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Enhanced Loyalty Management System Within A Digital Wallet For Seamless Shopping Experience

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ABSTRACT

Businesses and organisations are always looking for a way to improve sales and enhance customer satisfaction and experience, irrespective of the highly volatile competitive business environment. With the rise of a cashless society and the involvement of electronic transactions and the risk of carrying cash, which can result in theft, loss, and stress, the need for a robust system to manage the customer's experience and evoke loyalty has become paramount. This project, therefore, aimed at the development of an improved digital wallet and loyalty management system for a seamless shopping experience using a mobile application development framework to enhance customer loyalty and satisfaction. The system was developed using the adaptive software development (ASD) methodology, which is an improvement of the rapid application development (RAD) that addresses the internet economy and JavaScript, Typescript, React Native in Visual Studio Code IDE. The system was deployed and tested with several components and modules that handle user registration and account creation, loyalty point generation, transfer and gift card creation, respectively. The system is efficient and reliable, as it evokes customer loyalty and improves customer satisfaction and experience.

1. INTRODUCTION

The role of computers and information technology cannot be overemphasised as it has remained a veritable tool in the development and improvement of both human and material resources. To achieve sustainable development, information technology is crucial in every country. No nation can achieve quick socioeconomic development without making the most of information technology.

All organisations, especially those in the service sector, are dependent on information technology to succeed in the future. In fact, information technology has altered how businesses, financial institutions, and other organisations compete favourably in the market environment as it provides tools and products, they can all leverage to ensure improved productivity and service delivery. It encompasses more than just computers; it includes both the data that a company generates and consumes, as well as the vast array of increasingly linked and convergent technologies that do the processing of that data (Omokugbo and Festus, 2020).

One of the modern criteria for assessing the growth rate of a modern corporate enterprise is its information and technology infrastructural architecture and investment, as it acts as an indicator

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of the trajectory of the organisation's drive for profit maximisation. Banks and other financial institutions were among the first to adopt computers and information technology in Nigeria and around the world because it boosts business and profit margins. Adoption of information technology tools by the financial services sector has improved the efficiency and efficacy of services provided to customers, improved business processes, and enhanced managerial decision-making and workgroup collaborations over time (Luka and Frank, 2012). It has improved the ability of organisations to compete in emerging or rapidly changing markets. With the growth in business in the twenty-first century, customers are and have remained the focus of a highly competitive corporate environment that is being created by environmental, organisational, and technical variables. The need for alternative means of transaction other than the conventional currency trade has become the new normal as more electronic media and digital approaches are given to substitute the use of liquid cash in line with the cashless policy of the Nigerian government and indeed the global community driven by technology. One such novel approach in global business is the use of digital currency and a wallet, respectively. According to (Nandhini and Girija, 2019), a digital wallet is a virtual cashless service that can replace physical cash notes. It is typically a mobile application designed to store an individual's financial information, as well as the amount of money deposited from the user's bank account. The primary function is to simplify financial transactions while purchasing goods or services from e-commerce websites or online retailers.

The features that a digital wallet platform offers are what drew in the majority of users. These features allow electronic payments to be optimised to provide the greatest possible advantages for developers, businesses, and customers. Positive aspects of digital wallets include their ease of use, speedier payment processing, improved security for transactions and financial data, and multipurpose applications. Digital wallet providers offered a range of enticing benefits to consumers, including monthly discounts, loyalty points, exclusive offers, and random giveaways, to stay competitive in the market.

According to (Punwatkar and Verghese, 2018), discounts and offers are seen as perks that users of any digital wallet platform should anticipate. Similarly, the study by Nandhini and Girija (2019) revealed that e-wallet preferences are influenced by cash back and offers, which ranked third among the key influencing factors in their survey. Their respondents users surveyed in that study further indicated that in this digital age, e-wallets are a viable, appealing, helpful, and essential option. Lutpiyani and Prahesti (2025) empirically demonstrated that CRM programs have a significant and positive influence on customer loyalty, using Telkom Indonesia's IndiHome service as a case study. Their findings confirm that well-structured CRM strategies covering pre-sales, service delivery, and post-sales support enhance customer trust, satisfaction, and long-term retention. This aligns with the objectives of digital wallet-based loyalty systems, which similarly rely on integrated customer engagement to sustain user commitment.

