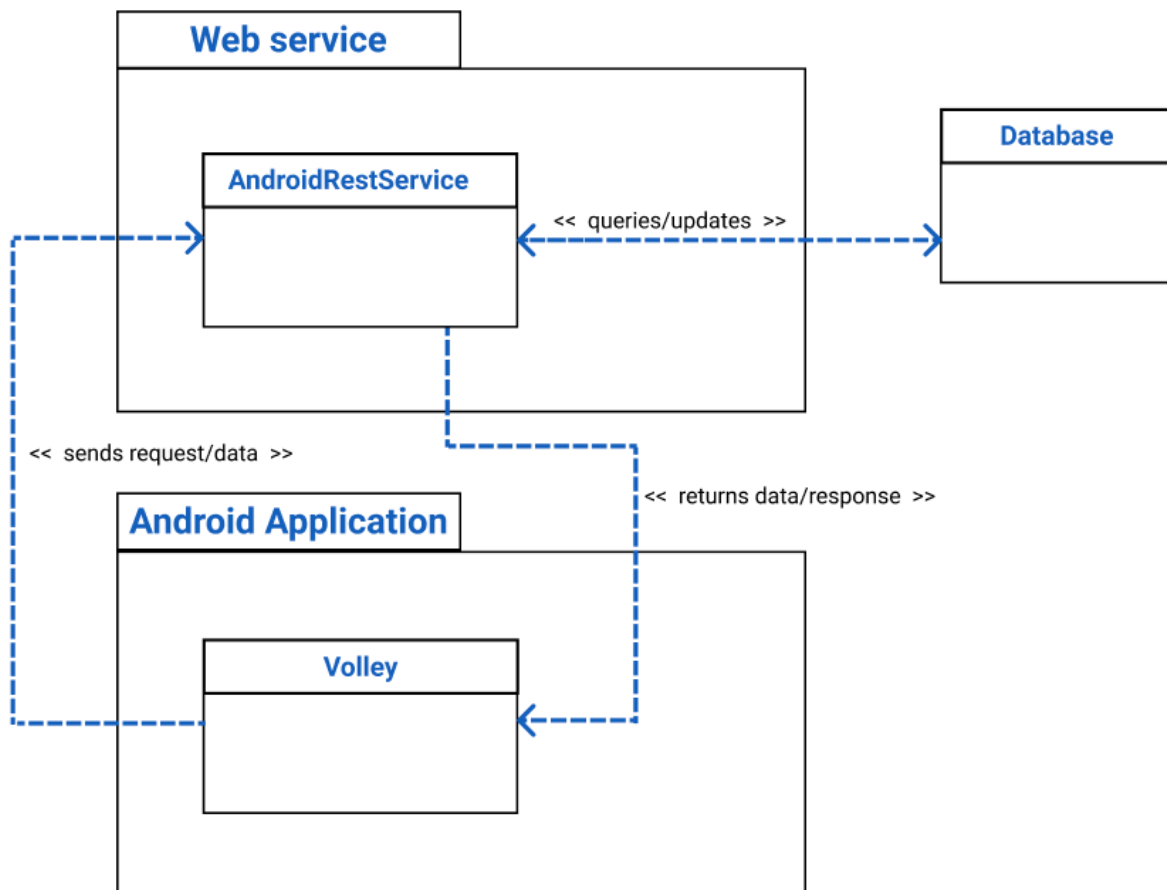


Figure 4: Package diagram

3.9 Android System Architecture

Android is a mobile operating system that is built on a Linux 2.6 kernel that has been revamped (Shibly, 2016). The layered Android Architecture is depicted in Fig. 5. The revised Linux kernel acts as a hardware abstraction layer (HAL), providing process management, networking, memory management, and system driver functionality. Java is used to link to the library layer. The Dalvik Virtual Machine (DVM) and the main libraries are housed in the Android runtime layer (such as Java or IO). The core libraries provide the majority of the functionality available in Android. In the Android architecture, the application layer is the topmost layer. All of Google's apps, including maps, camera, SMS, calendars, browser, and contacts, are native applications that run with the support of an application framework. The application framework layer is where you'll find the classes and resources you'll need. Application developers are free to extend and reuse the API's existing components. Sales and marketing application utilizes the android framework with the supporting libraries. A built-in database, SQLite databases are useful for storing and exchanging application data and play a major part in the native app to support offline application content access that is archived in the user's device. SimpleDateFormat is the date-time library used by this application to format dates and times in the preferred format before being displayed on a user interface (UI). Dalvik Virtual Machine assembles all of the necessary libraries along with the compiled source code and runs the program at runtime.

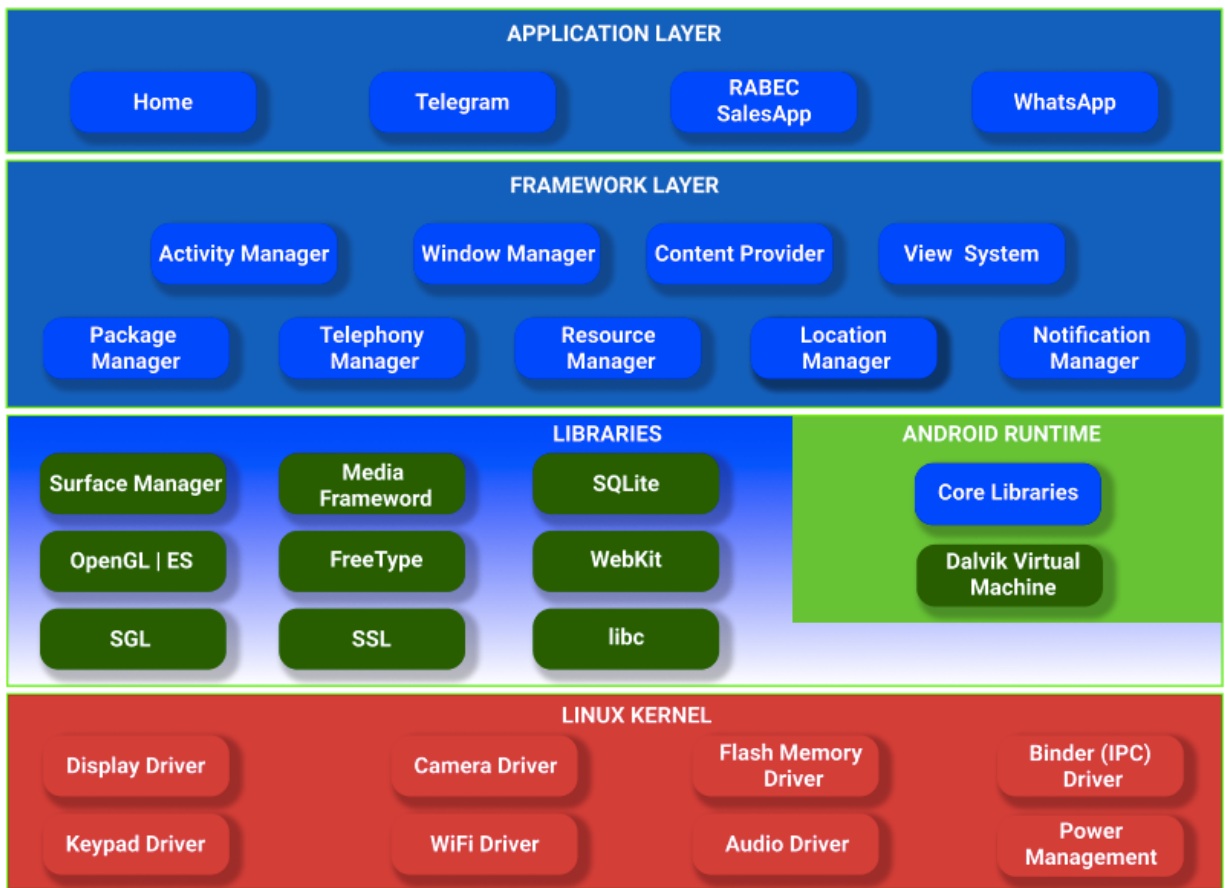


Figure 5: Android System Architecture (Kobayashi, 2011)

3.10 System Implementation

This stage entailed the system's creation through the generation of actual system code. This project was developed as an Android application, as specified in the system specifications. The programming language used was java due to its flexibility to maintain code complexity, implementation, test, integration, and support (Hariharan, 2017). It includes a variety of libraries, application services, and graphics libraries for 2D/3D applications. The integrated development environment used consists of JRE, JDK, and android studio. The JRE and JDK provide java platform tools and libraries needed while Android studio provides a developer’s editor, giving an interface to the android libraries and developing tools. Application programming interface (API) level 21 was set as the minimum SDK, and API level 29 was set as the aim SDK. During this point, the initial system prototype was developed, which included the very basic specifications as well as user interfaces. A mobile app for sales and marketing as part of the scheme.

3.11 Conceptual Framework

The proposed RahaSales mobile application uses the client-server mode of data flow with the formatting of data depending on the required output and displayed to the user interface, this was possible as the MVC returns the data without formatting. As a result, the same components may be utilized and used with any interface. Hence the best Framework for the proposed solution was Model-View-Controller (MVC). The MVC paradigm allows frontend and backend code to be separated into independent components. It's much easier to maintain and make adjustments on either side without interfering with the other.

3.12 Mobile Application System

Wholesalers could use the mobile app to create purchase orders, monitor their orders, connect with suppliers, and control their inventory. The mobile application was created using the tools and techniques mentioned below.

3.12.1 Android Studio

Google's Android Studio is an Integrated Development Environment (IDE) for developing Android apps. The Android Studio production environment was used to create the mobile application. An Android Software Development Kit (SDK) and an editing environment are included in Android Studio.

3.12.2 XAMPP Web Server

It's a cross-platform PHP programming environment that's free and open-source as opposed to other web servers such as the WAMP server. Since it is easy to use, it was selected for web server implementation.

3.13 Data Storage

MYSQL was used as the database for data storage in the system. Users who hesitated to provide their data for normal registration were authenticated using Firebase authentication services.

3.13.1 Firebase Authentication

Firebase is a Google platform that makes creating mobile and web apps easy. When a user does not want to provide their login data, Firebase authentication services (Google Sign-In) were used for user registration and login through Firebase Authentication APIs. Firebase authentication is a

service that uses only client-side code to authenticate users (Khawas & Shah, 2018). Since many users nowadays choose not to give their details during mobile app registration, this approach made the created mobile application simple to use. User registration and login were made possible by Firebase authentication, which used credentials previously given by third-party accounts, such as Google accounts. The third-party accounts were used to authenticate mobile app users without them having to manually enter their credentials.

3.13.2 MYSQL Database

The MYSQL database was used to generate orders and store order-scheduling information sent through the mobile application. Using cell data/Wi-Fi network facilities, all application data was transmitted in real-time to the MYSQL database server.

3.13.3 Data Structure

The data exchange amongst the mobile application and the webserver was done using the JavaScript Object Notation (JSON) data format. This data structure enabled data sent by users of the mobile application (wholesaler) to be obtained by sales representatives via the same mobile application. The JSON was chosen because of its basic format for data sharing that is easy to read/write for humans as well as machines alike.

3.14 System Testing and Validation

At this stage, the device was tested to see whether it meets its requirements and serves its intended function (it does what it is required to do). The mission entailed identifying and correcting system defects and errors before the system's original specifications were met. The users then verified that the application was fully functional.

3.14.1 System Testing

System testing consisted of a series of tests performed during the development and integration of modules, including unit testing, integration testing, and system testing, intending to exercise the entire system. Unit testing ensured every unit (module) performed as anticipated, while integration testing examined the relationship between various units to ensure that they communicated properly. Finally, system testing was performed on all of the modules to ensure that they operated properly together. In Chapter 4, the results of application testing were discussed.

3.14.2 System Validation

Users can be certain that the correct system was built by validating the system. The developed system was validated through user acceptance testing. During the validation process, the Technology Acceptance Model (TAM) was used, which is the most popular and widely used theory for defining an individual's acceptance of information systems, which was defined by two major variables: perceived usefulness (PU) and perceived ease of use (PEOU) (Lee *et al.*, 2003). A random sample of each user's group, including wholesalers and sales representatives, was selected at random to test the system for three to five days. Following that, a survey was performed to determine the system's perceived utility, perceived ease-of-use, and attitude toward use. The data for the assessment was gathered by the use of a questionnaire. In Chapter 4, the findings of system validation were discussed.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Results for Questionnaire from the Wholesalers Respondents

The conducted survey was focusing on determining the demographic characteristics of the respondents, the means used to purchase goods from Raha Beverages Company Limited, and the challenges faced by the wholesaler on getting the appropriate order that saves their demand.

(i) Demograph of the Wholesalers Respondents

The age and gender of the respondents were the types of demographics considered during the data collection. The group of businessmen and businesswomen who use smartphones in their business transactions was assessed using the respondent's era as shown in Appendix 1. Seventy-three (73) people responded, with 21.9% being female and 78.1% being male. According to Table 1, respondents aged 41 to 50 years accounted for 30.1% of all participants, 31 to 40 years accounted for 60.3%, 21 to 30 years accounted for 4.1%, and 51 and above accounted for 5.5% of all respondents.

Table 1: Demography of wholesalers' respondents

Demography	Respondents	Percentage (%)
<i>Gender</i>		
Male	57	78.1
Female	16	21.9
<i>Age range (years)</i>		
21 -30	3	4.1
31-40	44	60.3
41-50	22	30.1
51 - above	4	5.5

Field Data (2021)

(ii) Methods Used to Purchase Goods from Raha Beverages Company Limited

The involvement with the wholesalers focused to pin down the most used method of purchasing goods from the Raha Beverages Company Limited before the introduction of the proposed solution. The respondents were asked to describe how they received items from the firm, and three ways were mentioned: Weekly delivery, phone call, and visiting the company. The results for the methods used for product purchasing are shown in Fig. 6.

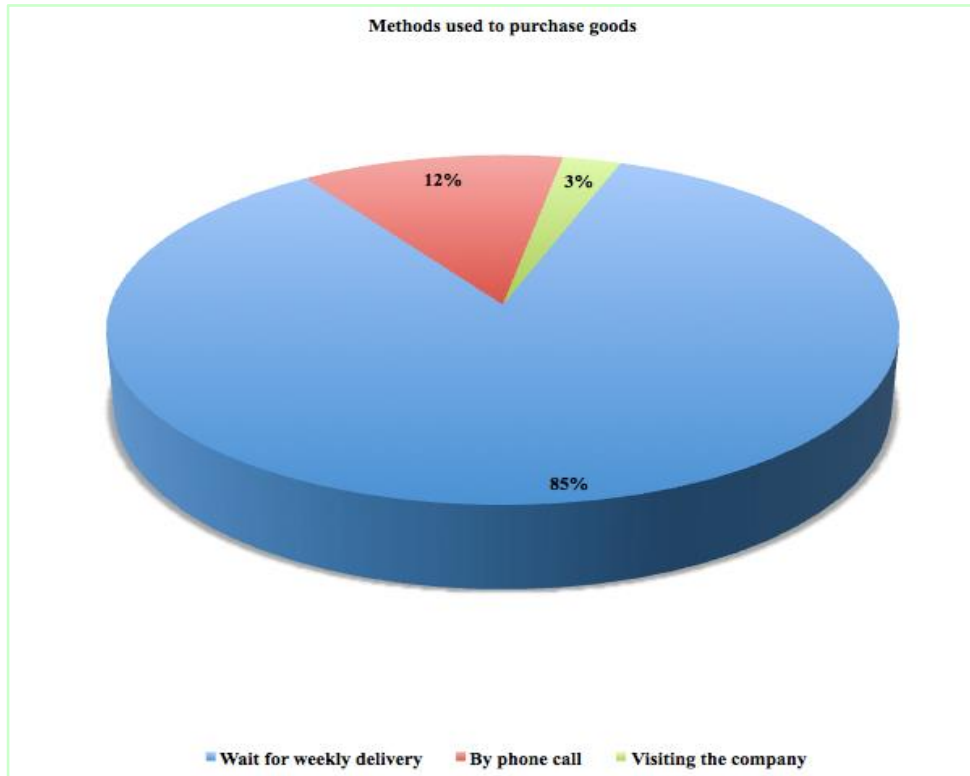


Figure 6: Methods used to purchase goods from the company

From Fig. 6, waiting for weekly delivery indicates that consumers are waiting for the distribution car to arrive at their area before making a purchase. This group accounted for 85% of all respondents, making it the most popular purchase method. Another group used to call the supplier when they ran out of stock, although this only accounted for around 12% of all respondents. The third method, which took 3% of the total respondents, was visiting the supplier to get products when they were out of stock and they did not expect timely delivery.

