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Mobile Android-Based Snack Food Production Management Information System (A Case Studi Of Mirasa Gendhis Sriyanti Tape Candy Factory)

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ABSTRACT
The snack industry, including the Mirasa Gendis Sriyanti Candy Factory in Magelang, faces various operational issues such as ineffective stock control, overproduction risks, and discrepancies between production processes and market demand. These challenges often lead to excess stock, inefficient costs, and financial losses. As a small business, the factory needs to adopt modern technological solutions to improve operational efficiency, particularly in production and inventory management. This study focuses on developing a mobile-based Production Management Information System called Sweet Candy for the factory. The application utilizes Firebase as its backend for real-time data storage, facilitating efficient management of production, scheduling, inventory, and reporting tasks. The system is built using Android Studio and Kotlin, offering features such as input for production requests, scheduling, and monthly reporting. Black box testing confirmed that the application meets the necessary requirements and performs as expected. This study contributes to the digitalization of small and medium-sized enterprises (SMEs) by presenting an innovative approach to production management.

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INTRODUCTION

In the era of globalization with rapid technological advancements, the snack industry, including the Mirasa Gendis Sriyanti Candy Factory in Magelang, faces various challenges. These challenges include inefficient stock management, the risk of overproduction, and mismatches between production processes and market demand. These issues can lead to unused stock, cost inefficiencies, and financial losses. As a small business, the factory needs to adopt modern technology to improve operational efficiency, especially in production and inventory management.

In Indonesia's economy, Micro, Small, and Medium Enterprises (MSMEs) play a crucial role, contributing 61.1% to GDP and employing around 97% of the national workforce (Sasongko, 2020). Despite their significant role in the economic sustainability of a country, basic needs fulfillment remains questionable. This issue is also related to the "missing middle" phenomenon in the MSME structure, where microenterprises dominate over small and medium-sized enterprises (Pradana & Sumiyana, 2023).

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Based on previous research titled "Pemanfaatan Sistem Informasi Manajemen untuk Meningkatkan Penjualan pada UMKM (Studi Kasus pada Dapur Keripik Rida 3 Kota Binjai)", highlights how technology-based information systems can improve operational efficiency and expand market reach. However, this study focused more on marketing training and did not delve deeply into the application of technology for production management in similar MSME sectors (Daulay et al., 2022). Therefore, this research proposes the implementation of a mobile-based Production Management Information System through the Sweet Candy application, which is expected to help address issues in production and inventory management.

Additionally, it was stated that implementing a mobile-based management information system can improve the accuracy of production and inventory data while accelerating decision-making processes with real-time data support (Habibullah, 2024). Several studies have shown that adopting technologies, such as mobile applications for production and inventory management, can enhance operational efficiency in small businesses. These technologies enable businesses to adapt more quickly to market changes and make better data-driven decisions (Mishrif & Khan, 2023). Mobile-based systems have proven to improve production data accuracy and speed up data-driven decision-making (Firmansyah Hidayat et al., 2024). The Sweet Candy application uses Firebase as the backend for database management. Firebase was chosen for its ability to support real-time data storage, user authentication, and centralized database management (Leonardo et al., 2020). By using Firebase, production, demand, and inventory data can be monitored in an integrated and aligned manner with other operational processes. The application's interface is developed using Kotlin, a high-performance programming language that integrates seamlessly with Android Studio (AryaRafa et al., 2024).

This study aims to design and implement the Sweet Candy application as a solution for a mobile-based Snack Production Management Information System. This application is expected to improve the operational efficiency of the Mirasa Gendis Sriyanti Candy Factory and offer innovations to other small businesses in the snack industry.

METHODS

This study applies a qualitative method to explore the challenges and needs faced by the Mirasa Gendis Sriyanti Tape Candy Factory, particularly in production and inventory management. The qualitative method is a research approach aimed at understanding and uncovering phenomena in-depth through the collection, analysis, and interpretation of non-numeric data. This approach focuses on the social context, individual experiences, and the meaning embedded in the studied phenomena (Rifa'i, 2023). The research process flow diagram is shown in Figure 1.