One of the most celebrated inventions of the twenty-first century is the digital wallet, which enables users to make purchases even if they leave their wallets at home. With the COVID-19 pandemic spreading, the adoption of these wallets as a preventative measure increased considerably. Nevertheless, consumers are no longer compelled to utilise mobile wallets due to the lifting of COVID-19 restrictions and pandemic adaptability. That is, the customer is free to select the

mode of payment, and things have returned to as they were before the pandemic. Therefore, companies must ensure that their clientele stays loyal to them and that they continue to use their own mobile wallets after COVID-19 (Al-Hattami *et al*., 2023).

1.1 Aim and Objectives of the Study

This study aims to design and develop an enhanced loyalty management system within a digital wallet to promote customer engagement, retention, and a seamless shopping experience using a mobile application framework.

The objectives of the study are:

i. Conduct a system analysis to evaluate existing digital wallet and loyalty systems, identify limitations, and define functional requirements.
ii. Design the proposed system, including architecture, user interface, database structure, and component modules such as wallet management, loyalty points, gift cards, and campaign promotions.
iii. Implement the system using React Native for the frontend, Node.js for backend services, and SQLite for data storage, incorporating features such as the RFM model, gift cards, and merchant campaigns.
iv. Test and evaluate the system, measuring performance, usability, and feature functionality to ensure it meets the defined requirements and improves customer retention and engagement.

2. LITERATURE REVIEW

Shukla (2016) examined mobile wallets in his paper "Mobile Wallet: Present and Future", including how they work, what varieties there are, and their merits and cons. His inquiry examined the opinions of customers and businesses regarding portable wallets. He reasoned that advertising and advanced organisations will use portable wallets to engage customers. Regardless of the market state of these multifunctional wallets, advertising could take advantage of the increasing opportunities.

Navya *et al*. (2018) describe the design and development of an Android app for handling numerous events. The programme is designed to remove, or at least decrease, the challenges that any event organiser faces. It is primarily intended to carry out activities smoothly and efficiently. Users will need to create accounts using their credentials. This programme has an easy-to-use interface that allows clients to successfully communicate with service providers. It also offers a note-keeping service, which sends reminders to the busy organiser regularly.

It allows users and clients to easily store prior expenses and events. This software helps event organisers plan their events more strategically and gives better services to clients.

Singh and Gupta (2016) conducted a study to discover various factors influencing the acceptance of mobile wallet payments among customers. They investigated several characteristics for the study, including convenience, trust, security, and adaptability, all of which have an impact on mobile wallet user satisfaction. The study was conducted in Kurali, Punjab. Pearson's Correlation Analysis was used to explore the link between the study's basic variables. According to the study's findings, mobile wallets are seen as the future of currency.

Ahuja and Joshi (2018) researched user perceptions of mobile wallets. In this study, they investigated how the exploration technique is utilised to categorise the elements that influence client attitudes towards mobile wallets. A study was undertaken on the various forms of mobile wallets in India. Data is acquired from both secondary and primary sources. The study was

performed among 139 mobile respondents from the telecommunications industry. The study also emphasised that CRM is no longer limited to interpersonal interactions but increasingly depends on supporting technologies that collect, analyse, and respond to customer data (Lutpiyani and Prahesti, 2025). This reinforces the argument that mobile applications, such as digital wallets with embedded loyalty management features, can act as technology-enabled CRM systems that personalise engagement and foster long-term brand attachment.

Munawar and Dini (2022) proposed the development of a mobile-based e-wallet prototype designed exclusively for electronic payment transactions on campus. Specifically, single tuition payments (UKT), payments at public service locations (cooperatives, canteens, photocopying centres), and fundraising for donations or events using the QR Code as a transaction medium. System needs are explored using questionnaires issued to target users (students) to generate a list of functional requirements. The application was developed using an iterative rational unified process (RUP) methodology, with stages categorised as ideation, elaboration, construction, and transition.

