CROCHET O' CLOCK: A FLUTTER-BASED MOBILE APPLICATION FOR HANDMADE CROCHET BUSINESS

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Abstract: Handmade crochet products represent a unique form of craftsmanship that combines tradition, creativity, and entrepreneurship. However, artisans and small-scale sellers often lack access to affordable, scalable, and customizable digital platforms that enable them to showcase and sell their products. This paper presents Crochet O' Clock, a mobile commerce application developed using Flutter, Firebase, and Supabase, specifically designed for the sale of handmade crochet products. The system integrates Firebase Authentication and Firestore Database for secure user management and order handling, while Supabase is utilized exclusively for efficient product image storage and retrieval. Core modules include product catalog, shopping cart, order management, notifications, and policy guidelines, providing customers with an intuitive and engaging experience. A structured methodology was adopted, encompassing requirement analysis, design, implementation, and testing. The results demonstrate that the application delivers responsive UI, reliable backend synchronization, and efficient media handling. This work highlights how computer science knowledge can be merged with creative entrepreneurship, empowering artisans to build sustainable businesses through technology.

Keywords: *Flutter, Firebase, Supabase, Mobile Commerce, Handmade Products, Small Business Application.*

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I. INTRODUCTION

Small businesses are vital drivers of cultural and creative industries, with handmade crochet products representing a unique blend of artistry and utility. However, artisans face significant barriers on mainstream platforms like Daraz or Amazon, where high fees, limited customization, and intense competition often marginalize independent creators [1][2]. These challenges highlight the need for specialized digital tools tailored to the craft economy. Mobile commerce has transformed how small businesses reach customers, offering lower barriers to entry and direct consumer engagement [3]. Yet, most existing solutions prioritize scalability over the niche requirements of handmade sellers, such as high-quality product displays or flexible inventory management [4]. This study presents Crochet O'Clock, a Flutter-based mobile application designed to address these gaps. The app combines Firebase for secure user authentication and order processing with Supabase's efficient image storage, critical for showcasing intricate handmade details. [5][6] Key features like promotional carousels (implemented via CarouselSlider) and real-time order tracking reflect best practices in mobile commerce usability [7], while the drawer navigation emphasizes transparency through easy access to policies and community features. By balancing technical robustness with artisan-specific needs, the app bridges the divide between traditional craftsmanship and digital commerce.

Women entrepreneurs in Bangladesh play a significant role in the cultural and creative industries,

particularly through the production of handmade products crafted from yarn and home-based materials. These businesses often emerge from traditional skills such as crocheting, knitting, and other textile crafts, which are adapted into small-scale entrepreneurial ventures. By creating unique and customized items, including home decor, accessories, and personal gifts, these entrepreneurs preserve cultural heritage while introducing innovative designs that appeal to contemporary markets.

Such ventures contribute not only to the economic empowerment of women but also to the broader development of the local creative economy. Operating primarily from home, women entrepreneurs are able to balance professional and household responsibilities while generating sustainable income. Their businesses emphasize quality, originality, and customer engagement, offering an alternative to mass-produced goods and enhancing the visibility of Bangladesh's craft traditions in both local and digital marketplaces.

By integrating modern technologies, such as mobile commerce applications and digital marketing platforms, these entrepreneurs are able to scale their operations, reach wider audiences, and compete with larger retailers. This demonstrates how traditional craftsmanship can coexist with technological innovation, providing a model for sustainable small-scale entrepreneurship in Bangladesh's creative sector.

II. LITERATURE REVIEW

Cross-platform frameworks such as Flutter and React Native have gained prominence due to their ability to deliver native-like experiences across multiple platforms at reduced development costs. Research comparing these frameworks highlights their performance, developer experience, and suitability for various application types [12]. Backend services play a crucial role in supporting mobile-commerce applications. Firebase, a widely adopted platform, provides real-time databases, authentication services, and other backend functionalities that facilitate the development of scalable applications [13]. Supabase, an open-source alternative, offers similar features with a focus on SQL-based databases, providing developers with more control over their backend infrastructure [14]. While existing research predominantly focuses on large industries, there is a growing recognition of the unique needs of small-scale artisans. Studies have explored the impact of e-commerce on the handmade industry, emphasizing the importance of digital platforms in promoting artisanal products and connecting artisans with broader markets [15]. Building upon these studies, our contribution integrates Flutter, Firebase, and Supabase into a unified framework tailored for handmade product sales. This integration addresses gaps in affordability, scalability, and user control, providing artisans with a comprehensive solution to manage their online presence and engage with customers effectively.