(iii) Challenges Encountered by Customer on Goods Availability

The questionnaire also covered the goods distribution and satisfaction to the market demands. Wholesalers responded to the two main challenges that face them frequently as per the currently used methods of distribution and delivery of products to the customers. The main two challenges reported were demands fluctuation that results in insufficient supply to the market and delayed delivery. The delayed delivery was due to the weekly routine model practiced by the company without tracing the area with high demand at a specific given time. The results for the encountered challenges are shown in Fig. 7.

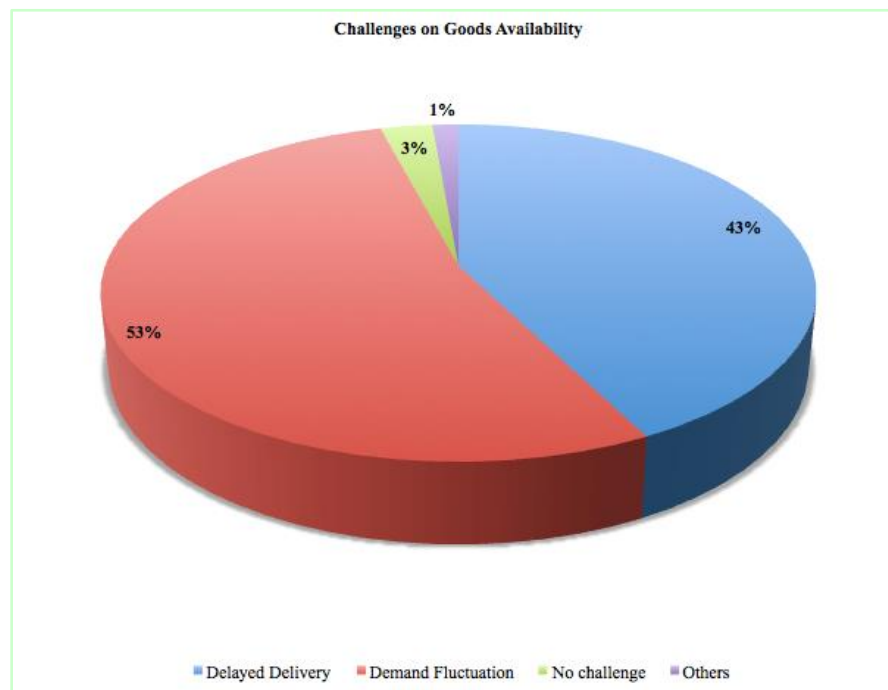


Figure 7: Challenges on Goods Availability

From Fig. 7 it was noted that the two challenges were common to most of the respondents. Demand fluctuation was leading with 53% among others followed by delayed delivery, which occupied 43% of total responses. The results show that there is a puzzle that needs to be solved to improve customer satisfaction and promote company profit. The 3% responded that they have not been challenged in anyhow on getting the products from the company and only 1% from the entire sample reported encountering other challenges.

(iv) Attitude of Wholesalers toward mobile Applications

The questionnaire was designed to investigate the tendency of users to use mobile applications for performing online purchases and to identify their affinity towards the use of a proposed solution. The data was collected on whether the user has been used any mobile applications to buy different products/goods from any seller, also ensure that the proposed solution is feasible, the responded

on their readiness to use the mobile application for business interaction and goods ordering from the company. Figures 8 (a) and 8 (b) show the response results.

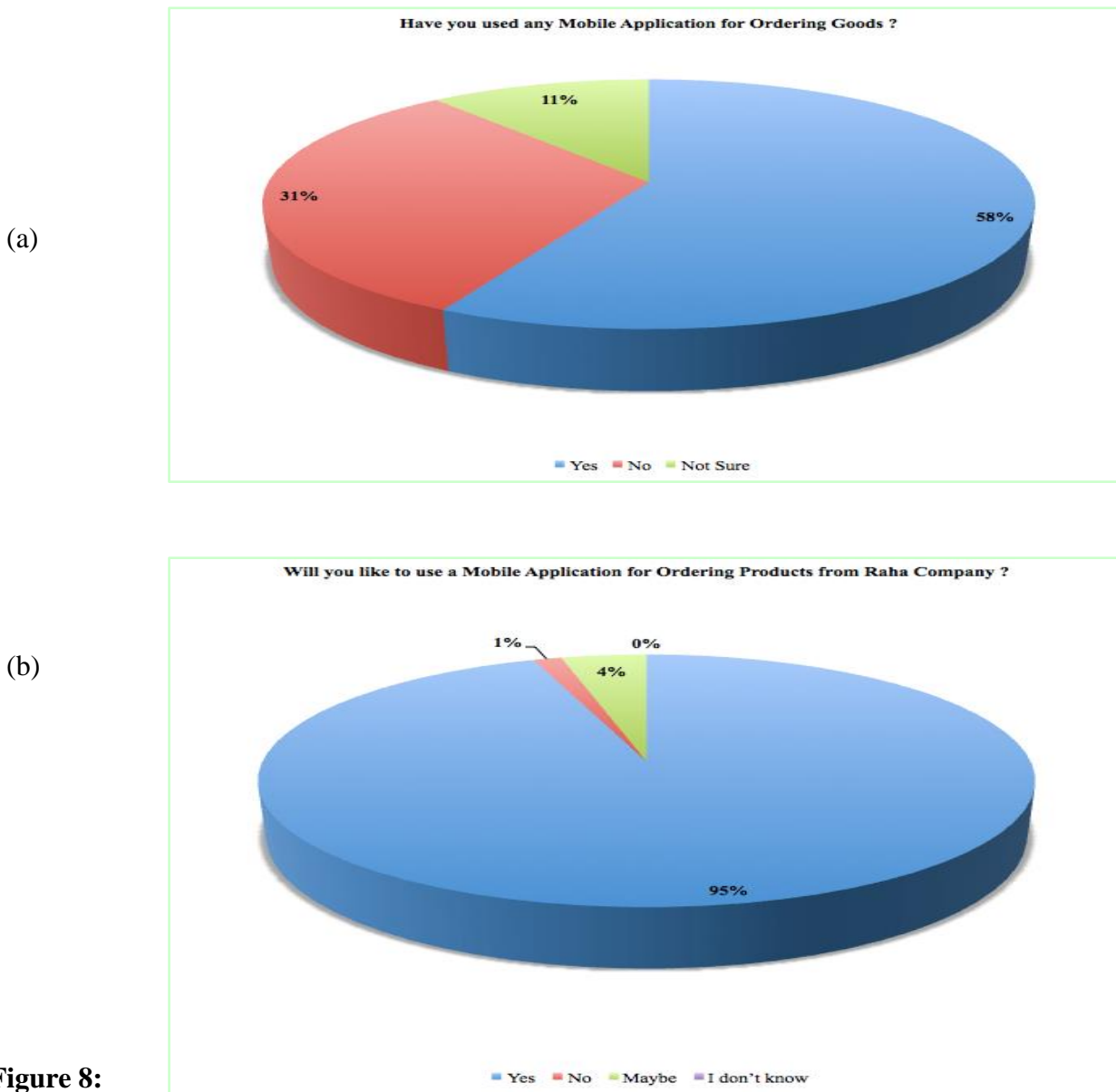


Figure 8:

(a) Mobile Application usage (b) Affinity Toward Proposed Solution

Figure 8 (a) shows that 58% of total respondents have used a mobile application for purchasing goods, whereas 31% of total respondents have not used a mobile application and 11% of total respondents are unsure whether they have used it or not. This means that more than half of the respondents can make an online purchase using the mobile application. Looking at Fig. 8 (b), the findings show that 95% of all respondents were eager to embrace the suggested system, compared to just 1% who were apathetic. The remaining 4% of all respondents were unsure whether to utilize or continue using the previous ways.

4.1.2 Results from Interview

The interview method for data collection was conducted by wholesalers and sales representatives to obtain their opinion about the use of a mobile application for ordering and order tracking from Raha Beverages Company Limited. Both semi-structured and structured interviews as shown in Appendix 7 and Appendix 6 respectively, were used to allow them to express their opinions and guide them on the view of the suggested solution respectively. The sales manager and production manager were interviewed by the guide questions as shown in Appendix 5 and Appendix 4 separately. The qualitative data were analyzed using a narrative analysis approach, in which the responses were interpreted to discover the features and behavior of the mobile application that clients required, which led to the capture of function requirements as shown in Table 2.

Table 2: Participants of the Interview

Participant	Job Description
Respondent 1	Sales Manager
Respondent 2	Sales representative
Respondent 3	Wholesaler

(i) Structured Interviews

Respondent 1 was interviewed about his opinion on the use of the sales and marketing mobile application for delivering products information and collecting purchase orders to the customers and he replied:

The mobile application will help on centralizing the sales data for the company, pre determine the market demand before distribution of the products go the customer. He explained more that “On the previous days it happed that sometimes we take less quantity to the market which leads to add more trips which increases cost and time consuming [Respondent 1].

One among the sales representative was interviewed was interviewed to get the experience and how they practice on the ground and his opinion on the proposed solution and he said that:

First we are dealing only with wholesaler and not retailers, hence we need the application to enable easy communication with wholesalers and be able to track the stock of the wholesalers so as I can know which wholesaler has enough stock and which one is running empty of stock” He added “This information will help us to plan our promotions and on those area with less consumptions so as to increase market share [Respondent 1].

Interview with some randomly picked wholesalers showed that there was a challenge on business communication between the customer (wholesaler side) and the seller (company side). Opinion from one of the respondents was that:

It happed one day I lost my phone and I needed to inform the supply that I need the products as I was out of stock, I struggled so much to get the contacts and I guess this doesn't happen only on my side, you can find many other faces the same problem so the mobile application will help in the single tap communication.

(ii) Semi-Structured Interviews

The wholesalers were also interviewed in semi-structured or moderately structured interviews to learn their thoughts on using the mobile application to order the products track their purchase history and manage their stocks. The moderately structured interviews were used because it allows the interviewer to ask only a few pre-planned questions while other questions are not determined in advance and it gives flexibility to the respondents to give more detailed opinions. The respondent insisted that the mobile application will help on the instant communication for any query concerning the products availability and the schedule to ensure enough supply, which was the suggestion to incorporate the easy interaction between customers and supplier. Also, the respondent wanted to see the price of the products and stock status and the purchase history, which means that the mobile application should have product track capability, displaying the quantity available in stock and the previously purchased orders. Furthermore, he added that:

simplifying the way of receiving the information about the products is essential, which implied that the mobile should be able to update any information about the products for example new products, new prices, promotions, etc [Respondent 3].

Respondent 2 responded to the mode of product delivery to the customers as follows:

Currently we deal only with wholesalers where we deliver products weekly in every route that we designed, we pass through following our route if there is any customer needs product he/she can purchase [Respondent 2].

This means that the products are delivered without any prior orders collection, that the quantity to the market is assumed. Suggested features for the mobile application were:

to enable the customer to create orders remotely and also show the current status of customer stocks, in addition to that the application should enable direct calling between supplier and customers. The current mode of advertisement of new products and prices was through bar promotions, televisions, radio, and social media. This implied that the

company lack the direct feedback and centralized information”. He added more “ Other features I can suggest to be included are locations of wholesalers and there should be the button where I can call the wholesaler direct [Respondent 1].

This implied that the wholesalers have to be identified on their locations for easy product delivery. The response of respondent 1 on the features to be included were as follows:

I want the mobile app to show the total sales for example sales per week or month, also it will be good if it will include the feature that can rate the customers depending on their purchase capability, like from top buyer to low so as we can award them and motivate to buy more [Respondent 1].

This implied the summary of total sales which can be categorized per product and displaying the leaderboard for all customers to be rated per their purchase using the mobile application. Reply on using any other application before:

Yes, previous days we used one of the applications but it was just like tracking our team when delivering the products to the customers, but no sales information was accompanied with that app [Respondent 1].

This implied that the supplier is interested more in the sales and marking of the products, sales information, and customers relationship.

4.1.3 Requirements Identification

The user and system requirements define how users will communicate with the system as well as how the system will behave or react. During this point, system requirements were gathered from the involved stakeholders, which included sales representatives, sales managers, and wholesalers, through field data collection. Some existing analogous systems were also investigated to identify their flaws and strengths. The system requirements were defined and divided into two categories: functional and non-functional requirements.

(i) Non-Functional Requirements

Non-functional requirements are the properties or constraints of the system and how it will act when invoked by users (Table 3).

Table 3: Non-functional requirements

Class of requirements	Description
Use-ability	The App should be easy and simple to use without requiring guidelines or help from an expert.
Scalability	The Application should be able to adapt itself to usage growth and be able to handle extra user data as time progress.
Reliability	The App should be available to perform user tasks all the time or should have minimum downtime.
Response time	The App should have short latency on responding to user invocation.
Security	The App should authenticate each user and their privileges before accessing any data from the system.
Memory	The App should not consume more user memory

Field Data (2021)**(ii) Functional Requirements**

Functional requirements are the ability of the system to perform a given task and therefore specify what the system should do (Table 4).

Table 4: Functional requirements

Class of requirements	Description	Actor
Login and registration of users	Users should use a phone number/email address and password to register before they can access the system or use a Google account to log in	Wholesaler
	Accounts for sales representatives and sales managers should be created by admin and provided with the login credentials	The sales rep, sales manager
Create orders	The system should allow users to create purchase orders, it should display the current price of each product	Wholesaler
Track orders	The customer should be able to monitor and see their order status as well as their purchasing history in the system.	Wholesaler
Update stock	Users should be able to update the customer stock	Wholesaler
	User should be able to update the supplier/company stock	Sales rep
View orders	The customer should be able to see open and closed orders in the system.	The sales rep, sales manager
Schedule delivery	The system should allow the user to schedule the order delivery	Sales rep
View customer stock	Users should be able to view the current customer stock	Wholesaler, sales rep
View supplier stock	Users should be able to view the current supply of the product	Sales rep
View report	The sales report should be visible to users.	The sales rep, sales manager
View location	Users should be able to view the locations of customers	Sales rep
Direct call	Users should be able to make a direct call from the system	The sales rep, wholesaler
View customer rank	Users should be able to view the current customer ranking from a top buyer in ascending order	The sales rep, sales manager

Field Data (2021)

4.1.4 System Design

The procedures for specifying the system architecture, modules, interfaces, and data to satisfy defined customer requirements are known as system design. The system design method necessitates the use of methods like the Data Flow Diagram (DFD), Unified Modeling Language (UML) diagrams, use case diagrams, and Entity Relationship Diagrams (ERD) (Sommerville, 2011). There were two key modules in the established system: wholesaler operations and sales representative modules as described in the following subsections.

(i) System Architecture

The proposed system and android application architecture, web-service architecture, and the package view of the communication flow between them are all presented in this section as shown in Fig. 9.

