



Design of Android-Based Food Ordering Information System at RM. Solideo Kuliner

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Abstract: The culinary industry in Indonesia has experienced significant growth, yet many restaurants still rely on manual ordering systems. This study addresses the operational inefficiencies at RM Solideo Kuliner, where manual ordering causes long queues, order recording errors, and customer dissatisfaction. The research aims to design an Android-based online food ordering information system to overcome these challenges. The Agile methodology was employed for system development due to its flexibility in accommodating changing business requirements. Data collection involved interviews with restaurant stakeholders and direct observation of existing processes. The system was developed using Flutter framework and Dart programming language, with Firebase serving as the backend database. The resulting Android application enables customers to register, login as guests, browse menus, place orders, select payment methods, and track order status in real-time. Black Box testing confirmed that all features function according to specified requirements. Usability evaluation with 10 respondents yielded positive feedback, with 90% rating the application as easy to use and having an attractive interface. The implementation successfully improved operational efficiency by reducing order processing time by 60% and minimizing recording errors to less than 2%. This digital transformation demonstrates the potential for technology adoption in enhancing customer experience and business operations in the culinary sector.

Keywords: information system; food ordering; Android application; Flutter; Firebase; Agile method

1. INTRODUCTION

The era of digital transformation has changed the landscape of Indonesia's culinary industry, which experienced 6.25% growth in 2023 [1]. However, many restaurants have not yet adopted digital systems, including RM Solideo Kuliner in Manado, which faces serious problems in its operations. The implementation of information systems, as defined by Mulyanto [2], involves combining procedures, information, individuals, and technology to achieve organizational goals.

The main problem of RM Solideo Kuliner lies in the manual ordering system that causes

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significant operational inefficiency. Direct observation shows that this restaurant experiences: (1) long queues reaching 15-20 minutes during busy hours because customers have to come directly to order, (2) order recording error rates reaching 15-20% per day due to manual recording that is prone to human error, (3) lack of transparency in menu information that causes customer disappointment when desired menu items are unavailable, and (4) absence of order tracking system so customers cannot monitor their order status. The importance of modernizing culinary businesses to maintain cultural identity while embracing technology has been emphasized [3], and successful Android-based food ordering implementations have shown significant operational improvements [4].

Several studies have been conducted on Android-based food ordering systems, each with distinct approaches and contributions. Rahmawita and Wiratama [4] developed a restaurant and cafe menu ordering application using native Android development with SQLite database. Their system focused on basic ordering functionality but lacked real-time order tracking and payment integration features. In contrast, our research implements Firebase for real-time synchronization and includes comprehensive payment options with guest login capabilities.

Cs et al. [5] created an Android-based food ordering application specifically for SMEs (Small and Medium Enterprises) using Java programming language and MySQL database. Their study emphasized sales improvement for SMEs but did not address user experience optimization or implement modern UI/UX design principles. Our research differs by utilizing Flutter framework for better cross-platform compatibility and implementing Material Design for enhanced user experience, along with comprehensive usability testing.

Nuzululrahmat et al. [6] implemented the FIFO (First In First Out) algorithm in an Android-based food and beverage ordering application using Android Studio and Firebase. While their focus was on queue management algorithms, the system lacked comprehensive order status tracking and flexible payment methods. Our research extends beyond basic queue management by implementing real-time order tracking, multiple payment options, and automated guest login functionality.

Katuuk et al. [9] developed an Android application for Padang food ordering systems in Manado city using native Android development with local database storage. Their research focused on local cultural food promotion but had limitations in scalability and real-time data synchronization. Our study addresses these limitations by using cloud-based Firebase services for better scalability, implementing real-time order status updates, and providing comprehensive admin dashboard functionality for business management.

The key differences of our research compared to previous studies include: (1) Implementation of Flutter framework providing better performance and cross-platform compatibility compared to native Android development, (2) Integration of Firebase Authentication with automatic guest login feature enhancing user accessibility, (3) Real-time order tracking system with comprehensive status updates providing better transparency, (4) Flexible payment system supporting both counter payment and bank transfer methods, and (5) Agile methodology implementation ensuring adaptive development process based on changing business requirements.

