

HYBRID APPLICATION FOR UNIVERSAL LOYALTY SYSTEM IN CONSUMER AND BRAND LOYALTY MANAGEMENT

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Declaration

I declare that this work has not been previously submitted and approved for the award of a bachelor's degree by this or any other university. To the best of my knowledge and belief, the proposal contains no material previously published or written by another person except where due reference is made in the documentation itself.

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Abstract

Loyalty being a particularistic virtue is used in customer relationship management initiatives as a basis for customer retention strategies. Evolvement of loyalty programs over the century has led to an increase of niche strategies that businesses tailor to best fit their end goal- profit. This is both a positive and negative influence on brand and consumer loyalty. In the long run, consumers are enrolled into endless customer loyalty programs by businesses and tend to forget about the existence of most of these programs due to mismanagement and/or lack of interest. It is a nuisance to customers to keep track of all these loyalty programs. On the other hand, the businesses struggle with liabilities and operational costs for management of loyalty programs.

The solution is a universal hybrid loyalty program that aims at increasing customer retention rates by use of a standardized loyalty program tailored objectively to meet business needs. The project applied Object-Oriented Analysis and Design (OOAD) for the design of the system diagrams because it models the system as a group of objects to identify the functional requirements of the system. The system development methodology used is Hybrid development methodology which is a combination of both waterfall and agile development methodologies. This is due to its utilization of the work breakdown structure that is both detailed and fast development strategy.

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List of Abbreviations

API- Application Program Interface

CBC- Customer Brand Commitment

CBA- Customer Brand Acceptance

CBB- Customer Brand Buying

EMV- Europay Mastercard Visa

FAQ- Frequently Asked Question

HTML- Hypertext Markup Language

HTTPS- Hypertext Transfer Protocol Secure

iOS- iPhone Operating System

JS- JavaScript

NFC- Near field communication

OOAD- Object Oriented Analysis and Design

PDF- Printer Definition File

POS- Point of Sale

QR- Quick Response

RFID- Radio Frequency Identification

RWRD- Reward

SD- Secure Digital

SDK- Software Development Kit

SMS- Short message service

UI- User Interface

WBS- Work Breakdown Structure

Chapter One: Introduction

1.1. Background

Loyalty is often deemed as a particularistic virtue which is constituted centrally by perseverance in an association such as in organizations which seek to encourage it as an aspect of affiliation or membership (Kleinig, 2017).

Loyalty programs used by merchants have been redesigned since it came into existence in the 18th century. The first kind of loyalty involved merchants rewarding customers with copper tokens to be redeemed in their future purchases (Ta-Yao, 2018). Presently, retailers have sought more modern ways of rewarding their customers. Most retailers have turned to technology to help them with their loyalty programs. Such include airlines awarding mileage points to travellers when they fly using their airlines, supermarkets award their customers based on their purchase value, fuelling stations as well award customers based on their fuel consumption, thus the more products or services purchased, the more points earned.

Customer loyalty programs are tactics for customer relationship management. The end goal is to increment sales revenues and by developing a closer bond between the brand and current customers in faith to maintain the existing customer base (Uncles et al., 2003). Most retailers offer loyalty programs to their customers and end up losing customers as members forget to be enrolled in any of their brand's loyalty programs (Burkard, 2019).

Most retailers have created loyalty programs but are not fully functional as consumers enroll to their loyalty programs, but are hardly active members who earns and redeems at minimal once a year (Hörold, n.d.). With 61.08% of consumers being loyal to 1-5 brands, 26.19% to 6-10 brands and 5.68% to 11-20 brands, the redemption rate is lower thus affecting brands (Autry, n.d.).

Researchers have proven that participants in a loyalty program have a higher share of purchase in the brand rather than non-participants (Ning et al., 2010). Therefore, with nearly 85 percent of consumers subscribing to more than one loyalty programs, with the average consumer involved in nearly 30, the goal is to increase the customer share wallet by engaging them in the loyalty program and encouraging active participation (Rewards, 2018).

Most households have more than one loyalty cards. Nonetheless, customers do not take an interest in all the loyalty programs that they in any case would if joining and maintaining a loyalty program account were simpler. A study found that most people feel loyalty programs have become excessively problematic and demanding and not truly driving loyalty. According

to the study, almost half of loyalty program members never or seldom exploit the benefits of loyalty programs when making purchases online. Likewise, members of loyalty programs express that simple online access to their loyalty program membership would make them bound to shop at retail sites that honor their loyalty programs online. Furthermore, when online shopping, just a small percentage of loyalty program members visit sites of retailers where discounts, coupons or rewards can be gained before searching on other sites. These facts illustrate that current loyalty systems are not meeting their potential due to the aforementioned inconveniences (Kenamer & Hauck, 2013).

1.2.Problem Statement

Consumers are engulfed by endless customer loyalty programs by merchants who tend to change redemption values and exclusion. On the other hand, the merchants struggle with liabilities, operational costs especially for unredeemed points, system inefficiencies and overall, the overhead for management of loyalty systems (M. Agrawal et al., 2019). Challenges consumers facing in current loyalty systems include the numerous loyalty cards they are engulfed in. Moreover, consumers are customarily required to sign up and recall unique log in credentials for each loyalty system that individual retailers provide applications/systems for and thus cause customers to refrain from signing up to loyalty programs (Kenamer & Hauck, 2013).

1.3.Aim

The aim of the project was to develop a universal loyalty system that solves the problem identified in the problem statement. This is done by providing consumers a hybrid application to manage their loyalty programs and improve the relationship between consumers and brands.

1.4.Objectives

- i. To investigate the basic operations of a loyalty system.
- ii. To review existing loyalty systems.
- iii. To design a loyalty system that can be integrated across different business operations.
- iv. To develop a hybrid loyalty application.
- v. To test the developed universal loyalty system.

1.5.Justification

Consumers and brands stand to benefit from this project as brands will maximize on customers' benefit and have a higher 'share-of-wallet' while consumers will enjoy the ease of management of the numerous loyalty programs they have subscribed to.

1.6.Scope and Limitations

The project will cover all the mentioned objectives. The project intended to be capable of registering both brands and consumers, analyse data collected and generate reports based on the same.

This project was limited to electronic devices only, thus users are expected to own a mobile phone or tablet. Brands are required to register before a user can register for the brands loyalty program on the application.

Chapter Two: Literature Review

2.1. Introduction

This chapter reviews existing literature on loyalty systems used in various industries, analyses and critiques them. It aims to identify the gaps between these loyalty systems and depict existing technologies that will in turn fill the gaps.

2.2. Basic Operations of Loyalty Systems

Loyalty programs are structured marketing efforts compensating a consumer for loyal buying behavior. By introducing a proof of membership in the loyalty program at a point of sale, the buyer is qualified for a rebate on the current purchase or to a quota of points that can be utilized for a rebate on a future purchase. This encourages consumers to purchase at retailer stores of the loyalty program and in turn the retailer benefits from the buying behavior at least as source of market research and client growth (Shvarts, 2014).