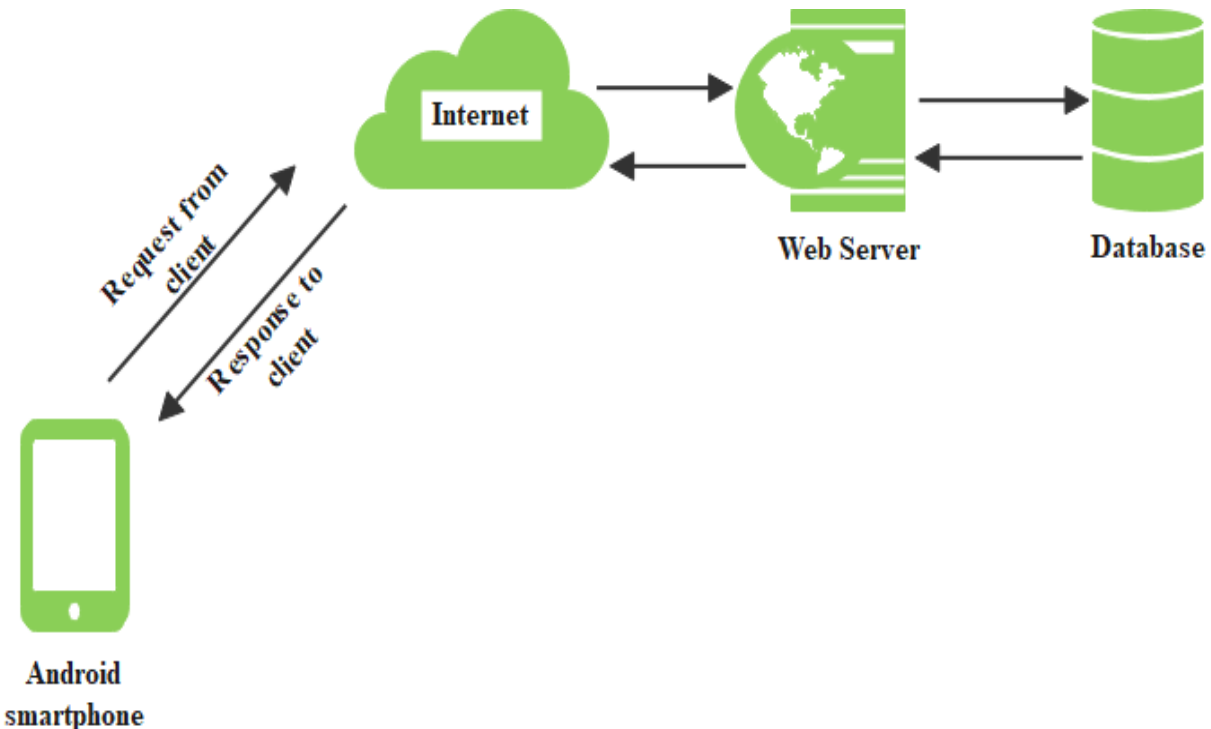


Figure 9: System Architecture

(ii) Design Approach

The design approach used in this project was functional design through empathizing; defining the Problem, Ideate, and Prototype. This method makes it easier to comprehend the project design by elucidating its flow, use cases, and implementation in a modular manner. There were separate functionalities and sub functionalities/modules which were designed and implemented separately

and then integrated to form a complete system. The modules (functionalities) were designed, implemented, tested, and integrated to ensure a flawless usable application.

(iii) Use Case Diagram

The use case diagram was created to highlight the main features of the mobile application, and the application requirements were evaluated. The use case diagrams are used to explain the scenarios that are expected within an application. Use case diagrams reveal the user interaction with the system; hence each use case represents the complete functionality that can accomplish a certain task as shown in Fig. 10.



Figure 10: Mobile Application Use Case Diagram

Each use case shown in Fig. 10 is described in Table 5.

Table 5: Use cases description

Use Case	Description	Actor
Login/Logout	Users can log in by providing their credentials and can logout when they need the App to prompt for login in the next launch	Wholesaler, sales manager, sales rep,
Create orders	Enables the user to create purchase orders	Wholesaler
Track orders	Allow users to see their order status and purchase history	Wholesaler
Update stock	Enables wholesaler to update customer stock and sales representative to update supplier stock	Wholesaler, Sales rep
View orders	Users can view the open and closed orders	Sales manager, sales rep,
Schedule delivery	Allow the user to attend the open orders from customers	Sales rep
View stock	Enables the wholesaler to view their current stock, sales rep, and sales manager to view customers' stock and current supplier stock	Wholesaler, sales rep, sales manager
View report	Allow sales representative and sales manager to view the summary of sales report	Sales manager, Sales rep,
View customer rank	Enable sales representative and sales manager to view the customer ranking according to their purchase capability	sales manager, sales rep,
Add user	Enables the system admin to create accounts for sales representative and sales manager	System admin

Field Data (2021)

(iv) Data Flow Diagram

Level 0 DFD

Figure 11 shows a Level 0 Data Flow Diagram (DFD) or context diagram, which provides a general overview of data flow in the system. The wholesalers, sales representatives, and sales managers are the three key actors in the diagram.

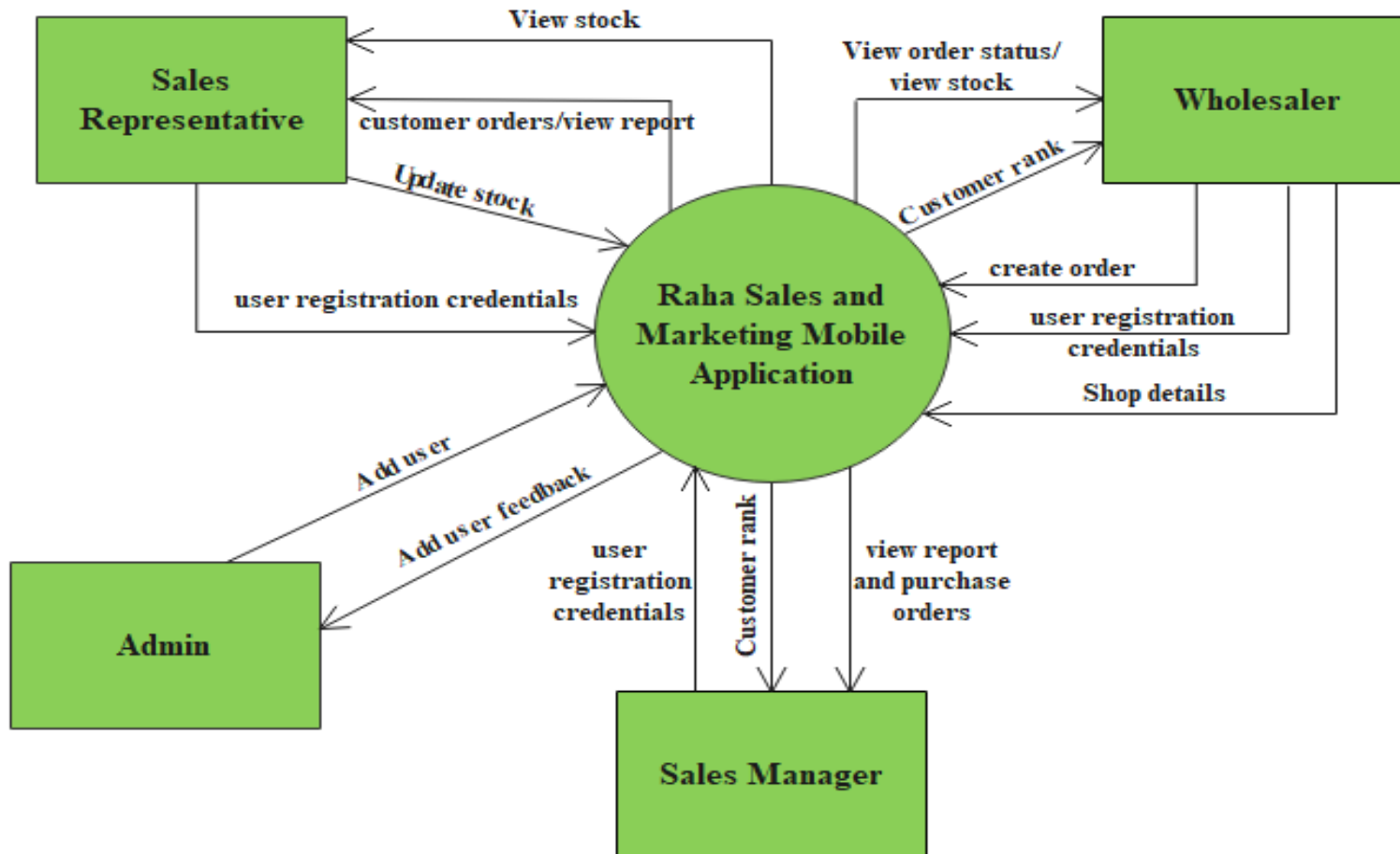


Figure 11: Level-0 DFD (Context Diagram)

Level 1 DFD

The level-1 DFD is the level 0 DFD decomposed into more explicit data flow diagrams, and it can be decomposed into more data flow diagrams (levels) whenever required (Ibrahim, 2010). Level 1 DFD notates all sub-processes that together form the complete system. It divides the system into several sub-processes. The data flow between numerous system processes, data stores, and actors is depicted in Fig. 12. External entities (actors) are represented by rectangles with a single section. An external entity (actor) is a person or a group of persons who are not under the control of the system being modeled. It illustrates the origins and destinations of data, such as "Wholesaler" in Fig. 12. Rounded Rectangles with two parts: they symbolize the system's processes (Aleryani, 2016). They depict a system component that converts inputs to outputs, such as "Authentication" and "Register" in Fig. 12. The data flows are represented by arrows. They might be computer data, physical goods, or a combination of both, such as "User details". Furthermore, arrows in data flow diagrams represent the direction in which data or things are moving out of or into a process. Open-ended Rectangles: They depict data stores such as "Orders" and "Stock" in Fig. 12, which include both electronic and physical stores. Datastores can be used to store data for either a long or short time.

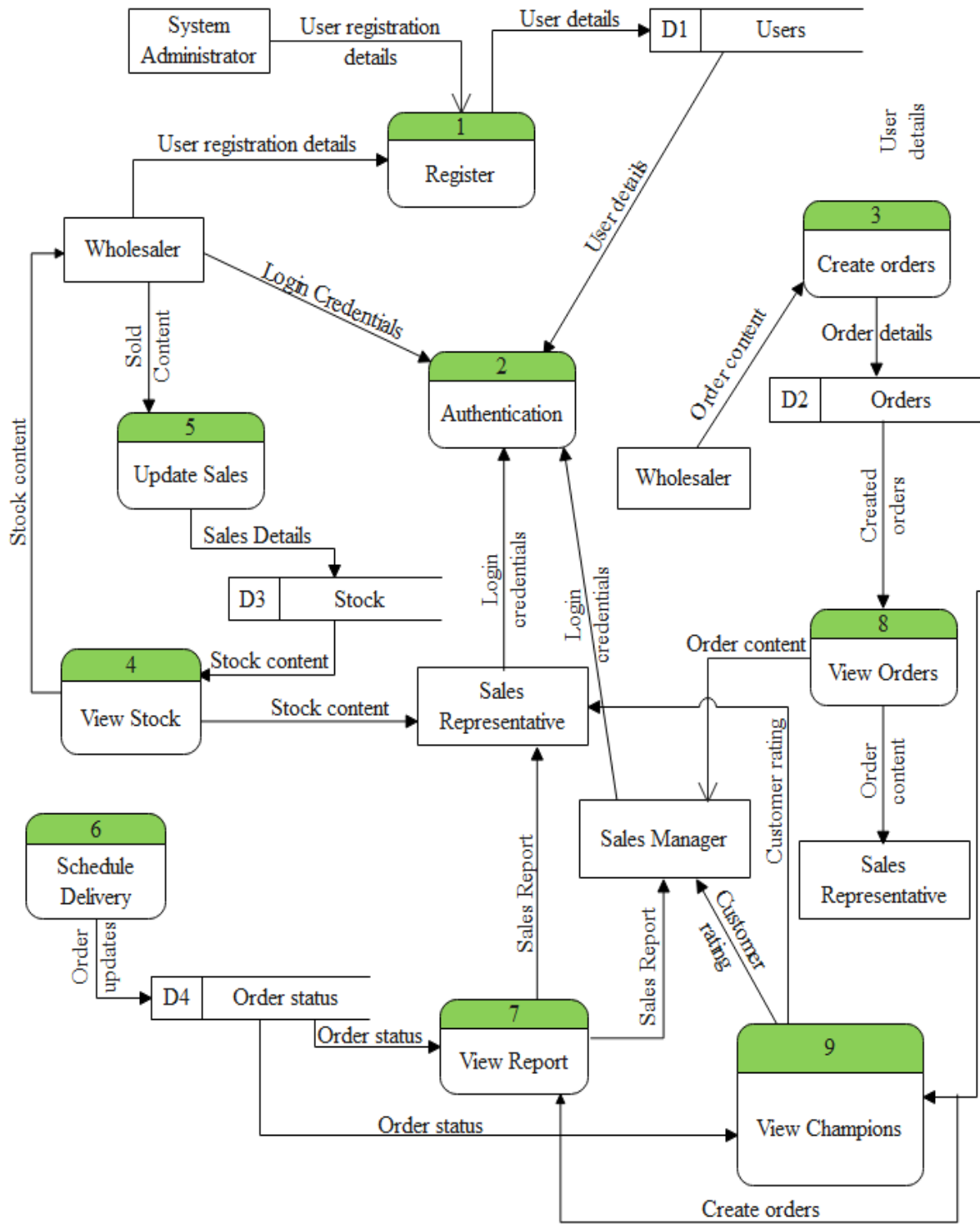


Figure 12: Level-1 DFD

4.1.5 Results for System Implementation

The mobile application was implemented through modules tested and integrated to accomplish the targeted task for each module. The designed user interfaces were simple but with good user experiences. The simple design made the application easy to use with a few clicks to accomplish a task that enables users to create orders faster and without hustle. The following sections illustrate the results of the developed application according to the task performed by each module. The functions of each module are described in the following section.

(i) Wholesaler Modules Mobile Application System Implementation

The developed mobile application could be downloaded from the Google play store and be installed on the Android platform. The key wholesaler functionalities are described in the sub-sections below.

User Registration

When a user needs to use the app, they should download it from the Google Play store, install it, and then register using the login credentials stated in the data requirement. During registration user information is verified to ensure spam-free data before being stored in the database. The stored user information is used to validate credentials for the next time he/she login.

User Login/Logout

The user is required to register before they can log in to the mobile application and use its features. The registration is done in two ways, the user can create a new account by providing login credentials (valid email or phone number and password) that will be used against authentication during login, or the user can log in using a Google account and will be verified by a third party (Google firebase). In either way, the user was able to access all the application features. After login, the user was redirected automatically to the home screen depending on the privilege of the user (wholesaler or sales representative) from which he/she can navigate to other user interfaces. Figure 13 (a) depict the mobile application login interface; Fig. 13 (b) is the user registrations interface and Fig. 13 (c) presents the home screen for wholesaler.

Create a Purchase Order

One of the potential features of the developed App was to enable users to create a purchase order, where user select the product and fill in the quantity of selected product that wants to purchase. The price for a single item and accumulative price for entered quantity was displayed on the screen

before the customer submits the order as shown in Fig. 14 (a). Then after clicking submits button, the confirmation dialogue was displayed to ensure the right decision for the purchase, the order was submitted after clicking on the confirm button Fig. 14 (b). Once the order is submitted, the system gives a beep and returns a confirmation message to the user indicating success or failure to create a purchase order Fig. 14 (c).

Tracking Order

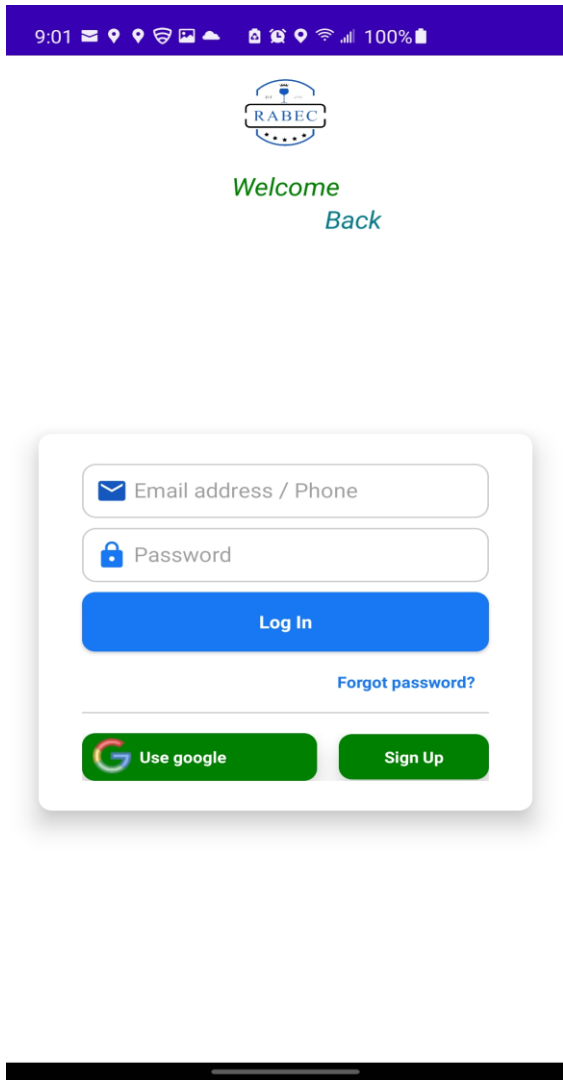
The application allows users to track their created orders and to know the status of when they could receive the ordered items from the company, user could view the list of items from the order list. In track order, the schedule for items delivery was set by the sales representative depending on the number of products demanded on the specific route. The order shows a list of product and the corresponding amount ordered, created date, order status, and a call button that enable a customer to make a direct call for any concern with the order. Also, the user interface displays current and previous orders in a scrollable manner as shown in Fig. 15 (a). From the order list, the customer could open the list of filtered unscheduled orders and could be able to delete the orders if he/she no longer wants to be delivered, Fig. 15 (b) illustrate.

