

# Website Based Cafe Operational Management System Design with Agile Development Method Using NX Monorepo Technology Case Study: Serasa Erat Kopi

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## ABSTRACT

The application of technology in the cafe industry is starting to be implemented in terms of ordering aspects to all aspects of operational activities that apply to the cafe. This is done to minimize the problems that occur due to human negligence so that it becomes efficient and more organized. Serasa Erat Kafe is the focus of research in designing a website-based operational management system that will be built using NX Monorepo technology. The application of NX Monorepo is expected to structure web application development in a more structured, organized, and modular manner. In addition, the Agile Development Method is applied to adjust to changes and needs in system development. The result of this research is an integrated website that provides benefits for customers, baristas, and cafe owners. There are three views for users to make it easier for users to use the website, such as mobile for cafe customers, tab for cafe baristas, and desktop for cafe owners. This development is a solution to revamping the cafe management system so that business operational needs can be adjusted to the expenses that occur daily. In addition, customers' views can be accessed through barcodes available at their respective tables, allowing them to easily

access the website and place orders without queuing or the hassle of additional services.

**Keywords:** technology, cafe operations management, efficiency, NX Monorepo, Agile Development

## INTRODUCTION

The rapid development of technology has spread to various industrial fields, including the café industry. There are many cafes that utilize technology to support their business in order to compete and grow rapidly with other cafes. The most important thing in the rapid development of cafes can be seen from the aspect of cafe management. The system adopted is required to have a good effect so that cafe activities will become more efficient and organized. In this context, it is important for every cafe company to adopt a web-based information system to support its various operational processes [1].

Serasa Erat Kopi is one of the cafes that still uses a manual system in its operational activities. So it is difficult for managers to obtain information such as sales volume, monitoring stock availability and turnover generated quickly and accurately. Traditional management causes problems such as miscalculations, incorrectly writing items, difficulties in service if customers ask

for bills, and it is not easy to find customers who have not paid if the cafe is crowded with customers. This has the potential to disrupt the management of cafe operations.

To overcome the challenges faced, Serasa Erat Kopi needs to adopt a system that is capable of managing its coffee.

various aspects in an integrated manner. This system should be able to improve the efficiency and quality of cafe management as well as reduce operational costs, save human resources, but also facilitate the management of daily cafe activities. By using web-based software, cafes can take advantage of centralized storage that will improve sales management and overall inventory management [2]. Implementing the right information system will help Serasa Erat Kopi improve its operational efficiency, enhance customer experience, and optimize raw material stock management.

The development will apply the Agile Development method. The application of Agile Development is crucial given the need to adapt to the changing needs of various parties, such as customers, baristas, and cafe owners. The Agile Development approach in the development of the system at Serasa Erat café will use a sprint division that allows the team to focus on developing the features required for three different views: the view for customers, the view for baristas, and the view for café owners.

NX Monorepo technology is a component in the development of this web-based operational management system because it will be more structured, organized, and can be elaborated modularly. With the

monorepo approach, all source code, modules, and project dependencies are combined in a single repository that simplifies code management, team collaboration, and applies development practices such as continuous integration and continuous delivery (CI/CD).

In the case study of Serasa Erat Kopi, the implementation of a web-based operational management system with the Agile Development method and Nx Monorepo technology is expected to overcome the problems faced by the cafe. With an integrated system, both in terms of customers, baristas, and owners, the cafe can increase operational efficiency, improve customer experience, and optimize inventory management. In an era of intense business competition, innovations like this are key to maintaining and improving the competitiveness of a business.

Based on the explanation above, the authors are interested in conducting research with the title "Designing a Website-Based Cafe Operational Management System with the Agile Development Method Using Nx Monorepo Technology Case Study: Serasa Erat Kopi".

## MATERIALS & METHODS

This development was carried out by direct observation in the field by conducting interviews with the owner and direct observation. Based on this analysis, a system is made using the agile method. The development stage of this Agile development refers to the cycle found in Figure 1.



Figure 1. Design flow of agile methods Source: Agile and Learn Concepts for Teaching and Learning (David Parsons- Kathryn MacCallum, 2019)

According to Zulkarnaini et al. in the journal [11], there are stages in Agile Software Development:

1. Planning

In the initial stages of planning the system to be developed by collecting data on users in the form of direct interviews to get the needs that users want, after getting user needs, then proceed with making a design using system tools and application tools.

2. Implementation

At this stage, implementing the stages of planning by creating program documentation using UML and creating user interfaces using the NextJS programming language.