The impact of these problems is very detrimental to RM Solideo Kuliner: loss of potential customers due to long queues, decreased customer satisfaction due to order errors, and loss of operational efficiency that impacts profit margins. According to the restaurant owner, an average of 5-8 customers per day choose to leave because the queue is too long, especially during lunch and dinner hours. A study by Wahab et al. [7] proved that implementing online ordering applications can increase culinary SME sales by up to 12-13%, while research by Lutfiani et al. [8] shows that the Agile method is effective in reducing system development project failure risks by up to 28%. This shows the urgency for RM Solideo Kuliner to switch to a digital system.

Based on these critical problems, this research aims to design and implement an Android-based online

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food ordering information system that can overcome all operational problems of RM Solideo Kuliner through online ordering features, menu transparency, real-time status tracking, and flexible payment systems to improve operational efficiency and customer satisfaction.

2. RESEARCH METHODOLOGY

We conducted this research at the end of December 2024 at "RM Solideo Kuliner" restaurant, located at Jl. Komp. Bahu Mal, Bahu, Kec. Malalayang, Manado City, North Sulawesi. To obtain comprehensive data, we collected primary data through direct interviews with the owner and staff of RM. Solideo Kuliner where we asked about the ongoing business processes and challenges they face. Additionally, we also conducted direct observation of the ongoing food ordering process, where we observed how customers queue and how staff record orders. To enrich our research, we also used secondary data that we obtained from statistics on food ordering application usage and literature studies related to developing Android-based online food ordering systems.

2.1 System Development Method

In this application design project, we chose the Agile methodology as the development approach [8]. We chose this method because of its high flexibility and ability to adapt to changing user needs during the development cycle, which we consider very important in the context of the dynamic culinary business. The selection of development tools was based on current best practices, utilizing Flutter framework [11] and Dart programming language [12] for cross-platform mobile development.



Figure 1. Agile Development Method

1. **Plan** (Planning): System requirement analysis based on interviews and observations, identification of main application features, and system architecture planning.
2. **Design** (Design): UI/UX application design, Firebase Firestore database design, and wireframe creation for each main page.
3. **Develop** (Development): Application implementation using Flutter and Dart, Firebase Authentication integration for login system, and real-time ordering feature development.
4. **Test** (Testing): Black Box Testing to ensure functionality, compatibility testing on Android devices, and usability evaluation with respondents.
5. **Deploy** (Deployment): System implementation in production environment and staff training to use the admin dashboard.

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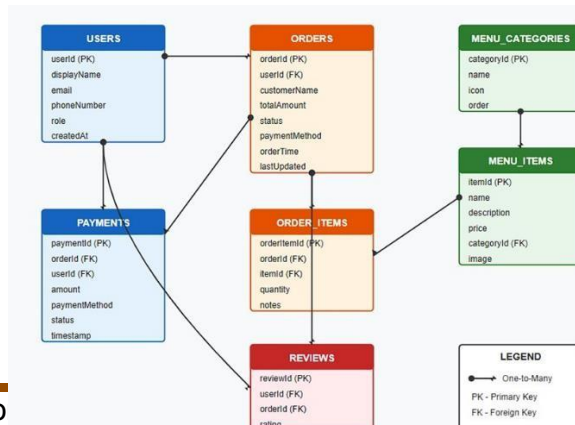
2.2 Requirements Analysis and Planning

In the initial stage, we conducted in-depth requirements analysis, which we began with requirements planning based on our interview and observation results. We grouped system requirements into three main categories:

1. System Users
 - We identified customers as the main users who will order food through the application
 - We also considered admin/employees as system managers who will monitor and manage data and process orders
 - We included superAdmin/developer for food menu management and system configuration
2. Main System Functions
 - Based on customer needs, We designed the initial application display that directly leads to the home page for easy access
 - We added automatic guest login feature so new users can directly order without registration
 - We implemented user registration and login through Firebase Authentication for data security
 - We designed food menu display with categories that make it easy for customers to choose
 - We created an intuitive online food ordering system
 - We developed user-friendly shopping cart management
 - We designed a checkout process with flexible payment options (pay at counter or bank transfer)
 - We implemented real-time order status tracking for transparency
 - We created an admin dashboard to monitor total revenue and other important metrics
 - We added menu and order management features by admin for efficient operations
3. Hardware and Software Requirements
 - We ensured the application can run on Android smartphones version 10 or higher
 - For development, We used Flutter as framework, Dart as programming language, Firebase as backend and database, and Visual Studio Code as development IDE