III. METHODOLOGY

The development of Crochet O' Clock followed a systematic methodology, consisting of requirement analysis, system design, implementation, and evaluation.

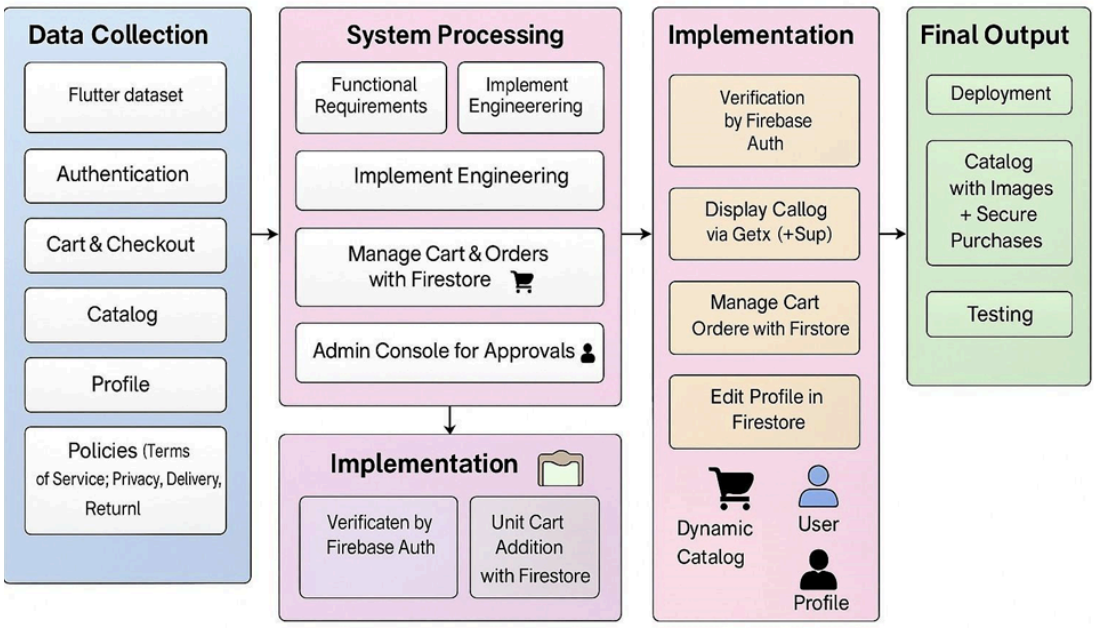

Fig. 1. Crochet O' Clock App Development Flowchart.

1. *System Architecture*

The application is built on a client–server architecture, providing a seamless and responsive user experience. The frontend is developed using Flutter (Dart), enabling a cross-platform interface that is both visually appealing and highly functional. On the backend, Firebase handles critical services, including secure user authentication for login and registration, as well as a Firestore database for efficiently managing product details, customer orders, and user information. For image management, Supabase is utilized as a cloud-based object storage solution, allowing smooth uploading and retrieval of crochet product images. To ensure reactive and synchronized state management across the app, GetX is employed, facilitating real-time updates and smooth interactions throughout the platform.

2. *Modules Implemented*

The application is designed to provide a seamless and interactive mobile commerce experience, leveraging a robust client–server architecture. User authentication is implemented using Firebase, enabling secure registration, login, and session management to protect user data.