3. Software Test (Testing)

To test the program that has been made whether it is correct or not, whether it is appropriate or not, it is tested manually using blackbox, because if an error is found on the website when the website is used, it can easily find the cause on the production server.

4. Documentation

At this stage, documentation of modules and functions in the information system is carried out as a profile during development and to facilitate further development by the team.

5. Deployment

This stage is the stage in system development and provides the system to end users.

6. Maintenance

At this point, system maintenance is carried out periodically to be safe from system failure/system failure, because the system is not necessarily free from system failure [8].

In addition, there are several things that support researchers in building a management system in the Serasa Erat Coffee Cafe operation:

1) Management System

According to Mary Parker Pollet (2002: 29) in the journal [12] that management is a process of planning, organizing, leading and

controlling with the efforts of organizational members, to use all resources to achieve predetermined goals or in accordance with targets. When put together a management system is a method applied by an organization to manage various parts related to business in order to achieve goals.

The management of café management is very important for operational sustainability. The use of system management to obtain information more efficiently is the future [3]. According to Hai, N., Ganapathy, V., Srivastava, A., et al. in the journal [3] "Intense competition in the 'food and beverage' market will require continuing to refine management technology, accumulate brand value, integrate resources, and expand financing channels". So that the need for the use of the system in the management of Serasa Erat Kopi Cafe management. This system management can improve the efficiency and quality of food and beverage services and reduce operational costs, save human resources, but also facilitate the daily management of restaurants [2]. One form of technology that can be used in creating an information system is a website. Website is one type of software application that can be built through the System Development Life Cycle (SDLC) process [3].

2) Cafe Operations

*Coffee Shop* is a place that offers superior types of coffee compared to non-coffee, available in a relaxed and comfortable place, and equipped with facilities to meet consumer needs, so that consumers feel a loss of burden and problems when they are in a *coffee shop* [14]. Various changes and threats. This strategy is very important for any type of business as it allows companies to increase their market share and determine the next steps to maintain their position among many competitors.

3) System Design

System design is usually documented in the form of UML. According to (M. T. Prihandoyo 2018), in the journal [3] Unified

Modeling Language (UML) is a graphical modeling language used to design, document, and understand software systems. UML allows software developers to visually describe the structure, behavior, and interactions of the system using a consistent notation. UML diagrams can be used to describe the system visually and are easily understood by all related parties [10]. In addition, the use of UML diagrams in designing payroll information systems can help facilitate understanding of the system, reduce the risk of errors, and increase the efficiency of system development [4].

Some modeling commonly used in UML include:

a. Use Case Diagram

*Use cases or use case diagrams* are modeled to describe the relationship between the system and actors. This diagram describes the set of *use cases* and actors. This diagram is very important in organizing and modeling the system behavior expected by users. [8].

b. Activity Diagram

Activity diagram is a model depiction that shows system activity in the form of a collection of actions that each action starts, decisions that may occur until the end of the action. Activity diagram is a dynamic diagram that shows the flow from one activity to another in a system [8].

c. Class Diagram

*Class diagram* is a class as a set of objects that have the same attributes and behavior in one model of a system. *Class diagrams* are also the rules and responsibilities of entities that determine the behavior of the system and show the attributes and operations of a class in relation to connected objects [8].

4) NX Monorepo

A monorepo is a repository that holds all of an organization's services, both server-side and server-side client [13]. Quoted from [9] Nx "*Nrwl Extensions*", is an *open-source build system* designed to help developers manage monorepos better.

efficient by using built-in *tooling* and advanced CI (*Continuous Integration*) capabilities. The system helps in maintaining and extending the monorepo, both locally and on CI. Nx comes with features to extend the monorepo locally and provide a good development experience, as well as to address one of the major pain points, which is fast and maintainable CI.

Researchers can access all service codes with the help of monorepo, making it easier to use software code in the construction of this website. NX Monorepo is used to facilitate the development period to accommodate 3 modules with different user roles. Managing multiple apps in a monorepo environment has become a major concern for developers in an effort to simplify development workflows and increase project efficiency. In this endeavor, tools like Nx offer an effective solution to the challenges of managing distributed code[9]. Using Nx, developers can easily organize related applications in a single repository, which allows for more organized and efficient development.

Nx can also make it easier to share code between apps and can increase project efficiency. Nx provides a *powerful* set of features, so it can help simplify the development process making it the right choice for large- scale projects or in large teams. One of the advantages of Nx is the caching system. This system intelligently caches builds, significantly reducing build time. Nx ensures that only the necessary or changed parts of the code are rebuilt, saving time and resources.

