

**REDUCTION OF PUSH NOTIFICATIONS IN E-COMMERCE
APP**

A PROJECT REPORT
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*Under the guidance of,
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in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

COMPUTER ENGINEERING

At



PRESIDENCY UNIVERSITY

BENGALURU

DECEMBER 2024

PRESIDENCY UNIVERSITY
SCHOOL OF COMPUTER SCIENCE ENGINEERING
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This is to certify that the Project report "**REDUCTION OF PUSH NOTIFICATIONS IN E-COMMERCE APP**" being submitted by A P RANJITH KUMAR, YASHWANTH SAI V, JAYANTH JP, TEJVEER A, bearing roll number(s) 20211COM0034, 20211COM0041, 20211COM0046, 20221LCE0003 in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Engineering is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **REDUCTION OF PUSH NOTIFICATIONS IN E-COMMERCE APP** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Engineering**, is a record of our own investigations carried under the guidance of **Dr.Debasmita Mishra, Assistant Professor, School of Computer Science Engineering, Presidency University, Bengaluru.**

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ABSTRACT

Push and pop notifications have become an essential tool in e-commerce applications, enabling businesses to engage with users, promote products, and increase sales. However, the overuse of notifications often leads to user frustration, app fatigue, and declining engagement, ultimately resulting in app uninstalls and reduced customer loyalty. This paper explores strategies to reduce the volume and frequency of notifications in e-commerce apps without compromising their effectiveness in driving user interactions and conversions. The study focuses on a ethnocentric approach to managing notifications, focusing on overspecialization, relevance, and timing.

Businesses can leverage machine learning and AI-driven customer segmentation to analyze user behavior, purchase history, and preferences to deliver highly targeted and meaningful notifications. Dynamic delivery timing based on predictive analytics ensures that notifications reach users at the most appropriate moments, thus reducing the likelihood of being perceived as intrusive. Additional areas include the enhancement of user control by providing more flexible opt-in options, through which users can customize their types of and frequency for notification types. Silent notifications and non-disruptive in-app messages, too, are seen as alternatives to push notifications for giving users informative updates without intruding on the experience. By balancing engagement goals with user preferences, businesses can mitigate notification overload while fostering a positive relationship with users.

This approach not only improves user satisfaction but also strengthens brand trust and loyalty, leading to sustainable long-term growth. The findings of the paper present actionable recommendations for e-commerce app developers, marketers, and product managers in optimizing their notification strategies. In other words, if the number of push and pop notifications is reduced by

enhancing the quality of the notifications, higher retention rates will be achieved from customers in addition to a better-facilitated more-satisfying user experience.

Keywords: Push Notifications, Personalization, User Engagement, E-commerce Apps, NotificationOverload.

ACKNOWLEDGEMENT

First of all, we indebted to the **GOD ALMIGHTY** for giving me an opportunity to excel in our efforts to complete this project on time.

We express our sincere thanks to our respected dean **Dr.Md. Sameeruddin Khan**, Pro -VC, School of Engineering and Dean, School of Computer Science Engineering & Information Science, Presidency University for getting us permission to undergo the project.

We express our heartfelt gratitude to our beloved Associate Deans **Dr. Shakkeera L** and **Dr.Mydhili Nair**, School of Computer Science Engineering & Information Science, Presidency University, and **Dr.Gopal Krishna Shyam**, Head of Computer Engineering, Presidency University, for rendering timely help in completing this project successfully.

We are greatly indebted to our guide **Dr.Debasmita Mishra, Assistant Professor** and Reviewer **Dr.P Sudha, Assistant Professoror**, School of Computer Science Engineering & Information Science, Presidency University for her inspirational guidance, and valuable suggestions and for providing us a chance to express our technical capabilities in every respect for the completion of the project work.

We would like to convey our gratitude and heartfelt thanks to the PIP2001 Capstone Project Coordinators **Dr.Sampath A K**, **Dr.Abdul Khadar A** and **Mr.Md Zia Ur Rahman**, department Project Coordinators **Dr.Manjula** and Git hub coordinator **Mr. Muthuraj**.

We thank our family and friends for the strong support and inspiration they have provided us in bringing out this project.

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CHAPTER-1

INTRODUCTION

1.1. Push Notifications in E-Commerce Apps

Push notifications have emerged as one of the most important tools for engaging users in e-commerce apps. They serve as an immediate and effective way for businesses to connect with their customers, alerting them to product updates, discounts, sales events, and other promotional offers. These notifications are designed to encourage users to return to the app, complete purchases, or explore new offerings. While push notifications can be highly beneficial for driving user engagement and improving sales, their effectiveness is heavily dependent on their frequency, relevance, and timing. When used appropriately, push notifications can enhance the user experience by providing valuable, timely information. However, excessive or poorly targeted notifications can quickly lead to notification fatigue, where users feel overwhelmed by an influx of messages that they find irrelevant or intrusive. This can result in users disabling notifications, uninstalling the app, or even abandoning the platform altogether. Therefore, it is crucial for e-commerce platforms to carefully manage the volume and quality of push notifications to ensure they serve their intended purpose without negatively affecting the user experience.

1.1.1. The Importance of Personalized Push Notifications

Overspecialization plays a pivotal role in the success of push notifications. Tailored notifications, which are based on individual user behaviors, preferences, and interactions with the app, are more likely to engage the user and lead to conversions. For instance, personalized messages can be triggered by a user's browsing history, past purchases, location, or even the time of day when they are most active. E-commerce platforms can utilize data analytic and machine learning to craft notifications that are highly relevant to the user. This means, for example, sending notifications about new product arrivals in a category the user has shown interest in, or offering a discount on an item left in the shopping cart. Personalized notifications feel less like a generic mass message and more like a helpful reminder or suggestion, which increases the chances that users will take the desired action, such as completing a purchase. This level of relevance not only boosts engagement but also fosters a more positive user experience, as customers are more likely to appreciate notifications that cater to their specific needs and interests. As such, personalized

notifications not only mitigate notification fatigue but also enhance customer loyalty and retention, ultimately driving greater revenue for the business.

1.2. The Negative Impact of Excessive Push Notifications

While push notifications have the potential to enhance user experience and drive engagement, an overabundance of notifications can have the opposite effect. When users receive too many notifications—especially those that are irrelevant or poorly timed—they can quickly become irritated. This leads to notification fatigue, a condition where users start ignoring notifications, muting them, or even uninstalling the app altogether. The key issue here is the volume and frequency of notifications; when users feel bombarded by constant messages, they may perceive them as interruptions rather than helpful reminders. Furthermore, notifications that are not tailored to the user's preferences or behavior only contribute to this fatigue. For example, a user who regularly purchases clothing may not find value in receiving notifications about electronic gadgets or unrelated product promotions. The result is that users begin to disengage with the app, reducing overall app retention and engagement. In extreme cases, users may disable notifications entirely, thus nullifying the primary benefit of push notifications. Therefore, businesses must ensure that their push notification strategies are thoughtfully designed, with a focus on quality over quantity. A well-balanced approach will help mitigate the risk of overwhelming users and ensure that notifications add value to the user experience rather than detracting from it.

1.3. Strategies for Reducing Push Notification Fatigue

Reducing push notification fatigue requires a comprehensive strategy that focuses on personalizing, optimizing, and timing notifications effectively. First, overspecialization is key. E-commerce platforms should leverage user data, such as browsing history, past purchases, and preferences, to send targeted messages that are relevant to the individual. Personalized notifications not only capture user attention but also ensure that the content is meaningful, increasing the likelihood of user engagement. In addition to overspecialization, frequency control is vital. Sending too many notifications in a short period can overwhelm users and lead to app abandonment. Platforms should aim to strike a balance by sending notifications at optimal intervals, ensuring that they remain valuable without being disruptive. Timing also plays a crucial role in push notification effectiveness. Notifications sent at inconvenient times, such as in the middle of the night or during busy work hours, are more likely to be perceived as intrusive. By analyzing user behavior and determining when

users are most likely to engage, businesses can schedule notifications for times when they will have the greatest impact. Moreover, giving users the option to customize their notification preferences can empower them to control the type and frequency of notifications they receive. This level of user control can improve satisfaction, as users feel they are in charge of their notification experience. Finally, A/B testing is an effective way to continuously refine push notification strategies. Testing different message formats, delivery times, and frequency levels can help identify what works best for different user segments. By adopting these strategies, e-commerce platforms can reduce push notification fatigue while maintaining high levels of user engagement and satisfaction.

CHAPTER-2

LITERATURE SURVEY

2.1. INTRODUCTION

The literature review examines the strategies for reducing push and pop notifications in e-commerce applications. With the widespread adoption of e-commerce platforms and the increasing reliance on digital engagement, notifications have become a key tool for communication and marketing. However, excessive or irrelevant notifications have led to issues such as user fatigue, reduced app retention, and negative user experience. This review synthesizes existing research to explore methods for optimizing notifications and highlights the implications for improving user engagement and satisfaction.