Loyalty programs reward their members using real-time POS at retail outlets for goods and services. The online channels permit customers to reclaim their points within a range of products or services in a redemption catalog. Mobile banking channels allow redemptions based on contactless transactions and various mobile-based applications (Yadav, 2012). Technological advancements have led to the evolution of loyalty systems. Such technologies include use of wireless devices to administer loyalty points. This is done by use of online and real-time technologies such as radio frequency identification (RFID), near field communication (NFC), and real-time point-of-sale (POS). In addition, contactless mobile payments have evolved since adoption of smartphones based on NFC and microSD card technology, and smartphone applications that allow transactions. Dual interface EMV cards provide an ease of use to customers at any retail outlet as it supports both contact and contactless transactions thus providing a universal acceptance of cards (Yadav, 2012).

Loyalty systems that are incorporated with financial infrastructure are provided to consumers such that these infrastructures can sustain transactions for members in loyalty programs. At the point of payment at POS terminal, the transaction between seller and buyer is intercepted using a loyalty switch which determines whether either party are participants in the loyalty program. The switch transmits the transaction commands to the financial infrastructure for authorization. Once approved, the switch executes a loyalty procedure that sustain the principles of the loyalty program (George & Cawthorne, 2009).

Information about the loyalty programs such as points awarded, redemption catalogues and discount rates are stored and executed remotely by the loyalty host instead of integrating it as

a function of a loyalty device. In instances of redemption of points at a POS terminal, the transmission of transaction information to the seller is accompanied with instructions for administering the rewards. The transaction is terminated if no authorization is received (George & Cawthorne, 2009).

Loyalty program providers maintain a loyalty system that incorporates a loyalty card account that has a unique identifier and points associated with it. The unique identifier is used to access a database that maintains the accumulated points, discount rates, redemption points and voucher information (Antonucci & Voltmer, 2013).

2.2.1. Challenges faced in current loyalty programs

2.2.1.1. Consumers' perspective.

The challenges faced by consumers in loyalty programs include the hectic registration process which is at times discouraging as some businesses require the customer to pay for initial contributions which may be inconveniencing to them (D. Agrawal et al., n.d.). Consumers also tend to sign up for more than necessary loyalty programs and end up ignoring the rewards or points earned. Moreover, most companies do not provide an extensive redemption catalog thus points gathered are rendered wasteful and companies may as well decide to devalue the points at their own disposal (M. Agrawal et al., 2019). Also, companies tend to tie the points to an expiration date which is inconveniencing to customers as products on redemption catalog may be unworthy to them. Consumers are often surprised with rules and changes to the loyalty programs made without informing them during the registration process (D. Agrawal et al., n.d.).

Consumers are sought after by retailers to join their exclusive loyalty programs. Most are reluctant due to the need to maintain separate accounts or own separate cards for each lone loyalty program. The programs may as well necessitate that any redemption of points earned to be done at a single retailer/ merchant or a limited group of merchants and thereby limiting the services or goods within a redemption catalog (Toumayan et al., 2014). It is burdensome for consumers to carry multiple cards for each loyalty program that they take interest in (Hoppe, 2012).

2.2.1.2. Companies' perspective.

The challenges faced by companies include lack of uniformity for reward and redemption preferences as it is hard to control and estimate liabilities in regards to redemption of points (D. Agrawal et al., n.d.). In addition, it is difficult to personalize loyalty programs tailored to meet the individual customer needs as most approaches fail and a lack of integration technology being utilized when running these programs (D. Agrawal et al., n.d.).

Most loyalty programs do not provide a sufficient system that the points earned are utilized. Regularly, members of these loyalty programs permits some discounts to lapse by without fulfillment of the prerequisites of the loyalty program (Shvarts, 2014). Production of loyalty cards are expensive to produce and waste of resources because each retailer develops their own (Hoppe, 2012).

2.3. Review of Existing Loyalty Systems

2.3.1. SkyMiles by Delta Airlines

This is a loyalty program offered by Delta Airlines for frequent travellers. A customer earns points or in this case ‘miles’ by travelling by air using Delta Airlines or purchasing goods on selected duty-free stores and partnered airlines, delta vacation package and shops. Once you have registered, you get to earn points by entering your SkyMiles number when booking flights with Delta Airlines or partnered airlines. The points earned do not expire and can be redeemed for upgrades in flights or book vacation destinations within the Delta Vacation package and still earn when you do that. In addition, you can bid for exclusive event seats such as a meet and greet with a celebrity, subscribe to magazine editions using SkyMiles, donate and experience the full SkyMiles marketplace (*SkyMiles® Loyalty Program : Delta Air Lines, 2020*).

2.3.2. Shell Club by Vivo Energy/ Shell petrol stations

This is a loyalty program offered by Vivo Energy to motorists in various countries that the business exists in, including Kenya. Customer must visit Shell petrol station to be registered and start earning points every time they spend on Shell fuels, Shell lubricants, Afrigas cooking gas and shop items at Shell and redeem them for exciting rewards. The redemption catalogue is a seasonal partnership-based awards for its consumers. It does not include services and products that they provide but instead forces the customer to redeem points from the partnered brands (*Shell Club, n.d.*).

2.3.3. Naivas Reward Card by Naivas supermarket

This is a loyalty program offered by the chain store Naivas supermarket to its customers. Its registration is done at any Naivas branch near you. Points are earned with every Ksh.100/= spent on goods sold and can be redeemed for more goods in any Naivas branch. It does not provide a system for customers to know how many points have been earned (Gamonde, 2019).

2.3.4. Rewards.com

This is a proposed blockchain based loyalty program that involves various merchants and connecting them to customers. The customers in turn earn 'RWRD' tokens which is a cryptocurrency that can be redeemed at any of the partnered companies or traded for cash. While using this blockchain technology, RWRD tokens do not disappear when redeemed thus do not expire. Once RWRD tokens are redeemed, Rewards.com converts the token value into fiat to pay the sponsoring program or merchant. In turn, Rewards.com re-issues the redeemed tokens to consumers in conjunction with new consumer earnings for purchases, contests, and surveys. In this case, RWRD tokens remain in circulation through the continuous and infinite earnings and redemption cycle (Rewards, 2018).

2.3.5. Rakuten Points Program

This is a loyalty program provided by Rakuten online shopping platform that is based in Japan. Customers can apply for Rakuten Points on the order "Payment" page of the Rakuten checkout process to start earning points and mature after a day. The mature points can be redeemed but have an expiration date. They provide Standard Rakuten Points which are earned when making regular purchases on Rakuten and Promotional Rakuten Points which are awarded when purchasing using special Rakuten Points promotional code. Standard Rakuten Points expire 1 (one) a year after the Rakuten Points become available to use. If customer makes a purchase within that period, all unused Standard Rakuten Points are renewed for another 1 (one) year from when their new order ships. Promotional Rakuten Points expires in accordance with the promotion's terms and conditions and do not renew because of subsequent purchases. Customers earn 1 standard Rakuten Points for each \$1 spent on any item (excluding shipping fees, tax, and any other fees associated with your order) and are not available for guest checkout (Susan, 2020).

2.3.6. Shukran Card by Landmark Group

Shukran is an award-winning retail loyalty programme in the Middle East. It involves over ten million users and fifty-seven brands in the United Arab Emirates. It is tailored to provide a unique and rewarding shopping experience for customers. The application is available on the web and as mobile applications. Members procure Shukrans on their purchases and spend them for instant savings on everything the group's various brands offer, including clothing, footwear, accessories, salons and spas, home furnishings, electronics, sports, entertainment, and restaurants (*Shukran / Landmark Group, 2020*).