## RESULT

### A. Discussion

In the work stage, there are several important points that need to be done in making this website-based cafe operational management system.

Among them are:

#### 1. Ongoing System Analysis

At this stage, the structure and flow of the system that runs on the operational

management of the Cafe which still uses a manual system is analyzed. Which is

described in the form of a flow diagram below.

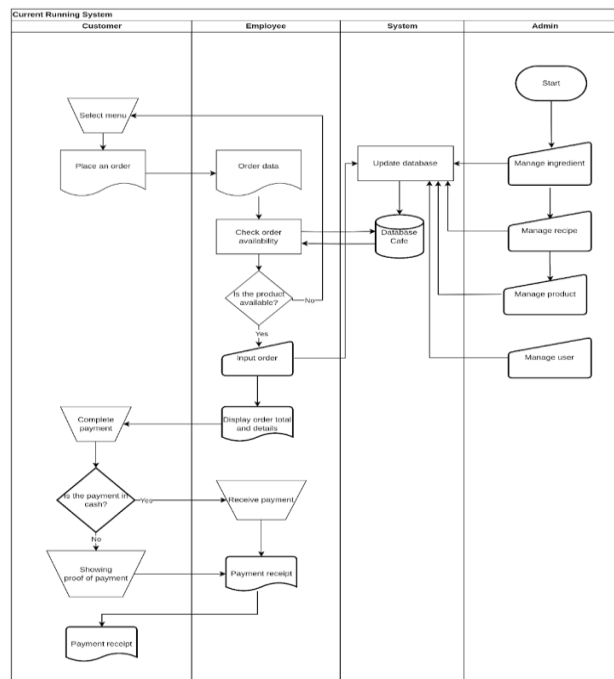


Figure 2. Analysis of the current system

## 2. Functional Requirement Analysis

Functional requirements are a type of requirement that contains what processes will be carried out by the system. In this application there are actors who are distinguished by role or role so that the functional requirements are grouped based on their respective roles or roles including:

### A. Admin

#### 1. Login Function

This function is used by actors to enter the system using email and password.

#### 2. User Management Function

This function is used to manage such as adding, editing and deleting user (employee) data and setting access rights.

#### 3. Function View Raw Materials

This function is used to monitor available and unavailable raw material stock and add, edit, or delete raw material data.

#### 4. Product Management Function

This function is used to manage products such as adding, editing or deleting product data and can manage prices, categories, and product stock.

#### 5. Transaction Viewing Function

This function is used to view a list of transactions that have occurred in the system.

### B. Employee

#### 1. Login Function

This function is used by actors who play the role of Employee (employee) to enter the system.

#### 2. Function View available products

This function is used to view a list of available products along with their inventory and raw material information.

#### 3. Order Management Function

This function is used to view and receive orders from customers then change the status of the order (being processed, completed).

#### 4. Function View Order History

This function is used to view and confirm the list of completed orders.

### C. Customer

#### 1. Function View Menu

This function is used by actors who act as customers to view a list of products

along with price, category, and description information.

2. Ordering Function

This function is used to select products, specify quantities, variants, and custom orders and add orders to the cart.

A) Hardware

**Table 1. Hardware Non-Functional Requirements**

No	Device	Specifications
1	Computer/Laptop	<ul style="list-style-type: none"> <li>- Processor AMD FX-7600P @2.7-3.6 GHz</li> <li>- 12 GB Memory</li> <li>- 500 GB SSD</li> <li>- VGA AMD Radeon R5 M230</li> </ul>
2	Monitor	One or more monitors with resolution sufficient to increase productivity development.
3	Input Device	Comfortable keyboard and mouse for development and navigation.
4	Server	<ul style="list-style-type: none"> <li>- Processor: Minimum 2.4 ghz 4 core</li> <li>- RAM: 8 GB</li> <li>- Storage: Minimum 200Gb Storage</li> </ul>

B). Software

**Table 2. Non-functional Software Requirements**

No.	Tools	Ket.
1	Code Editor	Visual tudio Code
2	Runtime Environment	Node JS
3	End-to-endtypesafe APIs	TRPC
4	Library Javascript	React.js
5	Framework Javascript	ExpressJS
6	Version Control	Github
7	Package Manager	Pnpm
8	Platform Cloud	Railways clouds

Non-functional requirements analysis is an analysis needed to determine the specifications of system requirements. Non-functional specifications also include what elements or components are needed from the system being built until it is implemented. In the analysis of non-functional requirements, the analysis of hardware and software requirements is explained.