Customer-Ranking

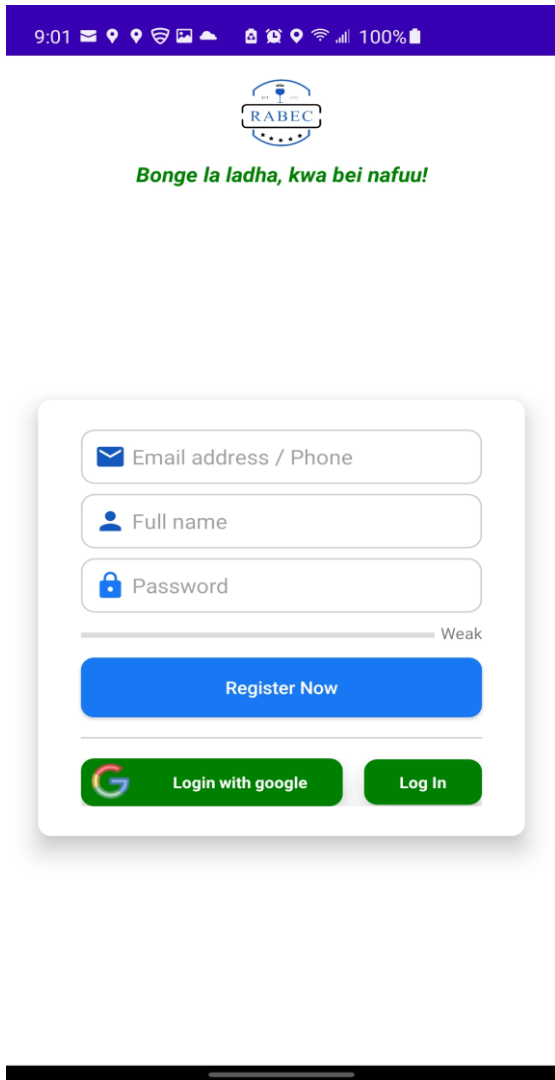
The customer-ranking interface displays the rank of customers from best purchasing customer to least purchasing customer. This rank helps the company to decide the reward to best purchasing customers to motivate other customers to purchase more and get rewarded. Figure 15 (c) shows the appearance of the customer-ranking screen.

Profile Settings and Privacy

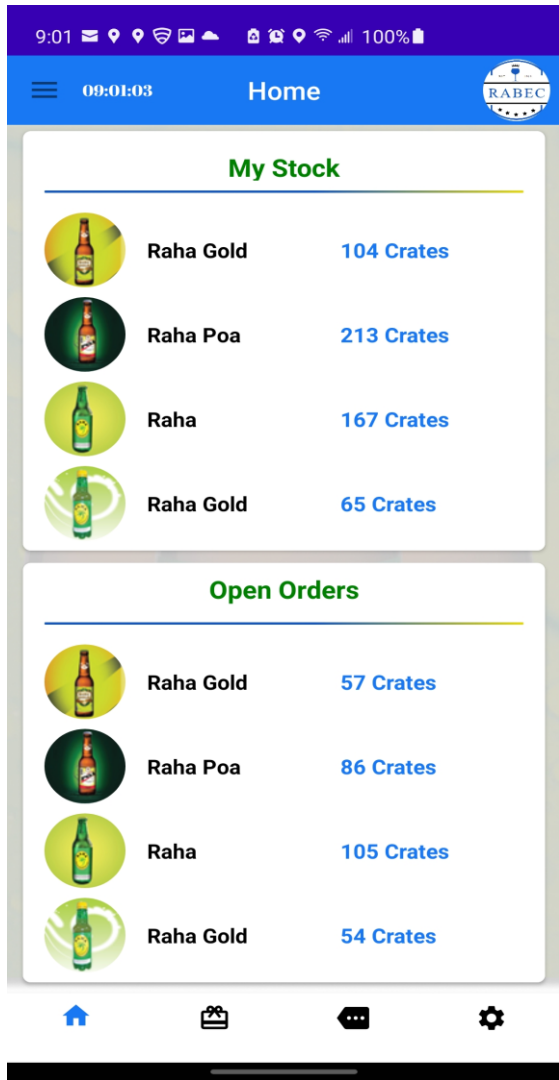
The user could use the settings screen to add shops with their details, where would be prompted to fill in all the necessary information and add it to his/her profile. The added information would be displayed on the screen; Fig. 16 (a) illustrates this. Figure 16 (b) shows the add shop screen that allows users to add shops information. Also, App users could change their password for security purposes as illustrated in Fig. 16 (c)



(a)

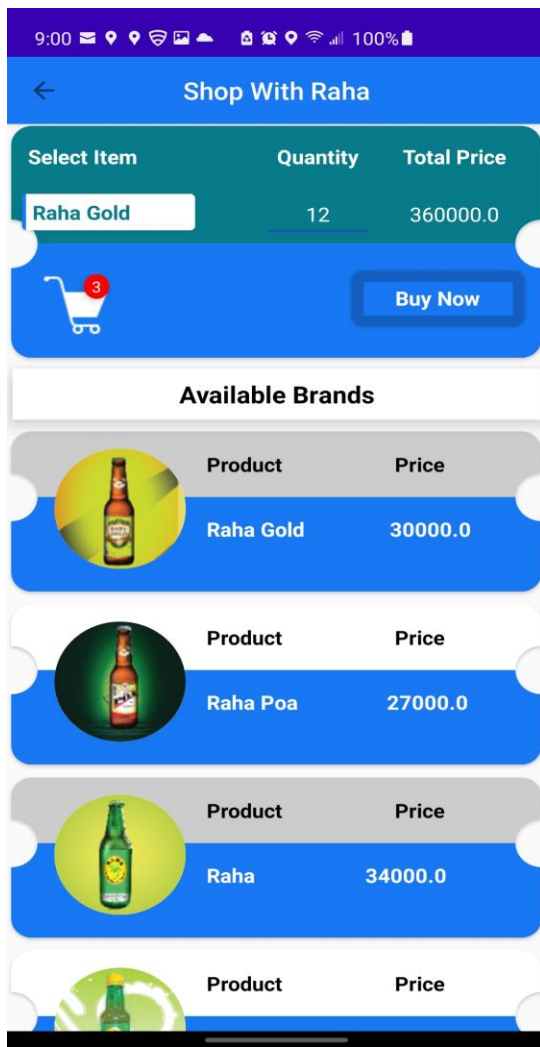


(b)

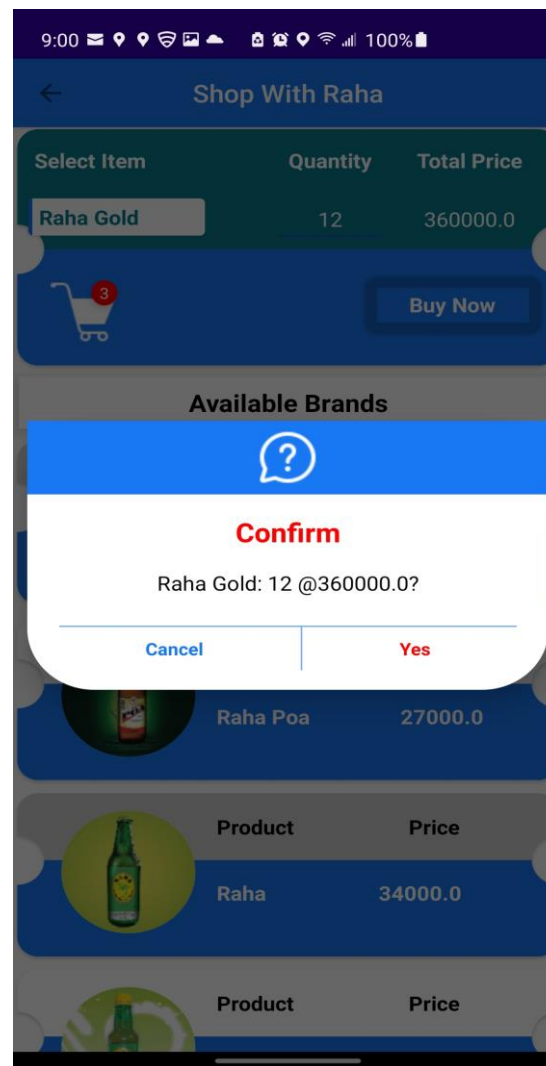


(c)

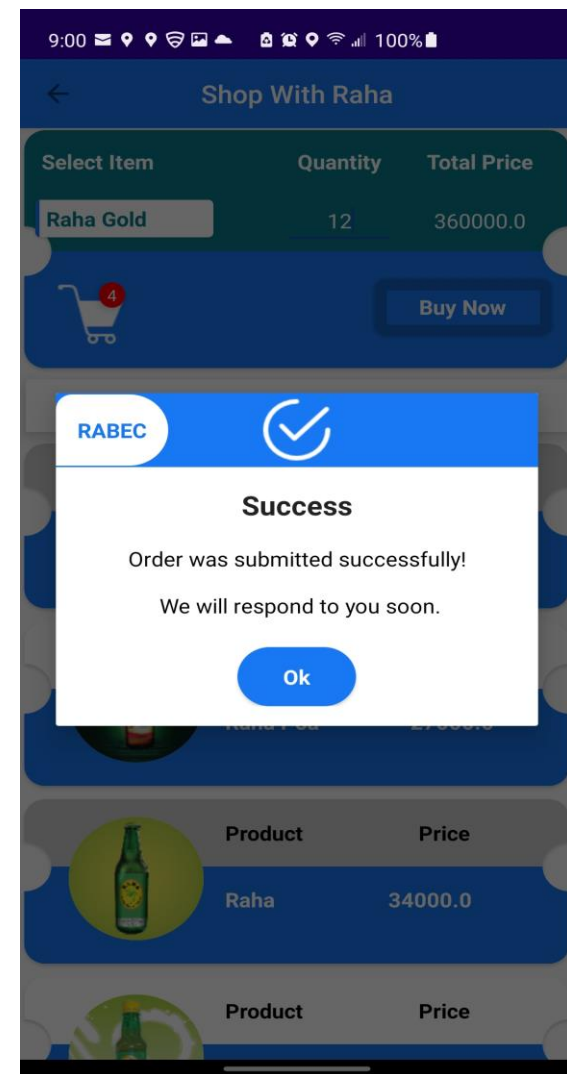
Figure 13: (a) User Login Screen (b) User Registration Screen (c) Home Screen



(a)

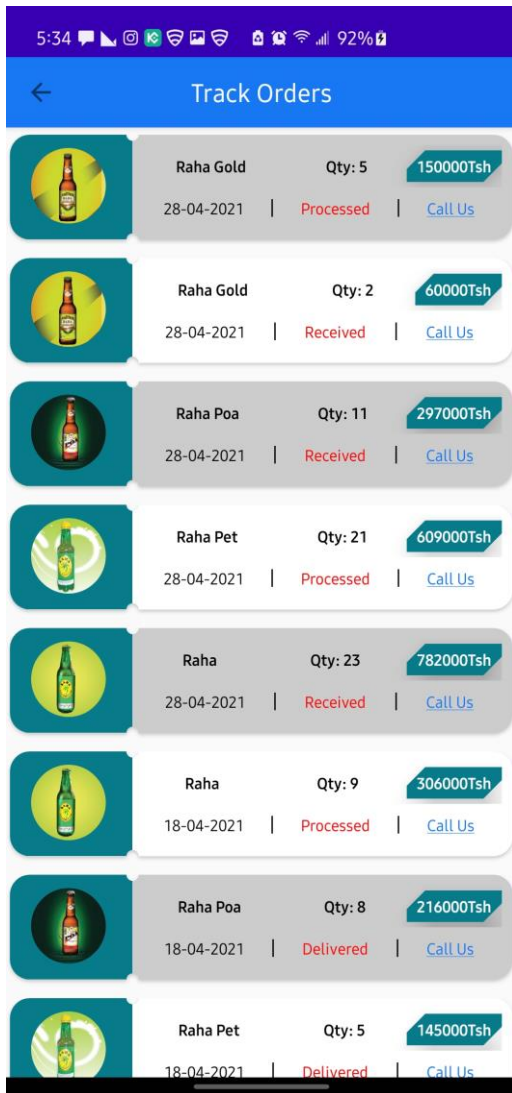


(b)

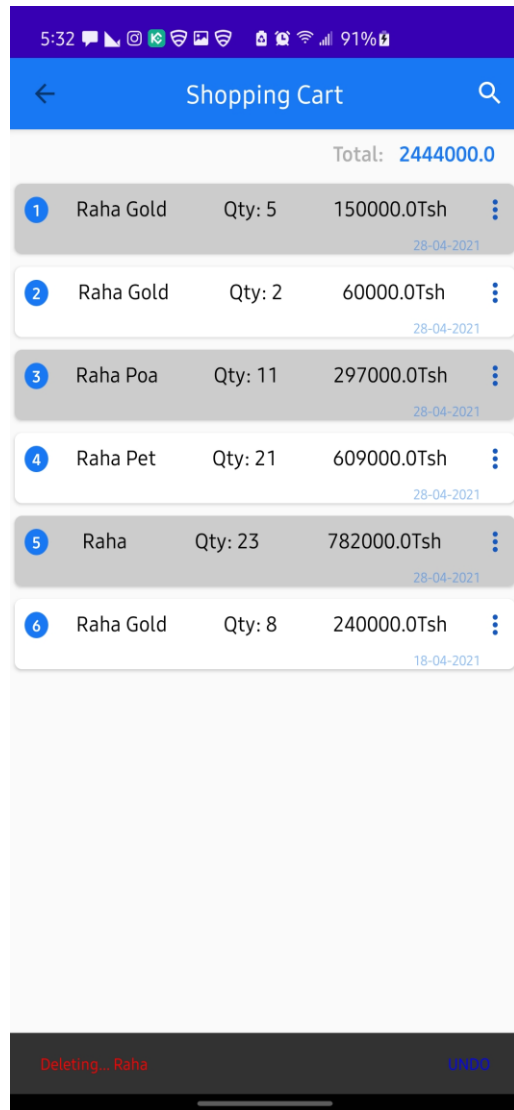


(c)

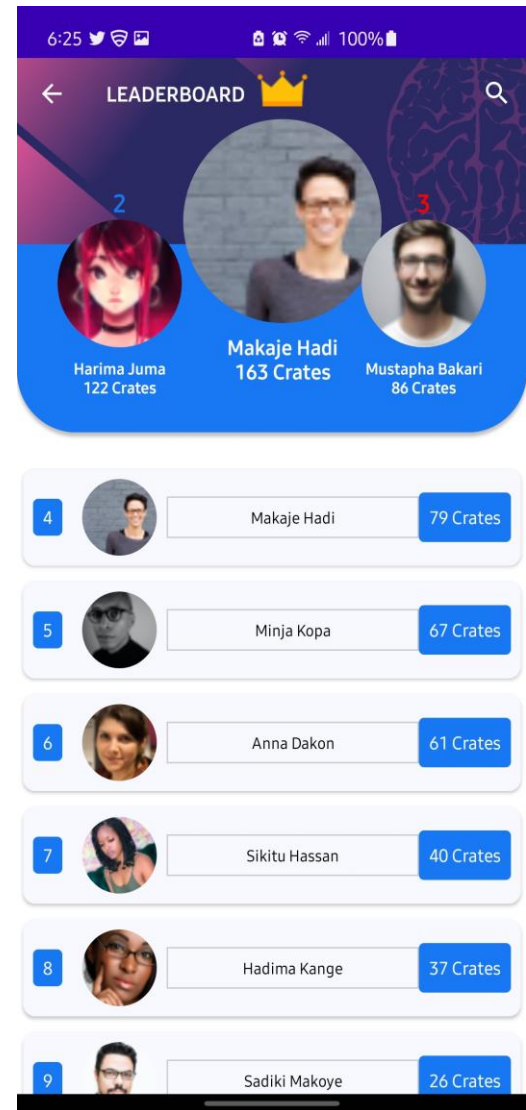
Figure 14: (a) Create Order Screen (b) Confirm Order (c) Create Order Feedback