2.4. Gaps Identified

The gaps identified include lack of a diverse redemption catalogue, lack of system to show points earned and lack of unified platform to support all these customer relationship management tactics.

Most of these loyalty systems are limited geographically such that they are not available in Kenya. Shukran loyalty system is the closest integration of a unified system has been done with the limitation that it is only available in the UAE only (*Shukran / Landmark Group, 2020*).

Redemption catalogues are necessary in a loyalty system to provide customers with a range of products and/or services to redeem their points on. With lack of a diverse redemption catalogues, customers are discouraged from signing up to loyalty programs as they deem it unworthy. Often customers are required to use a particular payment method when shopping in order to earn rewards and are required to redeem the earned points at a single retail or limited group of retail stores (Toumayan et al., 2014). An example is the shell loyalty club.

The existing loyalty programs in Kenya such as the Naivas reward card do not provide a system for customers to manage their loyalty points. Customers have no access to accumulated points total and managing it thus seems impossible (Ciccarone et al., 2017).

2.5. Conceptual Framework

The project creates a universal hybrid application that creates users and manages all redemption catalogues, enables users to earn and redeem points.

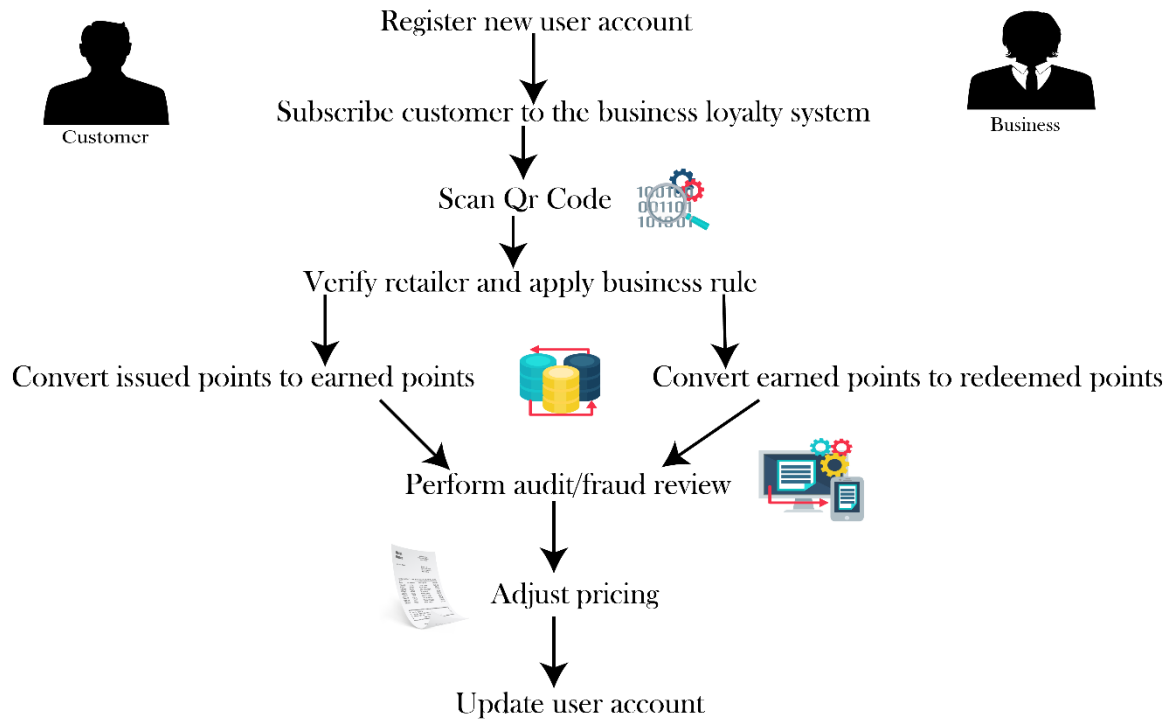


Figure 2.1 Universal Loyalty Program Conceptual Framework

Chapter Three: System Development Methodology

3.1. Introduction

System Development Methodology is a series of steps comprising a unified strategy for computer-based information system development that includes a flexible framework of the development tasks sequencing along with the techniques used to accomplish them (Roberts et al., 1998). The system development methodology used is Hybrid Development which is a combination of both agile and waterfall development methodology.

3.2. Hybrid Development Methodology

Hybrid Development Methodology joins waterfall and agile methods to create a new project development strategy. Hybrid utilizes the exhaustiveness of work breakdown structure (WBS) with speed and lean benefits of agile for a new project development strategy which is both detailed and fast (Binfire, n.d.).

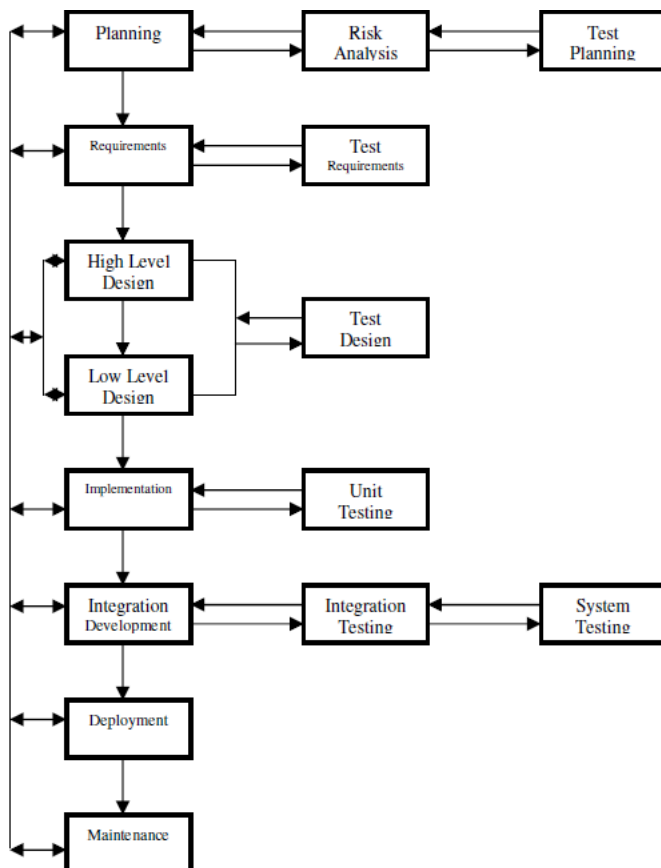


Figure 3.1 Hybrid Model (Munassar & Govardhan, n.d.)

3.2.1. Planning

In this phase, outlining of resources and schedules to better understand the business environment of the system was carried out. Review of business strategies and rules to find common ground for the system development. It involved devising of necessary tasks to characterize the resources and timelines and planning for system development processes and data required for the design of the system. In this case it was a necessity to determine the access levels for users of the loyalty system and the data they would view. Also, the method of transfer of data from POS terminals to the loyalty system during checkout by customers in retail stores is determined.