4. System Design

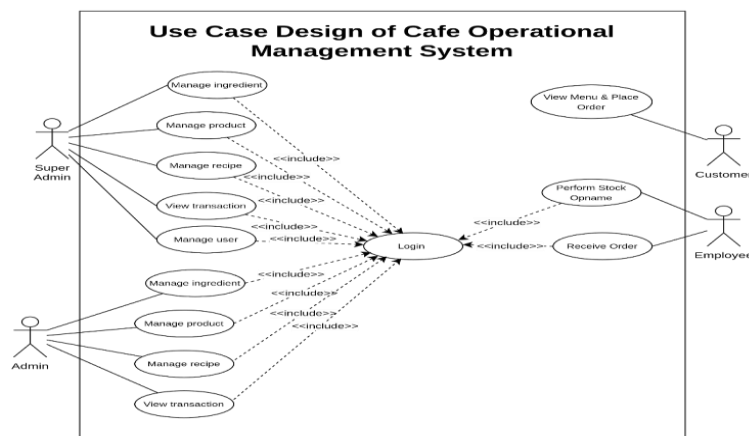
Before the development period begins, it is important to design to know and understand the flow of the system to be created, which is documented in the form of UML modeling as below:

3. Checkout and Payment Function

This function is used to checkout the order then make payment and complete the transaction.

