Efficient Software Development Process Using Component-Based and ORM

Kharisma Rizki Hidayatullah[*1], Hadiq[2]
[1,2] Informatics Engineering Study Program, STIKOM PGRI Banyuwangi, Indonesia
E-mail: [*1]**kharisma.rizki890@gmail.com**, [2]hadiq@stikombanyuwangi.ac.id

Abstract

The software development process has many variations. Each software development technique has its own advantages and disadvantages. There are efficient development processes and some could be more efficient. This research aims to build a web-based application efficiently utilizing component-based and ORM with a case study of financial management applications on community radio. This research begins with data collection through observations and interviews, requirement analysis, and system design, implementation, and testing. This research shows that combining component-based software development and object-relational mapping (ORM) can increase software development efficiency compared to non-component-based and pure SQL.

Keywords *— Component Based, ORM, Website*

1. INTRODUCTION

In the current era, the development of technology is increasing rapidly. Fast and accurate data processing/management is very important to produce the required data, especially if the data being processed is financial data, high accuracy or processing speed is also required [1]. Fast and accurate data processing or management is very important to produce the data needed, especially if the data processed is financial data, high accuracy and speed of data processing are required[2].

Radio Larasati FM is a business engaged in entertainment, more precisely a karaoke place. Radio Larasati FM was established in 2019, the product or service offered is retail karaoke aimed at the tastes of the middle to lower-class community.

Currently, the financial management of Larasati FM karaoke radio still uses a manual system. Not yet well computerized in handling financial data. Notes are still used to record incoming money, but the information to be processed is not small. This can cause problems in financial reports, for example, errors when entering financial data, so that the report results do not match the existing conditions. Processing financial data with a manual system also creates difficulties for users, when requiring calculations with formulas, users must work more carefully because the data to be entered is very large[3].

Because of this, the financial management system is a solution to replace the manual system. Using a financial management system can help business owners manage finances and produce good reports. Financial reports are an important source of information for companies when deciding on future plans and actions to achieve company goals.

Various studies that have been conducted include research with the title Evaluation of the Application of Simda Keuangan at the Department of Youth, Sports, and Tourism of Magelang City. Raises issues regarding the evaluation of the application of Simda finance at the Department of Youth, Sports, and Tourism of Magelang City. In the implementation and application of SIMDA at the Department of Youth, Sports and Tourism of Magelang City, several obstacles were found such as the quality of human resources and the quantity of human resources known to be lacking in mastering SIMDA management. However, constraints such as integrated procedures and guidelines also still need to be considered in the application of SIMDA Finance. Based on these problems, researchers conducted a study with the aim of evaluating the Application of the Regional Management Information System (SIMDA) Finance in the Department of Youth, Sports, and Tourism (DISPORAPAR) of Magelang City. This research was conducted by Siti Muthoharoh and Agustina Prativi Nugraheni[2].

Furthermore, research entitled Development of a Web-Based SPAB (Clean Water Provider Facility) Service System. Raising the issue of info about clean water services, which has constraints on the lack of socialization of these services. Therefore, this research has the aim of overcoming the problem of updating a system that is integrated with a database so that the recording process such as customer data, and user data is more effective. With the development of a Web-based SPAB (Clean Water Supply Facility) Service System, the registration process to customer complaints can be carried out effectively because it is done online and customers can also see their billing information on the website. With this system, it can facilitate customers in carrying out the process so that the service process is easier and more flexible in terms of time and place[4].

The next research is entitled One-Stop Application for New Student Admission at Senior High School. Raising the problem of registering new high school students in Palembang still using conventional methods to register new students. During the covid-19 pandemic, many parents of students had difficulty registering for school. because of the large-scale social restrictions launched by the government to deal with covid-19, requiring people to stay at home. The purpose of this research is to create a user interface in the form of a web-based and mobile new student registration application that will facilitate the registration process of prospective new students without having to enter the school. The result of this research is a new student registration application that can be used by prospective students to register. System testing is done through black box testing which shows that the system built works well and as expected[5].