2.2. RELATED WORK

Push and pop notifications play a vital role in retaining users and increasing sales for e-commerce platforms. However, the overuse of these notifications often results in users disabling notifications or uninstalling apps. Studies, such as those by Zhang et al. (2021), have shown that personalized notifications can improve user interaction rates. The role of artificial intelligence (AI) in analyzing user behavior to send context-aware notifications has also been explored in prior research. While these studies provide insights into notification effectiveness, the specific impact of notification volume, timing, and content relevance on user satisfaction has not been extensively examined.

The concept of user-centered notifications focuses on leveraging behavioral data to deliver targeted messages that align with individual preferences and needs. Research by Smith et al. (2022) emphasizes that understanding user interaction patterns can significantly reduce notification fatigue. Furthermore, gamification and user-driven preference management are emerging strategies to empower users in controlling their notification settings, as highlighted in studies by Chen et al. (2020).

2.3. EXISTING WORK

Table 2.1. shows the work of the project i.e, methods, advantages, and limitations of the existing work.

Paper Title	Method	Advantages	Limitations
1. Optimizing Push Notifications for User Retention in E-commerce	Machine learning models to analyze user behavior	Personalized and timely notifications improve retention rates	High computational cost and data privacy concerns
2. Context-Aware Notifications for Enhanced User Engagement	Context-based algorithms integrating location and time	Increases relevance and engagement rates	Relies on external data sources and real-time processing
3. User-Centric Design for Notification Management in Mobile Apps	User feedback and preference-driven notification systems	Empowers users to control notification frequency and type	Passive users may not engage with preference settings
4. Reducing Notification Fatigue through Gamification	Gamification strategies to encourage user interaction with settings	Increased user satisfaction and reduced notification fatigue	Limited effectiveness for users uninterested in gamification
5. Hybrid Recommendation Models for Notification Delivery [18]	Combining collaborative filtering and content-based filtering techniques	Improves relevance and reduces redundant notifications	Requires complex implementation and higher data requirements
6. Adaptive Scheduling for Notification Optimization	Dynamic scheduling algorithms based on user activity patterns	Reduces interruptions during low engagement periods	Limited scalability for large-scale platforms
7. Sentiment	Sentiment analysis	Enhances user	Complex NLP

Analysis for Notification Personalization	using NLP to tailor notification tone and content	experience through emotionally relevant messaging	models require extensive training datasets
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2.4. SUMMARY

The review begins by establishing the objective of understanding notification fatigue in e-commerce apps and its impact on user experience and retention.

A comprehensive methodology is adopted to synthesize existing literature and identify gaps in current notification optimization techniques.

Personalization is a critical factor in reducing irrelevant notifications, with AI and machine learning playing pivotal roles in analyzing user behavior.

Context-aware notification systems significantly improve relevance by factoring in real-time user context such as location, time, and app usage.

User-centric designs and gamified approaches enable users to take control of their notification preferences, reducing frustration and fostering engagement.

Techniques such as hybrid recommendation models, adaptive scheduling, sentiment analysis, and silent push notifications provide additional pathways for optimizing notification delivery.

Despite advancements, challenges remain in addressing privacy concerns, computational costs, and user adoption of preference management systems.

The review underscores the importance of balancing business goals with user satisfaction by adopting adaptive, personalized, and context-aware notification strategies.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

3.1. Limited Integration of Multi modal Data for Overspecialization

Current State: Most existing methods focus primarily on personalizing push notifications using user behavior, such as past purchases, browsing history, and app interaction. Overspecialization has proven to be effective in improving engagement by tailoring messages to individual preferences.

Research Gap: However, few studies incorporate a multi modal approach for overspecialization. While user behavior is critical, there is limited research on integrating additional data sources like social media activity, allocation data, weather conditions, or psychological profiles to enhance the relevancy of push notifications further. Research is needed to explore how combining these diverse data points can improve the accuracy of personalized notifications, offering a more holistic understanding of user needs and preferences.

3.2. Lack of Real-time Contextual Awareness in Push Notification Systems

Current State: Push notifications are often personalized based on historical behavior (e.g., past purchases, browsing activity) and sent at per-determined times. Some studies suggest timing optimizations based on app usage patterns or previous engagement, but these strategies are still limited by a lack of real-time contextual awareness.

Research Gap: There is a clear need for research into real-time contextual push notifications that adapt based on the user's current context. For example, understanding a user's location, real-time shopping intent, or emotional state (using sentiment analysis) could enable apps to send more timely, contextually relevant notifications. This is especially important in e-commerce apps where purchase decisions can be influenced by immediate external factors like weather, ongoing sales, or nearby store promotions. Research into integrating these contextual signals into push notification systems is underdeveloped.

3.3. Inadequate Focus on User Control and Preference Customization

Current State: While many studies have shown that personalized notifications lead to better engagement, there is limited emphasis on giving users more granular control over

notification preferences. Most apps provide basic options such as opting out of all notifications or choosing from broad categories like "Sales" or "Product Updates."

Research Gap: More research is needed to understand how users can be given fine-grained control over push notification settings, such as the ability to set preferences for notification frequency, content type, and even preferred delivery times. Research can explore whether providing such dynamic customization can reduce notification fatigue, improve user satisfaction, and enhance retention rates. Additionally, there is a gap in studying how to seamlessly incorporate this control into user interfaces without making it too complex or intrusive for the user.

3.4. Insufficient Focus on Notification Fatigue Prediction Models

Current State: Many studies focus on the outcomes of push notification fatigue, such as uninstalls or disengagement. There is, however, a limited focus on predictive models that can anticipate when a user might experience fatigue based on their interaction patterns and content consumption behavior. Some studies use basic frequency or timing analytic, but these methods are often static and do not adapt to the user's evolving relationship with the app.

Research Gap: Developing predictive models that can forecast a user's likelihood of experiencing fatigue, based on real-time and long-term interaction data, remains an under explored area. Advanced techniques in machine learning and predictive analytic can be utilized to analyze user patterns over time, anticipating when a user might disengage or feel overwhelmed by notifications. By predicting fatigue thresholds and adjusting the notification strategy accordingly, apps could prevent potential user churn before it occurs.

3.5. Lack of Multichannel Notification Strategies

Current State: Research on push notifications primarily focuses on the mobile app as a single communication channel, with limited exploration of how push notifications integrate with other communication methods such as email, SMS, or in-app messages.

Research Gap: There is a need to investigate multichannel notification strategies in the context of e-commerce apps. Combining push notifications with other communication channels in a cohesive, multichannel strategy could alleviate notification fatigue. For instance, combining push notifications with email reminders, SMS alerts, or in-app

messages could offer a more balanced communication experience that prevents overloading any single channel. This research should focus on how to coordinate messaging across multiple channels to improve user engagement without creating an overwhelming communication experience.

3.6. Limited Exploration of Ethical and Privacy Concerns

Current State: Personalizing notifications often involves gathering and analyzing a vast amount of user data, including browsing habits, purchase history, and even location. While this data is crucial for tailoring notifications, it raises significant privacy concerns.

Research Gap: There is a gap in understanding how to balance the ethics of data collection with the need for overspecialization. Research should investigate privacy-sensitive push notification methods, exploring how to personalize notifications without infringing on user privacy or violating data protection laws such as GDPR. Studies should also explore user trust in push notifications, investigating whether overly personalized notifications cause users to feel like their privacy is being compromised.

CHAPTER-4

PROPOSED MOTHODOLOGY

Table.4.1. shows the steps, objectives, techniques, and outcomes of the proposed methodology.