The application is implemented utilising the Android SDK mobile platform as a front-end technology and a model-view-presenter (MVP) architecture, with the Laravel web framework serving as the back-end technology. The created e-wallet prototype is then tested for functionality and evaluated using the user experience questionnaire (UEQ) approach.

Abasiama *et al*. (2018) proposed the development of an online wallet application system for a small business where clients register and create an account, allowing them to shop without carrying physical cash in the paper titled "E-Wallet System Implementation: Impact on Small Scale Business in Nigeria." The systems development life cycle contains several phases, and the structured system analysis and design methodology was selected since it offers precise instructions for navigating each one. The IDE (Integrated Development Environment) for developing the system was Adobe Macromedia Dreamweaver. Hypertext Pre-processor (PHP) was utilised to link the text field to the database; JavaScript was employed to verify text fields; and MYSQL was used to create and manage the database to improve system security.

Irina *et al.* (2016) proposed the development of an application that allows users to engage in a loyalty programme and helps Smartphone enterprises (Merchants) access, sell, and monitor consumer transactions using mobile applications. The design method utilised is object-based design, which contains a UML with use case diagrams, use case narratives, class diagrams, sequence diagrams, and activity diagrams. Results were accomplished in the form of mobile applications that can help customers manage their loyalty cards and boost consumer loyalty. This application includes features such as add points, redeem, news, transaction history, and message, which can help customers manage their loyalty cards. This design concludes that the application of E Points can allow users to manage a loyalty card on their smartphone, add points, redeem rewards, acquire the most recent promotional information through news features, and monitor transaction histories.

Wang *et al*. (2016) in "Mobile payment security, threats, and challenges" proposed a model for processing mobile payments and introduced the various types of mobile payment systems. They also outlined the security services that the systems should provide, as well as the security measures that are in place. They also identified and discussed three security threats: malware, SSL/TLS vulnerabilities, and data breaches, as well as four security challenges: malware detection, multi-factor authentication, data breach prevention, and fraud detection and prevention in mobile

payment systems.

Behrouzi *et al*. (2023) presented a blockchain-based platform leveraging design science research (DSR) to address shortcomings of traditional loyalty programmes. Smart contracts allow organisations to implement client loyalty programmes that align with their rules. The platform enables secure, transparent, and decentralised exchange of loyalty tokens among organisations and customers. They deployed expert opinion methodology to examine the technical considerations and execution of a blockchain-based loyalty programme platform, including its potential influence on user experience. The proposed platform enhances loyalty programme interoperability through a universal token, adding value for both businesses and customers.

According to Akhila (2018) study, digitalisation has recently experienced rapid growth, despite its long history. There may be various reasons for this, including a lack of awareness and expertise, fear of online payments, and security concerns. The E-Payment system can only be improved if it raises public awareness. India is gradually transitioning to a cashless economy, with a significant increase in digital wallet usage in recent years. The study further revealed that consumers are motivated by convenience, affordability, and reduced financial stress when adopting pay-later services (H. V., 2025). Similarly, loyalty systems embedded within digital wallets provide psychological and financial incentives that strengthen customer retention. Both approaches emphasise that reducing transactional barriers and enhancing value perception are central to sustaining customer loyalty in competitive markets.

Digital wallets simplify money transfers, making it easier to make purchases. Consumer impression of digital payment positively influences the uptake of digital wallets. The study assessed customer perceptions of digital wallets. The report suggests that e-wallets are gaining popularity among younger generations, including students and employees. The study found that Paytm is preferred over other wallet providers.

3. MATERIALS AND METHODS

The agile software development process was used for this project, which anticipates the requirement for flexibility and applies pragmatism to the delivery of the finished product. Agile software development necessitates a cultural shift in many organisations since it focuses on the clean delivery of individual software components rather than the full solution. The benefits of the agile methodology include the ability to assist teams in an ever-changing landscape while remaining focused on the effective delivery of business value. The agile methodology deployed in this work is the adaptive software development methodology.