3.2.2. Requirements

In this phase, outlining of resources, data type processed, access of data, intended use of a system and how software handles the data was determined. These requirements are pondered on before being segregated into system. The type of requirements that were determined in this phase include abstract functional requirements which actuated functionalities of the loyalty system in idealistic methods, system properties/nonfunctional requirements and undesirable characteristics which were unacceptable system behaviours. These requirements characterized and actuated the overall organization objectives of the system; functional and organizational objectives of the retailers that intended to use the loyalty system.

3.2.3. Design

The requirements gathered were incorporated into the system and high-end functions constructed as the requirements were interpreted into practical and working designs. In this phase, the system prerequisites were transformed to software representations. Production of meta-data and data dictionaries, logical diagrams, data-flow diagrams which were used to represent the flow of data in the loyalty system are shown. This involved implementing the business rules and transactional requirements from the retail stores and organizations into the development of the system. Incorporation of the organizational requirements with real time updates on the customer accounts on the transactions made at the POS terminals were represented.

3.2.4. Implementation and Testing

Results of the design phase were translated into code. This was written in the programming language determined during the planning phase. The developed system was tested to detect

errors and confirm that it meets the user requirements. Any errors discovered were then corrected before determining the appropriateness of the system.

3.2.5. Integration Development

This phase determined whether the system fulfilled all the system requirements and its integration on various system environments. The different components of the loyalty system completed each other and ran smoothly without any errors.

3.2.5. Deployment

After a successful testing and evaluation, the loyalty system will be deployed and released to the user.

3.2.6. Review and Maintenance

Once the loyalty system has been released into the market, maintenance is done for the initial customer base. This is necessary to eliminate errors that may have not been detected during the testing stage and to factor all variations in the working environs of the retailers and organizations using the loyalty system.

3.3. Analysis

Software requirements analysis involved a set of investigations and appraisals that decipher stakeholder needs and software requirements to appreciate the ramifications of every necessity on the extent of the development exertion (Schmidt, 2013). The project applied an Object-Oriented Analysis and Design (OOAD) on the grounds that it frames the system as a group of objects to distinguish the functional requirements of the system. It involved defining the objects, determining their attributes and relationships that exist amongst them. Plotting of real-world entities as objects improved the comprehension of the system design.

Below are the functional and nonfunctional requirements of the system.

3.3.1. Functional Requirements

Authentication- The system verifies access credentials from users during log in especially on different devices.

Reporting- The system appropriateness is measured on its capabilities to generate correct and timely reports based on transactional information in an organized format for the users of the loyalty system.

Business rules- The system accommodates different business rules such as each business owner can set their own discount rates, redemption catalogs and duration of redemption values.

Historical data- Access to data collected over a period about past events and transactions by customers in loyalty system is available at request.

Transaction correction, adjustments, and cancellation- The system monitors and correctly update all user account transactions timely and capture all business rules based on any transaction made.

3.3.2. Nonfunctional Requirements

Performance and scalability – This determined how quick the system responded to certain users' actions under certain workload and assessed the highest workloads under which the system still met the performance requirements.

Portability and compatibility- Measured the ability of system to launch on various operating systems and its coexistence with other systems within the same environment.

Reliability, availability, maintainability- Reliability specified how likely the system ran without a failure for a given period under predefined conditions. Availability portrayed how likely the system was accessible for a user at a given point in time. Maintainability defined the time required for a solution to be provided.

Security- Portrayed the safety of user data on the system against malware attacks and unauthorized access.

Localization- Described how well the system falls in accordance with the setting of the market-to-be.

Usability- This portrayed the ease of use of the system and satisfaction users get.

3.4. List of design diagrams

3.4.1. Use Case diagrams

This was utilized to show various ways the system user can interact with different modules of the system. This diagram demonstrated interactions between the user and the loyalty system, business and the system, business and user, system and POS terminals.

3.4.2. Class diagrams

It was used to model classes, attributes, operations, and relationships between objects within the system structure. Such objects included the users and business rules implicated on the loyalty system.

3.4.3. Sequence diagrams

This is an interaction diagram as it represented the relationship between various objects and how they function together. This was used to model the rationale behind the development of the system itself. This represented interactions between the users and system in time sequence such as the process of signing up to the point of transaction during checkout at a business.

3.4.4. Database schema

This was used to model the logic and appearance of the database. It showed the relationship between various components of a relational database and interaction of data provided from these components are used amongst each other. This was a representation of tables and their attributes in the database. These tables included customer, vendor/retailer, transaction, and redemption catalogs.

3.4.5. GUI design of forms and design

This was used to develop the user interface. It involved using user-friendly tools to create reports and forms for both output and input. Within the loyalty system, login forms were used to render data to servers to authenticate credentials and any checkout process.

3.5. List of development tools and techniques

3.5.1. Ionic React framework

Ionic React is an open-source UI and Native API project comprising of cross-platform UI components and native functionality for building iOS, Android, Electron and Progressive Web Apps using React and standard web technology.

3.5.2. Capacitor

Capacitor is an open source project that runs modern Web Apps natively on iOS, Android, Electron, and Web (using Progressive Web App technology) while providing a powerful and easy-to-use interface for accessing Native SDKs and Native APIs on each platform.

3.5.3. Firebase

Firebase Cloud Functions is a serverless framework that enables automatic backend code in response to events triggered by Firebase features and HTTPS requests. JavaScript or TypeScript code is stored in Google's cloud and runs in a managed environment.

3.5.4. QR Scanner

A fast, energy efficient, highly configurable QR code scanner for ionic applications.

3.5.5. JavaScript, Typescript, HTML, CSS

JavaScript (JS) is a lightweight, interpreted, and compiled scripting language web pages. It is a prototype-based, multi-paradigm, single-threaded, dynamic language, supporting object-oriented, imperative, and declarative styles. HTML is the standard mark-up language for

documents designed to be displayed in a web browser. Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a mark-up language like HTML.

3.5.6. Firebase Authenticate

Firebase Authentication provides backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate users to app. It supports authentication using passwords, phone numbers, popular federated identity providers like Google, Facebook, and Twitter.

3.6. Method to be used to test the system

The system was tested based on the functional and nonfunctional requirements.

The functional testing included:

- i. System testing- this involved testing of all modules to determine that they met the specified functions they intended to perform and how they work together to make the whole system. This was performed by the developer to detect bugs and fix them.
- ii. Acceptance testing- this was performed by the user to determine that the system met the specified requirements.
- iii. Unit testing- this involved testing individual components of the system to ensure that each component functions correctly.

The nonfunctional testing will involve:

- i. Usability testing- the user interacted with the system and determined whether it is user friendly or not.
- ii. Compatibility testing- the system was tested on various browsers to determine that it supports most browsers and works as expected across various platforms.
- iii. Security testing- this was carried out to determine confidentiality of user information and that unauthorized access was prevented. This was done by trying to enter user accounts by testing the password strength and code available.
- iv. Integration testing- The performance of the system is checked when all modules are integrated together. This was to make sure that all modules were operating correctly, and all functions were working as expected. All modules were expected to be able to interact with each other with no errors.
- v. System testing- The intent of this step was to verify whether the systems functional requirements were met or not. This was to be done through a *usability test* to measure the user friendliness of the system when interacting with it based on human computer

interaction. Secondly, a *compatibility test* to compare the system functioning on different browsers and devices. Lastly, *acceptance testing* to verify that the system met the user requirements and satisfied their needs. This was to be done through provision of a beta version to some selected users and use their feedback to improve the system before fully launching the system.