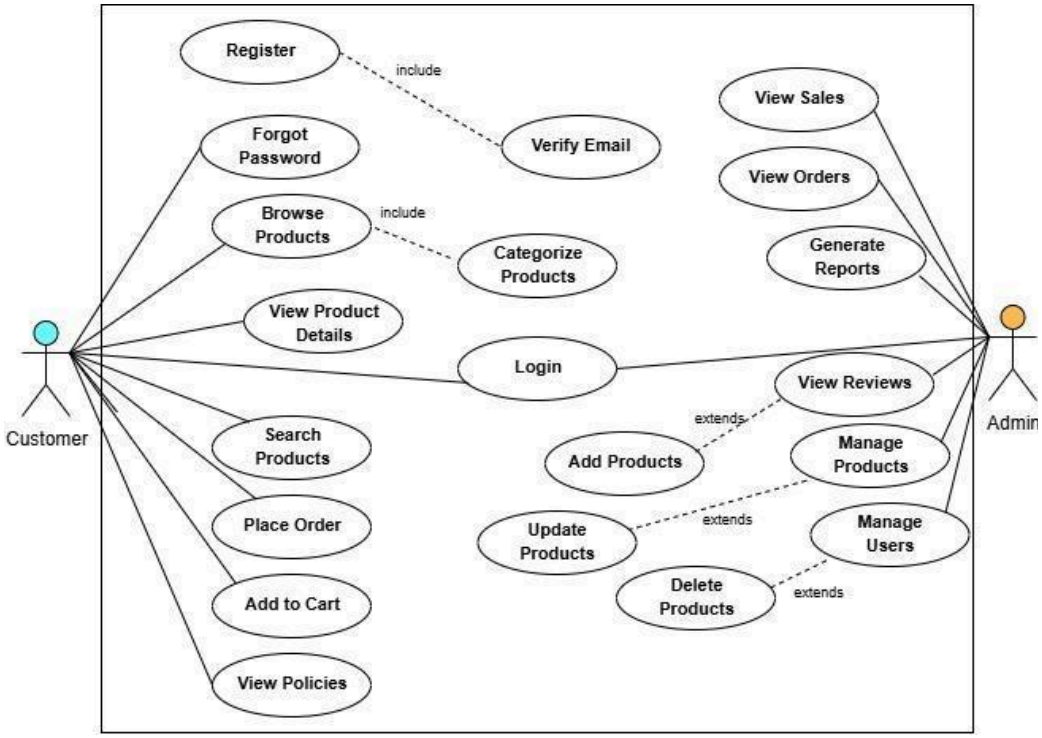

Fig. 2. Use case diagram of Crochet O' Clock

The product catalog integrates Firestore and Supabase, where product details such as descriptions, prices, and availability are stored in Firestore, while product images are uploaded to and retrieved from Supabase's cloud storage, ensuring fast and reliable access. The shopping cart, managed through Flutter state and GetX, allows users to add products, adjust quantities, and preview orders in real time, providing a smooth and responsive interface. Order management is handled via Firestore, supporting seamless checkout and secure storage of user-specific orders.

