

DEVELOPMENT OF SALES INFORMATION SYSTEM FOR SME WITH THE WATERFALL METHOD: A GROCERY STORE BSR CASE

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Abstract

Grocery store BSR is an SME engaged in the sale of goods for basic daily needs. Today's business processes are still done manually. It has in-store sales services and a mobile sales team to reach a wider rural area in Central Java province of Indonesia. The competition in the grocery store SME business is tighter and increasingly competitive, so shop owners consider increasing the efficiency of business processes by creating web and mobile android of sales information system applications, which are the objectives of this study. We use the waterfall method to develop the sales information system. The development of A web application for in-store use and an android mobile application for mobile sales teams. From the business process analysis, three processes can be streamlined with the use of this application. Also, another uniqueness is the minimum and maximum selling price feature for each sales item to give the sales team flexibility in determining the selling price to the customers. User acceptance test has been carried out by the research team with black-box method as per use-case diagram with the shop owner. The testing results showed that the developed information system increase the process business efficiency in the grocery store BSR. Hence, the objective to develop sales information system has been achieved.

Keywords: Grocery Store, Information System, Mobile Android, SME, Web Application.

PENGEMBANGAN SISTEM INFORMASI PENJUALAN UNTUK INDUSTRI KECIL DENGAN METODE WATERFALL: STUDI KASUS PADA TOKO SEMBAKO BSR

Abstrak

Toko sembako BSR merupakan UKM yang bergerak di bidang penjualan barang kebutuhan pokok sehari-hari. Proses bisnis saat ini masih dilakukan secara manual. BSR memiliki layanan penjualan di dalam toko dan tim penjualan di luar toko untuk menjangkau daerah pedesaan yang lebih luas di provinsi Jawa Tengah, Indonesia. Persaingan bisnis UKM toko kelontong semakin ketat dan kompetitif, sehingga pemilik toko mempertimbangkan untuk meningkatkan efisiensi proses bisnis dengan pengembangan sistem informasi penjualan berupa aplikasi web dan mobile android yang menjadi tujuan dari penelitian ini. Pengembangan sistem informasi penjualan menggunakan metode *waterfall*. Aplikasi web untuk penggunaan di dalam toko dan aplikasi seluler android untuk tim penjualan di luar toko. Dari analisis proses bisnis, tiga proses dapat disederhanakan dengan penggunaan aplikasi ini. Selain itu, keunikan lainnya adalah adanya fitur harga jual minimum dan maksimum untuk setiap item penjualan sehingga memberikan keleluasaan bagi tim penjualan dalam menentukan harga jual kepada pelanggan. Uji penerimaan pengguna telah dilakukan oleh tim peneliti dengan metode *black-box* sesuai dengan diagram kasus penggunaan dengan pemilik toko. Hasil dari pengujian menunjukkan sistem informasi yang dikembangkan membantu meningkatkan efisiensi proses bisnis pada toko sembako BSR. Oleh karena itu, tujuan untuk mengembangkan sistem informasi penjualan telah tercapai.

Kata kunci: Aplikasi Android, Aplikasi Web, Industri Kecil Menengah, Sistem Informasi, Toko Sembako.

1. INTRODUCTION

SMEs (Small and Medium Enterprises) are productive businesses managed by business entities or individuals, which refer to productive economic enterprises that meet the criteria stipulated in Law Number 20 of 2008. SMEs have become the

backbone of the Indonesian and ASEAN economies by absorbing workforce reached 51.8% - 97.2% [1]. The types of businesses that fall into the SME category are those with a gross turnover of less than 4.8 billion rupiah per year or 400 million rupiah per month, among others: grocery store, building shop, grocery store, building shop, apparel shop,

cooperative, rented/ boarding entrepreneur, and so on [2].

Based on Internet World Stats data, Indonesian internet users in 2020 Q1 was 171,260,000 people. Indonesia is ranked 4th in the world in terms of the number of internet users [3]. With a large number of internet users, Indonesia has become a large market for buying and selling services or products online. Data shows that transactions from four major e-commerce sites in Indonesia are estimated to reach 429 trillion rupiah in 2020, or an increase of two times more than the previous year. Based on existing data, it will be an opportunity for SME businesses to digitize their businesses towards online businesses [4].