Referring to the results of the review of research that has been done, all of them are website-based applications as a solution to existing problems. Basically, the three studies function in managing data can be done effectively and efficiently rather than using conventional systems. In this study, the financial management system is a web-based application designed using the Component-based development method where the method is one of the software development methods, which focuses on reusing components. This research also uses ORM (Object Relational Mapping) to query object oriented databases. The results are expected to be more efficient when designing and developing financial management systems than using non-component methods.

2. RESEARCH METHOD

2.1. Data Collection Method

The data collection method used in this research uses a qualitative method where the author goes directly to the place, investigates, records, analyzes, interprets, and reports a natural process or discovery, and draws conclusions about the process.

2.1.1. Observation

Observation activities, namely making direct observations of the object of research by visiting karaoke places to observe the financial management process of karaoke place rental results. So that researchers can find out the weaknesses and requirements of the system to be built[6].

Based on the observations made by researchers, the financial management process at Radio Larasati FM still uses a manual system by recording using a book. The existing customer data is also not small, especially in this place of business has three employees, where each employee has his own customers. This makes it difficult for business owners to calculate the results or income each week.

2.1.2. Interviews

In the interview stage, data collection is carried out directly through questions and answers with sources or business owners[7].

Below the author describes some of the questions used for interviews with business owners and the answers.

Table 1. Interviews

Questions	Answers
1. What kind of system is currently used to record customer data?	Still using manual recording using notebooks.
2. What difficulties are currently experienced when keeping financial records?	Difficult to calculate daily and weekly revenue due to a large amount of customer data.
3. How many employees are there?	There are three employees, all of whom are radio broadcasters.
4. How many customers do you have in a week?	There are approximately 45-55 customers.
5. What are the disadvantages of the current financial record?	It takes a long time to perform calculations, and has a high risk of miscalculating income.
6. What are the future expectations if a system for financial management is created?	The hope is that it can make financial calculations of both income and output more effective and efficient.

2.1.3. Literature Study

The last stage is the author collecting information by reading literature, journals, articles and readings sourced from books related to the research title to help complete the development of this system[8].

2.2. System Development Method

The method used in this research refers to the SDLC (Software Development Life Cycle) information system methodology. SDLC is a modeling process used to develop software systems. The SDLC method has many types of methods, the method used by the author in this research is the Waterfall method.

Waterfall method is a working method that emphasizes systematic stages. The waterfall method must be carried out sequentially according to the existing stages[9]. The following are the stages of the waterfall method in this research :