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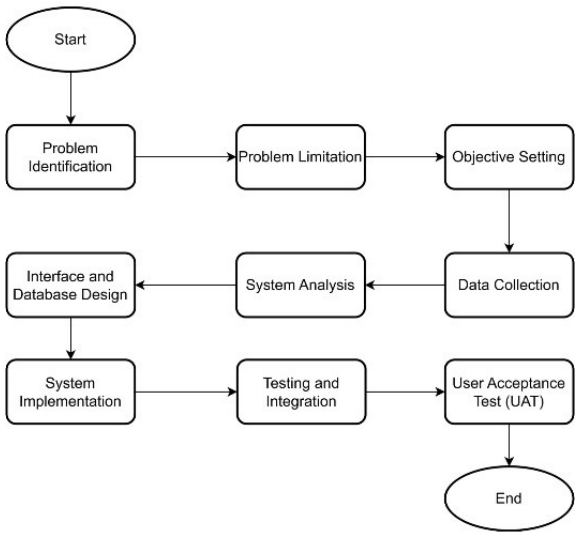

Figure 1. Research Flow

Data and Data Sources

The data used consists of primary and secondary data:

Primary Data

Primary data sources and secondary data sources are used in this study. Several techniques were used to obtain primary data, such as interviews, observations, and focus group discussions (Annisa Rizky Fadilla, 2023). The collected data encompasses details about daily production activities, the utilization and availability of raw materials, production duration, and the quality of the products. The interview data is shown in Table 1.

Table 1. Interview Data

No	Question	Respondent	Answer
1	What challenges do you face in daily production activities?	Owner	1. Difficulty in monitoring production schedules; 2. Inefficient raw material management.
2	How do you ensure the availability of raw materials for production?	Owner	1. Relying on manual stock checks; 2. Often unaware of shortages until production begins.
3	How do you currently handle daily production data?	Owner	1. Using handwritten logs; 2. Prone to errors and miscalculations.
4	What are your expectations for a production management system?	Owner	1. Real-time stock monitoring; 2. More organized production scheduling; 3. Automatic reporting.
5	How is production time managed in your factory?	Sales manager	1. Production is scheduled based on incoming requests; 2. Time management is inconsistent.

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No	Question	Respondent	Answer
6	What are the challenges in linking sales data to production?	Sales manager	1. Sales data is not immediately communicated to the production team; 2. Frequent delays or mismatches in production.
7	What features do you need in a production management system?	Sales manager	1. Customer order recording; 2. Monitoring production status; 3. Generating monthly reports.
8	How do employees access production schedules and stock information?	Employees	1. Information is shared verbally or through physical notices; 2. Often outdated or unclear.
9	What are the common issues affecting product quality?	Employees	1. Inconsistent raw material supply; 2. Lack of standardized production procedures.
10	What are your expectations for the application?	Employees	1. Easily accessible production schedules; 2. Regularly updated stock information.

Secondary Data

Secondary data was obtained through a literature review, including articles, journals, books, and other relevant sources. Although not specifically addressing the Mirasa Gendis Sriyanti Candy Factory, this information provided insights into operational practices, challenges, and solutions in the snack industry, enriching the analysis and understanding of the research.

System Architecture

The architecture of the Android-based mobile snack production management system outlines the data flow from users via smartphones to the backend and database. Users can use the mobile app to monitor and manage production. When data is sent from the smartphone, the app requests Firebase for authentication and real-time data storage. Firebase forwards this request to the backend, which processes it and interacts with the database to retrieve or save production data. The database then sends the necessary response, which the backend processes and sends back to the front-end application via Firebase for user display. This architecture allows the system to provide quick and accurate responses, facilitating efficient production management. The Firebase integration ensures real-time synchronization between the app, backend, and database, enabling smooth communication across all system components. This system architecture is shown in Figure 2.

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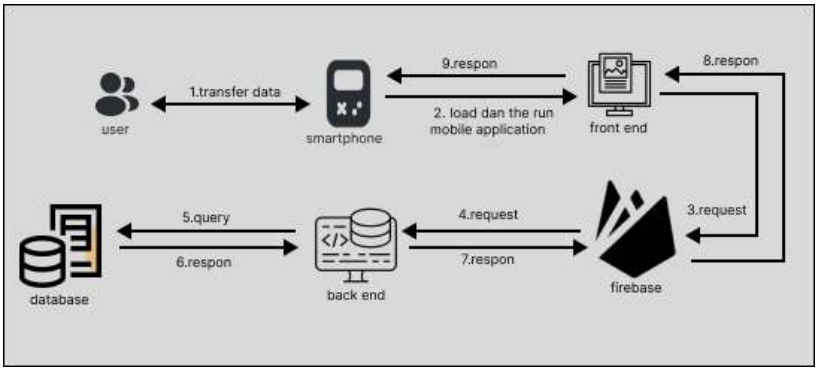

Figure 2. System Architecture

Analysis and Design

The analysis and design of this information system include identifying the functional and non-functional requirements essential for the system's performance. Functional requirements cover the features and services the system must provide to support operations. These requirements not only describe the expected actions but also how the system should respond to various conditions in the operational environment (Florentina Setyaningrum, 2024). Thus, functional requirements ensure that the system can perform according to the expectations and needs of users. The functional requirements of the information system are shown in Table 2.