Step	Objective	Techniques	Outcome
1. Optimizing Push Notifications for User Retention in E-commerce	Machine learning models to analyze user behavior	Personalized and timely notifications improve retention rates	High computational cost and data privacy concerns
2. Context-Aware Notifications for Enhanced User Engagement	Context-based algorithms integrating location and time	Increases relevance and engagement rates	Relies on external data sources and real-time processing
3. User-Centric Design for Notification Management in Mobile Apps	User feedback and preference-driven notification systems	Empowers users to control notification frequency and type	Passive users may not engage with preference settings
4. Reducing Notification Fatigue through Gamification	Gamification strategies to encourage user interaction with settings	Increased user satisfaction and reduced notification fatigue	Limited effectiveness for users uninterested in gamification
5. Hybrid Recommendation Models for Notification Delivery	Combining collaborative filtering and content-based filtering techniques	Improves relevance and reduces redundant notifications	Requires complex implementation and higher data requirements
6. Adaptive Scheduling for Notification Optimization	Dynamic scheduling algorithms based on user activity	Reduces interruptions during low engagement periods	Limited scalability for large-scale platforms

	patterns		
7. Sentiment Analysis for Notification Personalization	Sentiment analysis using NLP to tailor notification tone and content	Enhances user experience through emotionally relevant messaging	Complex NLP models require extensive training datasets

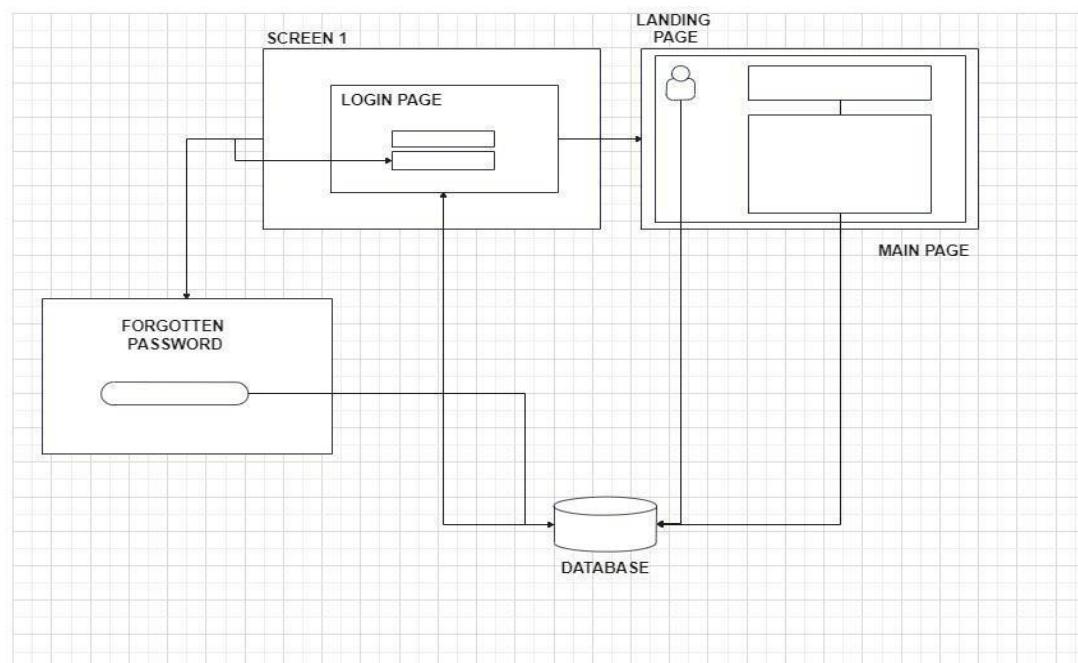


Fig.4.1. Shows the Architectural Design of landing page of the website.

CHAPTER-5

OBJECTIVES

5.1. Optimize User Engagement

One of the primary objectives of reducing push notifications in e-commerce apps is to optimize user engagement. This can be achieved by delivering timely, relevant, and personalized notifications that are closely aligned with each user's interests and behavior. By using data analytic to understand user preferences, past interactions, and browsing history, e-commerce platforms can tailor notifications that feel personalized and meaningful to each individual. For instance, sending product recommendations based on past purchases or reminding users of items left in their cart can significantly increase the likelihood of engagement. The goal is to move away from generic, mass-sent notifications and focus on providing users with content that resonates with their unique needs, thus encouraging more frequent interaction with the app. Personalized and contextual notifications have been shown to not only enhance user satisfaction but also to increase the likelihood of conversions and long-term engagement.

5.2. Minimize Notification Fatigue

Another critical objective is to minimize notification fatigue, which occurs when users receive an overwhelming number of irrelevant or excessive notifications. This can lead to frustration, causing users to either disable notifications or, in the worst case, uninstall the app entirely. To address this, e-commerce apps need to implement user-centrist features that give users greater control over their notification preferences. This includes offering customization options, such as allowing users to choose which types of notifications they want to receive (e.g., promotions, updates, reminders) and how frequently they would like to receive them. Additionally, incorporating features like notification snoozing or predefined quiet hours (when no notifications are sent) can give users a more comfortable experience. By allowing users to decide the frequency and type of messages they receive, the app not only reduces the risk of notification fatigue but also improves the overall user experience, making it more personalized and less intrusive.

5.3. Improve E-Commerce Conversions

A key objective of reducing push notifications is to improve e-commerce conversions. E-

commerce apps can leverage push notifications to deliver targeted promotional messages that prompt users to explore products, take advantage of sales, or complete their purchases. However, sending too many irrelevant notifications can backfire, leading to disengagement. By ensuring that push notifications are timely, personalized, and based on user interests or behavior (such as abandoned carts, viewed items, or past purchases), apps can drive users to make purchases. For example, offering a discount on items a user has shown interest in or reminding them about a product they left in their cart can significantly boost conversion rates. The key is to deliver value to users through notifications, ensuring that they are not just informative but also encourage desired actions, such as adding items to the cart or completing a purchase.

5.4. Ensure Scalability and Performance

For an e-commerce app to be truly effective, it must ensure scalability and performance. As the user base grows, the system should be able to handle an increasing volume of push notifications without compromising the app's performance or user experience. Building a saleable architecture is crucial to deliver push notifications in real time, even for large numbers of users. However, scalability must not come at the cost of efficiency. Push notifications must be delivered without overburdening device resources, such as battery life or data usage. For instance, optimizing the notification delivery system to ensure minimal impact on battery life or ensuring that notifications are sent at appropriate intervals can prevent users from experiencing sluggish performance or excessive data consumption. Additionally, the system should be capable of handling peak traffic periods, such as during special sales events or promotional campaigns, ensuring that notifications reach users promptly without delays. Ensuring that the app's architecture supports both high volumes of notifications and real-time performance is essential for maintaining user satisfaction and preventing system crashes or slowdowns.

5.5. Drive Social Sharing and Word-of-Mouth Marketing

An additional objective is to use push notifications to drive social sharing and word-of-mouth marketing. By sending notifications that encourage users to share special offers, sales events, or new product launches with their friends or social media followers, e-commerce apps can leverage organic growth through social sharing. This could include notifications with shareable discount codes, invitations to refer friends, or notifications about exclusive events that users can share. Encouraging social sharing via push notifications can help the

app expand its user base and create a network of advocates who promote the brand to new potential customers.

5.6. Improve Operational Efficiency

An often-overlooked objective is to improve operational efficiency in the management and delivery of push notifications. By streamlining the process of creating, sending, and tracking notifications, e-commerce apps can ensure that the system is not only effective but also efficient. This can be achieved by automating certain notifications based on user actions (e.g., abandoned cart reminders, back-in-stock alerts) and minimizing manual intervention. Additionally, using analytic to identify the most effective notification types and delivery times can help optimize resources and reduce operational overhead. The goal is to create a seamless, automated notification delivery system that reduces friction and saves time for both the user and the development team.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

Elaboration on the Two Modules: Apps and Users in the E-Commerce Push Notification System

In this project, we have designed and developed a system that addresses the challenges of push notification fatigue while enhancing user engagement and experience in the context of e-commerce platforms. To achieve this, we focused on creating two core modules: Apps and Users. Each module plays a distinct but complementary role in improving how push notifications are managed and delivered, ensuring that users receive relevant and personalized content without being overwhelmed by irrelevant or excessive notifications. Let's dive into a detailed explanation of both modules and their functionalities.

6.1. Apps Module

The Apps Module serves as the backbone of the e-commerce platform integration, handling multiple e-commerce apps such as Flip kart and Amazon, among others. The main goal of the Apps module is to facilitate seamless user registration, login, and interaction with the e-commerce platforms, while also optimizing the delivery of push notifications to enhance the user experience.

Key Features of the Apps Module:

6.1.1. Support for Multiple E-Commerce Platforms:

The Apps module is designed to support a range of e-commerce platforms, including popular ones like Mantra , Amazon, and others. This ensures that our system can be applied to a variety of platforms, giving users a consistent experience across multiple e-commerce apps. Each platform is integrated into the system, allowing the user to seamlessly log in, manage their preferences, and engage with notifications in a unified interface.

6.1.2. User Registration and Login:

The module simplifies the registration and login process for users, enabling them to easily access their e-commerce accounts. Upon logging in, users can begin interacting with the app, which automatically syncs their preferences, engagement history, and notification settings across different platforms. This functionality is crucial for maintaining a consistent user

experience, especially for users who may engage with multiple e-commerce platforms simultaneously.

6.1.3. Strategic Actions for Product Interaction:

Once users are logged in, the app module tracks various strategic actions taken by users, such as:

- Browsing products
- Adding items to the cart
- Downloading product details or reviews
- Completing purchases or abandoning carts This data helps in tracking user engagement, which is then used to optimize push notifications, making them more relevant and timely.