Grocery store BSR is an SME that is engaged in the sale of goods for basic daily needs. This SME is located in the village of Ajibarang, Banyumas Regency, Central Java Province of Indonesia. Business processes are still done manually. The sales process is carried out in two ways: serving buyers who come directly to the store and approaching the buyers' place by a traveling sales team to reach a wider rural area. The process of receiving goods is carried out in the shop by the reception staff. To maintain the accuracy of stock data, shop owners carry out daily stock checks, which are then correlated with incoming goods from the goods receiving process and goods leaving the sales process. The tight competition in the grocery store SME business and increased competition with modern minimarkets has made shop owners consider implementing the use of information technology in the form of integrated applications for the sales process, the goods receiving process, and the stock monitoring process.

Based on the description above, the researcher provides a solution to the grocery store BSR with references from research that has been done, namely by designing and making Sales Information System (SIS) of web-based applications and customization mobile androids according to the business process. The mobile sales team uses the android mobile application to record sales orders from customers. In addition, there is also a feature to add new customers, a feature to view daily sales results, and a feature to view daily product selling price updates. The web application is used by shop owners to create invoices and delivery notes/ travel documents. In addition, there are also features to add products, features to update selling prices, features for receiving goods from suppliers, and features for stock management.

This study uses a research methodology for making applications in a sequence from an analysis of user needs and a description of the system design using UML (Unified Modelling Language). Another advantage is that the application is made using an open-source platform to reduce costs according to budget, and there are features of a minimum price

and maximum price for each product price that is unique to the needs of Grocery store BSR.

2. RELATED WORK

UML (Unified Modelling Language) is a standard model language in the industry for visualizing, designing, and documenting software systems or applications. UML defines the standard notation and semantics of the modeling language for object-oriented applications. The basic concept consisting of structural classification, dynamic behavior, and management models can be understood through several diagrams. UML defines several diagrams as follows: use case diagrams, class diagrams, entity relationship diagrams, activity diagrams, and so on [5].

A web-based application is an application that is accessed by using a web browser via an internet or intranet network. Popular web-based applications use programming languages such as PHP, HTML, JavaScript, CSS, and others [6]. Modern web-based applications use frameworks such as Code Igniter, Laravel, and others to speed up the application creation process. The framework allows programmers to use programming languages such as PHP, HTML, CSS, and JavaScript. The Laravel framework is a PHP framework with an MVC (Model, View, Controller) structure which is popular and has many references on the Internet [7].

Android Mobile Application is an application that can be accessed via a smartphone device with the Android operating system. The operating system underlying Android is licensed under the GNU, General Public License version 2 (GPLv2). This system can be distributed to second parties and beyond with the Apache Software License (ASL) [8]. Applications that run on Android devices can be made with the Android programming language, React Native, Kotlin, and so on. React Native is an open-source software platform developed by Facebook, Inc. React Native has the advantage that it can be used to develop multi-platform applications by utilizing the native platform capabilities [9].

Web API (Application Programming Interface) is an application programming interface for a web server or web browser. Web API is a web development concept in the form of a function, method, or endpoint URL. Web API, which is intended as an interface in building web services, can be called a RESTful API [10].

JWT (JSON Web Token) is an open industry standard RFC7519 method of securely representing claims between two parties. JWT is a solid JSON token (size). This token can be verified and trusted because it has been digitally signed. JWT tokens can be signed using the HMAC algorithm or the RSA algorithm [11].

Implementation of the use of information technology and software for SMEs has been carried out in previous studies. The author in [12] examined

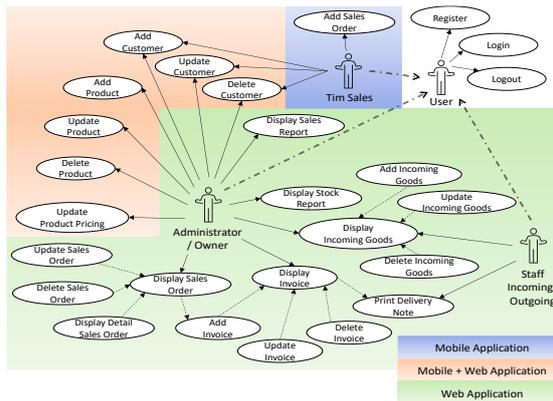


Figure 5 Use Case Diagram for the Application

the design and manufacture of e-commerce website applications for MSME Nena Namo. Their products are handicrafts with the advantage of applications equipped with features to make product customization designs by customers. Then the author in [13] built web and mobile android applications for boarding searches to help students looking for boarding houses and as a forum for boarding house entrepreneurs to promote themselves by utilizing phone gap technology and the Google Maps API. In addition, there is also research on MSME product websites based on CMS (Content Management System) that are optimized with SEO (Search Engine Optimization) [14]. Implementation in SME industry with integration to lean manufacturing system to improve production quality section has been introduced in [15], [16], and to improve supervision and technical planning process monitoring discussed in [17].