Table 2. Functional requirements

User	Input	Proses	Output
Owner	1. Enter production schedule; 2. Enter production quantity; 3. Enter type of raw materials; 4. Enter quantity of raw materials; 5. Update profile.	1. Handle production requests; 2. Handle production storage; 3. Calculate raw material requirements based on production requests; 4. Manage production schedule; 5. Handle user profile updates; 6. Process and analyze data for reports.	1. View monthly production report; 2. Download monthly report; 3. Share reports with relevant parties; 4. View raw material stock status; 5. View profile updates.
User	Input	Proses	Output
Sales Manager	1. Enter production request data; 2. Enter data for the monthly report; 3. Update profile.	1. Handle production requests; 2. Handle creation of monthly reports; 3. Handle profile updates.	1. View the total production request report for one (1) month; 2. View production request status; 3. View profile updates.
Employee	Update profile.	Handle profile updates.	1. View the production schedule page;

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User	Input	Proses	Output
			2. View the raw material management page; 3. View the analysis and reporting page; 4. View profile updates.

Non-functional requirements encompass aspects that are not directly related to the core functions of the system but are crucial for ensuring the system operates optimally. These include performance, data security, system reliability, and user comfort when accessing the provided features. Non-functional requirements help maintain the system's responsiveness, protect it from potential threats, and ensure a stable and consistent user experience under various operational conditions (Diatmika et al., 2024). These non-functional requirements are divided into two categories: software and hardware, as shown in Table 3.

Table 3. Non-functional requirements

Type	Description
Software	1. Microsoft Windows 10 Pro (64-bit) operating system as the main operating system; 2. Figma as the tool for designing user interfaces; 3. Android Studio as the Integrated Development Environment (IDE) for Android app development; 4. Firebase as a Backend-as-a-Service to simplify web and mobile development.
Hardware	1. Laptop a. Processor : Intel(R) Core ™ i3-6006U CPU @2.00GHz (4CPUs), ~2.0GHz b. Memory : 2 x 4 GB (8 GB) c. Disk 0 : SSD 128,03 GB d. Disk 1 : HDD 500,11 GB 2. Smartphone a. OS : Android b. Version : Android 8.0 (Oreo) API Level 26 c. SoC : Qualcomm MSM8940 d. Memory : 2 GB ROM, 1 GB RAM

Unified Modeling Language (UML)

Unified Modeling Language (UML) is a visual language presented in the form of diagrams or graphics, used to provide an overview and specifications in the development and documentation of object-oriented systems. UML serves as a standard for creating system blueprints, which can include business process concepts, class creation that can be translated into specific programming languages, database designs, and the necessary components for system development (Siska Narulita et al., 2024). In this research, the UML used is as follows.

Use Case Diagram

This explains the interaction between one or more roles and the information system being developed. A use case helps define the system's functions and determine which roles have access to those functions (Hafsari et al., 2023). The use case diagram shows that the Owner

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has full access to all features of the application, including managing production requests, production scheduling, inventory, and monthly reports. The Sales Manager has the same access as the Owner, which allows them to manage production and inventory according to sales needs. Employees can only view pages related to production input, scheduling, inventory, and monthly reports, but cannot modify data. This access restriction ensures security and guarantees that only authorized users can modify important information within the system. With clear access divisions, the system can run more organized and efficiently, ensuring each role has access appropriate to their responsibilities. The use case diagram for this system is shown in Figure 3.

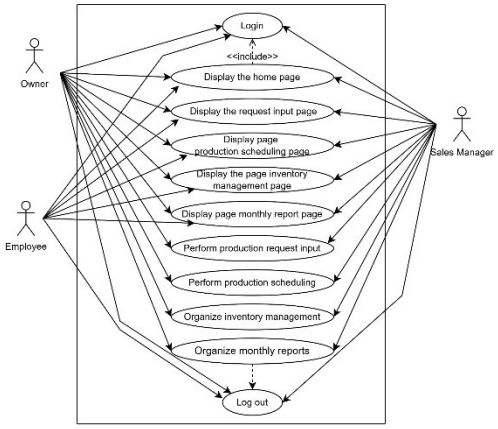

Figure 3. Use Case Diagram

Activity Diagram

An activity diagram is used to visualize the behavior of a system and the internal logic of complex operations (Simangunsong et al., 2023).

a. Owner Activity Diagram

The activity diagram illustrates the interaction between the Owner and the System in the Sweet Candy snack production management application. The process begins when the Owner opens the app and logs in with their username and password, with the system displaying the login page. Upon a successful login, the system shows the home page, allowing the Owner to access features like viewing the production request input page, inputting production requests, managing production scheduling, viewing the inventory management page, managing raw material inventory, and generating or managing monthly reports. If the login fails, the system provides feedback for correction. Once tasks are completed, the Owner can log out securely, ensuring smooth and effective management of the snack production process. The owner's activity diagram is shown in Figure 4.