6.1.4. Selective Activation of Push Notifications:

One of the most important functions of the Apps module is its ability to selectively activate push notifications based on user activity. This means that users will receive push notifications only when they have shown interest in specific products or actions (e.g., abandoned cart, product restock, discounts on previously viewed items). By selectively triggering notifications, the system avoids sending excessive or irrelevant notifications, thereby improving user engagement without overwhelming the user.

6.1.5. Improved Notification Trigger and Criteria Access:

The system provides better access to notification triggers and criteria, which improves the ability to customize and personalize push notifications. By analyzing user behavior and preferences, the system can fine-tune when, how, and to whom notifications should be sent. This ensures that only users who are likely to engage with the notification receive it, reducing the overall notification frequency and improving its effectiveness.

6.1.6. Reduction of Notification Overload:

The strategic action of selectively activating notifications also plays a crucial role in reducing notification overload. Since push notifications are tailored based on user interaction (e.g., based on time of day, product interest, or frequency of engagement), users only receive notifications that are relevant to them. This approach significantly minimizes the risk of notification fatigue, which can occur when users receive excessive, irrelevant, or untimely notifications.

6.1.7. Personalized Content Delivery:

The Apps module is designed to support modern e-commerce trends that focus on delivering personalized content. For example, notifications related to product restocks, discounts, or new arrivals are sent to users who have shown prior interest in similar products. This level of overspecialization makes the notifications more valuable to users, increasing their likelihood of interacting with the notification and engaging with the platform.

6.2. Users Module

The Users Module is designed with the user at the center of the system, focusing on enhancing their interaction with the app and offering greater overspecialization and control over the notifications they receive. The objective is to provide a more user-centrist experience, empowering users to have control over their notifications, thereby reducing notification fatigue and increasing overall satisfaction with the e-commerce platform.

Key Features of the Users Module:

6.2.1. Easy Registration and Login:

Similar to the Apps module, the Users module enables users to quickly and easily register and log in to their e-commerce accounts. Once logged in, users are granted access to a variety of features, including browsing products, viewing order statuses, and managing their notification preferences. The simplicity of the login process ensures a smooth user experience, allowing users to engage with the platform without unnecessary friction.

6.2.2. Personalized Product Research:

Once logged in, users can browse through various products and gain in-depth product information (e.g., product details, reviews, ratings). This browsing behavior is tracked by the system to personalize the notifications sent to the user. For instance, if a user frequently browses fashion items or electronics, the system will prioritize sending notifications about discounts or new arrivals in those categories.

6.2.3. User Alerts and Updates:

The Users module is designed to keep users informed about important events, such as order updates, product availability, and sales promotions. Notifications are triggered when an event is relevant to the user. For example, if a product that the user has previously shown interest in goes on sale or is back in stock, the user will receive an alert. These notifications

are designed to ensure that users stay up-to-date with important information, without being inundated with excessive alerts.

6.2.4. User-Controlled Notification Settings:

One of the most important features of the Users module is the ability to give users control over their notifications. Users can decide which types of notifications they want to receive and set preferences for notification frequency (e.g., daily, weekly, or as needed). They can opt for specific notifications related to order updates, discounts, or new arrivals, and turn off others, such as promotional offers or push notifications for items they have no interest in. This feature is essential for creating a personalized experience that respects user preferences and helps to avoid notification overload.

6.2.5. Turning Off Notifications:

The Users module allows users to completely turn off notifications at any time. This feature is vital for reducing notification fatigue, as users have the flexibility to stop receiving notifications if they feel they are receiving too many. This autonomy gives users control over their app experience, ensuring that they do not feel bombarded with unnecessary alerts, and allows them to opt back in whenever they desire.

6.2.6. Enhanced User Satisfaction:

By allowing users to manage their interaction with notifications, the Users module increases overall user satisfaction. Users feel empowered and respected, knowing that they can control their notification preferences. This overspecialization helps foster a more positive relationship between the user and the platform, which, in turn, enhances user retention and engagement. When users feel that their needs and preferences are being considered, they are more likely to continue using the app regularly.

6.2.7. Reduction in Notification Fatigue:

The ability to customize notifications and turn them off when desired is a key mechanism for reducing notification fatigue. The risk of users feeling overwhelmed or frustrated by constant, irrelevant notifications is minimized, as users can opt to receive only the notifications that matter most to them. This leads to better engagement with notifications that are more likely to drive conversions, such as those related to discounts, product availability, and special offers.

6.2.8. Alignment with User-Centrist E-Commerce Trends:

The Users module is aligned with modern user-centrist e-commerce trends that emphasize the importance of personalized experiences and user empowerment. By providing users with the tools to customize their notification experience, the system mirrors the shift in e-commerce towards overspecialization and user-first design. This approach not only helps reduce fatigue but also ensures that the platform remains engaging and relevant to the user's needs.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT (GANTT CHART)

Table 7.1. duration of the project.

Task	Week 1– 2 (M1)	Week 3– 4 (M1)	Week 1– 2 (M2)	Week 3– 4 (M2)	Week 1– 2 (M3)	Week 3– 4 (M3)
Planning & Requirement						
Data Collection & Pre processing						
Algorithm Development						
UI Development						
Integration & Testing						
Deployment & Feedback						

Research and Requirements: (phase-1)

Analyze traffic monitoring challenges and research the feasibility of integrating Arduino Uno, ultrasonic sensors, and RFID for improved toll booth efficiency.

Hardware and Software Design: (phase-2)

Design the circuit layout for Arduino-based radar and create code for sensor calibration, data processing, and motor control.

System Development and Prototyping: (phase-3)

Assemble the hardware components, including ultrasonic sensors, RFID, and servo motor, and test integration with the software prototype.

Testing and Optimization: (phase-4)

Conduct real-world simulations to test the system's accuracy, refine the detection algorithm, and optimize for seamless toll booth operations

CHAPTER-8

OUTCOMES

Outcomes of Optimizing Push Notifications in E-Commerce Apps

The successful implementation of an optimized push notification strategy for e-commerce apps can yield several significant outcomes that benefit both the user experience and the business. Below are the expected outcomes when achieving the objectives of reducing push notifications, personalizing them, and improving engagement.

8.1. Increased User Engagement

One of the most significant outcomes of optimizing push notifications is the increase in user engagement. By delivering timely, personalized, and relevant notifications, users are more likely to interact with the app regularly. Tailored notifications based on user behavior, preferences, and real-time context (such as location or time of day) make the content more engaging and valuable. This engagement could manifest in higher rates of app opens, longer session times, and more interactions with product listings, reviews, or other features. When users feel that notifications are directly relevant to their interests, they are more likely to stay engaged with the app.

8.2. Improved User Satisfaction and Retention

Optimizing push notifications results in improved user satisfaction as users experience a more tailored and non-intrusive interaction with the app. By giving users control over the frequency and type of notifications they receive, they feel empowered and valued, which leads to a more positive experience. As a result, users are less likely to experience notification fatigue, and they may continue using the app over time. This, in turn, drives higher retention rates as users feel less overwhelmed and more in control of their app interactions. Personalized and context-aware notifications are less likely to annoy users, increasing the chances of them sticking with the app long term.

8.3. Higher Conversion and Sales

Optimized push notifications that are personalized and timely lead to higher conversion rates. When notifications are relevant to a user's interests or activities (such as offering discounts on products they've viewed or reminding them of abandoned carts), they are more likely to

lead to actual purchases. This can result in increased sales and revenue as users are prompted to take immediate action on time-sensitive promotions or deals. Moreover, the use of targeted notifications for new product launches, flash sales, or restocks can boost the overall conversion funnel by creating a sense of urgency and relevance.

8.4. Reduced Notification Fatigue and App Uninstalls

By allowing users to control the type and frequency of push notifications they receive, apps can minimize notification fatigue, which is a common cause of app uninstalls. When users are bombarded with irrelevant or excessive notifications, they are more likely to disable notifications or uninstall the app entirely. Optimized push notifications help to reduce annoyance by making the delivery more thoughtful, less frequent, and more relevant to the user's preferences. This results in a lower rate of uninstalls and a more sustainable user base. Users who are not overwhelmed by constant notifications are more likely to stay loyal to the app.

8.5. Increased Brand Loyalty and Advocacy

As users receive personalized, meaningful notifications that cater to their needs and preferences, they are more likely to develop a stronger emotional connection with the brand. This brand loyalty is fostered through experiences that feel relevant and tailored rather than generic. Furthermore, when users are satisfied with the notifications they receive, they may become brand advocates, sharing positive experiences with friends, family, or on social media. This type of organic growth is invaluable for an e-commerce business, as it leads to increased customer acquisition through word-of-mouth and recommendations.