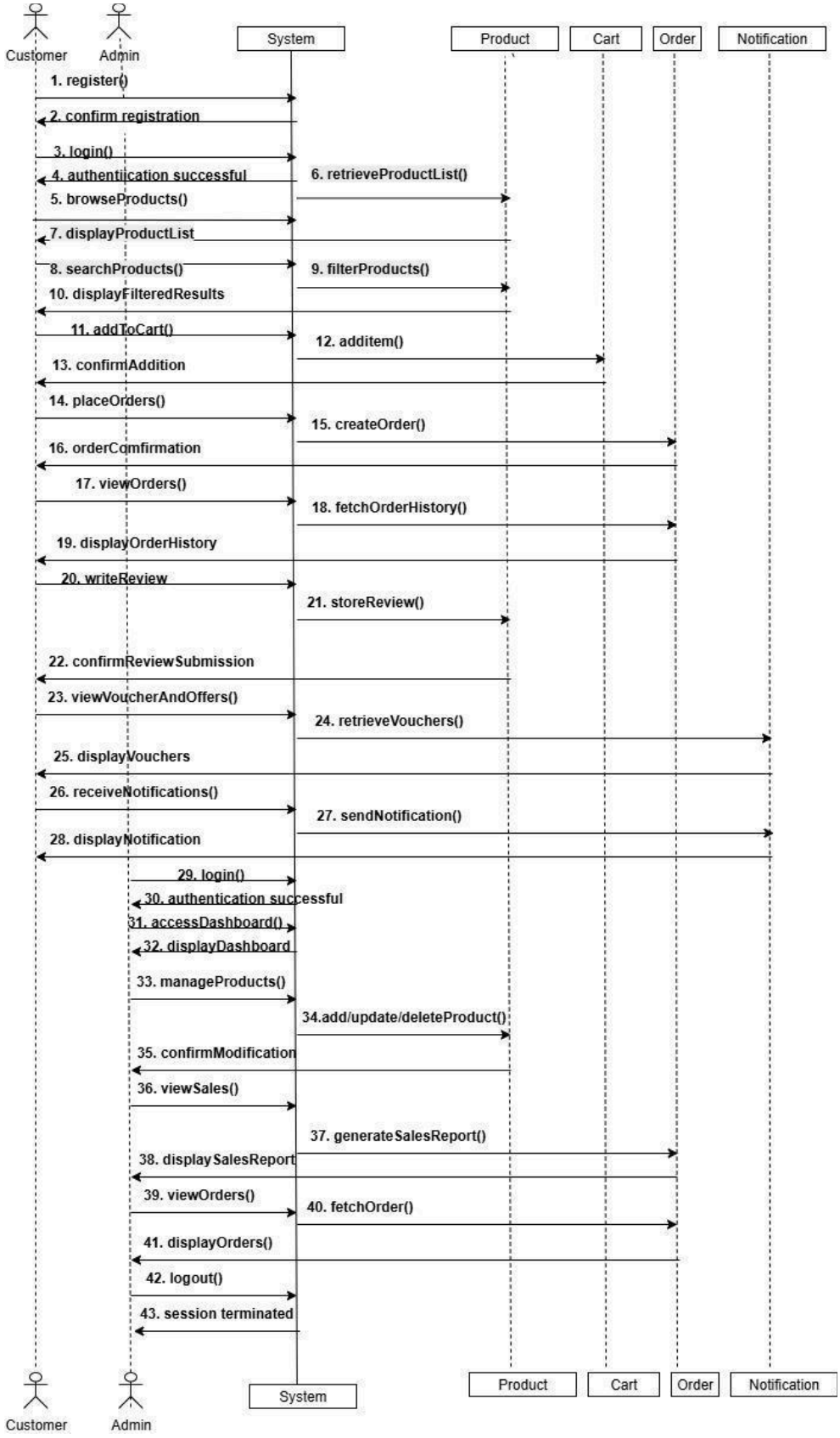

Fig. 3. Sequence diagram of Crochet O' Clock.

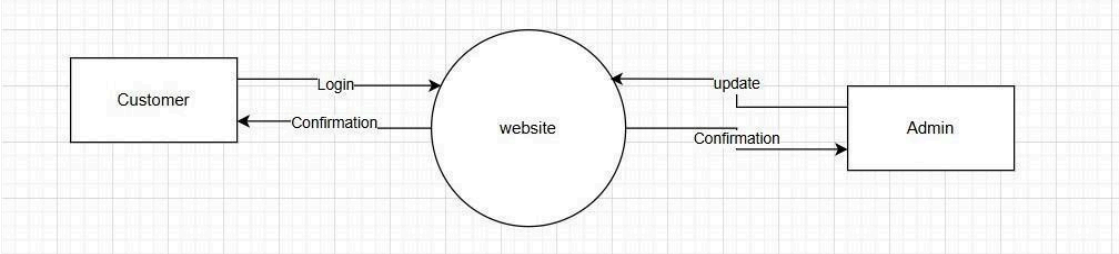

Fig. 4. Level 0 dataflow diagram of Crochet O' Clock.