4 Non-Functional Requirement Analysis

1. Use Case Diagram



**Figure 3. Use case design of cafe operational management**

## 2. Activity Diagram

### A. Login

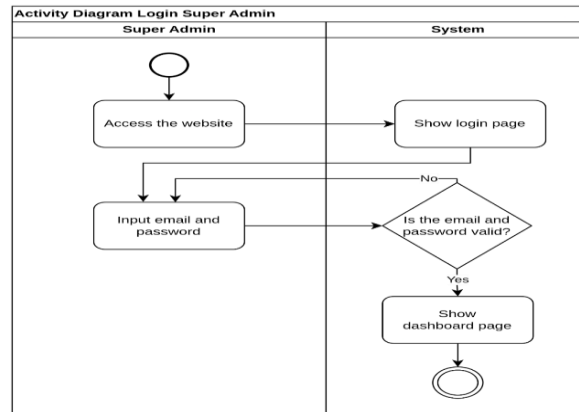


Figure 4. Login activity diagram

### B. Ordering Process

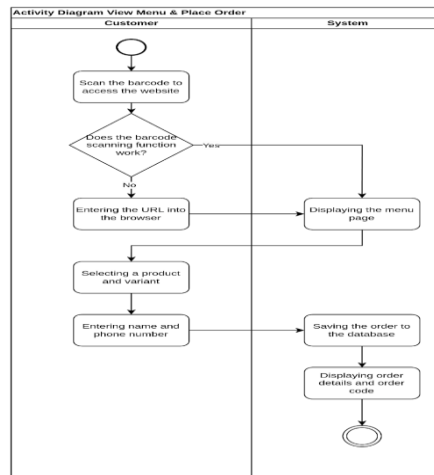


Figure 5. Activity diagram of ordering

### C. Activity Diagram Manage Products

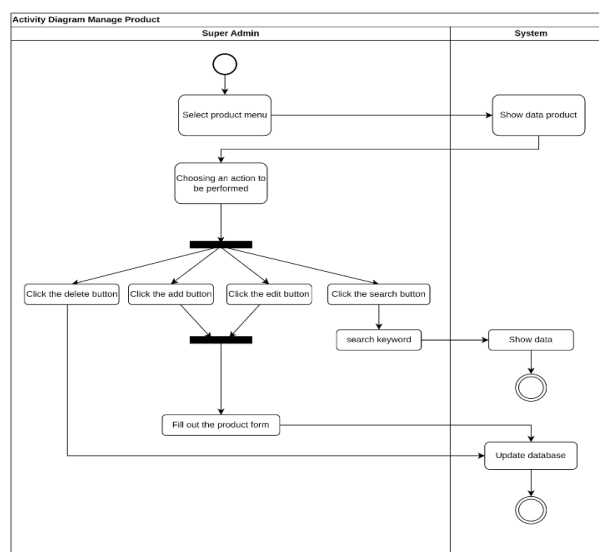


Figure 6. Activity diagram of managing products

### D. Order Acceptance

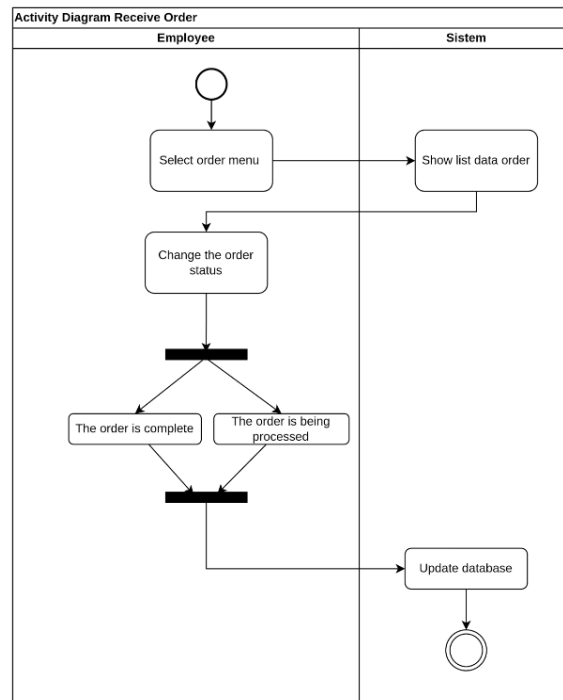


Figure 7. Order Acceptance

### E. Stock Opname

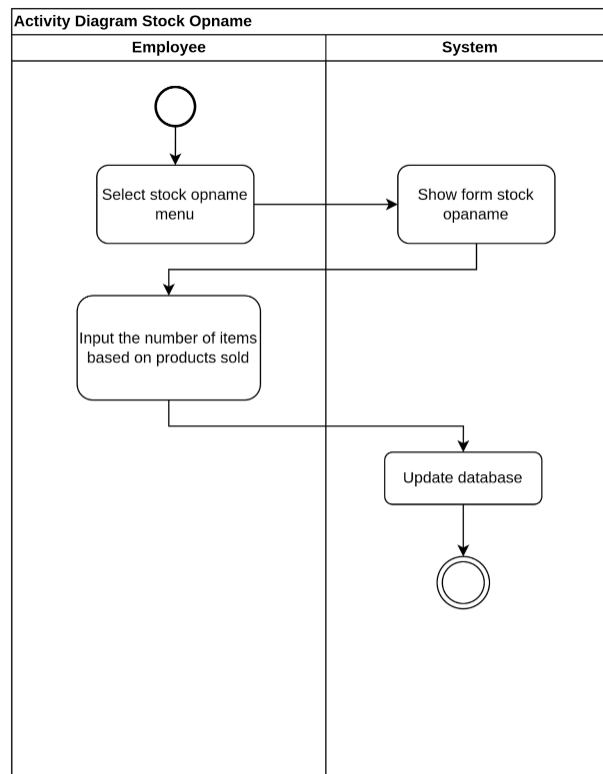


Figure 8. Stock Opname



### 3. Class Diagram

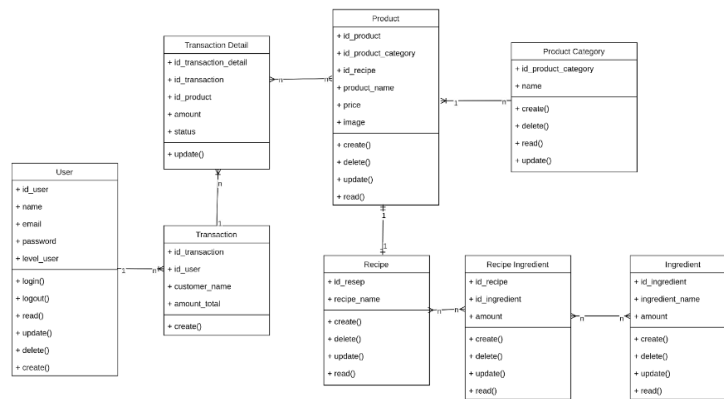


Figure 9. Class Diagram

### B. Implementation

After the design process, the implementation stage is carried out, namely the coding stage or implementing the design flow made into a website-based system.

The coding implementation will use TypeScript with React technology and Vite framework. For more structured project management, NX Monorepo will be used to manage modules and code more efficiently and centrally. The database system will use PostgreSQL accessed through the Drizzle ORM, while communication between services will be established using the tRPC protocol on Express. This approach not only ensures organized and efficient development, but also enables optimal adaptability and scalability for complex and modern web applications.