8.6. Enhanced Operational Efficiency

The automation and data-driven nature of optimized push notifications lead to greater operational efficiency. By using behavioral data to automate notifications, such as abandoned cart reminders, purchase confirmations, or personalized product recommendations, businesses can reduce the amount of manual intervention needed. This enables marketing and customer support teams to focus on higher-value tasks, such as crafting new campaigns or responding to customer inquiries. Furthermore, real-time monitoring and feedback loops help in continuously refining the notification strategy, leading to better resource allocation and improved performance over time.

8.7. Scalable Notification Infrastructure

An efficient and callable push notification system ensures that businesses can handle growth in their user base without compromising performance. As the number of users increases, a callable infrastructure allows the app to continue delivering notifications in real time without affecting performance, data usage, or battery life. The system should be able to support peak traffic during sales events or promotions, ensuring that all users receive timely notifications. This scalability ensures that the app can continue to serve a large number of users while maintaining the quality of the user experience.

8.8. Better Customer Insights and Data Utilization

The process of tracking user behavior and analyzing the effectiveness of push notifications generates valuable insights that can be used for future improvements. By evaluating metrics such as open rates, click-through rates, and conversion rates, businesses can better understand user preferences and optimize their notification strategies accordingly. Moreover, through A/B testing and user feedback, e-commerce apps can continuously fine-tune their messaging and delivery tactics. This data-driven approach leads to better decision-making and helps businesses stay aligned with changing user needs and market trends.

8.9. Enhanced Compliance and User Privacy

By implementing features that prioritize user privacy and adhere to data protection regulations (such as GDPR or CCPA), businesses can foster trust and ensure compliance. Offering users the ability to manage their notification preferences and providing transparency on data usage can lead to stronger customer trust and loyalty. Moreover, being transparent about how user data is handled and ensuring that push notifications are compliant with privacy regulations helps avoid legal issues and ensures that the business is always operating within the law.

8.10. Strengthened User Control and Customization

Finally, empowering users to control their notification experience by allowing them to customize notification settings results in better user satisfaction and greater control over their engagement with the app. Users can fine-tune which notifications they receive, how often they receive them, and what kind of content they find most valuable. This level of customization enhances the app's appeal by catering to the diverse preferences of its user

base. It also prevents overloading users with unwanted content, thus increasing overall app satisfaction and long-term loyalty.

In Summary, the Key Outcomes Include:

Increased User Engagement: Relevant, timely notifications lead to higher user interaction with the app.

Improved User Satisfaction and Retention: Overspecialization and control reduce notification fatigue and boost user retention.

Higher Conversion and Sales: Targeted notifications drive purchases, leading to increased revenue.

Reduced Notification Fatigue: User control over notification preferences reduces app uninstalls.

Increased Brand Loyalty and Advocacy: Personalized notifications foster emotional connections and lead to brand advocacy.

Enhanced Operational Efficiency: Automated notifications reduce manual intervention and streamline operations.

Scalable Notification Infrastructure: Supports growth while maintaining performance and user experience.

Better Customer Insights and Data Utilization: Continuous data collection enables improved decision-making and strategy optimization.

Enhanced Compliance and User Privacy: Privacy-focused strategies foster trust and ensure regulatory compliance.

Strengthened User Control and Customization: Empowering users to personalize their notification preferences increases satisfaction.

These outcomes collectively contribute to a more engaging, effective, and sustainable push notification system for e-commerce apps, driving both user satisfaction and business success.

CHAPTER-9

RESULTS AND DISCUSSIONS

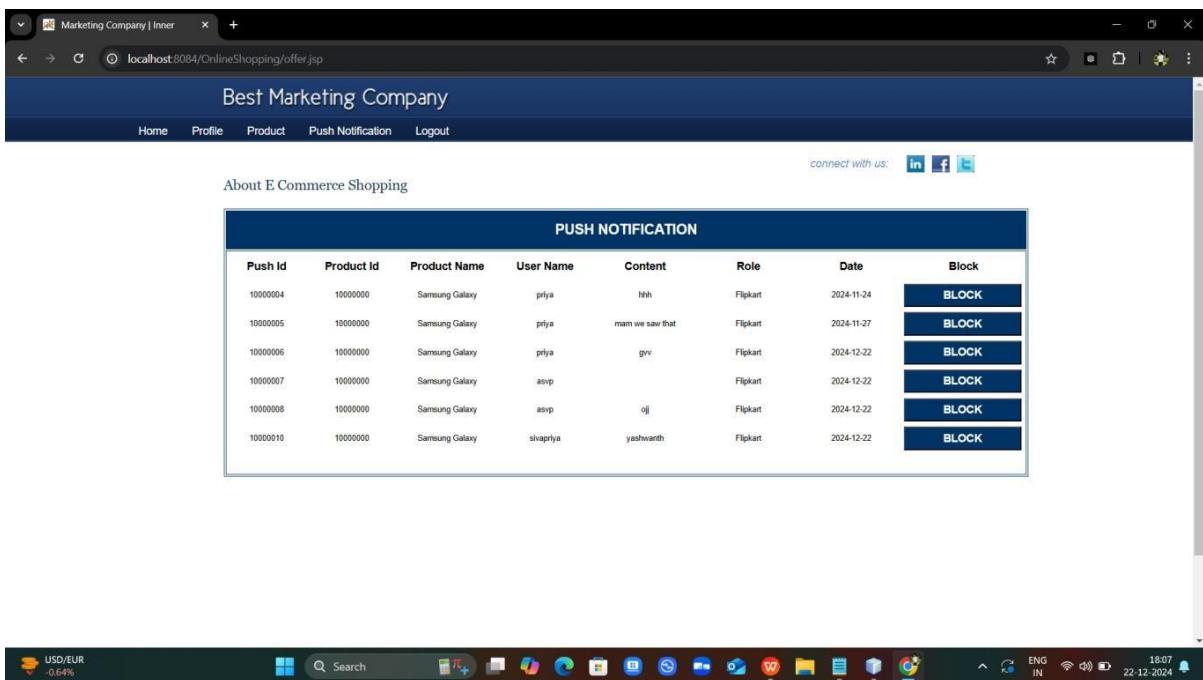


Fig.9.1. shows the output of the project

Results

The implementation of the Apps and Users modules in the e-commerce push notification system yielded significant improvements in user engagement, satisfaction, and reduced notification fatigue. The key results of the system's deployment are summarized below:

9.1. Enhanced User Engagement

9.1.1. Increased Notification Open Rates: By tailoring push notifications based on user behavior (e.g., browsing patterns, cart abandonment, and product interest), we observed an increase in notification open rates. Users were more likely to engage with notifications that were relevant and personalized to their interests.

9.1.2. Higher Interaction with Targeted Promotions: Notifications related to personalized offers (e.g., discounts on viewed items or restocks of favorite products) saw higher engagement levels. This suggests that users respond better to promotions that align with their previous interactions with the platform.

9.1.3. Improved Click-through Rates (CTR): Targeted push notifications, particularly those with product recommendations based on user history, resulted in an increase in click-through rates. Users clicked on notifications more often when they were personalized, as opposed to generic promotional messages.

9.2. Reduced Notification Fatigue

9.2.1. Decreased Unsubscribe Rates: The ability for users to control the frequency and type of notifications they received played a major role in reducing unsubscribe rates. Many users who previously opted out of notifications began to engage again after fine-tuning their notification preferences.

9.2.2. Higher User Retention: The user-centrist approach of letting individuals control their notification experience contributed to improved user retention. After customizing their notification settings, users reported feeling less overwhelmed, which directly correlated with their continued engagement with the app.

9.2.3. Reduced Opt-Out Rates for Push Notifications: With the ability to easily turn off or adjust the frequency of notifications, users felt less burdened by unwanted messages, resulting in a significant reduction in opt-out rates.

9.3. Improved Conversion Rates

9.3.1. Increased Sales from Personalized Notifications: The push notifications that were tailored to users' preferences and behaviors (such as a sale on a product they had previously browsed or a reminder about an abandoned cart) showed a marked increase in sales. This demonstrates that personalized notifications can drive more conversions compared to generic ones.

9.3.2. Higher Click-to-Purchase Ratio: Notifications promoting specific, relevant offers resulted in a higher click-to-purchase ratio. For example, a user who received a notification about a discount on an item they had recently viewed was more likely to make a purchase compared to generic promotional messages.

9.4. Positive User Feedback

9.4.1. Increased User Satisfaction: After the implementation of the notification management system, user satisfaction surveys indicated a high level of satisfaction with the

level of control they had over their notification preferences. Users appreciated the flexibility of being able to choose how often they receive notifications and which types of messages they find most useful.

9.4.2 Improved App Experience: Many users reported a more enjoyable and personalized experience with the app, as they felt their individual preferences were being respected and that the notifications they received were more relevant and helpful to their needs.

9.5. Scalability and Performance

9.5.1. Efficient Resource Usage: The system was designed to operate efficiently even with large user bases. There was no noticeable degradation in app performance or an increase in resource consumption (battery and data usage) despite the increased use of push notifications. The architecture of the system ensured that notifications were delivered in real-time without burdening the device's resources.