This study adopted the Adaptive Software Development (ASD) methodology, which is particularly suited for projects operating within dynamic, high-change environments such as mobile application development. The ASD methodology provides a flexible, iterative approach that allows continuous feedback integration and rapid adaptation to user and stakeholder needs. The methodology was instrumental in guiding the entire development process of the loyalty management system.

The system was developed using a robust technology stack:

- Frontend: React Native for building the cross-platform mobile application interface.
- Backend: Node.js and Express.js for the API logic and server operations.
- Database: MongoDB was used to structure data related to users, wallets, loyalty points, and merchant activities.

- Development Environment: Visual Studio Code (VS Code) was used as the Integrated Development Environment (IDE).
- Version Control: Git was used to manage source code and track changes across development stages.

3.1 Analysis of the Proposed Study

The proposed improved digital wallet loyalty management system adopts the principles of the existing system by (Abasiama *et al*, 2018) with some additions and variations. The existing system was an online E-wallet for managing sales and purchases within a given retail or business enterprise, while the proposed system will integrate the customer loyalty component into the system and also develop it not just for computers but to run on mobile devices.

The system proposed here will be able to generate bonus points for each transaction, and those points will be collated in the loyalty module to be used for purchase in subsequent transactions.
The system will be designed to automatically top-up loyalty points as it is generated, and user will be able to top-up the normal purchasing credit/ cash points from their bank accounts, which will be used for making purchases from the organisation.

It is important to note here that the digital wallet designed is a semi-closed wallet, which implies that it permits the user to make transactions, but only within predetermined bounds, with particular retailers or businesses, but can be deployed for other forms of online transactions also within and outside the issuer's domain.

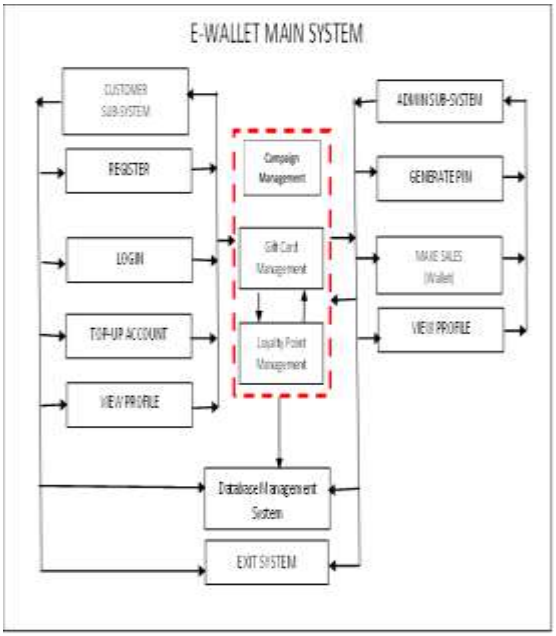
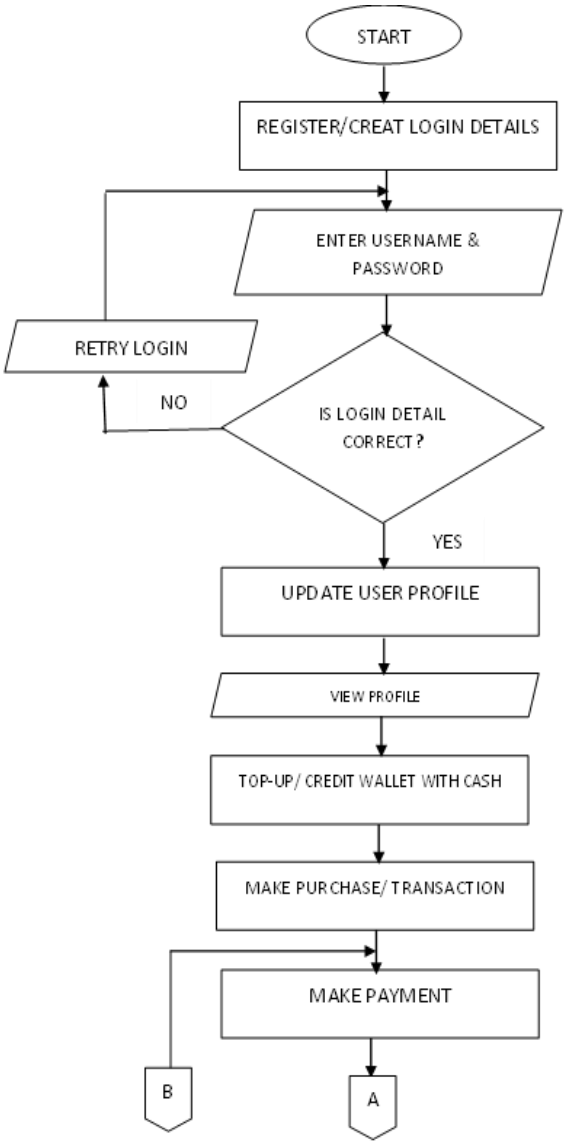