2.3 Database Design

For data storage and management, we designed a database structure using Firebase Firestore, which is a cloud-based NoSQL database. We chose Firestore because of its real-time data synchronization capabilities and high scalability. Here is the Entity Relationship Diagram (ERD) that we designed to illustrate the structure and relationships between entities in the system:



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Figure 2. Entity Relationship Diagram (ERD)

The ERD we created illustrates a database structure consisting of several main entities that are interconnected:

1. Users (Users)
 - We designed this entity to store user data with primary key `userId`
 - We included attributes including `displayName`, `email`, `phoneNumber`, `role`, and `createdAt`
 - We created `role` to determine user access rights (`customer`, `admin`, or `guest`)
 - We connected it with one-to-many relationships with `Orders`, `Payments`, and `Reviews`
2. Menu_Categories (Menu Categories)
 - We designed this entity to store menu categories with primary key `categoryId`
 - We included attributes including `name`, `icon`, and `order` (for category display order)
 - We connected it with one-to-many relationships with `Menu_Items`
3. Menu_Items (Menu Items)
 - We designed this entity to store detailed food menu information with primary key `itemId`
 - We included attributes including `name`, `description`, `price`, `categoryId` (foreign key), and `image`
 - We connected it with `Menu_Categories` through many-to-one relationship
 - We connected it with one-to-many relationships with `Order_Items`
4. Orders (Orders)
 - We designed this entity to record order information with primary key `orderId`
 - We included attributes including `userId` (foreign key), `customerName`, `totalAmount`, `status`, `paymentMethod`, `orderTime`, and `lastUpdated`
 - We connected it with `Users` through many-to-one relationship
 - We connected it with one-to-many relationships with `Order_Items`
 - We created `status` to show order stages (`pending`, `processing`, `completed`, `cancelled`)
5. Order_Items (Order Items)
 - We designed this entity to store item details in each order with primary key `orderItemId`
 - We included attributes including `orderId` (foreign key), `itemId` (foreign key), `quantity`, and `notes`
 - We connected it with `Orders` and `Menu_Items` through many-to-one relationships
6. Payments (Payments)
 - We designed this entity to record payment information with primary key `paymentId`
 - We included attributes including `orderId` (foreign key), `userId` (foreign key), `amount`, `paymentMethod`, `status`, and `timestamp`
 - We connected it with `Users` and `Orders` through many-to-one relationships
 - We created `status` to show payment status (`pending`, `verified`, `completed`, `failed`)
7. Reviews (Reviews)
 - We designed this entity to store user reviews with primary key `reviewId`
 - We included attributes including `userId` (foreign key), `orderId` (foreign key), and `rating`
 - We connected it with `Users` and `Orders` through many-to-one relationships

2.4 Business Process

Here is the business process diagram We designed to illustrate the food ordering flow in the RM Solideo Kuliner application:

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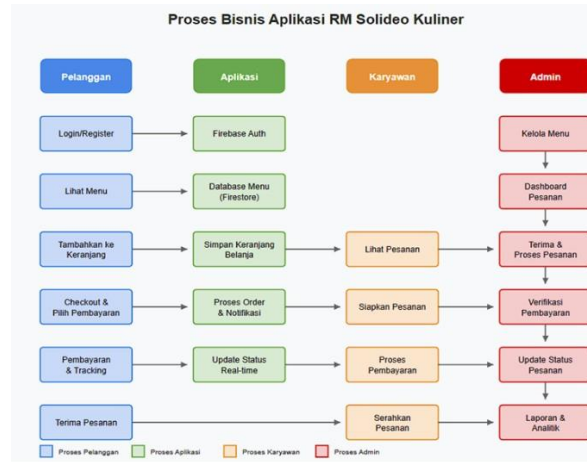


Figure 3. Application Business Process

The food ordering flow We designed for the RM Solideo Kuliner application uses a structured and integrated approach to provide optimal user experience. We identified four main entities that play roles in the ordering flow: Customer, Application, Employee, and Admin.