3. RESEARCH METHOD

The method of designing and making applications in this study is carried out with waterfall method [18] in stages, namely: requirement analysis, system design, application development, and the last part testing and implementation phase.

3.1. Requirement Analysis

The needs analysis stage is the initial stage that researchers do to find out the scope of needs in making customization applications according to the needs of grocery store BSR. Activities in carrying out these stages include:

1. User interviews: Implementation of the interview process with the owner of the grocery store SBR to get the scope of needs needed in application development.
2. Analysis of interview results: Interview results are translated into user stories. From the analysis, a list of application users is made and a description of their needs. After that, a use case diagram is made to help the system design stage.

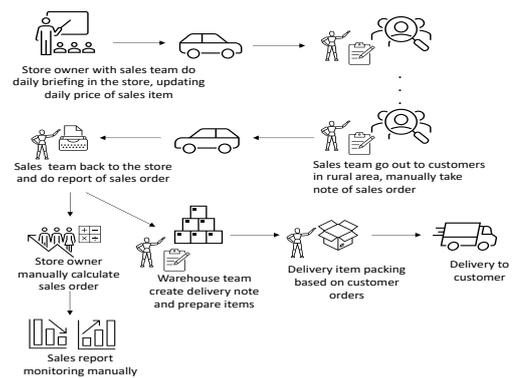


Figure 1 As-Is Model of Sales System

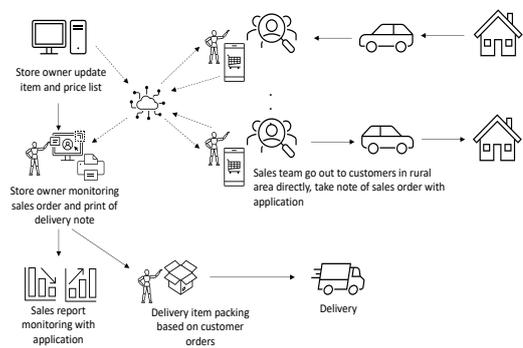


Figure 2 To-Be Model of Sales System

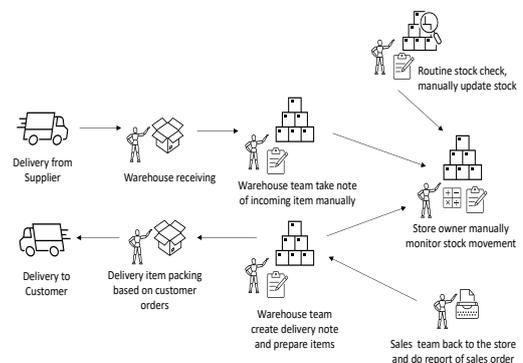


Figure 3 As-Is Model of Purchase System

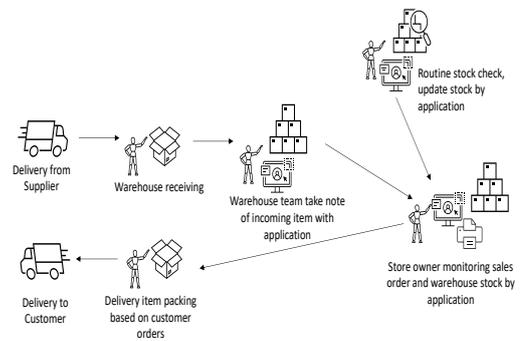


Figure 4 To-Be Model of Purchase System

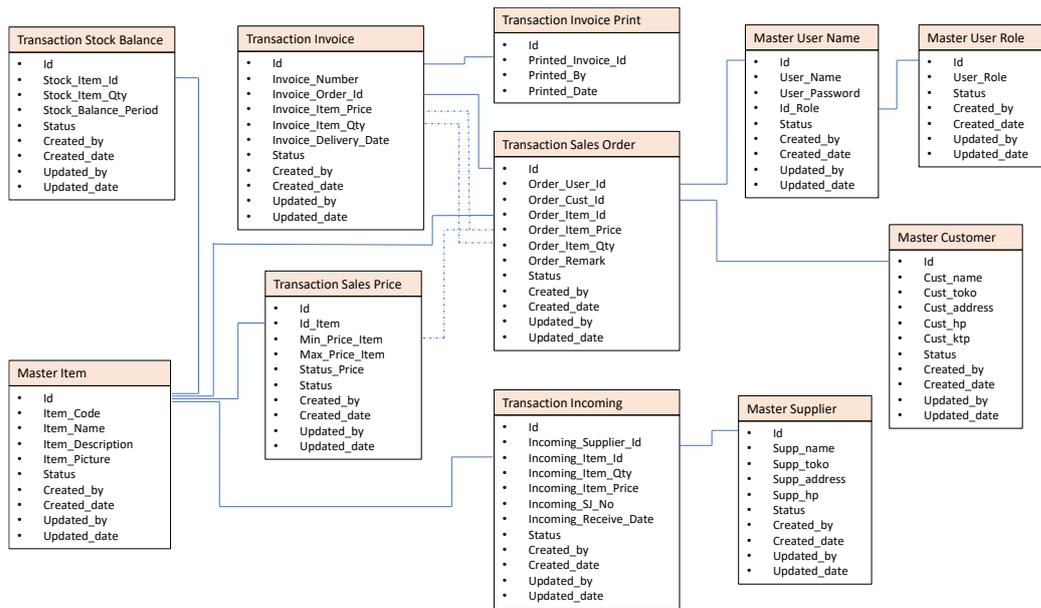


Figure 6 Entity Relationship Diagram

3. Comparison of the As-Is business model with the To-Be business model: This business model is made to compare business processes that can be streamlined with later application implementation.

3.2. System Design

In this design stage, the researcher describes all the needs of grocery store BSR that are obtained into UML. This stage will be explained using entity relationship diagrams, sequence diagrams, and activity diagrams.

3.3. Application Domain

Application development uses an open-source platform available on the Internet by considering a limited budget. In addition, choosing the type of programming language takes into account the availability of reference information on the Internet. For web applications, researchers use the Laravel framework as a web interface on the application server.