Figure 1: *System Design Architecture*

The system is designed to automatically accumulate loyalty points based on user activity during purchases. These points are stored and can be redeemed once they reach a usable threshold. Rather than assigning rewards manually, the system ensures an automated and transparent point management process. Users can monitor their earned loyalty points and view their wallet activity through the app interface. Unlike H. V. (2025), who adopted a mixed-methods approach to analyse consumer adoption of BNPL services, this study focused on system development and performance testing. However, both works converge on the shared objective of enhancing customer satisfaction and loyalty through innovative financial technologies. While Lutpiyani and Prahesti (2025) adopted a positivistic paradigm and quantitative methodology to statistically measure the relationship between CRM and loyalty, this study contributes by developing and evaluating a digital wallet application as a practical CRM tool. Both approaches converge on the shared conclusion that structured engagement programs significantly enhance customer loyalty in competitive digital markets.

The system incorporates an RFM-based analysis to categorise customers based on their purchase patterns, helping merchants personalise offers and prioritise high-value customers. Recency tracks recent purchases, Frequency measures purchase regularity, and Monetary evaluates total spending.



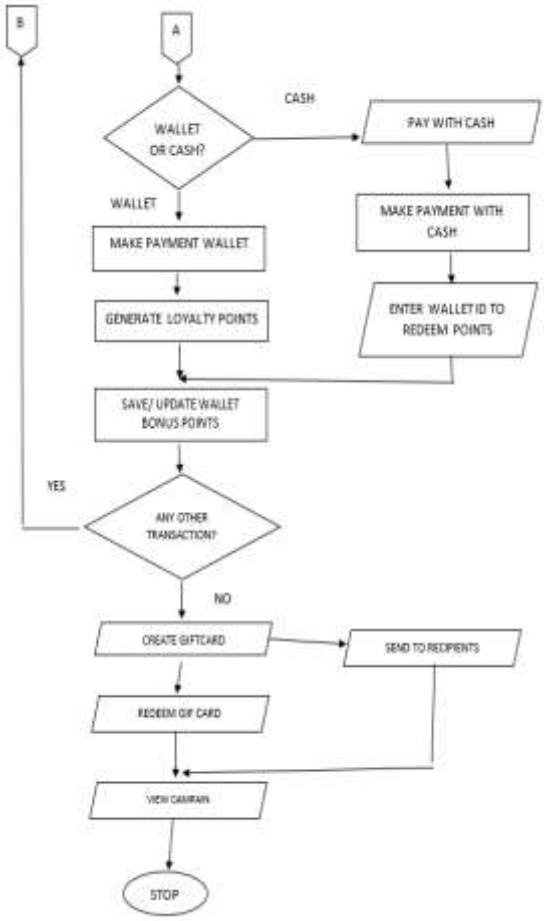


Figure 2: Flowchart

4. RESULTS

The realisation of the key objective of a software development project is seen in the implementation stage, which entails the process of putting the system developed to work to ascertain its performance and efficiency. It is the act of deploying and using the system to perform the task it has been developed to do. It is simply the process or act of putting the system to work in line with the design requirements and procedures. It is a series of activities arranged deliberately to ensure that the proposed system is delivered and put into use so as to achieve set goals and objectives.