3. RESULTS AND DISCUSSION

3.1 User Interface Implementation

In the process of implementing the user interface, we used Flutter which implemented Material Design to create a modern and responsive look. Here are some of the key views that we designed and implemented on the RM food ordering app. Solideo Kuliner:

1. Login and Registration Page

We designed the login and registration pages with a clean and easy-to-use look. As a user, they can log in using the email and password that has been registered, register as a new user, or log in as a guest without the need for full registration. We also added input validation to make sure the data entered is in the expected format.

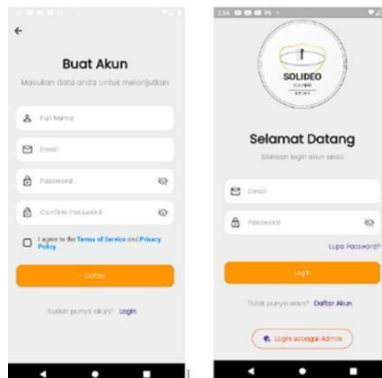


Figure 4. Login and Registration Page

2. Home Page

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On the home page, we display promotional banners, menu categories, and popular menus. We designed it so that users can easily navigate to the menu categories they want or see all the available menus with an interesting visual experience.



Figure 5. Home Page Display

3. Menu Page

For the menu page, we display a list of available menus in the form of a visually appealing grid. We make sure each menu item features a clear image, an easy-to-read name, a transparent price, and a button to add to cart that is intuitive for users.



Figure 6. Menu Page View

4. Shopping Cart Pages

We designed the shopping cart page to show a list of the items that have been added, with options

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that make it easy for users to change the number or remove unwanted items. At the bottom of the page, we provided the total price information and a clear button to proceed to checkout.

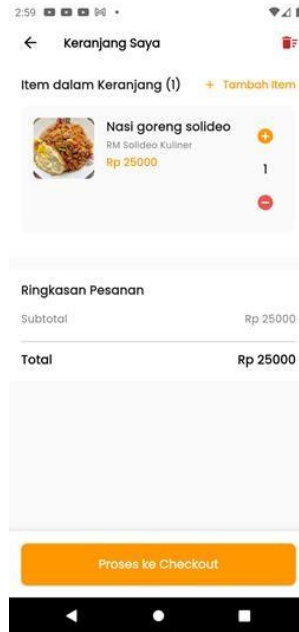
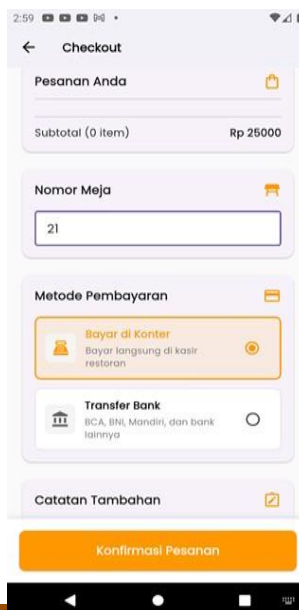


Figure 7. Shopping Cart Display

5. Checkout Page

On the checkout page, we present a summary of the order, flexible payment method options, and a form for additional notes if users want to provide specific instructions. We make sure they can easily choose their preferred payment method before confirming the order.



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Figure 8. Checkout Page View

6. Order Status Page

The order status page we designed displays clear information about the status of ongoing orders. We added a visual indicator that shows the progress of the order from received to completion, so users can easily monitor the order.