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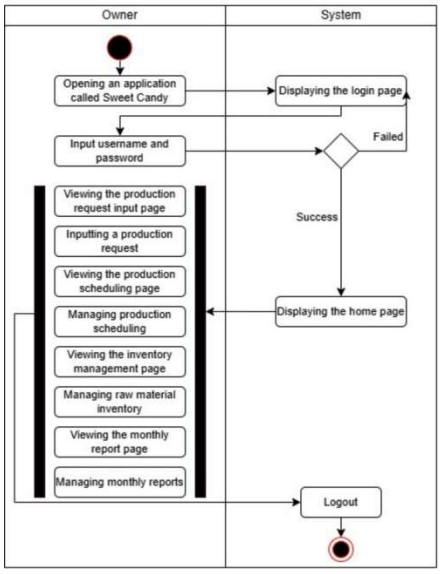

Figure 4. Owner Activity Diagram

b. Sales Manager Activity Diagram

The activity diagram illustrates the interaction between the Sales Manager and the System in the Sweet Candy app. The Sales Manager has the same access as the Owner, as they serve as the second admin. After a successful login, the Sales Manager can manage production requests, production scheduling, raw material inventory, and monthly reports. If the login fails, the system provides feedback for correction. Once tasks are completed, the Sales Manager can securely log out. The sales manager's activity diagram is shown in Figure 5.

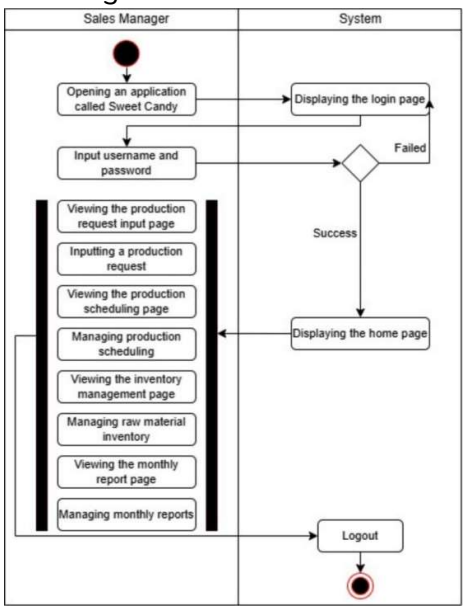

Figure 5. Sales Manager Activity Diagram

c. Employee Activity Diagram

This explains the interaction between employees and the system in the Sweet Candy app. Employees open the app and log in by entering their username and password.

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Once logged in, the system displays the home page, where they can access pages to view production requests, view production scheduling, manage inventory, and check monthly reports. If login fails, the system provides appropriate feedback, and employees can log out after completing their tasks. Employees have limited access to certain functions that support production operations, but they do not have the ability to input production requests or manage scheduling. The activity diagram for employees is shown in Figure 6.

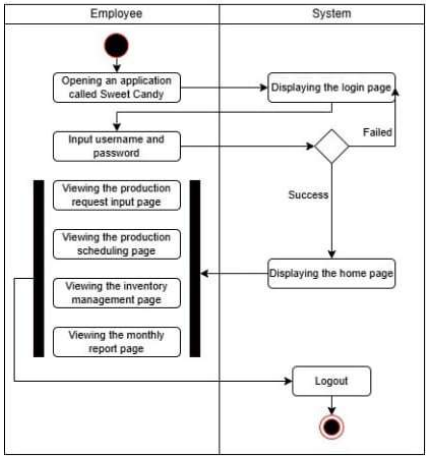

Figure 6. Employee Activity Diagram

Sequence Diagram

This diagram illustrates the dynamic collaboration between different objects. It represents the interactions between objects within and around the system, involving sequential messages or instructions (Bayu Anwari et al., 2020).

a. Owner Sequence Diagram

This explains the interaction between the owner and the system in the snack production management application. The process begins when the owner enters their username and password to log in. The system validates this information and displays the main page. From there, the owner can access menus to input production requests, manage production scheduling, and oversee inventory and monthly reports. After completing these tasks, the owner logs out, signaling the end of the work session. This process ensures that the owner can efficiently manage all production aspects while maintaining data security through a secure login system. Thus, the application supports smooth operations and better decision-making. The owner's sequence diagram is shown in Figure 7.