From the onset, we have established that loyalty programs are designed to evoke patronage and loyalty from customers of a given organisation to ensure they remain with the brand by providing some form of incentives and waivers for them. The development of a mobile application for enhancing loyalty is a calculated attempt to leverage on mobile application framework to improve the whole consumer experience with an organisation.

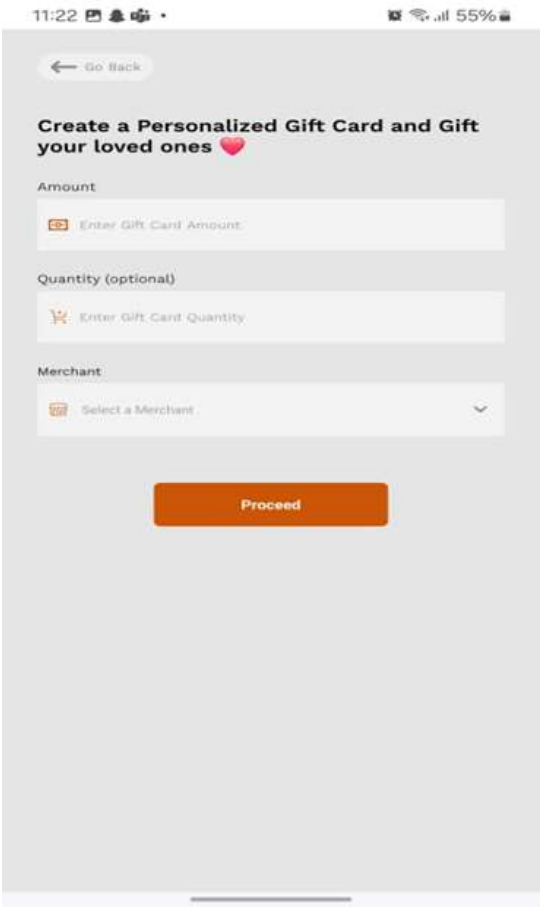


Figure 3: Gift card creation

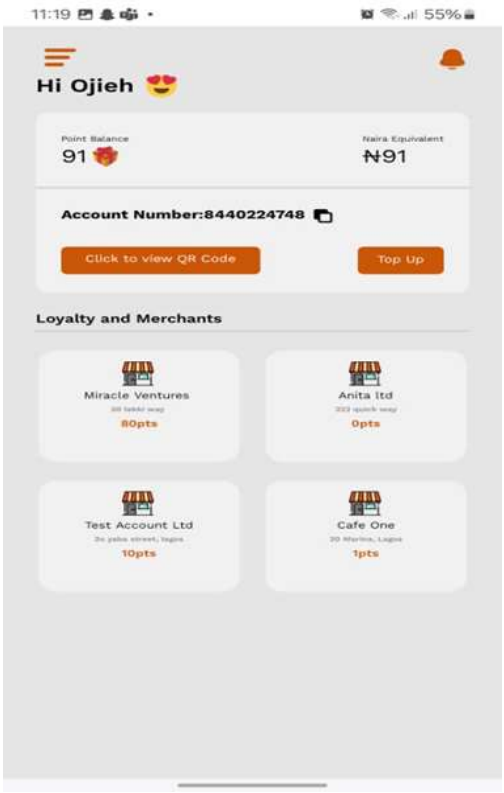


Figure 4 Loyalty Merchants Module

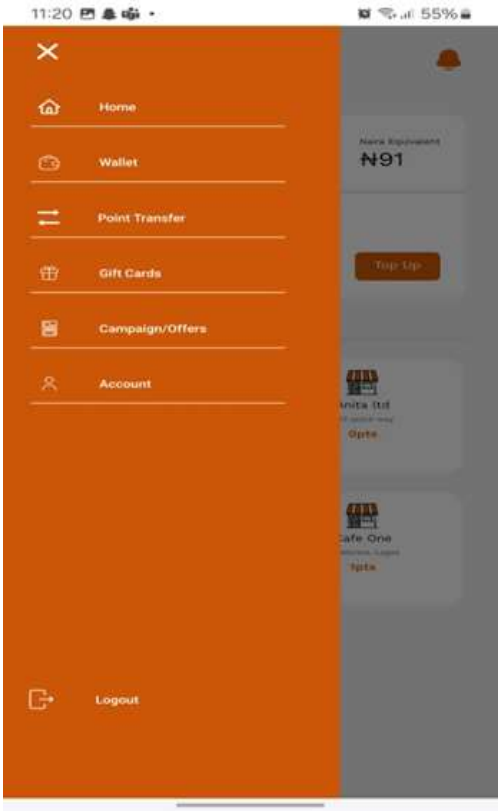


Figure 5 Navigation drawer

The loyalty merchant module in Figure 4 shows the number of loyalty points accrued and their equivalent in local

currency; it also indicates the number of merchants the user is transacting with. The module also shows the user's bank account number and a loyalty top-up button from which points can be added to the user. Figure 5 shows the dashboard of the new system. From this point, the user can navigate around the various functions of the system to perform the inherent activities such as view and access wallet, transfer loyalty points, gift card and account update feature respectively.

Table 1 provides a summary of key performance indicators observed during testing. These results illustrate the advantages of the enhanced application in areas such as reward redemption efficiency, user engagement, and task responsiveness.

Metric	Existing System	Enhanced App
Avg. Time to Redeem Reward (sec)	300.0	30.0
Monthly Active Users	100.0	210.0
Reward Redemption Rate (%)	28.0	65.0
User Satisfaction Score (1–5)	2.8	4.5
Monthly Point Transactions	45.0	160.0
Wallet Activation Success Rate (%)		98.0
Campaign Interaction Rate (%)		53.0
Gift Card Usage (per month)		75.0

Table 1: Summary of System Performance Metrics

Figure 5 Reward redemption rate comparison

Figure 6: Task completion time comparison for shared features

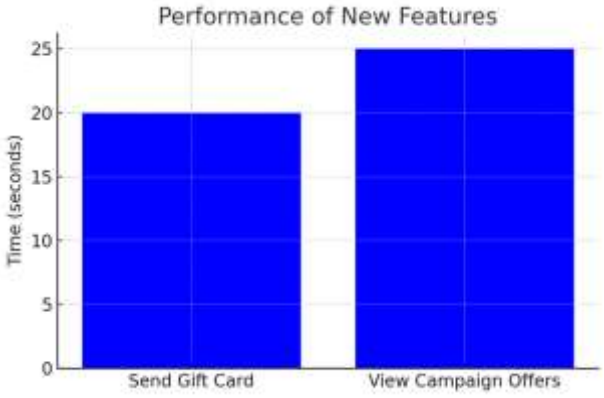


Figure 7: Performance of select features