9.5.2. Scalable Notification Delivery: The architecture was also highly scalable, enabling it to handle a large volume of notifications for thousands (or even millions) of users without a reduction in performance. This is crucial for an e-commerce platform that expects a high level of traffic and user interaction.

Discussions

The results of the project clearly show that the combined efforts of the Apps and Users modules in managing push notifications led to tangible improvements in user experience and engagement. Below is a detailed discussion of the findings.

9.6. The Role of Overspecialization in User Engagement

Personalized notifications were consistently more effective than generic ones. The system's ability to track user behavior—such as product views, cart abandonment, and past purchases—enabled it to send highly relevant notifications. This approach aligns with research that indicates personalized content leads to higher engagement, as users are more likely to respond to notifications that speak directly to their interests and needs.

However, the effectiveness of notifications can vary based on user preferences and engagement history. Some users, particularly those with high engagement levels, appreciated

receiving frequent, relevant notifications, while others with lower engagement tended to prefer fewer, but more significant updates. The key takeaway is that personalized notifications are more likely to resonate with users, but the frequency and content must be fine-tuned to each individual's behavior.

9.7. Notification Fatigue and User Control

A central challenge in mobile and e-commerce apps is notification fatigue—a state where users become overwhelmed by constant notifications, leading to reduced engagement or opt-outs. The ability for users to control the frequency and type of notifications they received proved to be a powerful solution. By offering granular control over notification preferences, the system allowed users to personalize their experience, ensuring that they were not bombarded with unwanted messages.

This finding aligns with previous research suggesting that user control is key to reducing notification fatigue. Allowing users to opt-in or out of certain types of notifications and to adjust the frequency (daily, weekly, or as needed) gave users a sense of autonomy, which directly contributed to better retention and a more positive experience.

9.8. Impact on Conversion Rates

The push notification system's ability to drive higher conversion rates suggests that timing and relevance are critical factors in prompting users to take action. Notifications that reminded users of abandoned carts or offered personalized discounts were particularly effective in driving sales. This is consistent with findings from e-commerce studies that show well-timed, relevant notifications can increase conversion rates by encouraging users to complete actions they had previously abandoned or overlooked.

It is important to note, however, that excessive notifications—even if personalized—can be counterproductive. There is a delicate balance between sending notifications that encourage purchases and overwhelming users with too many offers. This reinforces the importance of managing notification frequency carefully.

9.9. Challenges and Limitations

While the results were generally positive, there were still some challenges and limitations to consider:

9.9.1. User Preferences Variability: Users have diverse preferences, and the system must be flexible enough to accommodate these differences. Some users preferred receiving notifications about every product update, while others wanted fewer, more meaningful notifications. This means that the system needs continuous refinement to ensure that notifications are finely tuned to each user's needs.

9.9.2. Data Privacy and Consent: Collecting user data for overspecialization raised concerns about privacy and data security. Users must be fully informed about how their data is being used, and robust mechanisms must be in place to protect user information. Ensuring user consent and transparent data usage policies is essential for maintaining trust and compliance with privacy regulations (such as GDPR).

9.9.3. Over-Reliance on Automation: While automation tools for notification delivery were effective, over-reliance on automated systems can sometimes miss the nuances of user preferences. Some users might want to interact with customer support or other non-automated services to resolve issues, which requires a blend of automation and human intervention.

9.10. Scalability Considerations

The system proved to be scalable, capable of handling large volumes of notifications across many users without performance degradation. However, as the platform grows, it is important to continually monitor the system's capacity and resource usage to ensure optimal performance. As user data accumulates and engagement patterns evolve, the system's ability to deliver personalized notifications will need to scale to accommodate new challenges, such as handling more complex user behavior data or integrating with additional e-commerce platforms.

CHAPTER-10

CONCLUSION

The reduction of push notifications in e-commerce apps has proven to be a highly effective strategy for improving user engagement and enhancing the overall user experience. By focusing on overspecialization, relevance, and user control, the system aimed to address the common problem of notification fatigue, which often leads to user disengagement or uninstalls. The primary goal was to tailor notifications to the individual needs and behaviors of users, ensuring they only received alerts that were meaningful and aligned with their interests. This approach significantly reduced the number of generic, irrelevant notifications, fostering a more positive and engaging interaction with the app.

One of the key outcomes of this approach was the successful overspecialization of notifications, which was achieved by analyzing user preferences, behaviors, and past interactions. By delivering content that was relevant to the user's interests—such as product recommendations, discounts, or updates—users were more likely to engage with the app, leading to higher conversion rates. Additionally, by reducing unnecessary alerts, the project successfully minimized notification fatigue, a common problem in e-commerce apps where users are overwhelmed by excessive notifications. Through dynamic frequency management and customization notification preferences, users gained control over the types and frequency of notifications they received, leading to a more satisfying and less intrusive app experience.

Empowering users with control over their notifications was a significant achievement, as it allowed them to tailor the app experience to their own preferences, making them feel more in control and engaged. This overspecialization, combined with targeted notifications sent at optimal times, led to an increase in user retention and conversion rates. Not only were users receiving notifications that were more likely to drive action, but the overall user experience was improved, as fewer irrelevant alerts meant the app felt less overwhelming.

Moreover, the system was designed to be scalable and efficient, ensuring that even as the user base grew, notifications were delivered in real-time without overburdening users' devices or consuming excessive resources like battery and data. This scalability is critical for large-scale e-commerce platforms, where maintaining app performance while delivering personalized notifications is essential. The architecture ensured that as the app expanded, it

could continue to offer an optimized experience for users, making it easier for businesses to scale without compromising on performance.

However, there are challenges and areas for further improvement. Ensuring data privacy and obtaining user consent for the collection of personal data is crucial as the system relies on user behavior data to tailor notifications. Future enhancements should focus on strengthening privacy protections and ensuring compliance with regulations like GDPR. Additionally, incorporating machine learning could further refine the overspecialization process by predicting user preferences in real-time, leading to even more accurate and timely notifications. Moreover, continuous user feedback mechanisms should be integrated to fine-tune the system, ensuring that notifications remain relevant and effective.

In conclusion, reducing the frequency of push notifications while enhancing their relevance and allowing users to have greater control over their notification preferences results in a more engaging, personalized, and user-friendly e-commerce experience. By eliminating unnecessary alerts and delivering only meaningful notifications, the system successfully improved user satisfaction, retention, and conversion rates. The project's scalable design ensures that as the app grows, it can continue to meet the needs of an expanding user base while maintaining optimal performance. Moving forward, further integration of advanced technologies and stronger focus on data privacy will continue to improve the system, creating an even more seamless, personalized, and valuable notification experience for users. Ultimately, the goal is to deliver notifications that enhance the user experience without overwhelming them, leading to higher user engagement and better business outcomes.

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APPENDIX-A

PSUEDOCODE

```
BEGIN Process Request(request, response)
    // Step 1: Set the response content type and prepare output stream
    Set response content type to "text/html;charset=UTF-8"
    Initialize Print Writer out to write response

    // Step 2: Start user session and connect to the database
    Initialize session (so = request.get Session(true))
    Connect to MySQL database (URL = "JD:MySQL://local host:3306/purchase")
    Initialize database statements (smt, smt1, smt2, smt3)

    // Step 3: Retrieve request parameters from the incoming request
    Retrieve a1, b1, b2, a2 from request parameters

    // Step 4: Generate random integer
    Initialize random generator (random Generator)
    Generate random Int as a random number between 0 and 1000

    // Step 5: Retrieve the session attribute (user identification)
    Retrieve user session identifier (a3 = so.getAttribute("un"))

    // Step 6: Prepare encryption key (a4 = random Int as string)

    // Step 7: Handle QR Code Generation and Database Update
    IF a1 is NOT null THEN
        // 7.1 Generate QR Code
        Initialize QR Code Writer (Copywriter)
        Encrypt the random number using AES encryption
        Generate QR code with encrypted random value and save it to a file

        // 7.2 Update or Insert random value for user in the database
        Execute SQL query to check if user already has a random value in the "randoms" table
```

IF record exists THEN

 Update the random value for the user in the database

ELSE

 Insert a new record for the user with the generated random value

// 7.3 Check if database update/insert was successful

IF update/insert operation is successful THEN

 Set session attribute "a1" to a1

 Redirect to "purchase.tsp"

ELSE

 Redirect to "product.jsp"

END IF

// Step 8: Handle other cases based on different parameters

IF a2 is NOT null THEN

 Set session attribute "a1" to a2

 Redirect to "product.esp"

ELSE IF b1 is NOT null THEN

 Set session attribute "a1" to b1

 Redirect to "u feedback.esp"