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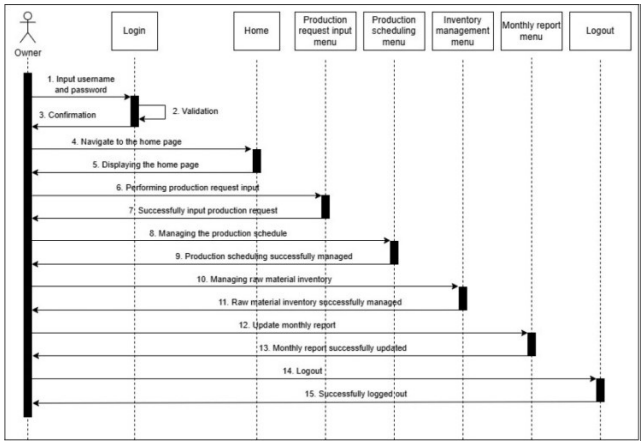

Figure 7. Owner Sequence Diagram

b. Sales Manager Sequence Diagram

This illustrates the interaction between the sales manager, who serves as the second admin, and the system in the snack management application. With access rights equal to the owner, the sales manager can input production requests, manage production scheduling, and oversee raw material inventory. Each step in the diagram represents a structured and efficient communication flow in snack production management. Through this system, the sales manager can quickly adjust production based on market demand, improving responsiveness in operations. Additionally, real-time data access enables quick and informed decision-making, supporting the success of the entire production process. The sales manager's sequence diagram is shown in Figure 8.

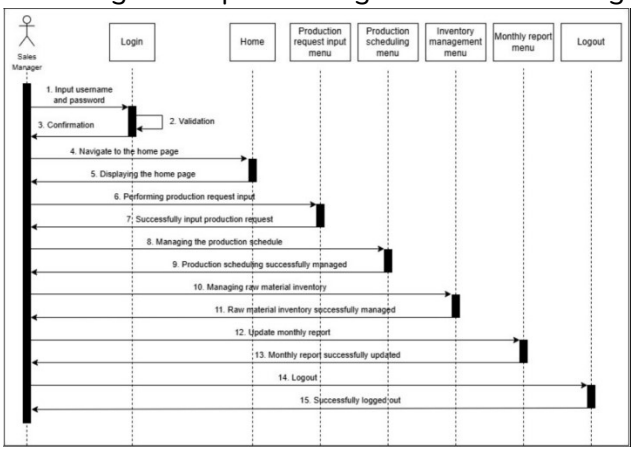

Figure 8. Sales Manager Sequence Diagram

c. Employee Sequence Diagram

This illustrates the interaction between employees and the system in the snack production management application. Employees have limited access, allowing them to log in and view available features in Sweet Candy. After logging in, they can access information about production, schedules, and inventory, but cannot make changes to the data. Once tasks are completed, employees can log out, marking the end of their session. These access restrictions ensure data security and integrity while allowing

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employees to view necessary information to support operations. The employee's sequence diagram is shown in Figure 9.

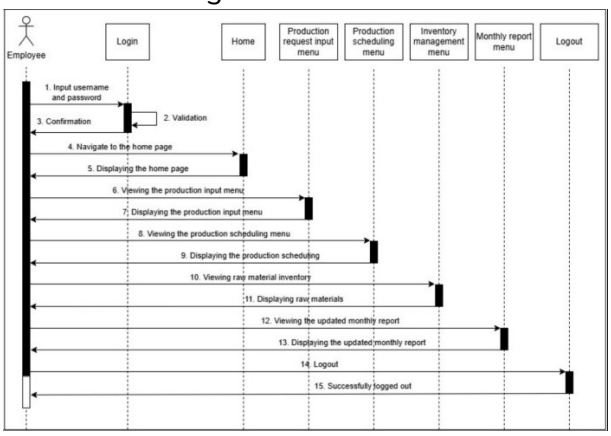

Figure 9. Employee Sequence Diagram

Class Diagram

This diagram is a software modeling tool that visualizes the system design. It shows the involved classes, their attributes, and methods, as well as the relationships between them (Maulana et al., 2024). The class diagram outlines the system structure with six main classes: the `User` class contains attributes like `userId`, `username`, and `password`, along with methods for login and data updates. The `Home` class displays the homepage with the `pageTitle` attribute. The `ProductionRequest` class records order details like `orderId` and `quantity` with management methods. The `MonthlyReport` class handles attributes and methods for displaying and generating reports. The `ProductionSchedule` class stores product information, while the `InventoryManagement` class manages raw materials and stock. This diagram illustrates the relationships between these classes, allowing the user to access all system components for production and reporting. The class diagram is shown in Figure 10.