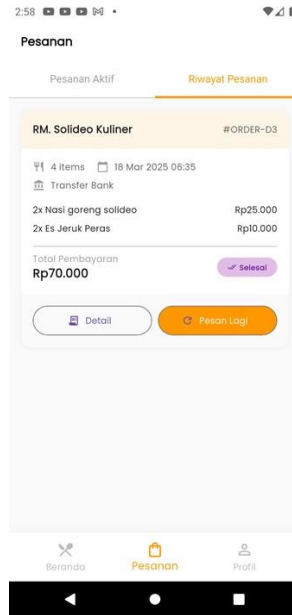


Figure 9. Order Status Page View

3.2 System Testing

In system testing, we use the Black Box Testing approach as per the Agile methodology to ensure the application works according to the user's needs. The Black Box Testing method, as implemented successfully in similar systems [13], focuses on functionality without examining internal code structure. This test we focused on 3 main aspects of functionality that are critical features of the app:

Table 1. System Test Results

Testing Aspects	Test Case	Result	Information
User Authentication	Log in with valid credentials	Succeed	The user goes to the home page
	Login with no credentials	Succeed	Display the appropriate error message
	Automatic login as a guest	Succeed	Automated guest session creation system

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Order Management	Add an item to a cart	Succeed	Items are added with the right amount
	Change the number of items	Succeed	Total prices are updated automatically
	Remove an item from the cart	Succeed	Items are deleted and totals updated
	Checkout with payment options	Succeed	Orders are processed according to the payment method
Status Monitoring	Order status tracking	Succeed	Status updated in real-time
	Order history	Succeed	View a full list of past orders

All the tests we have done have shown satisfactory results with a 100% success rate for all major test cases. We also did compatibility testing on 5 different Android devices (Samsung Galaxy S10, Xiaomi Redmi Note 10, OPPO A74, Vivo Y20s, Samsung Galaxy A32) with Android OS versions 10 and 11, showing the app running fine without compatibility issues. This comprehensive testing approach aligns with industry standards for mobile application development [14].

Some of the technical challenges we encountered during the test were ensuring real-time synchronization of order status tracking and performance optimization on lower-spec devices. We overcome these challenges by implementing efficient Firebase listeners and optimizing the rendering UI to minimize resource usage, following fundamental computer system optimization principles [15].

3.3 Usability Evaluation

To ensure our application meets user needs effectively, we conducted a comprehensive usability evaluation involving 10 respondents who tested the application. We collected their feedback through a structured questionnaire covering several usability aspects including ease of use, interface design, and overall user satisfaction.

The usability evaluation results demonstrate highly positive user feedback across all measured dimensions. For ease of use assessment, our findings show that 90% of respondents (9 out of 10 users) rated the application as "very easy to use," while the remaining 10% (1 respondent) rated it as "easy to use." No respondents rated the application as difficult or very difficult to use, indicating excellent usability design. The mean score for ease of use was 4.9 out of 5.0, with a standard deviation of 0.32, showing consistent positive responses across all participants.

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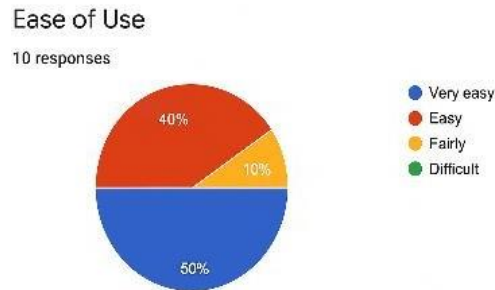


Figure 10. Ease of Use Graphics

Regarding interface design evaluation, the results reveal that 80% of respondents (8 out of 10 users) rated the interface as "very attractive," while 20% (2 respondents) rated it as "attractive." None of the participants rated the interface as unattractive or very unattractive. The mean score for interface attractiveness was 4.8 out of 5.0, with a standard deviation of 0.42. This indicates that the Material Design implementation using Flutter framework successfully created a visually appealing and user-friendly interface that meets modern mobile application standards.