(a)



(b)



(c)

Figure 15: (a) Track Oder Screen (b) Unscheduled Orders (c) Customer Ranking

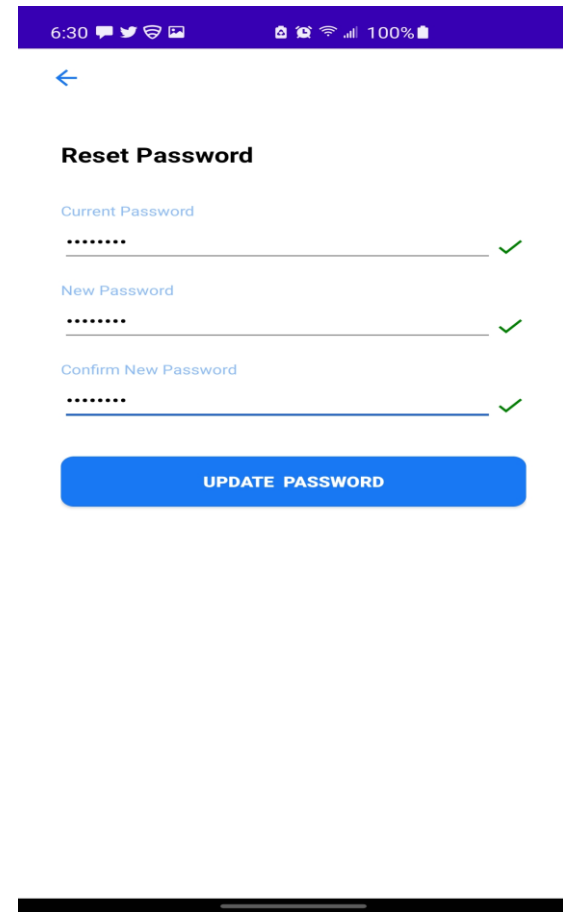
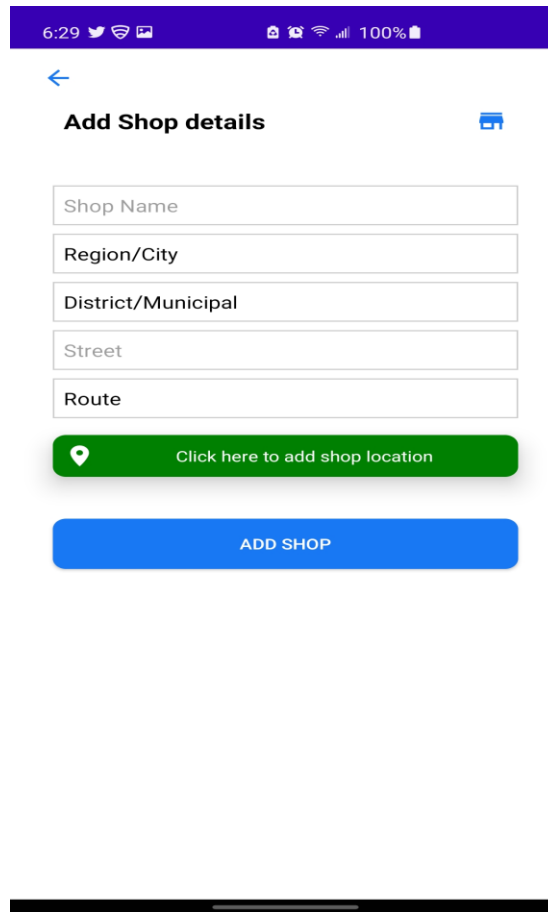
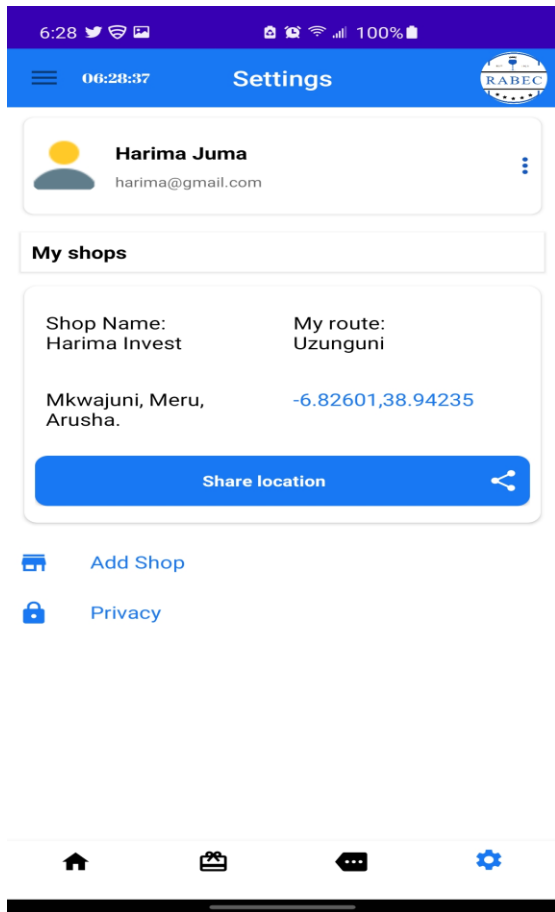
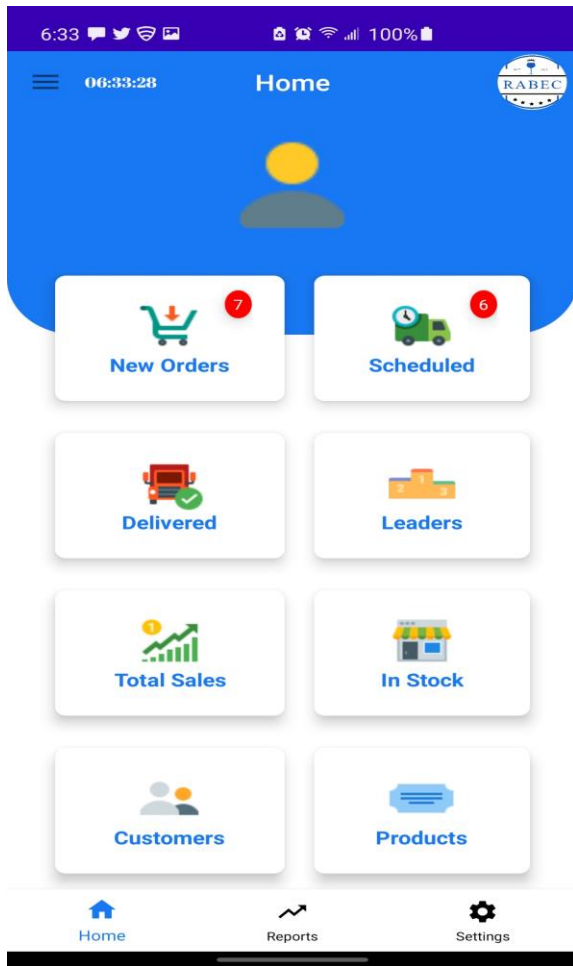
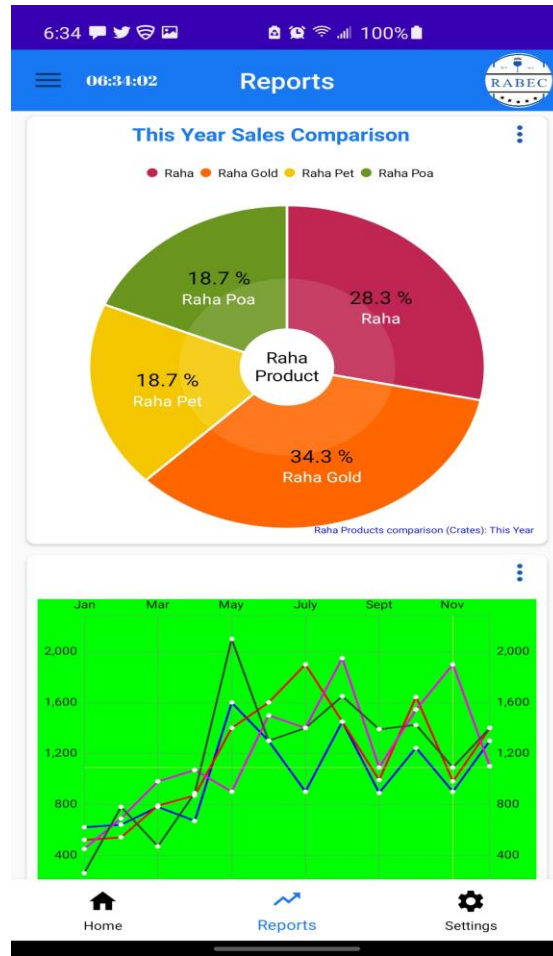


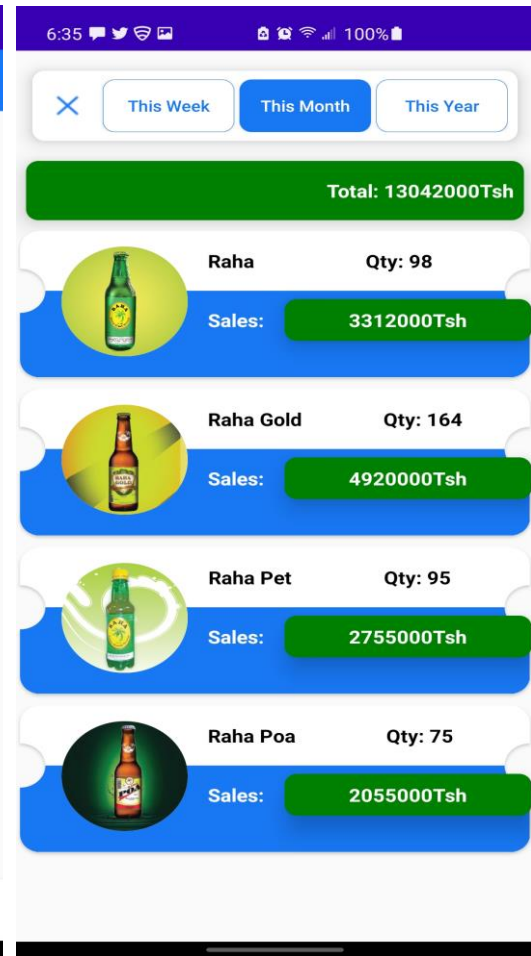
Figure 16: (a) User Profile Screen (b) Add Shop Screen (c) Reset Password Screen



(a)



(b)



(c)

Figure 17: (a) Home Dashboard (b) Report Screen (c) Total Sales Screen

(ii) Sales Representative Modules Mobile Application System Implementation

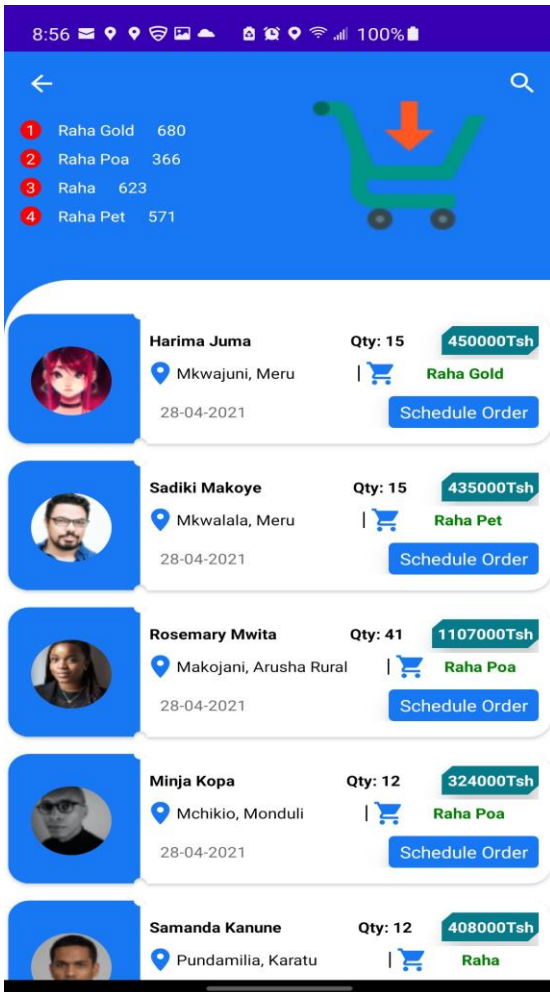
The main functionalities for sales representatives are described in the following sub-sections.

Home Dashboard

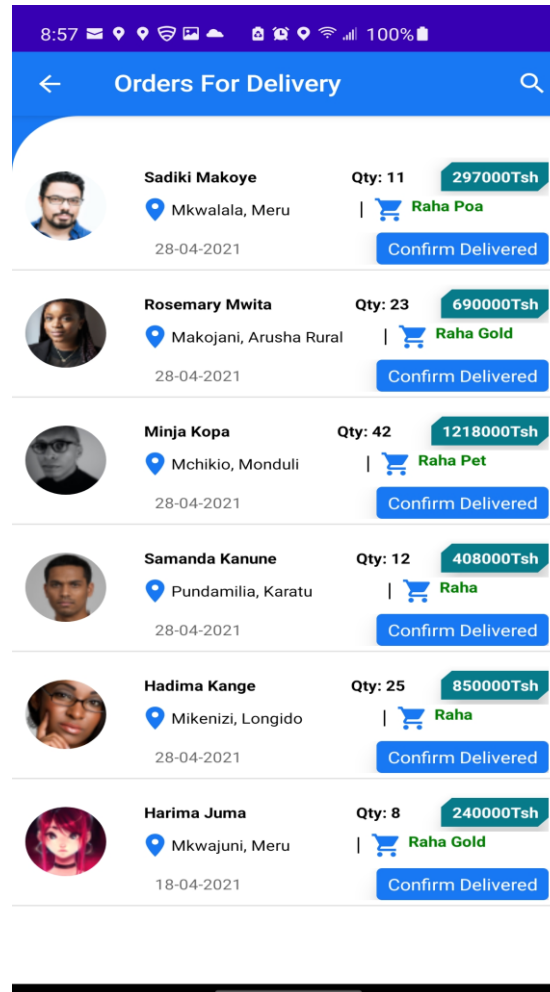
The home dashboard displays all shortcuts for the main functionalities that could be invoked by the sales representative. Figure 17 (a) shows the dashboard for sales representative functionalities. Figure 17 (b) illustrates the report screen that summarizes the comparison of sales performance for each product from the company. The sales report could be filtered on a weekly, monthly, or yearly basis. From the dashboard, users could click the total sales icon and view the total sales based on time intervals like a current week, month, or year as shown in Fig. 17 (c).

New Orders, Schedule Orders, And Delivered Orders

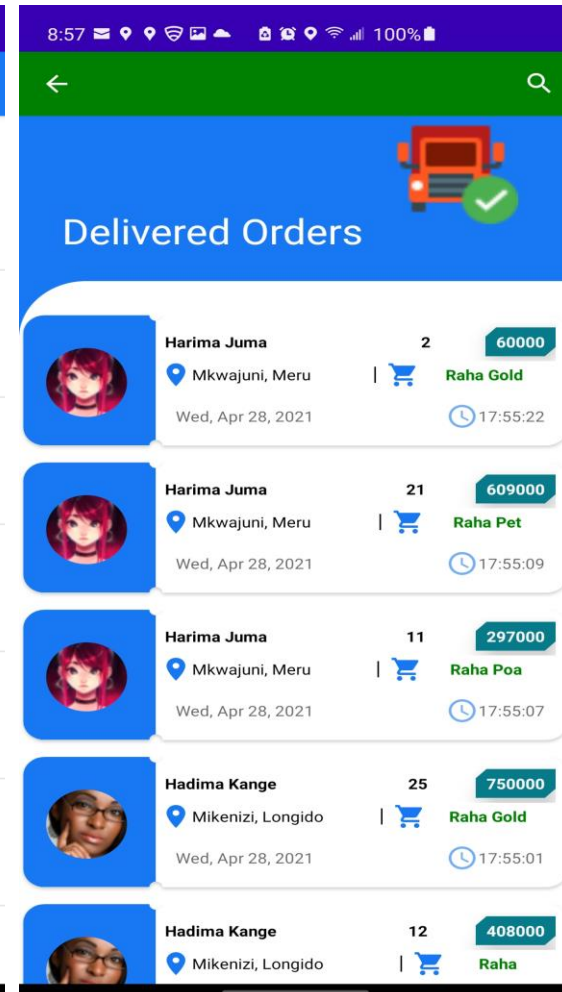
New orders from the dashboard shortcut enable a user to view the new orders in the queue waiting to be attended. The new order list displays the order information including the category of the product and the quantity required by the customer as shown in Fig. 18 (a). The schedule order screen allows the user to attend to the order and schedule for delivery if the stock is enough to fulfill the market demand. Figure 18 (b) shows the schedule order screen. The delivered orders are listed in the delivered screen to enable a user to view the serviced orders as shown in Fig. 18 (c), on both of the aforementioned screens users could filter a specific order using order information.