As for the android mobile application, researchers use React Native to create applications on smartphones. For data processing, it is connected to the web API on the application server. As for the security system for access to the application, the researchers implemented JWT from Google Firebase into the android mobile application. The database uses the MySQL DBMS.

3.4. Testing and Implementation

The testing stage is carried out by means of simulations based on use case diagrams of each feature in the grocery store BSR application. Implementation of the application is carried out with

black box method until the UAT (User Acceptance Test) stage is complete.

Based on the list of system requirements, web-based and mobile android applications for customization according to business processes will be developed. The android mobile application is used by the mobile sales team to record sales orders from customers. In addition, there is also a feature to add new customers, a feature to view daily sales results, and a feature to view daily product selling price updates. The web application is used by shop owners to create invoices and delivery notes/ travel documents. In addition, there are also features to add products, features to update selling prices, features for receiving goods from suppliers, and features for stock management.

4. RESULT AND DISCUSSION

At this stage, the researcher converts the interview results to list system requirements, system functional requirements, system users, and comparisons of business process as-is models with business process-to-be models.

System users consist of three actors, namely: administrator/ shop owner, sales team, and goods receiving staff. Figure 5 displays a use case diagram of the relationship between the functional requirements of each actor. In addition, it can also be seen the scope of each application to the needs of each actor. The features contained in the Android mobile application alone are in the blue scope. The features contained in the web and mobile android applications are in the scope of brown. The features contained in the web application alone are in the green color scope.