- vi. Environmental needs- The system required that the user had good internet connection, a compatible browser and an electronic device that provided access to the internet.

3.7. Domain of Execution

The system is a hybrid application because it required the device hardware features and was to be displayed as a web page. This was to also operate on different operating systems and it thus easier to launch patches and updates.

3.8. Proposed modules and System Architecture

3.8.1. Administrator Module

1. Sign In/Up module- Access level authentication module.
2. Membership- This module lets the administrator create a new customer to the loyalty program.
3. Campaign Management- Administrator sets redemption catalogue products/services and sets discount rates.
4. Reports- This module generates and renders statistical reports based on transactions.
5. Member panel- Lists all users subscribed to the business' loyalty system.
6. Business Rules module- this module contains the promotion rules and all other rules specific to the business.
7. Product catalogue module- Lists the type and percentage of redemption rate based on campaign management.

3.8.2. Customer module

1. Sign In/Up module- Access level authentication module.
2. Redemption Catalogue- List of products/services offered in the redemption catalogue based on the business and vouchers/coupons available.
3. User profile- Module contains all user information.
4. Subscription module- Lists all businesses user has signed up for their loyalty program.
5. E-statement- Provides transaction statements per business subscribed to.

Chapter Four: System Analysis and Design

4.1. Introduction

System analysis is an examination of an identified problem by collecting and interpreting facts gathered. This is for identifying system objectives and its basic functionalities. On the other hand, system design refers to the construction of a computer-based solution as per requirements gathered from the analysis stage. Its focus is on achieving the system objectives set (tutorialspoint.com, n.d.).

4.2. System Analysis

4.2.1. Functional Requirements

These are the description of the expected system services from the loyalty hybrid application.

Table 0.1 Functional requirements

Requirements ID	Requirements Category	Requirements description
FRQ1	Functional	The system provides a user-friendly interface that enables users to navigate between several menus/ pages easily
FRQ2	Functional	The system provides basic storage of standard user information in a database.
FRQ3	Functional	The system authenticates functionalities based on role for editing and posting records.
FRQ4	Functional	The system actively plays its main function of awarding and redeeming points.
FRQ5	Functional	The system should be capable of authenticating user sessions by allowing users to create accounts and login successfully.

4.2.2. Non- functional requirements

These describe the system attributes and how it functions serving as constraints to the system development.

Table 0.2 Non-functional requirements

Requirement Id	Requirement category	Requirement description
URQ1	Usability	User content ought to be secured and authenticated before logging in.
RRQ1	Reliability	Stable system performance during its uptime and downtime.
SRQ1	System	The system ought be scalable and able to handle many users.
URQ2	Usability	End user satisfaction and acceptance.
SRQ2	System	The system needs to be reliable in terms of rendering the expected modules and be readily available
SRQ3	System	The system ought to be easily maintained and updated.
CRQ1	Compatibility	System runs on supported browsers and devices.
IRQ1	Integration	System response time is quick during processing.