The results demonstrate that the enhanced application offers significant improvements in usability and functionality compared to traditional systems. User satisfaction also improved significantly, with a notable shift toward higher engagement and faster performance. Feature usage metrics further indicate increased interaction with loyalty transactions, gift cards, and promotional campaigns.

This system also includes exclusive functionalities such as campaign viewing and gift card transactions, which were not available in the existing system. Their performance, measured in task completion time, indicates a user-friendly implementation with minimal delays.

5. CONCLUSION

Electronic transactions (e-transactions), which are a component of information technology, are still underutilised in

Nigerian commerce and business environment, which currently only entails the direct exchange of products and services with actual cash. Since businesses currently rely entirely on information and computer technology for their daily operations, business organisations must take the initiative and fully embrace the rapidly expanding technological advancements in the business sector. However, with ongoing global technological advancements, businesses can now leverage these tools to enhance and improve their customer base by implementing technological application that leads to customer retention and loyalty.

Leading businesses use technology to provide exceptional customer service and experience, and with the emergence of digital wallets, loyalty programmes can be up-scaled to benefit both the business community and their teeming customer base. Until digital wallets become a natural business partner that provides value and satisfaction to customers, businesses, and organisations will not reap the inherent benefits. The use of digital wallets in loyalty programmes facilitates seamless transactions and improves customer relations and experience, thereby boosting business turnover.

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