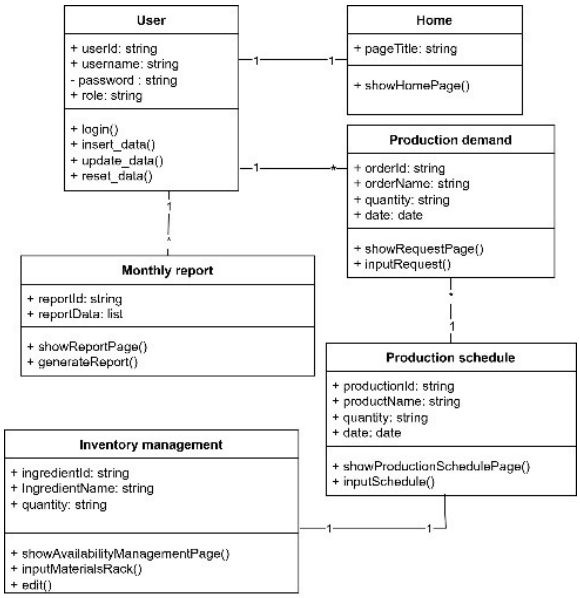

Figure 10. Class Diagram

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RESULTS AND DISCUSSION

This study implements and tests a Snack Production Management Information System based on Android. The application uses Android Studio for frontend development and Firebase as the backend for data storage. This chapter discusses the implementation of the frontend and integration with the backend through Firebase for data management. System testing was conducted using the black box testing method, focusing on verifying the functionality of the application without examining the source code, to ensure that all features work as expected and meet user needs.

Front End Implementation

This section discusses the implementation of the frontend for the snack production management system. It shows how the application interface looks and how users interact with its features. The review covers the design, navigation, and responsiveness of the interface, all aimed at improving the user experience in efficiently managing production data.

Splash Screen

The splash screen introduces the app's visual identity before users access its main features. With a bright blue background and pink and blue candy icons, it creates a fresh, appealing impression. The minimalist "Sweet Candy" text below the icon gives a simple and user-friendly feel. The goal is to leave a positive first impression and allow the app time to load in the background for a smooth user experience. The splash screen is shown in Figure 12.

Figure 12. Splash screen

1. Login

Users, such as the owner, sales manager, or employees, must enter their email and password on the login page to access the system. After entering the information, users press the login button to enter, ensuring that only verified users can access the app. The login screen is shown in Figure 13.

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Figure 13. Login screen

2. Home

After successfully logging into the Sweet Candy app, users are directed to the homepage, where they can easily access key features such as Input Orders, Production Scheduling, Inventory Management, and Monthly Reports. At the top of the page, the user's profile information is prominently displayed, providing a quick overview of their account details. Below the main features, a comprehensive list of products along with their relevant details is presented, allowing users to view important information at a glance. The layout is designed to enhance navigation, with intuitive menus and a clean interface that makes it easy to manage production-related tasks. This streamlined design ensures that users can efficiently track and update production processes, monitor inventory levels, and generate reports, all within a user-friendly environment. The home screen is shown in Figure 14.

Figure 14. Home screen

3. Daily Production Request Input

Users are required to select the product type and enter the desired quantity. They also need to fill in the production request date. Once the data is entered, there are two options at the bottom: a cancel button to discard changes and a save button to submit the request. The daily production request input screen is shown in Figure 15.

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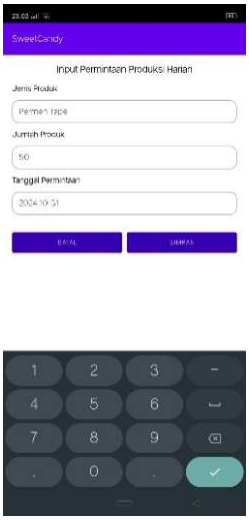

Figure 15. Daily production request input screen

4. Production Scheduling

Users can access and view the production schedule, which includes detailed information such as product names, quantities, scheduled production dates, and the current production status. The schedule is displayed in an organized format, making it easy to track the progress of each production batch. At the top of the page, there is a prominent option to add a new production schedule, allowing users to quickly plan and schedule upcoming production tasks. This feature enables users to stay on top of production needs and maintain an efficient workflow. Additionally, at the bottom of the page, a "Back" button is available, providing users with a simple way to navigate back to the previous screen, ensuring smooth and intuitive navigation throughout the app. The production scheduling screen is shown in Figure 16.