The sales business process is shown in Figure 1 and Figure 2. The purchase business process is shown in Figure 3 and Figure 4. From the

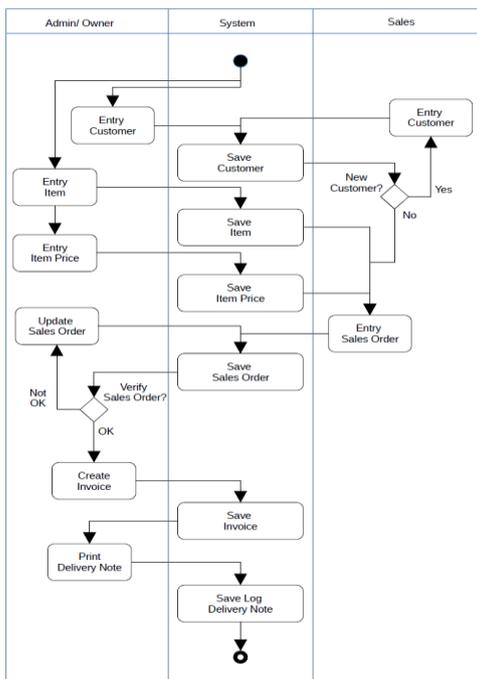


Figure 7 Activity Diagram of Sales Process

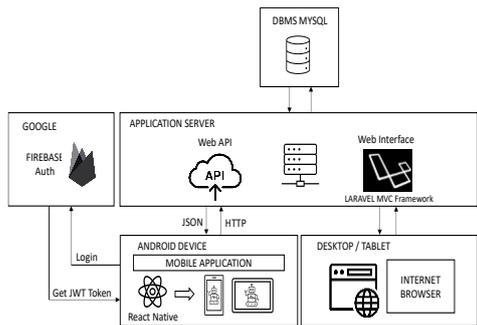


Figure 8 System Architecture for Android Web and Mobile Applications

description of the business process, as shown in figures, it can be analyzed that the application implementation in the to-be model will be able to streamline three business processes, namely: the process of "sales team back to the store for sales reports," the process of "owner of sales calculations," and the process of "recording of outgoing goods."

The entity relationship diagram design is shown in Figure 6. The physical data model design that has been created is translated into a specific database, and the implementation uses MySQL DBMS technology. The uniqueness of this database design is that there is a minimum and maximum price for each item sold and these prices are updated daily by the shop owner. With this need, there is a special table of goods price transactions in the database. The latest minimum and maximum item price transaction data, and master data for selling goods are displayed on the android mobile application to make Sales Order transactions at one fixed price determined by the sales team, which can vary depending on the customer, but still within the

minimum and maximum price limits the item. Further explanations in this publication focus on the sales process due to limited space.

Figure 7 shows the activity diagram of the interaction between the user and the system for the sales process of Grocery store BSR. For this system, the sales team can make new customer entries if they are not already in the customer master data. In addition, the sales team performs sales order entries based on customer orders based on the goods sold and the price set by the shop owner. The admin/

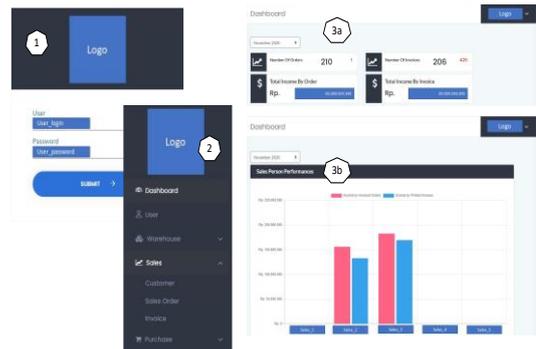


Figure 9 Web Application Display, Login Feature (1), Sidebar Feature (2), Dashboard Feature (3a, 3b)

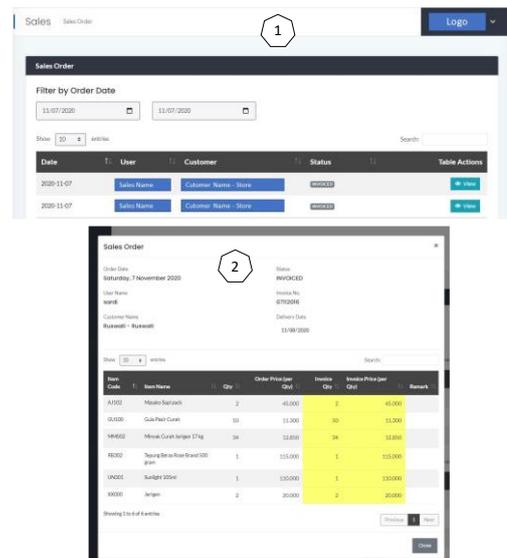


Figure 10 Web Application Display, Sales Order Feature (1), Sales Order Detail Feature (2)