(a)



(b)



(c)


Figure 18: (a) Schedule Orders Screen (b) Scheduled Orders (c) Delivered Orders Screen

(iii) Admin Web Interface Implementation

The admin web interface was created to allow system administrators to create accounts for sales representatives and managers and delegate privileges to them to be able to log in and use the mobile application. The login credentials are shared with the respective users. The registration of the above users was done by the admin to ensure nonrepudiation. Before using the mobile application, the user account was established and the users were given their login credentials. The admin interface's functionalities are as follows.

Admin Log In Page

The system administrator had a role to register sales representatives and sales managers as system users and assign their privileges. They could use their login credentials to log in to the system after they had been registered. Figure 19 (a) shows the admin login page and Fig.19 (b) shows the admin login validation error.



Welcome To Admin Panel

Log In


Username *

Password *

Login

© Katwale & CENIT@EA

(a)



Welcome To Admin Panel

Log In

Username

Password * required.

Login

© Katwale & CENIT@EA

(b)

. Figure 19: (a) Admin Log In Page (b) Admin Log In Validation Error

Add User Page

After logging in this web page helps the system administrator to add new users to the system by providing their registration credentials (full name, email address, and initial password). When the admin submits the user credentials to be added to the system, all inputs are validated to ensure no duplicate users are added in the database, the admin receives the feedback message for either user was successfully registered or it failed to register the added user. Figure 20 (a) shows the add user web page and Fig. 20 (b) shows Add User Validation Error.

[Logout](#)

Register User

Username *

Email *


Password *

Confirm Password *

[Add User](#)

© Katwale & CENIT@EA

(a)


Welcome Ngollo

[Logout](#)

Register User

Username

Email * required

Password *

Confirm Password *

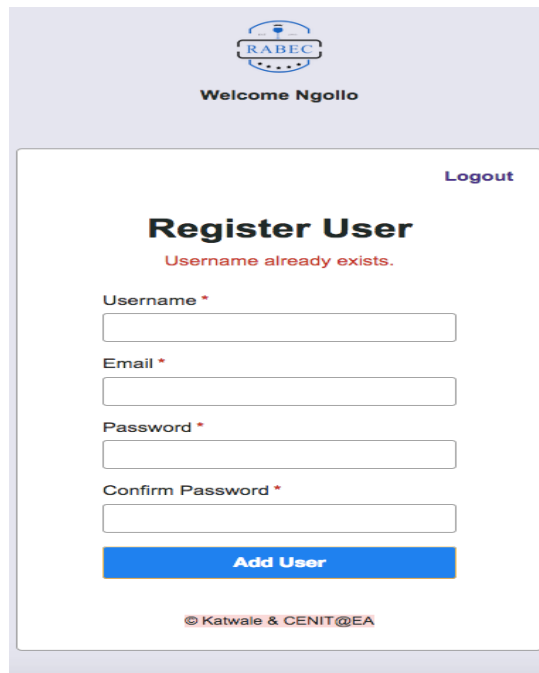
[Add User](#)

© Katwale & CENIT@EA

(b)

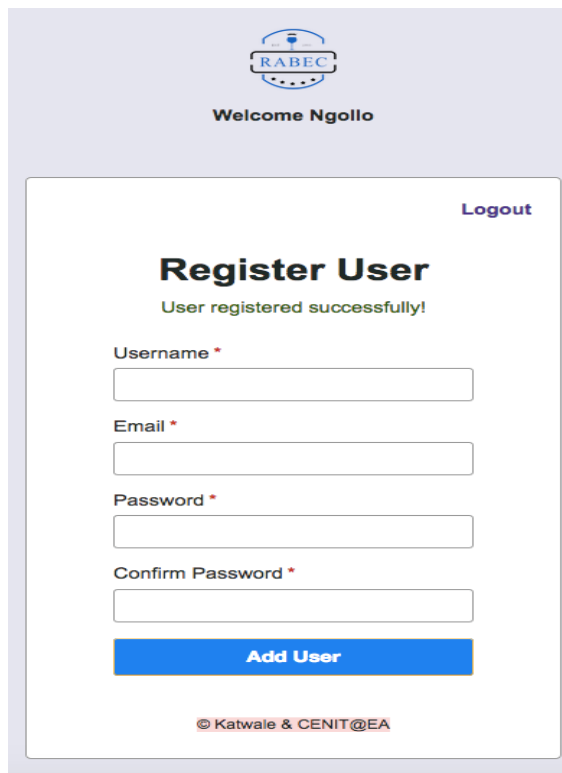
Figure 20: (a) Add User Web Page (b) Add User Validation Error

Figure 21 (a) shows the registration error caused by trying to register an existing user and the admin receives the feedback for the registration error. This ensures that the data in the users' table has no duplicate. If no error for the submitted credentials the user is registered successfully and the admin receives feedback as shown in Fig. 21 (b)



The screenshot shows a web interface for user registration. At the top, there is a logo for 'RABEC' and the text 'Welcome Ngollo'. A 'Logout' link is in the top right corner. The main heading is 'Register User'. Below it, a red error message reads 'Username already exists.'. The form contains four input fields: 'Username *', 'Email *', 'Password *', and 'Confirm Password *'. A blue 'Add User' button is at the bottom. A footer note says '© Katwale & CENIT@EA'.

(a)



The screenshot shows the same 'Register User' form as in (a). The error message is replaced by a green success message: 'User registered successfully!'. The form fields and 'Add User' button remain the same. The footer note '© Katwale & CENIT@EA' is also present.

(b)

Figure 21: (a) User Registration Error Feedback (b) Registration Success Feedback

(iv) Database Implementation

The relational database was created to facilitate data access and exploitation. Tables' relationships were precisely defined and enforced since data in the database is identified and accessed with other pieces of data. The data type to be stored in the table was prior known to avoid database query/update failure and the size of the data element expected to be stored in the field. A well-defined database simplifies manipulation operations that are performed in a way that added, updates, query, or delete records.

In this project, MySQL database was chosen over other DBMS, which is an open-source SQL database. It is used for both web application and mobile application development and is often accessed using PHP. The advantages of using MySQL are easy to install and use, reliable (because has been used since 1995), inexpensive, and have an accumulation of developers who could share knowledge and experience. One of the disadvantages is that it tends to suffer from poor performance when scaling up, thus why for the bigger projects developers choose Oracle over MySQL, but for this project, Because of the nature of stored data, MySQL is the best option; it has all of the necessary functionality, and the project's size can be supported with reasonable results. To make it secure the database server should be installed and set the user credentials such as username and password that are required to login the server and manipulate the database.

The created database is accessed remotely using REST web service, which is an architectural style, which means each unique URL represents an independent object of some kind. The REST web service serves as a link between the Android application and the database enables two electronic devices to communicate using the HTTP protocol (over, World Wide Web), and supporting several HTTP methods (POST, GET, DELETE or PUT).

The data is transferred and fetched in XML or JSON formats to and from the database. The user's information is collected and sent to the database via web services in JSON format, where it is then displayed to the users from the MySQL database.

Entity Relationship Diagram (ERD)

An entity-relationship diagram (ERD) is a type of flowchart that shows how "entities" in a system, such as persons, objects, interact with one another. The ERD is a relational database architecture and debugging tool. Figure 22 depicts the ER Diagram of the developed system.

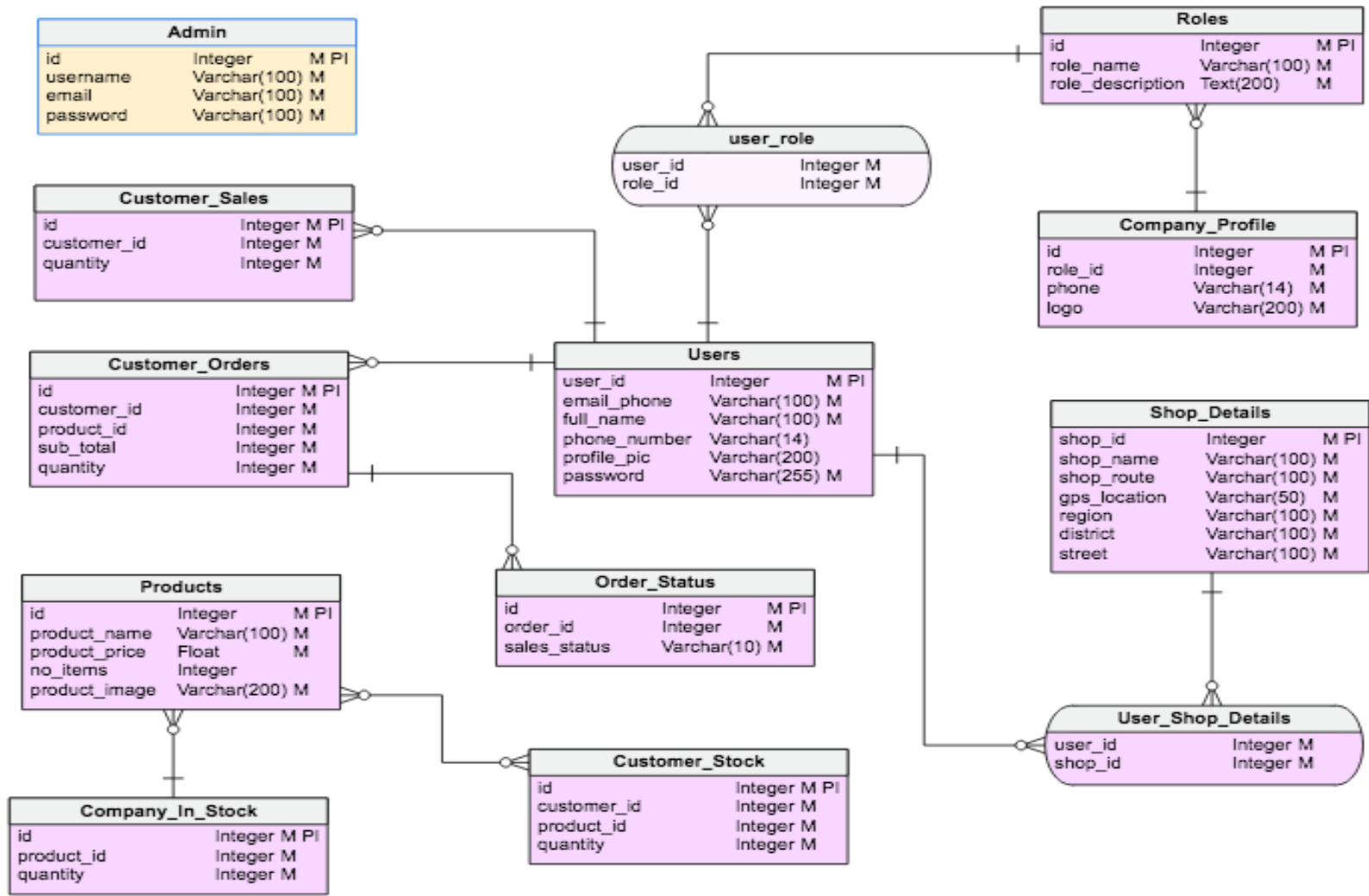


Figure 22: ER Diagram

MYSQL Database

The mobile application uses the MYSQL database for storing user data and company information. The database had 13 tables as illustrated in Fig. 23. The user role table uses Role_id to distinguish the role of the user, either wholesaler, sales representative, or sales manager and uses that information to redirect users to an appropriate home screen. Users table store the user credential and basic information, which are uniquely distinguished by User_id. Order_Status table stores the status of the orders distinguished by their Order_id. Admin login table is the separate table that stores admin credentials for system login.

Server: localhost » Database: raha_salesdb

Structure SQL Search Query Export Import Operations Privileges Routines Events Triggers More

Filters

Containing the word:

Table	Action	Rows	Type	Collation	Size	Overhead
<input type="checkbox"/> admin_login	★ Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> company_in_stock	★ Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> company_profile	★ Browse Structure Search Insert Empty Drop	1	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> current_stock	★ Browse Structure Search Insert Empty Drop	6	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> customer_orders	★ Browse Structure Search Insert Empty Drop	30	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> customer_sales	★ Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> order_status	★ Browse Structure Search Insert Empty Drop	30	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> products	★ Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> roles	★ Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> shop_details	★ Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> users	★ Browse Structure Search Insert Empty Drop	13	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> users_role	★ Browse Structure Search Insert Empty Drop	10	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> user_shop_details	★ Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	48.0 KiB	-
13 tables	Sum	108	InnoDB	utf8mb4_general_ci	496.0 KiB	0 B

Check all With selected:

Name: Number of columns:

Figure 23: MYSQL Database Tables

4.1.6 System Validation

The system had undergone a series of testing during development and after development. The testing conducted during the development phase was unit testing and integration testing, then, after the system's development, the validation was conducted for system testing followed by a user acceptance test.

(i) Unit Testing

During the development phase, each functional unit was tested separately to ensure that it performs as expected. This test helped to build a flawless software code and simplifies troubleshooting once an error occurs during system integration, as it would be simple to trace the source of the error. At this stage of testing data format, data type, execution behavior, input violation, and user errors were tested to ensure the usefulness of each software code.

(ii) Integration Testing

The integration test was conducted after the integration of different units to form the App. The purpose of the test was to expose all defects in the interfaces while separate units interact or when one unit consumes data that was produced by another unit. This test helps to synchronize execution timing for each unit.

(iii) System Testing

The functional components were integrated for a complete system and the system was tested for both non-functional and functional requirements. The aim of the test was to evaluate the system specification. During this test, the component interfaces and data flow between components were tested. Different users in the Arusha region were involved in system testing to ensure system adoption. The test results for different functionality were shown in Table 6.

Table 6: System Testing Results

System Requirement	Test Result
Users should register using a phone number/email address and password before they can access the system or use a Google account to log in	PASS
Accounts for sales representatives and sales managers should be created by admin and provided with the login credentials	PASS
The system should allow users to create purchase orders, it should display the current price of each product	PASS
The system should allow the user to track and see their order status and track the purchase history	PASS
Users should be able to update the customer stock	PASS
User should be able to update the supplier/company stock	PASS
The system should allow the user to view the open and closed orders	PASS
The system should allow the user to schedule the order delivery	PASS
Users should be able to view the current customer stock	PASS
Users should be able to view the current supply of the product	PASS
Users should be able to view the sales report	PASS
Users should be able to view the locations of customers	PASS
Users should be able to make a direct call from the system	PASS
Users should be able to view the current customer ranking from the top buyer in ascending order	PASS

Field Data (2021)
(iv) User Acceptance Test

The user acceptance test aimed to decide whether or not potential users were confident in adopting the developed system. This test was mainly to ensure by the potential users that the developed system was the one expected and performing what is required to do as expected. The model chosen to perform the acceptance test was Technology Acceptance Model (TAM). During the validation process, the Technology Acceptance Model (TAM) was used, A sample of each user's category, including wholesalers and sales representatives, was selected at random to test the system for three to five days. Following that, a survey was performed to determine the system's perceived usefulness, perceived ease-of-use, and attitude toward use.

The data for the assessment was gathered by the use of a questionnaire as shown in Appendix 2 and Appendix 3. The user acceptance test was conducted with the randomly selected user to

validate the functionalities of the developed system and the usefulness of the App. A total of 12 users (3 sales representatives and 9 wholesalers) were involved in testing the system for 3 days before the validation survey. The proposed system's usefulness was assessed using a five-point Likert scale, which was designed to test users' attitudes and rate their level of agreement or disagreement with a proposed system (Sullivan & Artino, 2013). Table 7 and Table 8 illustrate the validation outcomes of wholesalers and sales representatives respectively.