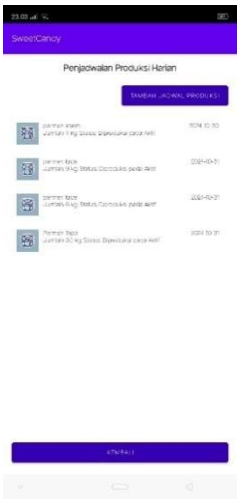

Figure 16. Production scheduling screen

5. Inventory Management

Users can update the stock quantity by entering a new value in the provided input box. After entering the desired quantity, two options are available: the "Cancel" button to discard changes and the "Save" button to confirm and update the new stock quantity in the system.

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This feature is designed to allow quick and accurate inventory updates. The interface provides clear visual cues to help users avoid mistakes. The system also tracks changes made to the inventory, providing a transparent update history to facilitate auditing and stock control. The inventory management screen is shown in Figure 18.

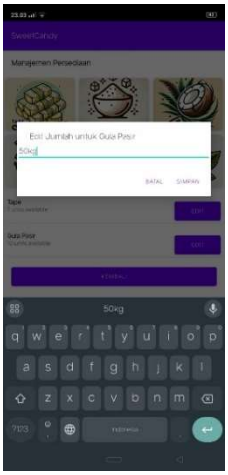

Figure 17. Inventory management screen

6. Monthly Report

Users can view the total production request calculations for the month presented in a clear and visually appealing format. This display offers a comprehensive summary of all production requests, helping users easily track the overall production demand. The visual format is designed to highlight key figures, such as the total quantity of products requested, making it easier for users to analyze and interpret the data at a glance. At the bottom of the page, there are two interactive options: the "Back" button, which allows users to navigate back to the previous page, and the "Reset" button, which enables users to clear the current report and reset the displayed data. The monthly report screen is shown in Figure 18.

Figure 18. Monthly report screen

7. User Profile

Users can effortlessly access and manage their personal account information through a dedicated section within the app. This section provides several useful options to customize

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and secure their account. One of the available options is the "Change Name" feature, which allows users to update their username if they wish to make it more personal or relevant. Another important option is the "Change Password" feature, which enables users to enhance the security of their account by setting a new, stronger password. For added flexibility, there is also a "Log Out" button that allows users to securely exit their account when they are finished, ensuring that their information remains protected. These features are designed to give users full control over their account settings, enabling them to manage their personal information efficiently and securely. The user profile screen is shown in Figure 19.

Figure 19. User profile screen

Integration with Firebase

This section explains the integration of the snack production management information system with Firebase as the backend. Firebase was chosen for its ability to provide real-time data storage, user authentication, and centralized database management. This integration allows the system to efficiently manage user data, orders, and inventory, improving the application's performance.

1. User Data

This refers to user data (owner, sales manager, and employees), showing how user information is integrated into Firebase within the snack production management app. Each user has a unique document ID that stores key details like displayName, email, and username. This integration allows the app to manage user information efficiently, support authentication, and facilitate access to necessary data for smooth operations. An example of the user data is shown in Figure 20.

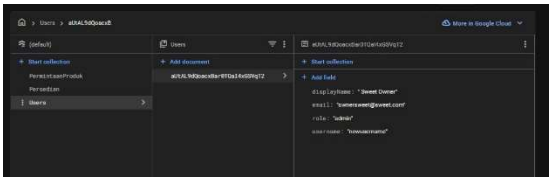

Figure 20. Example of user data

2. Request Data

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This is the daily production request data, showing the integration of product request data in Firebase for the snack production management system. It includes details such as product type, quantity, and request date, all stored under a unique ID. This integration allows the app to efficiently manage product requests, ensuring easy access and data management for smooth operations. An example of the request data is shown in Figure 21.

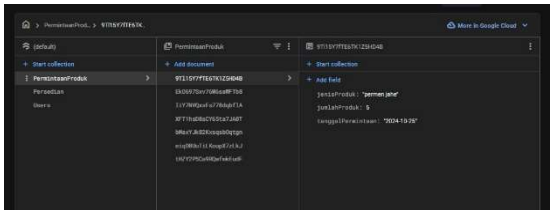


Figure 21. Example of request data

3. Inventory Data

This is the raw material inventory data, showing the integration of stock data in Firebase for the snack production management app. It includes details such as product name and quantity, stored under a unique ID. This integration allows efficient inventory management, supports decision-making, and ensures the right product availability to meet demand. The system provides accurate, up-to-date information for smooth operations. An example of the inventory data is shown in Figure 22.