NX Monorepo is used as a powerful project management tool that enables development teams to centrally and efficiently manage frontend and backend code in a single repository. With the monorepo approach, all modules and services related to the project can be organized in one place, facilitating better collaboration between teams and minimizing administrative overhead in code management.

The use of NX Monorepo is also used to manage 3 modules, namely client, backoffice, and warehouse in one single repository which provides many advantages in the development of systems consisting of several different parts or modules. With this approach, the development team can organize, manage, and collaborate more efficiently in the development cycle, as well as maintain consistency and coherence between all parts of the system.

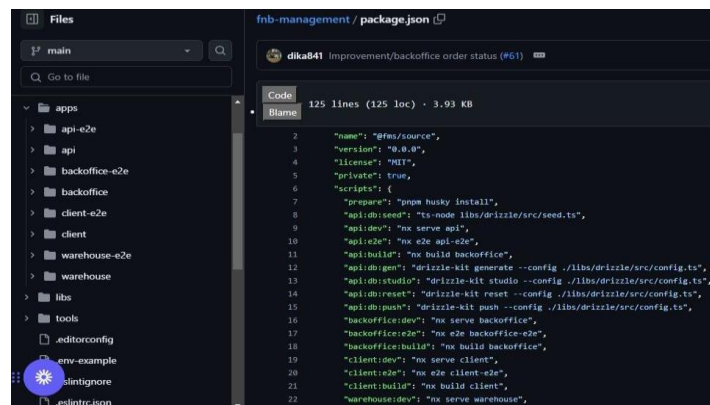


Figure 10. Sample code from the repository

The use of NX Monorepo in development not only facilitates centralized and efficient code management, but also strongly supports the application of Agile development methodologies. In the Agile approach, flexibility and adaptability are highly emphasized to enable teams to address changing needs or issues that arise during the development cycle.

With NX Monorepo, teams can organize their projects into modules and services that

can be elaborated separately according to the iterative and incremental nature of Agile. Developers can easily assign sprint planning to implement or improve certain features in the application, with frontend and backend modules well integrated in a single repository. This simplifies testing, delivery, and continuous integration (CI/CD), which are essential practices in Agile development to ensure the quality and reliability of the developed product.

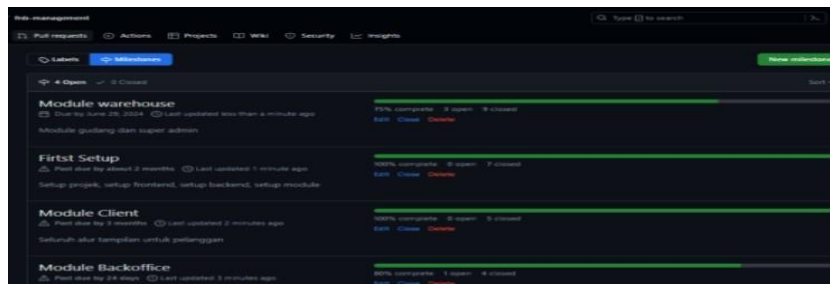


Figure 11. Example of github sprint planning

Overall, Monorepo's integration of NX with Agile methodologies provides a strong foundation for web application development that is adaptive and responsive to business and user needs. It enables teams to improve collaboration, accelerate feature delivery, and ensure optimal product quality, all while maintaining an organized and controllable structure of the code and development process.

### C. RESULTS

The results of this research are in the form of a cafe operational management system design that has been implemented into a website using monorepo technology. The design that has been implemented is then tested using black box testing which is documented in the form of an information system in this paper by paying attention to the agile stages that exist in the modules of the website system built.

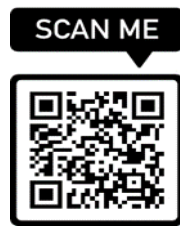
At the deployment stage, researchers use a free server for the development and testing period. the website can be accessed through link the following links are :  
<https://fnb-managements.vercel.app/>,

<https://fnb-management-backoffice.vercel.app/>,  
<https://fnb-management-warehouse.vercel.app/>.

For the production period or when it will be implemented later, it will use the server of the owner of Serasa Kopi. For website maintenance, researchers only reach the deployment stage so that further maintenance will be submitted to the owner who will manage if it is at the stage of use by customers and cafe employees. Here are some views of this website:

#### 1. Customer View

Customers can access the barcode installed on each table with their special ID or table number. This aims to make it easier for customers to place orders without the need to queue, as well as optimize service efficiency. With this system, customers can directly place orders from their table using the app or their mobile device. This process not only speeds up service, but also minimizes errors in order recording as it is done directly from the table.