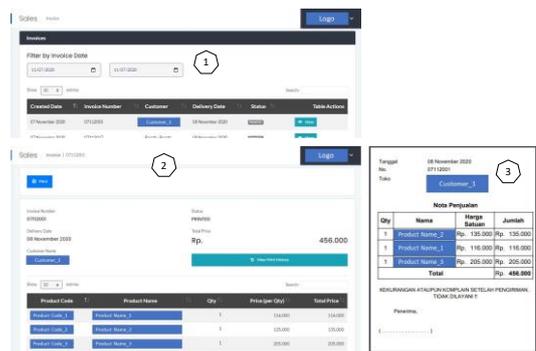


Figure 11 Web Application Display, Invoice Feature (1), Invoice Detail Feature (2), Receipt Output (3)

shop owner has a customer entry feature, item entry feature, item price entry feature apart from that, there is also a feature for making invoices to print delivery notes.

Figure 8 shows the architectural schematic of the web and mobile android application system as a whole. The application made uses an open-source platform to reduce costs according to the budget of Grocery store BSR. The programming language was chosen based on the ability of the research team and the availability of reference materials on the Internet.

Web application: This application was developed using the Laravel framework with an MVC (Model, View, Controller) structure. The appearance of the web application can be seen in Figure 9, Figure 10, and Figure 11.

Figure 9 shows the login feature (1), the sidebar menu feature (2), the dashboard feature (3a, 3b). Figure 10 shows the sales order feature (1), the sales order detail feature (2). Figure 11 **Error! Reference source not found.** shows the invoice feature (1), the invoice detail feature (2), and the travel pass print feature (3). Several displays were closed to maintain the confidentiality of Grocery store BSR's data without reducing the things the researchers wanted to convey.

The dashboard display contains a daily summary/ recapitulation of total revenue from sales orders, and total revenue from bills/ invoices that have been printed. In addition, it can also be seen the performance of each salesperson against daily sales. The sales order feature and the invoice display feature are made in two forms, namely a summary display and a detailed view according to the needs of grocery store BSR.

Android mobile application: This application was developed with the React Native programming language and is compiled to operate on the Android system. Authentication and session use google firebase to get JWT so that the level of security is more guaranteed. The web API for the android mobile application is still independent of the web application, so the android mobile application can still be operational even though the web application is experiencing problems. The appearance of the android mobile application can be seen in Figure 12 and Figure 13.

In general, there are four main features, namely: Home, Items, Cart, and Setup. Figure 12 (2) shows the Home feature, which has a recapitulation of daily sales orders per customer for the sales team to know daily performance. In addition, the Home feature also displays a list of items that have changed prices on that day so that the sales team can continue to follow price changes determined by the shop owner. Figure 13 (1) displays the Items feature for the sales team to enter sales orders for goods according to customer orders and determine the fixed price of the goods. After entering all customer

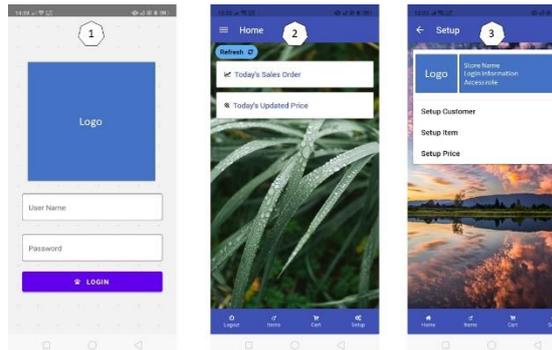


Figure 12 Android Mobile Application Display, Login Feature (1), Home Feature (2), and Setup Feature (3)

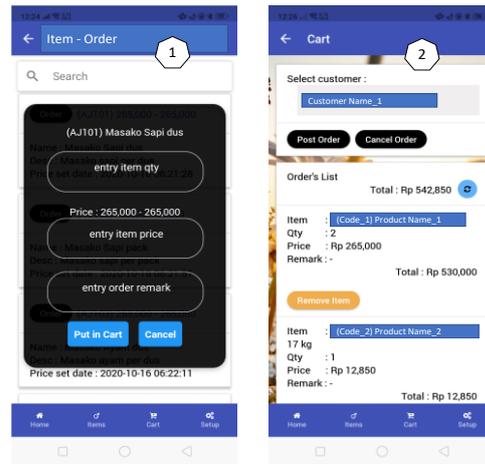


Figure 13 Android Mobile Application Display, Item Features (1), Cart Features (2)

orders, the sales team can open the Cart feature in Figure 13 (2) to see the sales order summary and determine the name of the customer before saving the sales order.