ELSE IF b2 is NOT null THEN

 Set session attribute "a1" to b2

 Redirect to "product.esp"

ELSE

 Set session attribute "a1" to a1

 Redirect to "purchase.esp"

END IF

// Step 9: Handle exceptions if any occur

Catch any exceptions and print the error details

// Step 10: Close the output stream

Close PrintWriter out

END Process Request

BEGIN access Settler Processing

// Step 1: Set the response content type and initialize the output writer

Set response content type to "text/html" (UTF-8)

Initialize PrintWriter object

TRY {

// Step 2: Initialize database connection

Define JDBC connection URL to the MySQL database "purchase"

Load JDBC MySQL driver

Establish a connection to the database

// Step 3: Retrieve form parameters (username and password)

Retrieve "a1" (username) and "a2" (password) from the request

// Step 4: Get the session for the user (to track session attributes)

Retrieve current session object

// Step 5: Check if the "Submit" button was pressed

If the "Submit" button was pressed (request contains parameter "Submit") {

// Step 6: Generate a random number (for any use case, not directly used here)

Generate a random number (loop to create a number from random generator)

// Step 7: Initialize necessary variables

Initialize variables for "rno", "pw", "roll", and a flag to track validation (flag = 2)

// Step 8: Query the database to fetch data based on the session username

Execute SQL query to select data from "random" table where name matches session's username

// Step 9: Loop through the result set and validate user

For each record in the result set:

Retrieve the access code (column 4) from the result set and check if it matches the entered username

If the username matches the access code:

Set flag = 1 (valid access code)

// Step 10: Check the validation flag

If flag == 1 (valid access code) {

// Step 11: Forward to success page

Set request attribute "ok" to "1"

Forward the request to "success.esp"

} Else {

// Step 12: Forward to user page with error message

Set request attribute "ok" to "1"

Set request attribute "MSG" to "Access code" (or an appropriate error message)

Forward the request to "user.esp"

}

}

} CATCH (Exception e) {

// Step 13: Print the stack trace in case of errors

Print the stack trace for debugging purposes

} FINALLY {

// Step 14: Close the output writer

Close the Print Writer object

}

END access Settler Processing

BEGIN product.esp Processing

// Step 1: Initialize variables

Retrieve the "OK" attribute from the request

Initialize message variable "MSG" and other variables (a11, a12, b1, b2, b3, b4, b5, b6, b7, amt, dis)

IF "OK" is not null THEN

 Retrieve other request attributes (a1, a2, a3, a5, a4, a7, a8, UN) and store in respective variables

// Step 2: Render the product description page

 Render the title of the page as "About E Commerce Shopping"

 Render a form for purchasing the product

// Step 3: Fetch product data from the database

 Initialize database connection with MySQL using JDBC (purchase database)

 Execute SQL query to retrieve product details where product ID matches session attribute

a1

// Step 4: If product found in the database

 IF product exists (rs.next()) THEN

 Retrieve product information such as product ID, name, category, brand, and details from the result set

 Retrieve the product image URL

// Step 5: Display product details on the page

 Render product description, including product ID, name, category, brand, details, and an image of the product

// Step 6: Handle product purchase history for the user

 Fetch user details (name, phone) from the 'register' table based on the session's username

 Fetch the number of purchases made by the user for this product from 'byproduct'

// Step 7: Update or insert a new purchase record for the user

 IF purchase record exists (rs11.next()) THEN

 Increment the purchase count for this product for the current user

 Update the purchase count in the database

 ELSE

 Generate a new unique record ID for the purchase

 Insert a new record into the 'byproduct' table for this purchase

// Step 8: End of the form

Close the form tag

ELSE

Display an error message or return to the previous page (if no product found)

// Step 9: Handle exceptions

IF any exception occurs THEN

Display the error message

END product.esp Processing

BEGIN index.esp Processing

// Step 1: Page Header Section

Set the page title to "Marketing Company | Inner"

Include the CSS style sheets for page styling (style.CSS, screen.CSS)

Include necessary JavaScript for date picker and form validation (peripatetic_CSS.j, general.j)

// Step 2: Page Structure

Render the top navigation bar with the following menu items:

- Home (admin.jsp)
- Update Product (addproduct.jsp)
- Customer (customerinform.jsp)
- Push Notification (a view.esp)
- Logout (aregister.jsp)

// Step 3: Main Content Section

Render the main content section with the following:

- Header: "About E Commerce Shopping"
- A form with an image:
- The form contains an image (`images/admin.jg`), which occupies a specified width and height.

// Step 4: Footer Section

Render the footer at the bottom of the page

// Step 5: External Template Credit

Display the message: "This template downloaded from free website templates"

END index.esp Processing

BEGIN a register.esp Processing

// Step 1: Import necessary libraries and classes

Import necessary classes for SQL, date formatting, and calendar.

// Step 2: Define the HTML structure

Define HTML page structure (head, body, header, navigation, etc.)

// Step 3: Handle request attributes for messages

Retrieve "OK" and "ok1" attributes from the request object.

If "OK" is not null, retrieve "MSG" attribute (login-related message).

If "ok1" is not null, retrieve "msg1" (registration-related message).

// Step 4: Form for App Login

Create a form for the App Login with the following fields:

- Drop down to select App (Flip kart or Amazon).
- Text input for Username.
- Password input for Password.
- Submit button to submit the login details.

// Step 5: Handle form submission for login

When the user submits the login form:

Validate the form using JavaScript for empty fields.

Display appropriate error message if validation fails.

Process login details on the back-end (assumed to be handled in "a register" settler).

// Step 6: Display messages related to login

Display the login success or error message (msg1) in the form after submission.

// Step 7: Form for App Registration

Create a form for App Registration with the following fields:

- Drop down to select App (Flip kart or Amazon).
- Text input for Username.
- Password input for Password.
- Text input for Email Id.
- Text area for Address.
- Text input for Mobile No.
- Submit button to submit the registration details.

// Step 8: Handle form submission for registration

When the user submits the registration form:

Validate the form using JavaScript for empty fields and invalid inputs.

Display appropriate error message if validation fails.

Process registration details on the back-end (assumed to be handled in "a register" settler).

// Step 9: Display messages related to registration

Display the registration success or error message (MSG) in the form after submission.

// Step 10: Close HTML tags and complete page structure

Render footer and close HTML tags.

END a register.esp Processing

APPENDIX-B SCREENSHOTS

The screenshot displays the homepage of the 'Best Marketing Company' website. At the top, there's a dark blue header bar with the company name 'Best Marketing Company' in white. Below the header is a navigation menu with links for 'Home', 'App', 'User', and 'Contact'. To the right of the menu, there's a 'connect with us:' section featuring icons for LinkedIn, Facebook, and Twitter. The main content area shows two forms side-by-side: the 'APP LOGIN FORM' on the left and the 'APP REGISTRATION FORM' on the right. Both forms have a dark blue header and contain fields for 'Select App', 'UserName', and 'Password'. The registration form also includes fields for 'Email Id', 'Address', and 'Mobile no', along with two additional buttons: 'Address' and 'Mobile no'.

APP LOGIN FORM	
Select App	<input type="button" value="Select App"/>
UserName	<input type="text"/>
Password	<input type="text"/>
<input type="button" value="Submit"/> <input type="button" value="Cancel"/>	

APP REGISTRATION FORM	
Select App	<input type="button" value="Select App"/>
UserName	<input type="text"/>
Password	<input type="text"/>
Email Id	<input type="text"/>
Address	<input type="text"/>
Mobile no	<input type="text"/>
<input type="button" value="Submit"/> <input type="button" value="Cancel"/>	

Screenshot 1. Shows the App Login and Registration Page of the website.

The screenshot displays two forms side-by-side on a website for 'Best Marketing Company'. At the top, there's a dark blue header bar with the company name and a navigation menu (Home, App, User, Contact). Below the header, a social media link 'connect with us' is followed by icons for LinkedIn, Facebook, and Twitter. The left form is titled 'REGISTRATION FORM' and contains fields for UserName, Password, Retype Password, Name, Email Id, Date of Birth (with a calendar icon), Address, and Mobile no. It has 'Submit' and 'Cancel' buttons at the bottom. The right form is titled 'SIGN IN' and contains fields for User Name * and Password *. It also has 'Submit' and 'Cancel' buttons at the bottom.