4.3. System Design

4.3.1. Use Case Diagram

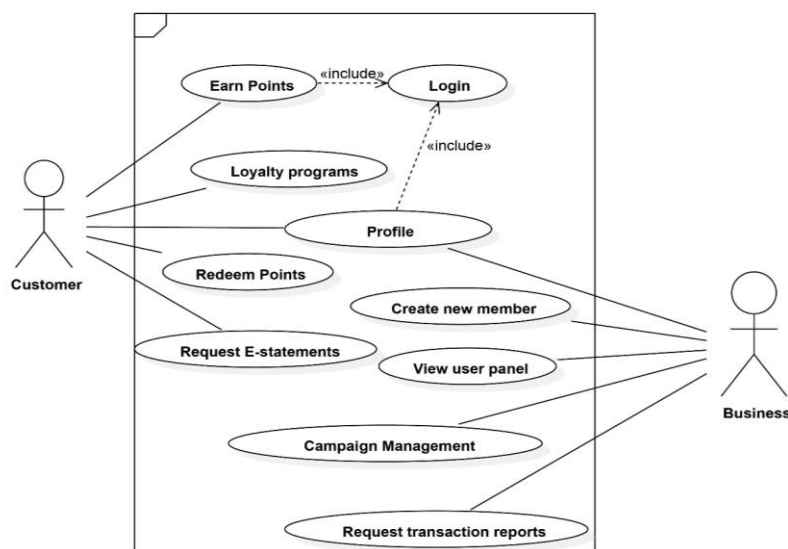


Figure 4.1 Use Case Diagram

4.3.4. Database Schema

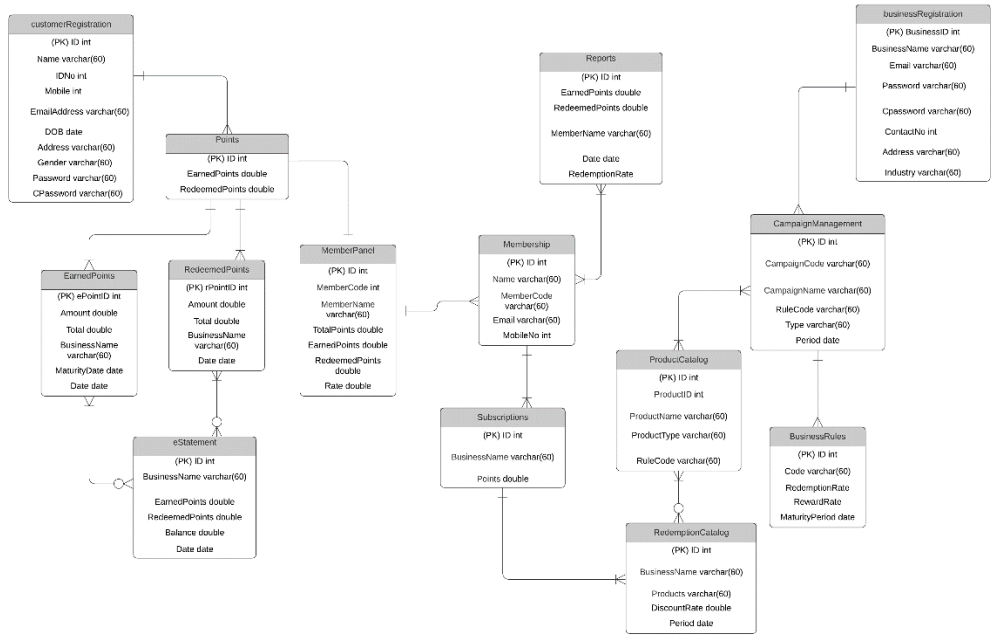


Figure 4.4 Database Schema

4.3.5. GUI design of forms and reports

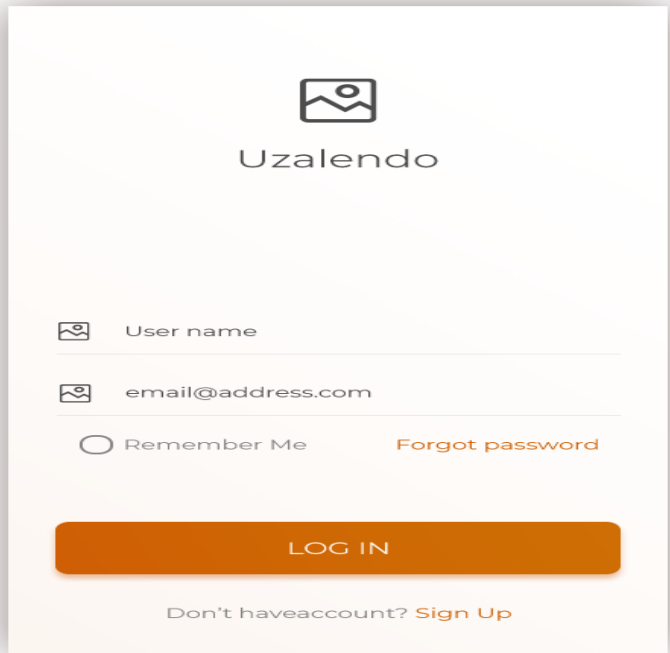


Figure 4.5 GUI Form and design

4.4. System Architecture and Design

The system implemented the MVC- Model View Controller architecture for easier and better maintainability and scalability. This was because the size of a web system tends to increase over time. In addition, most web frameworks provide MVC architecture which is easier for adoption and maintenance.(Al-Brashdi, n.d.)

Chapter Five: System Implementation and Testing

5.1. Introduction

This chapter focuses on describing how the system was developed, the back end and the front-end logic of the loyalty system. In addition to that, it provides a description of how the system was tested to ensure that it fulfilled specified requirements with the aim of achieving the general objective.

5.2. Implementation

A phased implementation was best suited for the integration of the system with the existing one. Its appeal was that it provided very managed risk management. If a module does not function properly, then without too much damage to the business, the older component of the system is re-instated. The breaking down of the system modules varies depending on the existing system of each business. If a business does not have an existing reward system, they integrate it directly to their point-of-sale system. Otherwise, the business chooses which module they would like to replace.

5.3 Testing

System testing is a degree of testing that validates a software product that is complete and fully implemented. A system test aims to determine the end-to-end specifications of the system (*What Is System Testing? Types & Definition with Example*, n.d.). The chapter focuses on the system requirements and its functionalities. The system modules were tested to determine that they met both functional and non-functional requirements.

The testing done included:

- i. Usability testing- the user interacted with the system and determines whether it is user-friendly or not.
- ii. Integration testing- The performance of the system was checked when all modules were integrated together. This was to make sure that all modules were operating correctly, and all functions were working as expected. All modules were expected to be able to interact with each other with no errors.
- iii. Security testing- this was carried out to determine confidentiality of user information and that unauthorized access was prevented.

5.3.1. Test Cases

Table 5.1 Test Cases

Test Id	Related Requirements	Inspect Check	Pre-condition	Test data	Priority test
T1	User registration validation	Is the user able to register?	All details should be specified	User details filled in form	High
T2	User login verification	Is the user able to login?	User must have a registered account	Data from database: username and password	High
T3	Session maintenance	Is the user able to maintain session between web pages?	User must have successfully logged in	User session details	High
T4	Subscribing to a business	Is the user able to join a membership subscription for a chosen business?	Both users must exist in order to subscribe to a business	User membership data	Moderate
T5	Creating a campaign management and assigning business rule	Is the user able to create a campaign management?	User must be a registered business to create a campaign management	Campaign management data	Moderate
T6	View redemption catalogue items created by business	Is the user able to view a list of products created by business they subscribed to in the redemption catalogue?	User must be logged in	User session details	Moderate
T7	User interface	Is the user interface friendly?	Information is displayed in the right format.	User information	High
T8	Earned Points	Is the business able to award points to users and users able to view their earned points?	Both users must exist and session created. Data should pass between both views immediately.	Earned points data	High
T9	Redeemed Points	Is the customer able to redeem points based on the discount rate	Product must exist on the catalogue and discounted	Redeemed points data	High

		in the product catalogue and is the business able to verify and view the redeemed points of a user?	based on the rate given.		
T10	Reports	Are both users able to view transactional statement when transactions are complete?	Transaction must have occurred and verified in order to be generated.	Earned points and redeemed points data	Low

5.3.2. Test Results

Table 5.2 Test Results

Test Id	Expected results	Actual results	Status	Remarks
T1	User successfully fills in all required fields and an account is created.	Account was successfully created.	Pass	Good performance
T2	User can log in	Login is successful	Pass	Good performance
T3	User session is considered	Session is maintained	Pass	Good performance
T4	User can subscribe to a business' membership.	Membership was created successfully	Pass	Good performance
T5	Business can create a campaign and assign business rule to it	Campaign created successfully	Pass	Good performance
T6	View redemption catalogue items created by business	Catalogue created successfully	Pass	Needs improvement
T7	User interface is friendly	Users are happy with the interface	Pass	Could be better

T8	Earned points	User can earn points and business can award points once QR is scanned	Pass	Good performance
T9	Redeemed points	User can redeem points and business can receive points once QR is scanned	Pass	Good performance
T10	Reports	Transactional reports are generated	Pass	Good performance

Chapter Six: Conclusion and Recommendations for Future Works

6.1. Conclusions

The system focused on reducing reward systems liability for businesses and managing membership for customers to create a fully functioning and independent relationship between the business and their customers. It was developed using an Ionic v5 and React- typescript based on a hybrid development methodology.

6.2. Recommendations

The adoption of this system by businesses will be highly beneficiary to both stakeholders (business and their customers). The system can be integrated with the business point-of-sale system and run transactions along with it.

The limitation of the scope of the project is highly acknowledged such as addition of users and functionalities. One would consider including business-business type of transactions and customer-customer type of transactions. In addition, one could consider adding the tax rates based on the state's authorized statutes and adding an offline support or use of SMS to award points for customers who lack smart phones or a reliable internet connection. This can be included in future research whereby time is not much of a constraint.

6.3. Deliverables

The following are the modules developed for the hybrid loyalty management system:

- i. Registration and Login module – these modules are used to login after a successful registration of the user.
- ii. Product and Redemption catalogue – contains list of all products that are available to the customer at discounted prices and created by the business they are subscribed to.
- iii. Campaign management – lists all campaign type such as promotions for various holidays that are available on the business' marketing calendar.
- iv. Business rule- this module specifies the list of various award and redemption rates created by the business.
- v. QR scanner and code- the two modules show the qr scanner and qr code for both the business and customer respectively.
- vi. Membership and subscription- This creates a customer into the subscription list of the business and renders the business name in a list on the customer view.
- vii. Reports- lists transactional statements for both the business and customer.

viii. Database – stores all user data.

User manual – this is a documentation containing guidelines on how to use the loyalty system.

This is for the end users to guide them through the system functionalities.