Table 7: Responses to the Validation Survey for Wholesaler

Model Element	Asked Question	Number of Respondents					Mean Score
		Strong agree	Agree	Neutral	Disagree	Strong disagree	
Perceived Usefulness	The use of the <i>RahaSales</i> mobile application could help to the easy ordering of products	5	2	1	1	0	4.22
Perceived Ease of Use	I used the mobile application without the need for any help from an expert within a few minutes	4	3	1	1	0	4.11
Attitude Toward Use	I believe that using the RahaSales mobile app to track my inventory and communicate with my supplier is a smart idea.	5	2	2	0	0	4.33
Willingness to use the App/ Behavioral Intention to Use	I intend to use RahaSales mobile App once it becomes available in Google Play Store	6	1	1	1	0	4.33

Field Data (2021)

Table 8: Sales Representative Validation Survey Responses

Model Element	Asked Question	Number of Respondents					Mean Score
		Strong agree	Agree	Neutral	Disagree	Strong disagree	
Perceived Usefulness	The use of the <i>RahaSales</i> mobile application could help to reach customers faster and enhance customer royalty	3	0	0	0	0	5.00
Perceived Ease of Use	The mobile application was simple to use and all features were easily accessible	2	1	0	0	0	4.66
Attitude Toward Use	I think it is a good idea to use <i>RahaSales</i> mobile App for easy reaching customers and to know the market demand in time	2	1	0	0	0	4.66
Willingness to use the App/ Behavioral Intention to Use	I am waiting to use the mobile app once it becomes available in Google Play Store	3	0	0	0	0	5

Field Data (2021)

From Table 7 and Table 8 above, the majority of respondents agreed that the established mobile application was useful in product orders, with a mean score of 4.11 and above. The stock management for wholesalers and helps on the side of sales representative to manage customer's purchase orders and reaching customers easily, they showed high affinity to use the application. Also, both wholesalers and sales representatives agreed that the developed mobile application had a nice user experience.

Some of the wholesalers who participated in the validation of the mobile application suggested that more features should be added for enhancing its utility. One of the suggested features to be added was the in-application instant chats with the supplier-customer care to solve different queries. Another suggested feature from one of the sales representatives was to add a feature where all customers can be mapped on the Google map for easy visualization when analyzing marketing coverage.

Discussion

As claimed by the results, this study developed a RahaSales mobile application for Raha Beverages Company that enables customers to request goods and manage their stock related to Raha Beverages Company products. Also, the developed application could help wholesalers and sales managers to have centralized data for sales and they can easily reach and interact with their customers. The developed application also could help the company to deliver information like product price updates, availability of new products, and products promotions to their customers very quickly and easily. Potential users tested the system and developed the confidence that the system could be used to improve customer service and reduce the running cost that could be incurred for advertisement, un-foreseen market fluctuation, and increase sales marketing impact as per the study by Smith (2019) discussed in section 2.4. The potentials presented by the system increased the affinity of the user toward adopting the system.

The customer orders comprising product name, product price, and purchased quantity are stored in the MYSQL database server. The orders in the database are categorized into three different statuses of service namely receive status (submitted by the customer successfully and received by the supplier), processed status (scheduled for delivery and the supplier stock is enough), and delivered status (products already delivered to the customer). The sales report are generated by aggregating the data from the database, formatted, and displayed to the sales representatives and sales managers. Moreover, the generated report is displayed on a weekly, monthly, and yearly basis.

The orders are filtered according to their status formatted and displayed to the sales representative. A sales representative can access these order categories through the main dashboard on the home screen. On each order list, the user can filter the specific order/orders by typing keywords in the search field; he/she can search a person's name, customer route, or customer location. On the other hand, the customer updates his/her stock by adding the sold quantity to the database through the updated stock interface and is automatically deducted from the current stock. Also, the customer can create the order by just entering the quantity of the items he/she wish to purchase, the total price is updated automatically on the screen reflecting the amount he/she will pay against that quantity of product. After submitting the order, the customer can see his/her open orders and their status. Besides, the customer can add more than one shop details, which are in a different location, no need to create an account for each shop to receive the delivery service. All added shops are associated with their GPS location, which makes it easy for product delivery even by the new sales representative. Lastly, the system challenges customers to buy more products from the company to enter the top three champions to be rewarded every month. This rank is displayed to all users so that they can see the ranking list and make a decision to buy more and move to a high rank.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The goal of the research was to evaluate current business interaction methods, such as stock management, purchase order processing, and product delivery to customers, then create a mobile application that would add value to those methods, enhance company interaction, as well as increase customer loyalty. There were three research questions in this study, which are described below:

- (i) What are the system requirements for sales and marketing mobile application for Raha Beverages Company Limited?
- (ii) How to develop a sales and marketing mobile application?
- (iii) How to validate a mobile application for sales and marketing?

For the first research question, a literature review on the existing methods for B2B and B2C in addition to a field survey to study the current situation on the wholesaler and sales representative was conducted. After the field survey, the user and application specifications for the development of a sales and marketing mobile application for Raha Beverages Company were captured.

The second research question was successfully answered by developing the RahaSales mobile application using Agile Scrum methodology, which is an agile approach. During system implementation, a variety of system modeling approaches, user interface design techniques, and technologies such as use cases, UML diagrams, and DFD were used. A good example of user interface design used was “*Figma tool for user interface design*”, which helped to visualize the interface before the actual implementation. The study developed the mobile application the help the B2B interaction between wholesalers and Raha Beverages Company Limited. The implemented feature enables customers to create a purchase order and be sure of the product delivery by making follow-ups of their open orders on their smartphones. Also, the developed App helps the company to manage the market demand by tracking the customer stock and customer purchase orders.

Ultimately, the wholesalers and sales representatives tested and validated the developed mobile application to find out whether it does what was intended to do as per requirements captured in the foremost research method. This was done through user acceptance testing using Technology

Acceptance Model (TAM). Where users who may profit were involved in testing the functionalities of the system and evaluated in the area of usefulness, ease of use, and their behaviors toward the intention of use. In which the potential users were satisfied to accept the mobile App, and they showed high intention to use the developed mobile application. In general, the study aimed to improve the B2B relationship between customers and suppliers in terms of business interaction by ensuring the availability of information concerning the undertaken business, through smooth means of collecting information from both sides. Customers created market status information i.e., demand or products dump and where the customer can be found, while the supplier produces information about the availability of supply current price and delivery plan.

5.2 Recommendations

According to the study, the developed RahaSales mobile application for Raha Beverages Company Limited should be piloted and adopted by the stakeholders such as sales managers, sales representatives, and wholesalers. The wholesalers should be motivated to use the mobile application to create purchase orders, track their orders and update their stock as they sell the goods. Another issue to emphasize is to encourage them to get all the products information from the App where they can be regularly updated. On the other side, the sales representatives should be well informed on the advantages of using the mobile application for receiving customer orders and interacting directly with customers using the developed App features. Once the sales representative knows the benefits of adopting the mobile application they can easily encourage the customers to adopt it.

In addition to the aforementioned actions, also the company should take seriously, the customer-ranking feature in the app and perform regular monthly rewards to the top-ranked buyers. This will encourage more customers to use the mobile application to make their orders. The developed mobile system could not be perfect as it is not easy to get everything covered for the first time, especially in software technology, it may need further study and evolve from time to time to incorporate more features. Some of the suggested features on further studies about the developed RahaSales mobile App are as follows:

- (i) Using the GPS locations collected from the customers. All customers can then be mapped on Google map for easy visualization of current customers and will help the company to determine where there is a gap in the market share and focus more in terms of advertisement and promotions.

- (ii) I recommend future studies on how machine learning may be used in conjunction with sales data analysis to automate reporting and anticipate market trends.

REFERENCES

- Adamashvili, N., & Fiore, M. (2017). Investigating the role of business marketing techniques in sales process. *European Journal of Management Issues*, 25(3–4), 12-25. <https://doi.org/10.15421/191717>
- Alambaigi, A., & Ahangari, I. (2016). Technology Acceptance Model (TAM) As a Predictor Model for Explaining Agricultural Experts Behavior in Acceptance of ICT. *International Journal of Agricultural Management and Development*, 6(2), 235-247.
- Aleryani, A. (2016). Comparative Study between Data Flow Diagram and Use Case Diagram. *International Journal of Scientific and Research Publications*, 6(3), 124–2250.
- Anderson, E., & Oliver, R. (1987). *Perspectives on Behavior-Based versus Outcome-Based Salesforce Control Systems*. 51(4),76-88. <https://doi.org/10.1177/002224298705100407>
- Andrei, B., CasuPop, A. C., Gheorghe, S. C., & Boiangiu, C. A. (2019). *A Study On Using Waterfall And Agile Methods In Software Project Management*. <https://www.google.com>
- citypopulation. (2020). *Tanzania: Regions and Cities United Republic of Tanzania*. <https://www.google.com>
- CollabNet VersionOne. (2020, May 28). *14th Annual State of Agile Report Shows 60% of Respondents have Increased Speed to Market and 55% are Planning to Implement Value Stream Management | CollabNet VersionOne*. <https://www.collab.net/news/press/14th-annual-state-agile-report-shows-60-respondents-have-increased-speed-market-and-55>
- Danziger, P. N. (2018, April 23). *Why Zara Succeeds: It Focuses on Pulling People in, Not Pushing Product Out*. Forbes. <https://www.forbes.com/sites/pamdanziger/2018/04/23/zaras-difference-pull-people-in-not-push-product-out/>
- Demir, S., & Pismek, N. (2018). *A Convergent Parallel Mixed-Methods Study of Controversial Issues in Social Studies Classes: A Clash of Ideologies*. <https://www.google.com>
- Desai, A., Subramanian, A., & Mital, A. (2014). *Assessing the Market Demand for the Product*. <https://doi.org/10.1016/B978-0-12-799945-6.00013-2>
- Duoyan, H. (2021). Research on ZARA Strategy from the Perspective of SWOT Analysis Method. *Advances in Social Science, Education and Humanities Research*, 543, 2352-5398.

- Ferdows, K. (2003). *The case describes how Zara, operating out of the Galician port of La Coruña in north-west Spain has managed to become a benchmark for speed and flexibility in the garment industry.* <https://www.google.com>
- Hariharan, S. (2017). *ZeroQ: Android mobile application. Presented to the Faculty of the Department of Computer Science California State University, Sacramento.* <https://www.google.com>
- Ibrahim, R. (2010). Formalization of the Data Flow Diagram Rules for Consistency Check. *International Journal of Software Engineering & Applications, 1(4), 95-111.*
- Ila, J. (2021). Zoho CRM Review: Is It Right for Your Business? *Fit Small Business.* <https://fitsmallbusiness.com/zoho-crm-review/>
- John, J. (2021). *Jiji Africa rebrands to focus on customer satisfaction and ease of online shopping.* <https://www.google.com>
- Johnston, M. (2021). *Smartphones Are Changing Advertising & Marketing.* Investopedia. <https://www.investopedia.com/articles/personal-finance/062315/how-smartphones-are-changing-advertising-marketing.asp>
- Kabir, S. M. (2016). Methods of data collection. <https://www.google.com>
- Khawas, C., & Shah, P. (2018). Application of Firebase in Android App Development-A Study. *International Journal of Computer Applications, 179, 49–53.* <https://doi.org/10.5120/ijca2018917200>
- Kikuu. (2018). KiKUU: Online Shopping in China, Delivery in Africa for Android. *KiKUU: Online Shopping in China, Delivery in Africa for Android.* https://download.cnet.com/KiKUU-Online-Shopping-in-China-Delivery-in-Africa/3000-2649_4-76462387.html
- Kobayashi, T. (2011). *Android Architecture: ELinux.org.* Android Architecture. https://elinux.org/Android_Architecture
- Kukhnavets, P. (2018). *Advantages and disadvantages of Extreme Programming (XP).* Hygger. <https://hygger.io/blog/disadvantages-and-advantages-of-extreme-programming/>
- Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems, 12(50), 752-780*

- Lockett, A. (2018). Online Marketing Strategies for Increasing Sales Revenues of Small Retail Businesses. *Walden Dissertations and Doctoral Studies*. <https://scholarworks.waldenu.edu/dissertations/5896>
- Okwara, C., & Ben, I. (2019). The Effect of Relationship Marketing on the Sales Performance of Firms in Imo State. *Journal of Business Administration Annals*, 7(3), 067-072
- Omona, J. (2013). Sampling in Qualitative Research: Improving the Quality of Research Outcomes in Higher Education. *Makerere Journal of Higher Education*, 4(2), 170-185.
- Pop, D. P., & Altar, S. A. (2014). Designing an MVC Model for Rapid Web Application Development. *Procedia Engineering*, 69, 1172-1179. <https://doi.org/10.1016/j.proeng.2014.03.106>
- Razali, F., Aziz, N., & Rasli, R. (2019). *Using Convergent Parallel Design Mixed Method to Assess the Usage of Multi-Touch Hand Gestures Towards Fine Motor Skills Among Pre-School Children*. <https://www.google>.
- RetailMeNot, R. (2015). *The Impact of Mobile Marketing on Retailer Sales, Effective mobile campaign strategies drive more sales online and in stores*. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjK_sv93K7sAhWHHRQKHcFKBDMQFjADegQIARAC&url=http%3A%2F%2Fwww.mmaglobal.com%2Ffiles%2Fcasestudies%2Frmn-wp-valueofmobilemarketing-web-101515.pdf&usg=AOvVaw1QqL7ffTDX-7vlaeK63rRd
- Sharma, S., Sarkar, D., & Gupta, D. (2012). Agile Processes and Methodologies: A Conceptual Study. *International Journal on Computer Science and Engineering*, 4(5), 892-898.
- Shibly, A. (2016). *Android Operating System: Architecture, Security Challenges and Solutions*. <https://doi.org/10.13140/RG.2.1.4966.3126>
- Shorten, A., & Smith, J. (2017). Mixed methods research: Expanding the evidence base. *Evidence-Based Nursing*, 20(3), 74–75. <https://doi.org/10.1136/eb-2017-102699>
- Singh, S. (2020). MVC Framework: A Modern Web Application Development Approach and Working. *International Research Journal of Engineering and Technology*, 07(01), 51-55.
- Smith, A. (2019). *Do those Retail Apps Increase Customer Engagement and Sales in All Channels? New Research Says 'Yes' on Both Sales and Returns*. <https://www.informs>.

org/ About- INFORMS/ News-Room/ Press-Releases/ Do-those-Retail-Apps-Increase-Customer-Engagement-and-Sales-in-All-Channels-New-Research-Says-Yes-on-Both-Sales- and>Returns.

Sommerville, I. (2011). *Software engineering 9th Edition*. <https://www.google.com>

Ström, R., Vendel, M., & Bredican, J. (2014). Mobile marketing: A literature review on its value for consumers and retailers. *Journal of Retailing and Consumer Services*, 21(6), 1001–1012. <https://doi.org/10.1016/j.jretconser.2013.12.003>

Suaib, M. (2014). Requirement Elicitation Technique: A Review Paper. *Journal of Advanced Research in Dynamical and Control Systems*, 11(12), 59-68

Sullivan, G. M., & Artino, A. R. (2013). Analyzing and Interpreting Data From Likert-Type Scales. *Journal of Graduate Medical Education*, 5(4), 541–542. <https://doi.org/10.4300/JGME-5-4-18>

Titova, A. (2016). *How a Mobile App Can Increase Your Sales*. <https://easternpeak.com/blog/how-to-increase-sales-with-mobile-app/>

Usmani, N., Farooqui, S., Ali, M., & Mahmood, W. (2017). *Benefits to Organizations after Migrating to Scrum*. In 29th International Business Information Management Association Conference. <https://www.google.com>

Van Casteren, W. (2017). *The Waterfall Model and the Agile Methodologies: A comparison by project characteristics - short*. <https://doi.org/10.13140/RG.2.2.10021.50403>

Weng, F. (2018). *A TAM-Based Study of the Attitude towards Use Intention of Multimedia among School Teachers*. <https://www.google.com>

Wesley, A. (2011). *Software engineering / Ian Sommerville: 9th ed*. <https://www.google.com>

Worldometer. (2020). *Tanzania Demographics*. <https://www.worldometers.info/world-population/tanzania-population/>

Young, D. (2013). *Software Development Methodologies*. <https://www.google.com>

Zallocco, R., Pullins, E., & Mallin, M. (2009). A re-examination of B2B sales performance. *Journal of Business & Industrial Marketing*, 24(8), 598–610. <https://doi.org/10.1108/08858620910999466>

APPENDICES

Appendix 1: Wholesalers' Data Collection Questionnaires from Field Surveys DODOSO KWA AJILI MFUMO WA KUAGIZA BIDHAA NA KUTUNZA TAKWIMU ZA MANUNUZI WA KAMPUNI YA VIVYAJI RAHA

Majina yangu ni **Samwel Katwale**, mwanafunzi ninaechukua shahada ya uzamili katika chuo kikuu cha **Nelson Mandela Institution of Science and Technology (NM-AIST)**. Ninafanya utafiti kuhusu utengenezaji wa mfumo ambao utamwezesha mteja kuagiza bidhaa, kufuatilia manunuzi yake na kuhifani kumbukuku ya manunuzi njia ya aplikesheni ya simu. Ili kufanikisha kutengeneza huo mfumo nimeandaa dodoso zitakazoniwezesha kung'amua mahitaji kutoka kwa watumiaji yatakayohitajika. Umuhimu wa majibu yako ni mkubwa kuwezesha utafiti huu, hautahusishwa moja kwa moja kutokana na majibu yako.