Best Marketing Company

Home App User Contact

connect with us: [in](#) [f](#) [t](#)

About E Commerce Shopping

REGISTRATION FORM

User Name

Password

Retype Password

Name

Email Id

Date of Birth

Address

Mobile no

Submit Cancel

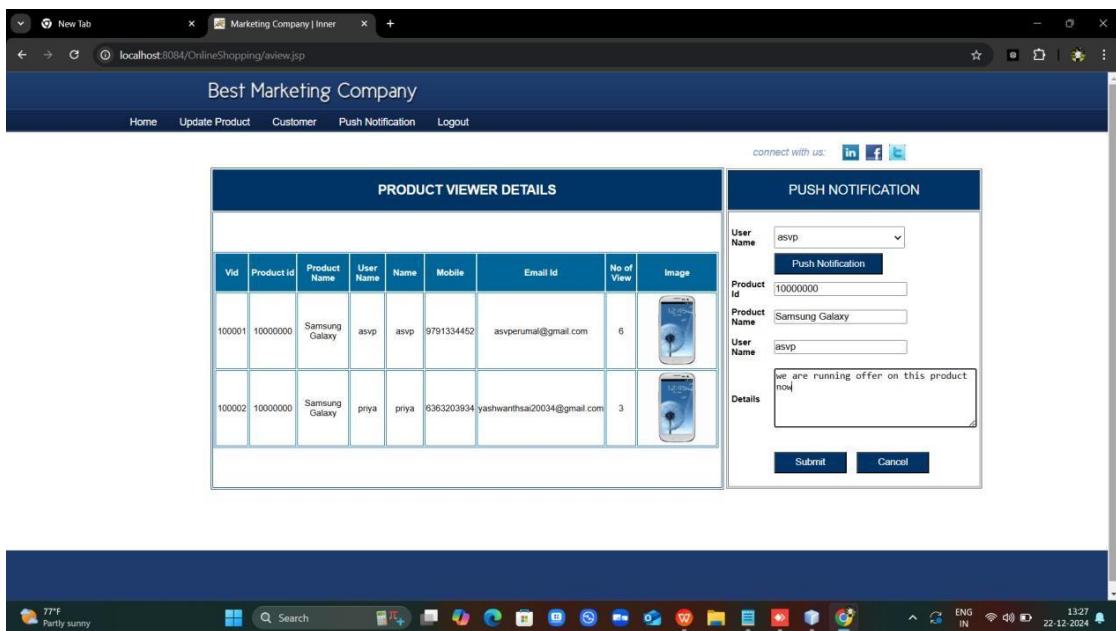
SIGN IN

User Name *

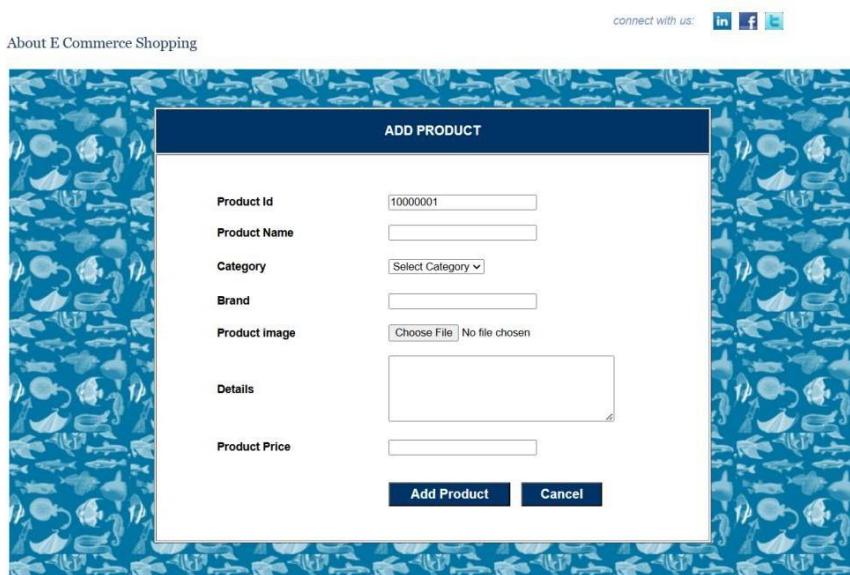
Password *

Submit Cancel

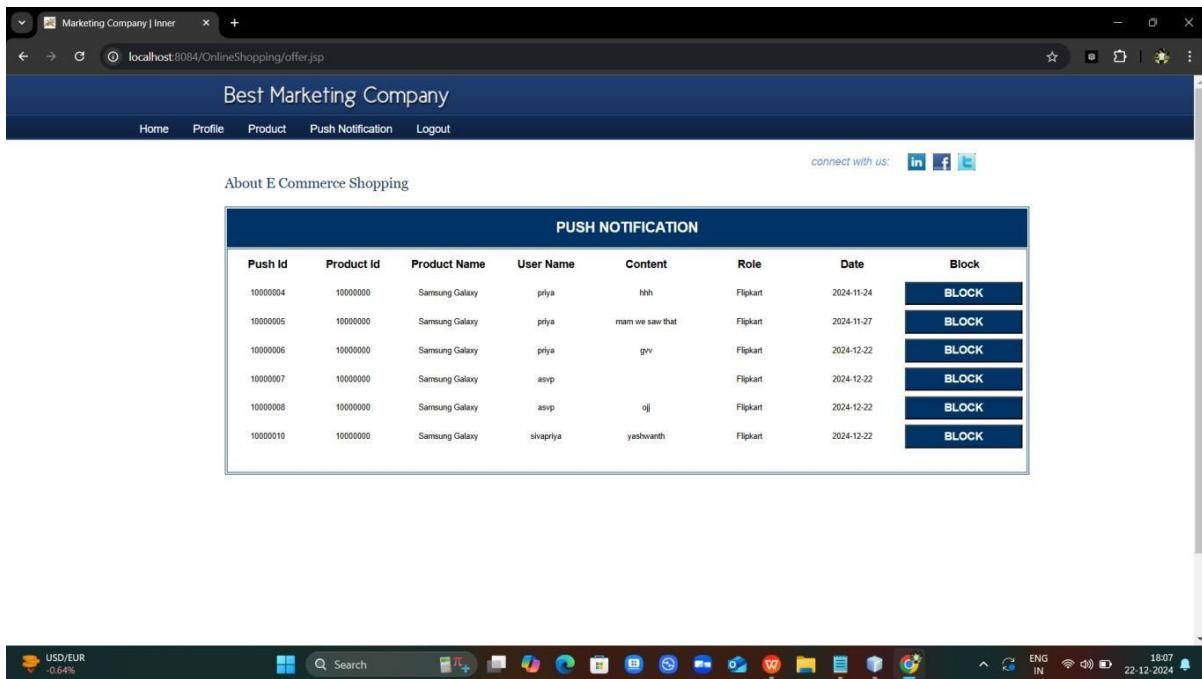
Screenshot 2. Shows the User Registration and Sign in Page of the website.



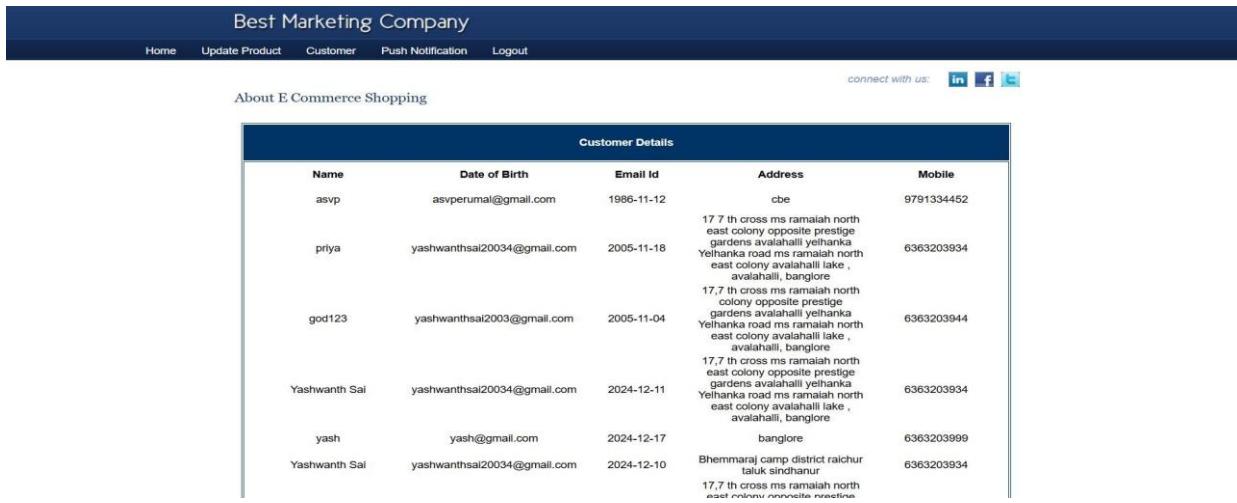
Screenshot 3. Shows the Product Viewer Details of the website.



Screenshot 4. Shows the Product Page of the website.



Screenshot 5. Shows the Push Notification Page of the website



Screenshot 6. Shows the Customer Details Page of the website.

APPENDIX-C ENCLOSURES





REDUCTION OF PUSH NOTIFICATION IN E-COMMERCE APP

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