Application alpha testing is carried out with black-box method. The testing results as shown in Table 1 based on input and output of use case diagrams and is carried out with shop owners to obtain UAT approval. The implementation stage still encountered several obstacles, especially the problem of weak signals due to the sales team reaching rural areas.

Table 1. Black-box Testing Results

Web Application Testing Result			
Input	Process	Output	Result
Username & Password	Login	Go to homepage dashboard	Valid
Customer	Add, Update, Delete of Customer Data	Lists of Customer Data	Valid
Product	Add, Update, Delete of Product Data	Lists of Product Data	Valid
Product Price	Add, Update, Delete of Product Price	Lists of Updated Product Price	Valid
Sales Order	Update, Delete of Sales Order Data	Lists of Sales Order Data	Valid
Invoice	Add, Update, Delete of Invoice Data	Lists of Invoice Data and Lists of Updated	Valid

Incoming Goods	Add, Update, Delete of Incoming Goods Data	Warehouse Stock Lists of Incoming Goods and Lists of Updated Warehouse Stock	Valid
Input Username & Password	Mobile Application Process Login	Testing Result Output Go to Dashboard	Result Valid
Customer	Add, Update, Delete of Customer Data	Lists of Customer Data	Valid
Sales Order	Add of Sales Order Data	Lists of Sales Order Data	Valid

Beta testing also has been carried out to obtain feedback from the grocery store BSR users. Table 2 shows the questionnaire results from 3 users in grocery store BSR. Based on user's role, it is divided to 2 sales person, and 1 owner.

Table 2. Questionnaire Results

No	Questions	5	4	3	2	1
1	Is the appearance of this Sales Information System (SIS) attractive?	1	2			
2	Is the user interface of this Sales Information System (SIS) easy to understand and operate?	2		1		
3	Have all the features in this Sales Information System (SIS) fulfilled all the needs?		2	1		
4	Does the existence of this Sales Information System (SIS) make operational and management activities more effective and efficient?		1	1	1	
5	Have the information and reports displayed on this Sales Information System (SIS) meet the needs?	1	1		1	
6	Is this Sales Information System (SIS) feasible for continue use?	1	1	1		

We calculated the questionnaire results with formula: $p = (f / N) \times 100\%$, where p is the evaluated percentage score; f is the total actual score from all the users; and N is the maximum possible score from all the users. The result of p means the percentage of the assessment score on each question. We categorize p value as follows: 0% - 20% as Very Bad, 20.01% - 40% as Bad, 40.01% - 60% as Average, 60.01% - 80% as Good, 80.01% - 100% as Very Good.

Table 3 shows the beta testing results of each question. We can observed that SIS received Very Good result in Questions number 1 and 2, Good result in Questions number 3, 5 and 6, Average result in Question number 4. Averagely our application received 76.67% which is a Good result from all of the users.

Future work includes improvement of the SIS to increase operational and management activities effectiveness in the grocery store BSR.

Table 3. Beta Testing Results

Questions	Total Score	Percentage	Category
1	13	86.67%	Very Good
2	13	86.67%	Very Good
3	11	73.33%	Good
4	9	60.00%	Average
5	11	73.33%	Good
6	12	80.00%	Good
Average		76.67%	Good

5. CONCLUSION

Based on the results and discussion of this research, researchers have designed and created SIS of web applications and mobile android applications for the digitalization needs of Grocery store BSR. There are three business processes that can be streamlined by implementing this system and overall make it easy for shop owners and sales teams to run a business. Among the features this application has, there is a unique feature where there is a minimum price and maximum price for each item sold which is determined by the shop owner. With this feature, the sales team has the flexibility to determine prices depending on the customers faced when reaching rural areas around the village of Ajibarang, Banyumas District, Central Java province of Indonesia.

This research has not yet discussed aspects of the analysis of implementation results, especially from an economic perspective, analytical data for business decision systems, and other post-application aspects. Therefore, further research is needed to analyze the above aspects. In addition, there is also a need for continued application development with features to increase the efficiency of business processes and expansion of the area covered, as well as an android mobile application that customers can use directly according to the CI/CD (Continuous Improvement/ Continuous Development) process for digitizing Grocery store BSR.

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