Nipende kukushukuru kwa ushirikiano na muda wako.

Tafadhali jaza alama ya vema (√) panapositahili.

1. Je, jinsia yako ni ipi?

Mwanamke

Mwanaume

2. Je, una umri gani?

Miaka 21 hadi 30

Miaka 31 hadi 40

Miaka 41 hadi 50

Miaka 51 na kuendelea

3. Huwa unatumia njia gani kununua bidhaa za kampuni ya Raha?

Nasubiri wanavyopitisha kila wiki

Huwa nawapigia simu

Huwa ninakwenda kiwandani

4. Ni changamoto gani unakumbananazo katika upatikanaji wa bidhaa za kampuni ya Raha?

Ucheleweshaji wa bidhaa

Soko kutoendana na upatikanaji wa bidhaa

Hakuna changamoto yoyote

Nyinginezo

5. Umeshawahi kutumia aplikesheni ya simu kununua ama kuagiza bidhaa?

Ndio

Hapana

Sina uhakika

Appendix 2: Wholesalers' Validation Questionnaires from Field Surveys
DODOSO KWA LENGO LA KUTHIBITISHA UTENDAJI WA MFUMO WA MAUZO
NA MATANGAZO WA KAMPUNI YA VIVYAJI YA RAHA

Majina yangu ni **Samwel Katwale**, mwanafunzi ninaechukua shahada ya uzamili katika chuo kikuu cha **Nelson Mandela Institution of Science and Technology (NM-AIST)**. Ninafanya utafiti kuhusu utengenezaji wa mfumo ambao utamwezesha mteja kuagiza bidhaa, kufuatilia manunuzi yake na kuhifani kumbukuku ya manunuzi njia ya aplikesheni ya simu. Lengo la dodoso hii ni kuthibitisha kutoka kwenye namna gani mmeuona utendaji wa mfumo.

Nashukuru kwa ushirikiano na muda wako.

Weka alama ya vema (✓) kwenye kisanduku kinachoonesha hali ya utendaji wa mfumo kutokana na maoni yako binafsi.

Swali	<i>5=Nimekubali Kabisa, 4=Nimekubali, 3=Sina uhakika, 2=Ninakataa, 1=Ninakataa Kabisa</i>				
	5	4	3	2	1
Matumizi ya mfumo yanaweza kurahisisha manunuzi na uagizaji wa bidhaa za kampuni ya Raha					
Nimeitumia hii aplikesheni bila kuhitaji msaada wa kitaalamu wa aina yoyote					
Naonelea kuwa itakuwa vizuri sana kutumia hii aplikesheni kutunza kumbukumbu za bidhaa zangu na kuwa na uhusiano wa karibu na kampuni					
Natarajia kuitumia hii aplikesheni pindi itakapokuwa tayari kwa matumizi rasimi					

Appendix 3: Sales Representative's validation Questinnares from field Surveys
DODOSO KWA LENGO LA KUTHIBITISHA UTENDAJI WA MFUMO WA MAUZO
NA MATANGAZO WA KAMPUNI YA VIVYAJI YA RAHA

Majina yangu ni **Samwel Katwale**, mwanafunzi ninaechukua shahada ya uzamili katika chuo kikuu cha **Nelson Mandela Institution of Science and Technology (NM-AIST)**. Ninafanya utafiti kuhusu utengenezaji wa mfumo ambao utamwezesha mteja kuagiza bidhaa, kufuatilia manunuzi yake na kuhifani kumbukuku ya manunuzi njia ya aplikesheni ya simu. Lengo la dodoso hii ni kuthibitisha kutoka kwenye namna gani mmeuona utendaji wa mfumo.

Nashukuru kwa ushirikiano na muda wako.

Weka alama ya vema (✓) kwenye kisanduku kinachoonesha hali ya utendaji wa mfumo kutokana na maoni yako binafsi.

Swali	<i>5=Nimekubali Sana, 4=Nimekubali, 3=Sina hakika, 2=Ninakataa, 1=Ninakataa mno</i>				
	5	4	3	2	1
Utumiaji wa mfumo wa aplikesheni utawezesha kuwafikia wateja haraka na kwa urahisi na vilevile kuboresha mahusiano na wateja					
Mfumo wa aplikesheni uliotengenezwa ni rahisi kutumia					
Nadhani ni vizuri zaidi kutumia mfumu ili kuwafikia wateja na kujua mahitaji yao					
Natarajia kuitumia hii aplikesheni pindi itakapokuwa tayari kwa matumizi rasimi					

Appendix 4: Sample Questions for Production Manager Interview

1. What is your opinion on the use of the sales and marketing mobile application for delivering products information and collecting purchase orders from the customers?

Appendix 5: Sample Questions for Sales Manager Interview

1. What features do you suggest for the mobile application?
2. There is any other application that you have used before?
3. How do you get the summary of total sales from the sales team?

Appendix 6: Sample Questions for Sales Representative Interview

1. What are your target customers?
2. How do you collect purchase orders and deliver the products?
3. What is the current mode of products delivered to the customers?
4. What features do you suggest for the mobile application?
5. Do you have a company logo?
6. What other additional feature would you like the mobile application to include?
7. What are your opinion/features that you can suggest for the proposed solution?

Appendix 7: Sample Questions for Wholesalers Interview

1. What are the challenges that you face in purchasing goods from Raha Beverages Company?
2. We suggest creating a mobile application that will help you place purchase orders that will ease the way you communicate with the seller, what features will you like to see from the mobile application?
3. Do you think the mobile application for ordering products from Raha Beverages Company will improve the business interaction?
4. What features do you think the mobile application should have to enable you to use it effectively?
5. What are the purposes that you want to achieve through this mobile application?

Appendix 8: The Mobile App Sample Codes

RegisterActivity.java

```
1  package com.raha.beverages.adverts.ui.activities.customer;
2
3  import androidx.appcompat.app.AppCompatActivity;
4
5  import android.content.Intent;
6  import android.os.Bundle;
7  import android.text.Editable;
8  import android.text.TextWatcher;
9  import android.util.Log;
10 import android.view.View;
11 import android.widget.EditText;
12 import android.widget.ProgressBar;
13 import android.widget.TextView;
14 import android.widget.Toast;
15
16 import com.android.volley.AuthFailureError;
17 import com.android.volley.Request;
18 import com.android.volley.Response;
19 import com.android.volley.VolleyError;
20 import com.android.volley.toolbox.StringRequest;
21 import com.raha.beverages.adverts.R;
22 import com.raha.beverages.adverts.singleton.LinkstoDatabase;
23 import com.raha.beverages.adverts.singleton.MySingleton;
24 import com.raha.beverages.adverts.singleton.SharedPrefManager;
25 import com.ybs.passwordstrengthmeter.PasswordStrength;
26
27 import org.json.JSONException;
28 import org.json.JSONObject;
29
30 import java.util.HashMap;
31 import java.util.Map;
32
33 import timber.log.Timber;
34
35 public class RegisterActivity extends AppCompatActivity
36 {
37
38
39
40     String email_phone,full_name, password;
41
42     EditText user_email, user_name,user_password;
43
44     ProgressBar loading;
45
46
47     @Override
48     protected void onCreate(Bundle savedInstanceState)
49     {
```

```

49     {
50         super.onCreate(savedInstanceState);
51         setContentView(R.layout.activity_register);
52
53         //Object linking with UI
54         user_email=findViewById(R.id.email_register);
55         user_name=findViewById(R.id.personName);
56         user_password=findViewById(R.id.password_register);
57         loading=findViewById(R.id.loadingBar);
58
59
60         //Calculating password strength
61
62         user_password.addTextChangedListener(new TextWatcher() {
63             @Override
64             public void beforeTextChanged(CharSequence s, int start, int count, int after) {
65
66             }
67
68             @Override
69             public void onTextChanged(CharSequence s, int start, int before, int count)
70             {
71                 updatePasswordStrengthView(s.toString());
72             }
73
74
75             @Override
76             public void afterTextChanged(Editable s) {
77
78             }
79         });
80
81
82
83     }
84
85     private void updatePasswordStrengthView(String password)
86     {
87
88         ProgressBar progressBar = (ProgressBar) findViewById(R.id.progressBar);
89         TextView strengthView = (TextView) findViewById(R.id.password_strength);
90         if (TextView.VISIBLE != strengthView.getVisibility())
91             return;
92
93         if (password.isEmpty()) {
94             strengthView.setText("");
95             progressBar.setProgress(0);
96             return;
97         }
98
99         PasswordStrength str = PasswordStrength.calculateStrength(password);
100        strengthView.setText(str.getText(this));

```

```

100     strengthView.setText(str.getText(this));
101     strengthView.setTextColor(str.getColor());
102
103     progressBar.getProgressDrawable().setColorFilter(str.getColor(), android.graphics.PorterDuff.Mode.SRC_IN);
104     if (str.getText(this).equals("Weak")) {
105         progressBar.setProgress(25);
106     } else if (str.getText(this).equals("Medium")) {
107         progressBar.setProgress(50);
108     } else if (str.getText(this).equals("Strong")) {
109         progressBar.setProgress(75);
110     } else {
111         progressBar.setProgress(100);
112     }
113 }
114
115 //Method to control buttons on click
116 public void clickedBtn(View view){
117     switch (view.getId()){
118         case R.id.login_link:
119             Intent loginIntent=new Intent(getApplicationContext(), LoginActivity.class);
120             startActivity(loginIntent);
121             break;
122
123         case R.id.login_google:
124             Intent googleIntent=new Intent(getApplicationContext(), GoogleTest.class);
125             startActivity(googleIntent);
126             break;
127
128         case R.id.register_btn:
129             full_name=user_name.getText().toString().trim();
130             email_phone=user_email.getText().toString().trim();
131             password=user_password.getText().toString().trim();
132
133             //Control user input and actions
134             if(email_phone.isEmpty()){
135                 user_email.setError("Fill email or Phone number");
136             }
137             else if(full_name.isEmpty()){
138                 user_name.setError("Fill full name");
139             }
140             else if(password.isEmpty()){
141                 user_password.setError("Fill password");
142             }
143             else if(password.length()<8){
144                 user_password.setError("Weak password");
145             }
146             else if(password.contains(".")||password.contains("_")||password.contains("/")||password.contains("*")||password.contains(",")){
147                 user_password.setError("., _ / * ) Not allowed");
148             }
149
150
151
152
153             else {
154                 loading.setVisibility(View.VISIBLE);
155                 user_email.setVisibility(View.GONE);
156                 user_name.setVisibility(View.GONE);
157                 user_password.setVisibility(View.GONE);
158                 //spinnerRoute.setVisibility(View.GONE);
159                 addUser();
160
161             }
162
163             break;
164         default:
165             break;
166
167     }
168 }
169
170 }
171
172 //method to add user in the database
173 private void addUser()
174 {
175     String url= LinksToDatabase.getInstance().addUserNormalUrl;
176     StringRequest stringRequest=new StringRequest(Request.Method.POST, url, new Response.Listener<String>() {
177         @Override
178         public void onResponse(String response) {
179             try {
180                 JSONObject obj=new JSONObject(response);
181                 String success=obj.getString("success");
182
183                 switch (success) {
184                     case "1":
185                         Log.d("Register success", "onResponse: Registering");
186                         loading.setVisibility(View.GONE);
187                         SharedPreferences.getInstance(getApplicationContext()).userLogin(String.valueOf(obj.getInt("id")),
188                             obj.getString("name"),
189                             obj.getString("email_phone"),
190                             String.valueOf(obj.getInt("role")))
191                         );
192                         Intent intentHome = new Intent(getApplicationContext(), HomeActivity.class);
193                         startActivity(intentHome);
194                         finish();
195                         break;
196                     case "0":
197                         Timber.d("onResponse: Registering");
198                         Toast.makeText(RegisterActivity.this, "Network Error, Please try to login", Toast.LENGTH_LONG).show();
199
200
201

```

```

201         Toast.makeText(RegisterActivity.this, "Network Error, Please try to login", Toast.LENGTH_LONG).show();
202         startActivity(new Intent(getApplicationContext(), LoginActivity.class));
203         finish();
204         break;
205     case "2":
206         Timber.d("onResponse: Registering");
207         Toast.makeText(RegisterActivity.this, "Account already exists!", Toast.LENGTH_LONG).show();
208         user_email.setVisibility(View.VISIBLE);
209         user_name.setVisibility(View.VISIBLE);
210         user_password.setVisibility(View.VISIBLE);
211         loading.setVisibility(View.GONE);
212         // spinnerRoute.setVisibility(View.VISIBLE);
213         break;
214     case "3":
215         Timber.d("onResponse: Registering");
216
217         Toast.makeText(RegisterActivity.this, "Invalid email or phone number", Toast.LENGTH_LONG).show();
218         user_email.setError("Invalid email or phone number");
219         user_email.setVisibility(View.VISIBLE);
220         user_name.setVisibility(View.VISIBLE);
221         user_password.setVisibility(View.VISIBLE);
222         //spinnerRoute.setVisibility(View.VISIBLE);
223         loading.setVisibility(View.GONE);
224         break;
225     default:
226         Timber.d("onResponse: Registering");
227         loading.setVisibility(View.GONE);
228         user_email.setVisibility(View.VISIBLE);
229         user_name.setVisibility(View.VISIBLE);
230         user_password.setVisibility(View.VISIBLE);
231         // spinnerRoute.setVisibility(View.VISIBLE);
232         break;
233     }
234
235     } catch (JSONException e)
236     {
237         {
238             e.printStackTrace();
239         }
240
241     }
242
243     }, error -> {
244         if(error instanceof com.android.volley.NoConnectionError){
245             Toast.makeText(RegisterActivity.this, "Connections Error", Toast.LENGTH_LONG).show();
246         }
247         loading.setVisibility(View.GONE);
248         user_email.setVisibility(View.VISIBLE);
249         user_name.setVisibility(View.VISIBLE);
250         user_password.setVisibility(View.VISIBLE);
251
252     }}
253
254     @Override
255     protected Map<String, String> getParams() throws AuthFailureError
256     {
257         Map<String,String> params=new HashMap<String, String>();
258         params.put("a_email",email_phone);
259         params.put("a_name",full_name);
260         params.put("a_password",password);
261         return params;
262     }
263
264     };
265     MySingleton.getInstance(getApplicationContext()).addToRequestQueue(stringRequest);
266 }
267
268
269
270 }

```

register.php

```
63 1 <?php
64 2 // Create connection
65 3 require_once 'connection.php';
66 4
67 5
68 6     $email_id=$_POST["a_email"];
69 7     $name=$_POST["a_name"];
70 8     $password=$_POST["a_password"];
71 9
72 10     $password = password_hash($password,PASSWORD_DEFAULT);
73 11
74 12 $query="INSERT INTO users(email_phone_id,full_name,password)
75 13 values('$email_id','$name','$password');";
76 14
77 15     $sql="SELECT users.*, users_role.role_id AS role FROM users
78 16     INNER JOIN users_role ON(users.user_id=users_role.user_id) WHERE
79 17     email_phone_id='$email_phone'";
80 18     $result=array();
81 19
82 20     $response=$conn->query($sql);
83 21
84 22     $email_id = filter_var($email_id, FILTER_SANITIZE_EMAIL);
85 23     $name = filter_var($name, FILTER_SANITIZE_STRING);
86 24
87 25
88 26     if ($response->num_rows > 0)
89 27     {
90 28         $result['success'] = "2";
91 29     }
92 30
93 31
94 32 else if(!validate_phone($email_id)&&!validate_email($email_id))
95 33 {
96 34     $result['success'] = "3";
97 35 }
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