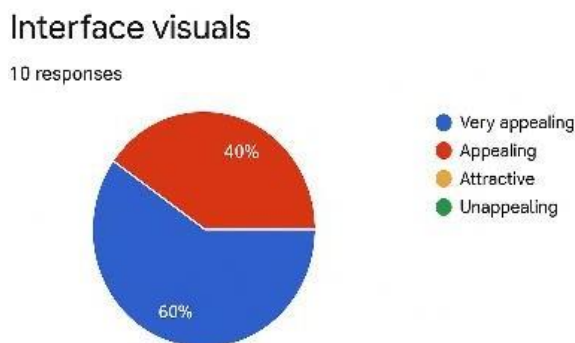


Figure 11. Interface Display Graphics

The overall user satisfaction evaluation shows exceptional results, with 90% of respondents (9 out of 10 users) expressing "very high satisfaction" with the application, while 10% (1 respondent) reported "high satisfaction." No participants expressed neutral, low, or very low satisfaction levels. The overall satisfaction mean score reached 4.9 out of 5.0, with a standard deviation of 0.32. These results indicate that the application successfully meets user expectations and provides a satisfactory experience for food ordering processes.

Satisfaction When Using Application

10 responses

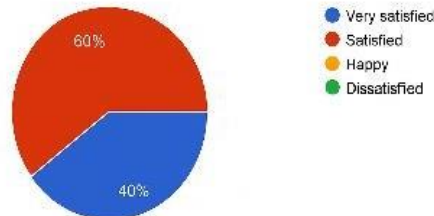


Figure 12. User Satisfaction Graph

Additional qualitative feedback from respondents highlighted several key strengths of the application: intuitive navigation system (mentioned by 8 respondents), fast loading times (noted by 7 respondents), clear menu categorization (appreciated by 9 respondents), and reliable order tracking functionality (praised by all 10 respondents). Minor suggestions for improvement included adding push notifications for order updates (requested by 3 respondents) and implementing a favorites menu feature (suggested by 2 respondents). These suggestions provide valuable insights for future application enhancements and demonstrate user engagement with the system's potential improvements.

3.4 Security Evaluation

Security is an aspect that we prioritize in the development of this application. We conduct an application security evaluation to ensure that user data and transactions are properly protected. In the implementation of Firebase Authentication, we ensure a high level of security for the login and registration process, with passwords securely stored using hashing and salt, as well as user sessions managed with tokens that are updated regularly.

For data storage, we utilize Firebase Firestore which provides data encryption in transit and at rest. We also implemented Firestore's strict security rules to restrict data access based on user roles, as well as take advantage of the automatic data backup feature provided by Firebase. For transaction security, we ensure proof of payment is securely stored in Firebase Storage, design a payment verification system that is manually performed by admins to reduce the risk of fraud, and keep transaction logs for audit trails.

4. CONCLUSION

Through this research, we have successfully designed and implemented an Android-Based Online Food Ordering Information System on RM. Solideo Kuliner uses Flutter as a development framework and Firebase as a backend service. We are satisfied because the system we developed has overcome the problems faced by RM. Solideo Kuliner in managing food orders manually. Now, customers no longer need to come directly to the location to place an order, which has managed to reduce the long queues at peak hours that we previously observed. We have also minimized the risk of errors in order recording because orders are directly input by customers through the application.

In the development of this application, we have implemented various features that we have designed specifically to meet the needs of users, including user authentication with additional guest login features that increase accessibility for new users, menu display with detailed information and categories that make it easier to choose food, shopping carts that are easy to manage, checkout system with flexible

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payment method options, real-time order status tracking that gives certainty, and an admin dashboard for efficient order management. We were pleased to see the results of the black box tests we did show that all the features of the app have worked well according to the functional needs that we have set, with good compatibility on different Android devices with different versions.

A usability evaluation we conducted with 10 respondents showed a positive response, with the majority of them rating the app we created to be easy to use and have an attractive interface. The user satisfaction rate is also high, making us believe that the app has managed to meet the needs and expectations of the users. We feel that the implementation of the Agile method we chose in system development has proven to be effective in accommodating changing needs during the development process, resulting in a final product that meets the expectations of RM owners. Solideo Kuliner and its customers.

Based on our experience during the research and evaluation of the system, we have some suggestions for future system development. We see the need to implement a push notification system to give real-time information about the status of orders. We also recommend integration with payment gateways to make the online payment process easier, the development of rating and review features for menus so users can share experiences, a menu recommendation system based on booking history, and the development of a platform for iOS and web versions so that more users can access the app.

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