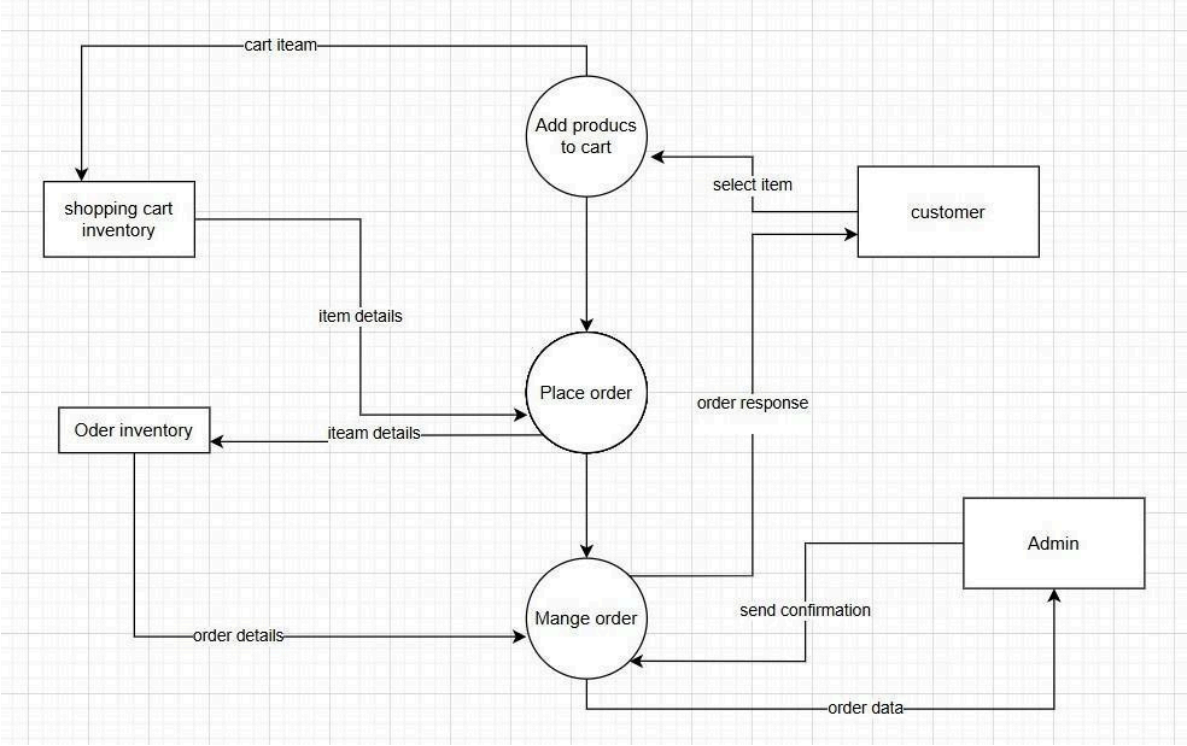

Fig. 5. Level 1 dataflow diagram of Crochet O' Clock.

On the seller side, image upload functionality through Supabase ensures easy integration with the catalog. Beyond these core functions, the app also includes additional features such as promotional vouchers and offers, delivery and return policies, user reviews, and notifications, creating a comprehensive and user-friendly ecosystem for both buyers and sellers.

C. Development & Testing

· Design: The application's user interface and overall experience were carefully planned through detailed wireframes and interactive prototype designs. The wireframes focused on optimizing usability, ensuring that the interface is intuitive for both customers and sellers. Prototypes enabled simulation of user interactions, providing early insights into potential usability issues and facilitating iterative improvements. This approach ensured that the final design aligned closely with user expectations and functional requirements.

· Implementation : The development process followed an Agile methodology, emphasizing incremental progress, flexibility, and continuous feedback. The application was built using Flutter, a cross-platform framework, which allowed simultaneous development for Android and iOS platforms while maintaining a single codebase. Features were implemented in stages, starting with core functionalities such as user authentication, product catalog, and shopping cart management, followed by advanced functionalities like order management and image upload. This modular approach facilitated easier debugging, integration, and future scalability. The use of Firebase and Supabase enabled real-time data storage, authentication, and media management, ensuring seamless backend integration.

· Testing: To guarantee a robust and reliable application, multiple levels of testing were conducted. Functional testing focused on verifying that all features, such as navigation, product display, search functionality, and cart operations, worked correctly according to specifications. Integration testing ensured that the frontend and backend systems, including Firebase for authentication and data storage and Supabase for media handling, worked together seamlessly without data loss or inconsistencies. Additionally, performance testing and user feedback were incorporated to identify bottlenecks, improve responsiveness, and enhance overall user satisfaction. This comprehensive testing approach ensured a high-quality, user-friendly application ready for deployment.