After scanning the barcode, this page will be displayed on the website in a mobile-first format (prioritizing design for mobile devices before being adapted to larger screens such as desktops) and is responsive. On this page customers can easily choose the menu to be ordered.



Figure 12. Customer view

On this page the user can select several categories as desired, for example on the size variant, the amount of ice and the amount of sugar.

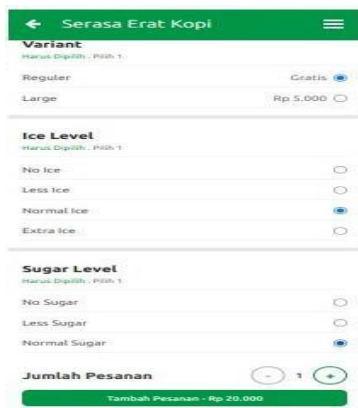


Figure 13. Menu view

Customers can select multiple products in one order and perform the same steps as before.



Figure 14. Coffee shop menu as close as you can get

After selecting the product to be ordered, the customer will be directed to the order form page which contains the name form, table number and order details as well as the amount of payment that needs to be paid.



Figure 15. Order form

After completing the order form, the order will be received by the barista and processed immediately.



Figure 16. Order processing page

## 2. Cashier View

This page is managed by the barista or cashier admin on duty that day. There are 4 order tabs that are divided into incoming orders, being processed, unpaid and completed. Every order that has been completed by the customer will enter the incoming order tab which will be arranged based on the time the order was made. Orders that appear at the bottom are orders that need to be processed first.

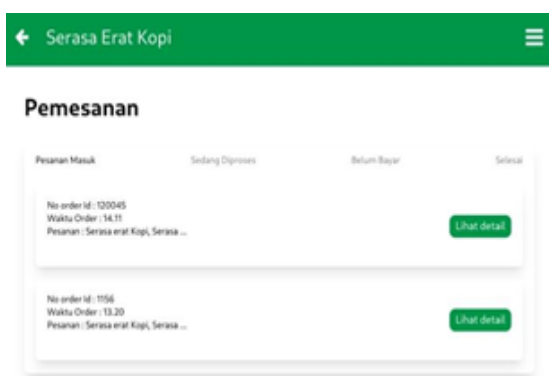


Figure 17: Order received by barista page

The barista can see the details of the order and each tab of the process needs to be confirmed in order to move to the next tab.

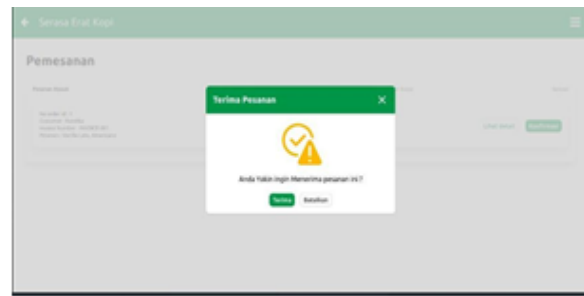


Figure 18. Order confirmation

After the order has been delivered and has been paid by the customer, the order details will be as shown below



Figure 19. Completed Order Details

## 3. Warehouse view

In the warehouse view, there is a dashboard that contains a recapitulation of frequently used materials, frequently purchased products, number of transactions, number of orders to measure performance, identify trends, evaluate strategies, and improve business efficiency.



Figure 20. Warehouse dashboard

The warehouse admin can also manage the ingredients used in making coffee products, such as milk, coffee, caramel, sugar and so on. Admins can add new ingredients, edit and delete ingredients that are no longer used in existing products.

No	Created At	Nama	Aksi
1	Kamis, 06 Juni 2024	Coffee	Detail Stok
2	Kamis, 06 Juni 2024	Milk	Detail Stok
3	Kamis, 06 Juni 2024	Tea	Detail Stok
4	Kamis, 06 Juni 2024	Water	Detail Stok
5	Kamis, 06 Juni 2024	Sugar	Detail Stok
6	Kamis, 06 Juni 2024	Ice	Detail Stok

Figure 21: Material Management Table

Furthermore, there is a product page that contains products according to the availability of raw materials that will appear on the customer's page. On the warehouse admin side, the admin can add edit and delete products

No	Image	Nama Produk	Stok	Aksi
1		High Low Beans	1000	Detail Stok
2		High Low Grand	1000	Detail Stok
3		High Low Special	1000	Detail Stok

Figure 22: Manage Product Table

Furthermore, there is a page for managing ingredients requested by baristas, on this page the warehouse admin can confirm what ingredients I will add back to stock.