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Universal Loyalty Program

May 31, 2020

Project manager
Project dates

Apr
15,
202
0 -
Nov
7,
202
0

Completion
Tasks
Resources

0%
38
0

Universal Loyalty Program

May 31, 2020

Tasks

2

Name	Begin date	End date
Project Ideas	4/15/20	4/15/20
Project Ideas Submission	4/15/20	4/21/20
Pick Supervisor	4/22/20	4/22/20
Supervisor Meeting	4/23/20	4/23/20
Concept Note	4/24/20	4/29/20
Supervision Meeting	4/29/20	4/29/20
Supervision Meeting	4/30/20	4/30/20
Chapter One	4/29/20	5/5/20
Supervision Meeting	5/13/20	5/13/20
Chapter Two	5/6/20	5/13/20
Supervision Meeting	5/14/20	5/14/20
Chapter Three	5/15/20	5/20/20
Proposal	5/21/20	5/27/20
Supervision Meeting	5/27/20	5/27/20
Supervision Meeting	6/2/20	6/2/20
Proposal Submission	6/3/20	6/3/20
Return Proposals	6/17/20	6/17/20
Supervision Meeting	6/17/20	6/17/20
User Requirements	6/15/20	6/18/20
Chapter 4	6/18/20	6/24/20
Risk Analysis	6/18/20	6/22/20
Supervision Meeting	6/24/20	6/24/20

Universal Loyalty Program

May 31, 2020

Progress Presentation	7/1/20	7/1/20
Supervison Meeting	8/4/20	8/4/20
High Level Design	8/18/20	10/6/20
Coding	8/5/20	10/30/20
Supervison Meeting	8/18/20	8/18/20
Supervison Meeting	9/9/20	9/9/20
Supervison Meeting	9/30/20	9/30/20

Tasks

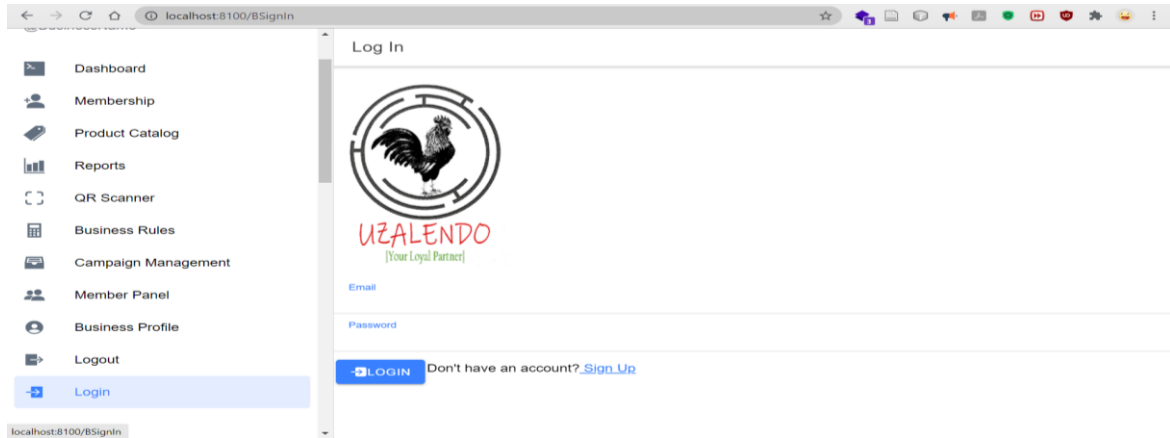
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Name	Begin date	End date
Supervison Meeting	10/12/20	10/12/20
Chapter 5	9/8/20	9/18/20
Test Planning	9/8/20	9/14/20
System Testing	9/15/20	9/18/20
Supervison Meeting	10/21/20	10/21/20
Maintenance	10/20/20	10/27/20
Chapter 6	10/21/20	10/28/20
Project Presentation	11/3/20	11/6/20
Low Level Design	10/12/20	10/28/20

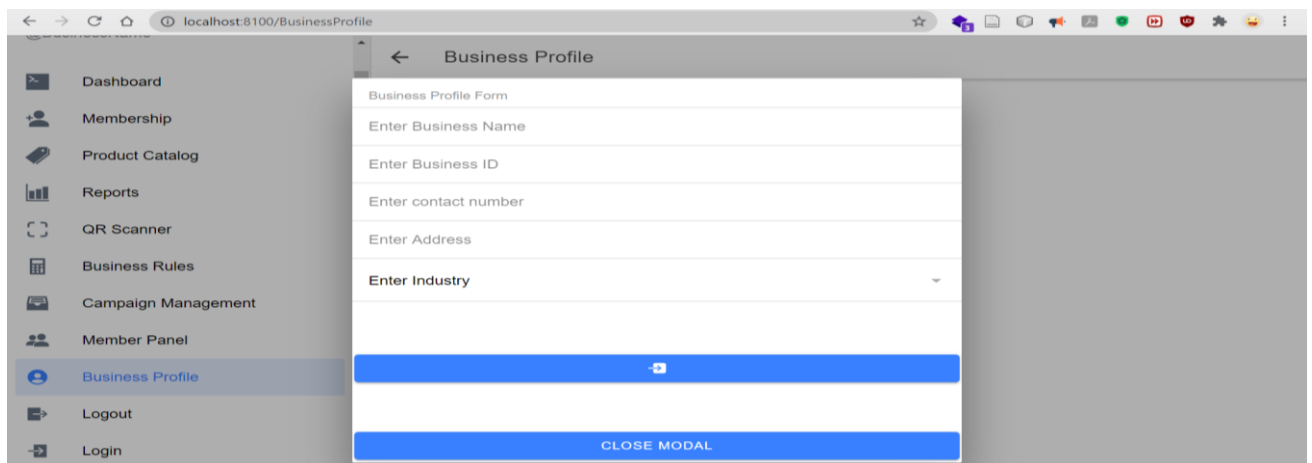
User Manual

Businesses

Step 1: Register user account when application is downloaded or login if the account is already created.



Step 2: Set up business profile.

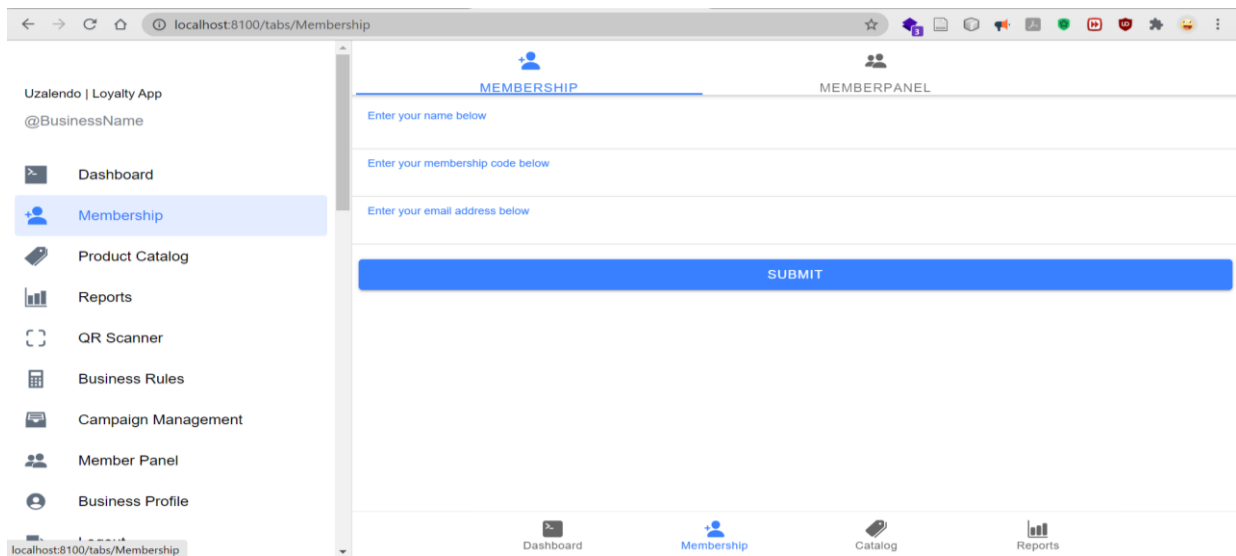


Step 3: Create business rules for setting awarding and discounting rates for products.