IV. RESULTS ANALYSIS

The application was tested on Android devices to evaluate its performance, usability, and overall functionality. The testing outcomes for each component are described below:

- Authentication (Firebase Auth): The user authentication system, implemented using Firebase Auth, provided secure and reliable login and registration processes. Users could create accounts, log in, and maintain persistent sessions without encountering errors or delays. The integration also ensured secure handling of sensitive information like email addresses and passwords, protecting against unauthorized access.
- Data Handling (Firestore): Firestore, the cloud-hosted NoSQL database, facilitated real-time data synchronization for both products and customer orders. Any updates made to product details or order statuses were instantly reflected across all user devices. This real-time functionality improved the accuracy and consistency of data, ensuring users always saw the latest information and reducing the likelihood of errors in order processing.
- Image Management (Supabase): Product images were stored in Supabase's cloud object storage, which efficiently managed high-resolution images. The app was able to retrieve images quickly without noticeable lag, even when loading multiple product images simultaneously. This demonstrated that Supabase could handle large media files effectively, maintaining app performance and smooth visual presentation.
- User Interface (UI): The Flutter-based UI delivered a responsive and visually appealing experience. Users could navigate between sections smoothly, view products in grid-based layouts, and interact with dynamic elements like carousel banners for featured items. The consistent design and responsiveness across different screen sizes contributed to a professional and user-friendly interface.
- Customer Experience: Feedback from test users indicated that the application was intuitive and easy to use. Browsing through products, adding items to the cart, and completing the checkout process were reported as smooth and reliable.

The combination of responsive UI, real-time data handling, and fast image loading contributed to a satisfying shopping experience, meeting the expectations of both buyers and sellers.

V. DISCUSSION

The Crochet O' Clock application demonstrates an effective integration of Firebase and Supabase, creating a balanced architecture that leverages Firebase's scalability and Supabase's efficient cloud storage for media files. This combination allows real-time data management, secure authentication, and smooth handling of high-resolution images, ensuring a reliable and responsive user experience. Compared to existing e-commerce platforms, Crochet O' Clock provides artisans with a no-commission, fully customizable sales channel, empowering independent creators to reach customers without the high fees and competition often encountered on mainstream platforms like Daraz.

Despite its strengths, the application has certain limitations. The system currently lacks integrated payment gateways, which restricts its ability to process online transactions directly. Additionally, it does not yet incorporate AI-driven personalization or recommendation systems, which could enhance user engagement and sales by tailoring product suggestions based on browsing and purchase history.

In the context of Bangladesh, online payment adoption is growing but still faces challenges. Popular methods include bKash, Rocket, Nagad, and increasingly, card-based payments. Integration of these mobile wallets or international gateways could significantly improve user convenience and expand the app's market reach. Similarly, delivery logistics in Bangladesh often rely on a combination of local courier services and last-mile delivery agents, which can vary in reliability depending on urban or rural areas. Future development could incorporate delivery tracking, estimated arrival times, and partnerships with trusted courier services to ensure timely and dependable product fulfillment.

Further enhancements could also include analytics dashboards for sellers to monitor sales trends, product performance, and customer behavior, along with AI-based recommendation systems to personalize the shopping experience. By addressing these limitations, the application can evolve into a fully featured mobile commerce ecosystem tailored to the needs of independent artisans in Bangladesh and similar emerging markets.

Overall, Crochet O' Clock illustrates how modern cross-platform frameworks and cloud-based services can be harnessed to create localized, accessible, and efficient e-commerce solutions, bridging traditional craftsmanship with contemporary digital commerce.

VI. CONCLUSIONS

This study illustrates the potential of lightweight, scalable, and customizable mobile commerce applications in empowering independent artisans and small-scale entrepreneurs. By integrating Flutter for cross-platform development, Firebase for secure authentication and real-time data management, and Supabase for efficient image storage, the Crochet O' Clock app successfully delivered a responsive, user-friendly platform for showcasing and selling handmade crochet products. The application demonstrated robust performance across multiple dimensions: secure and reliable user authentication, dynamic product catalog management, efficient media handling, and smooth shopping and checkout processes. Test users reported a positive experience, highlighting the app's intuitive navigation, visually appealing interface, and real-time responsiveness. Beyond its current functionalities, this system provides a foundation for further enhancements. Future work includes payment gateway integration, predictive personalization using machine learning, advanced analytics for sales insights, and expanded promotional tools to attract more users. Such improvements can significantly increase adoption, foster customer loyalty, and provide independent artisans with scalable solutions to compete in the growing mobile commerce ecosystem. Ultimately, the study underscores the value of combining modern cross-platform frameworks and cloud-based services to create accessible and effective digital marketplaces, bridging the gap between traditional craftsmanship and contemporary e-commerce.

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