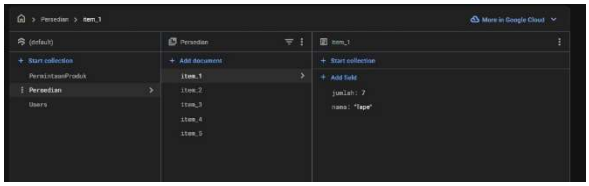
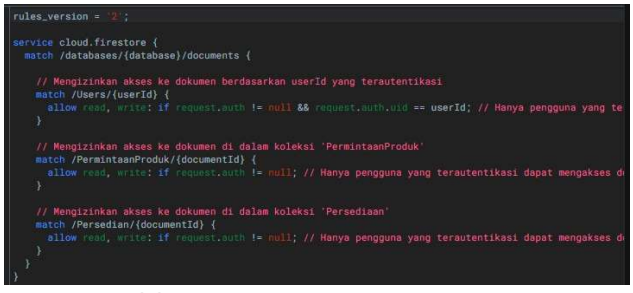


Figure 22. Example of inventory data

4. Firebase Firestore Configuration

The Firebase Firestore security rules govern access in the Android-based snack production management system. The users collection is only accessible to authenticated users, matching their userId, ensuring the privacy and security of personal data. Similarly, the ProductRequests and Inventory collections, which track orders and stock, can only be accessed by logged-in users. This system ensures secure management of user data, product requests, and inventory, accessible only by authorized individuals. The Firebase Firestore rules are shown in Figure 23.



```
rules_version = '2';

service cloud.firestore {
  match /databases/{database}/documents {

    // Mengizinkan akses ke dokumen berdasarkan userId yang terautentikasi
    match /Users/{userId} {
      allow read, write: if request.auth != null && request.auth.uid == userId; // Hanya pengguna yang te
    }

    // Mengizinkan akses ke dokumen di dalam koleksi 'PermintaanProduk'
    match /PermintaanProduk/{documentId} {
      allow read, write: if request.auth != null; // Hanya pengguna yang terautentikasi dapat mengakses d
    }

    // Mengizinkan akses ke dokumen di dalam koleksi 'Persediaan'
    match /Persediaan/{documentId} {
      allow read, write: if request.auth != null; // Hanya pengguna yang terautentikasi dapat mengakses d
    }
  }
}
```

Figure 23. Firebase firestore configuration

Jurnal Info Sains : Informatika dan Sains
Volume 14, Number 04, 2024, DOI 10.54209/infosains.v14i04
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Black Box Testing

In this study, the researcher selected several respondents, including the owner, sales manager, and employees from the candy factory, to test the developed information system application. The mobile application was tested using the black box testing method, which focuses on evaluating the software's functionality. The goal of black box testing is to identify incorrect functions, interface errors, data structure issues, performance problems, initialization errors, and termination issues (Dwi Wijaya & Wardah Astuti, 2021). The results of the black box testing are shown in Table 4.

Table 4. Black box testing

Module	Test Case	Description (Success/No)
Login	1. Enter a valid email and password.	1. Success.
	2. Enter a valid email but an incorrect password.	2. No.
	3. Enter an unregistered email.	3. Success.
Input request	1. Enter product request with valid data.	1. Success.
	2. Enter negative product quantity.	2. No.
	3. Leave the product type column empty.	3. No.
Production scheduling	1. Add a new production schedule with valid data (according to the factory product).	1. Success.
	2. Input a schedule for a past date.	2. No
Inventory Management	1. Edit the inventory quantity.	1. Success.
	2. Input invalid inventory quantity.	2. No.
Monthly Report	1. Access the monthly report and view the requests.	1. Success.
	2. Reset the report.	2. No.
Module	Test Case	Description (Success/No)
User Profile	1. Change username.	1. Success
	2. Change password.	2. Success
	3. Logout.	3. Success

CONCLUSION

This research successfully designed and implemented the Sweet Candy application, tackling the operational challenges faced by the Mirasa Gendis Sriyanti Candy Factory. The application enables real-time monitoring of production and inventory, improving processes such as order entry, production scheduling, and monthly reporting. By boosting production efficiency and minimizing the risks of overproduction, the system offers a useful tool for small businesses to respond to market demands. The findings indicate that this mobile-based solution could be beneficial for other small businesses in the snack industry. Future developments should consider expanding the system's features, including better integration with sales and customer relationship management, to create a more comprehensive business solution.

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