Step 4: Create a campaign type based on holidays/ marketing items in your marketing calendar such as Christmas or customize your own and set business rule to it.

Step 5: List selected products in the product catalogue that you wish to be available for your customers.

Step 6: Create members in the membership and view the registered members in the member panel.



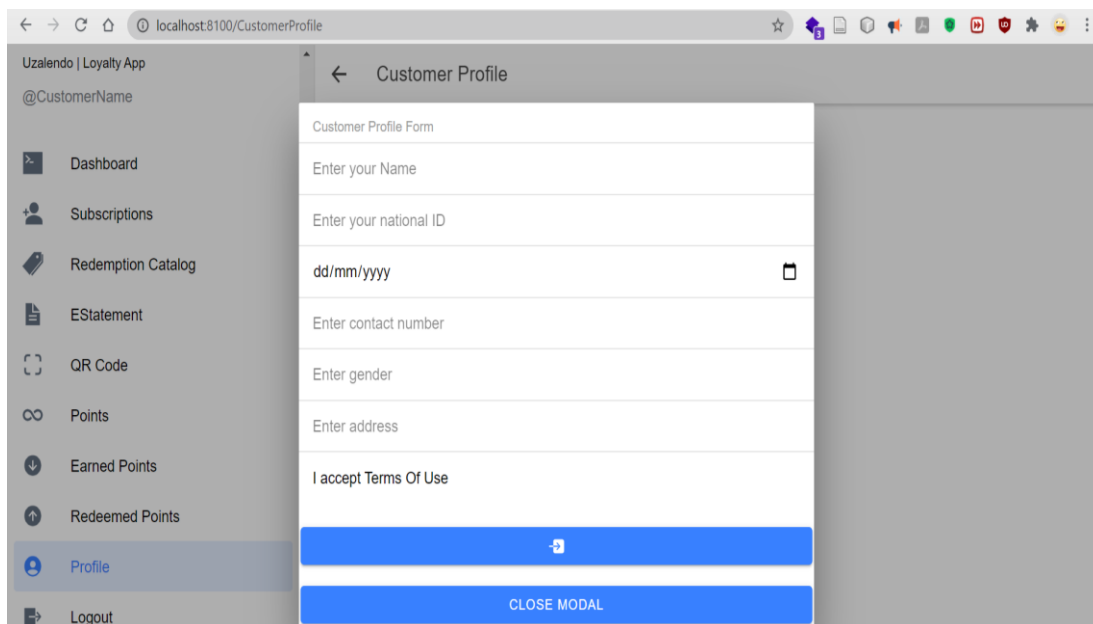
Step 7: View reports of members transactions.

Step 8: Scan members Qr code to award or redeem points.

Customers

Step 1: Register user account when application is downloaded or login if the account is already created.

Step 2: Set up customer profile.



Step 3: View businesses you have subscribed to.

Step 4: View earned points and redeemed points in their respective modules for business.

Step 5: List selected products in the product catalogue that you can redeem.

Step 6: View transactional reports based on your earning and redemption rates.

Step 7: Scan Qr code to earn or redeem points.

Sample Code

```
import React, { useState, useEffect } from 'react';

import { IonHeader, IonToolbar, IonTitle, IonContent, IonPage, IonButtons, IonMenuButton,
IonButton, IonList, IonItem, IonLabel, IonInput, IonText } from '@ionic/react';

import fireConfig from '../data/firebaseConfig';

const BSignUp: React.FC = () => {
  const [user, setUser] = useState("");
  const [email, setEmail] = useState("");
  const [password, setPassword] = useState("");
  const [confirmPassword, setConfirmPassword] = useState("");
  const [formSubmitted, setFormSubmitted] = useState(false);
  const [emailError, setEmailError] = useState(false);
  const [passwordError, setPasswordError] = useState(false);
  const clearInputs = () =>{
    setEmail("");
    setPassword("");
  }
  const clearErrors = () =>{
    setEmailError(true);
    setPasswordError(true);
  }
  const handleBSignUp= () =>{
    clearErrors();
    fireConfig
    .auth()
    .createUserWithEmailAndPassword(email, password)
    .then((user) => {
      // Signed in
      // ...
    }
  )
}
```

```

.catch((error) => {
  switch (error.code) {
    case "auth/email-already-exists":
    case "auth/invalid-email":
      setEmailError(error.message);
      break;
    case "auth/weak-password":
      setPasswordError(error.message);
      break;
  }
});
}
const userAuthListener=()=>{
clearInputs();
fireConfig
.auth()
.onAuthStateChanged((user) => {
if (user) {
  setUser("");
  /*setUser(user);*/
} else {
  setUser("");
}
});
};
useEffect(()=>{
  userAuthListener();
}, []);

return (
  <IonPage id="signup-page">

```

```

<IonHeader>
  <IonToolbar>
    <IonButtons slot="start">
      <IonMenuButton></IonMenuButton>
    </IonButtons>
    <IonTitle>Signup</IonTitle>
  </IonToolbar>
</IonHeader>
<IonContent>
<div className="login-logo">
  
</div>
<form onSubmit={handleBSignUp}>
  <IonList>
    <IonItem>
      <IonLabel position="stacked" color="primary">Email</IonLabel>
      <IonInput name="email" type="email" value={email} spellCheck={false}
autocapitalize="off" onChange={e => {
        setEmail(e.detail.value!);
        setEmailError(false);
      }}
      required>
    </IonInput>
  </IonItem>
  {formSubmitted && emailError && <IonText color="danger">
    <p className="ion-padding-start">
      email is required
    </p>
  </IonText>}
  <IonItem>
    <IonLabel position="stacked" color="primary">Password</IonLabel>

```

```

=> {
  <IonInput name="password" type="password" value={password} onChange={e
    setPassword(e.detail.value!);
    setPasswordError(false);
  }} required>
  </IonInput>
</IonItem>

{formSubmitted && passwordError && <IonText color="danger">
  <p className="ion-padding-start">
    Password is required
  </p>
</IonText>}
<IonItem>
  <IonLabel position="stacked" color="primary">Confirm Password</IonLabel>
  <IonInput name="confirmPassword" type="password" value={confirmPassword}
onIonChange={e => {
    setConfirmPassword(e.detail.value!);
    setPasswordError(false);
  }} required>
  </IonInput>
</IonItem>
{formSubmitted && passwordError && <IonText color="danger">
  <p className="ion-padding-start">
    Password is required
  </p>
</IonText>}
</IonList>
<IonButton type="submit">Sign Up</IonButton>
<span>Already have an account?<a href="/BSignIn"> Sign In</a></span>
</form>
</IonContent>

```

```
    </IonPage>  
  );  
};  
export default BSignUp;
```