No	Trigger	Nama Bahan	Jumlah	Request by	Tindakan
1	Rabu, 12 Juni 2024	Soda	400 ml	Admin	Detail Stok / Confirm
2	Rabu, 12 Juni 2024	Kopi	300 ml	Admin	Detail Stok / Confirm
3	Rabu, 12 Juni 2024	Gula	800 ml	Admin	Detail Stok / Confirm
4	Rabu, 12 Juni 2024	Sirup Banana	100 ml	Admin	Detail Stok / Confirm
5	Rabu, 12 Juni 2024	Sirup Anacard	50 ml	Admin	Detail Stok / Confirm
6	Rabu, 12 Juni 2024	Sirup Strawberry	100 ml	Admin	Detail Stok / Confirm

Figure 23: Stock-Taking Table

In addition, there is a stock-taking table to equalize or compare the original stock with

the reduced stock on the system. This table aims to reduce fraud and maximize the calculation of materials in the products made.

No	Nama Bahan	Jumlah Stok	Tindakan
1	Soda	400 ml	Detail Stok
2	Kopi	4000 g	Detail Stok
3	Teh	2000 g	Detail Stok
4	Gula	4000 g	Detail Stok
5	Sirup Banana	600 ml	Detail Stok
6	Sirup Orange	500 ml	Detail Stok

Figure 24: Stock Opname Table

Finally, there are role settings that can be accessed by the owner to manage features on the system that can be accessed by existing users.

Menu	Detail	Update	Detail	Update
Warehouse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Back Office	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Client	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Figure 25: Role Settings page

#### D. Testing

This tester stage is carried out to test the application that has been made using black box testing. Black box testing aims to find incorrect functions, interface errors, errors in data structures, performance errors in users. This test was carried out by the owner of Serasa Erat Kopi.

**Testing Date:** June 03, 2024

**Examiners:** Bayu Numan Syifa (Owner of Serasa Erat Kopi) and team

**Table 3. Blackbox Testing**

No	Test Description	Expected Result	Result
1	Login attempt with incorrect username or password	The system can display the appropriate error message if the username/password is incorrect	Successfull
2	Login experiment without filling in the username or password	Button submit will be display the appropriate error message if the username/password is incorrect	Successfull
3	Login experiment using the appropriate username and password	Button save successfully submitted and will enter the dashboard.	Successfull
4	Experiment accessing the website using a barcode	Displays the address of the access link to the website page as tightly as coffee and is immediately directed to the product list page.	Successfull
5	Attempting to add more than 1 order	The number of products displayed is in accordance with what was added	Successfull
6	Experiment filling out the order from correctly	Data can be submitted and generate order number	Successfull
7	Experiment confirming an order from a customer	There is a confirmation button that display data and orders detail from customer, and mutation moves to the process page	Successfull
8	Experiment confirming payment from customers	There is a confirmation button, which when submitted mutase moves to the finished page	Successfull
9	Experiment inputing material stock data with the appropriate data	Displays the material stock data input form, can press the save button, and display the material stock	Successfull
10	Try to add product data with the appropriate data	Displays the product data input form, can press the save button, and display the new product	Successfull
11	Attempting to edit product data with the appropriate data	Displays a form containing previous data, can press the save button, and display the latest product	Successfull
12	Attempting to delete product data	There is the delet button, there is the confirmation of the deletion, and the data is no longer displayed in the list	Successfull
13	Experiment to confirm the stock inputted in stock-taking	Displays the data inputted by employees, matches the stock, and can press the confirmation button	Successfull

## CONCLUSION

From the results of the above research, it can be concluded that this research has successfully answered the problems found in Serasa Erat Kopi. Below are some of the conclusions that have been obtained:

1. Serasa Erat Kopi's operational management website can help in facing challenges in operational management that still rely on manual systems. So as to improve the efficiency and quality of cafe management.
2. The application of the Agile Development method in the development of operational management systems at Serasa Erat Kopi systems can be well integrated from the customer, barista, and cafe owner sides so that this method can increase flexibility, transparency, and responsiveness to

change, allowing iterative adaptation to evolving business needs.

3. Implementing NX monorepo technology at the development stage makes all source code, modules, and project dependencies combined in a single repository that facilitates code management, team collaboration in the construction of a cafe operational management system at Serasa Erat Kopi.

### *Declaration by Authors*

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**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

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