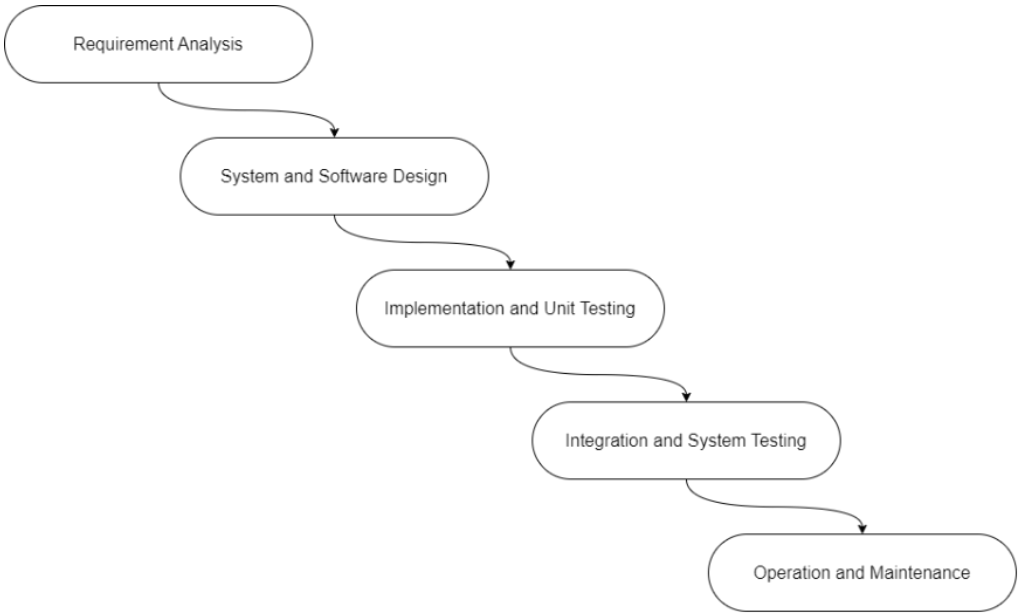

Figure 1. Methode

2.2.1. Requirement Analysis

The first stage in this waterfall method is to analyze what needs the system must achieve. Study the advantages and disadvantages of the system, understand and model processes, data storage and data requirements. As well as defining what needs are required by the system[8].

In this financial management system there are two users who interact into the system environment, namely employees (*broadcasters*) and admin (*owner*). Both users have different access rights to the system. Among them are as follows :

A. Admin Requirements (*Owner*)
   1) Manage employee user data.
   2) View total revenue.
   3) View and manage all customer data.

B. Employee Requirements (*Broadcasters*)
   1) Manage each customer's data.
   2) View employee income.

2.2.2. System and Software Design

At this stage is to design the application design that will be developed according to the proposed system. Both UI design, database design and system design using UML [9].

A. Design UI

1) Login Page
   This page is used to validate users accessing the application system. There are two input boxes, the first is the username and the second is the password and the signin button if you want to enter the application system.

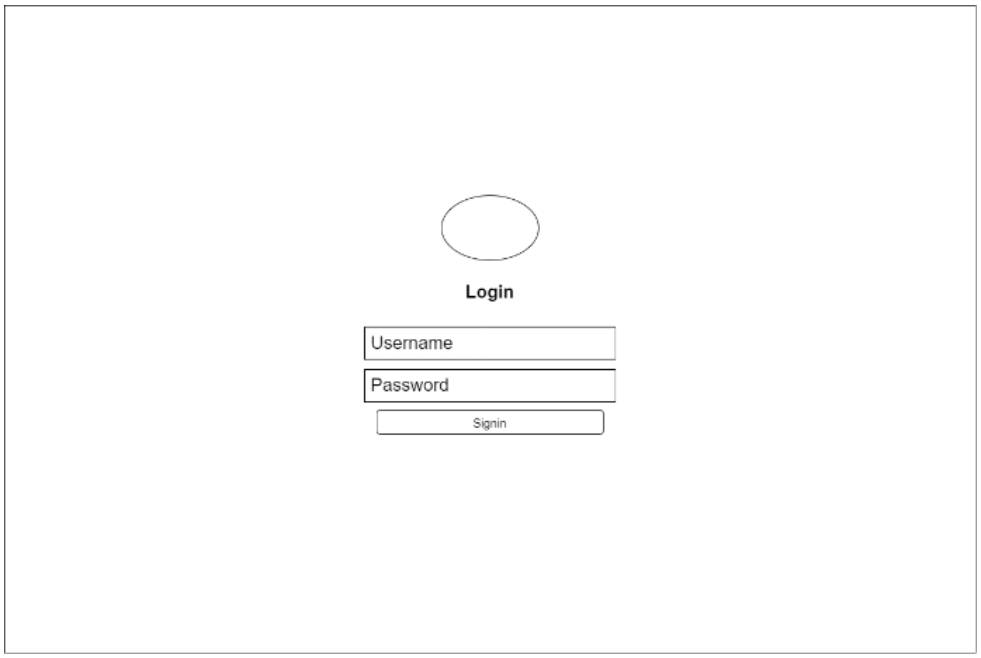

Figure 2. Design Login Page

2) Dashboard
   The dashboard page is useful for displaying a summary of overall data, such as displaying revenue for one day or a month, total customers in one month, a chart of revenue in a week, and a list of customers - the latest customers.

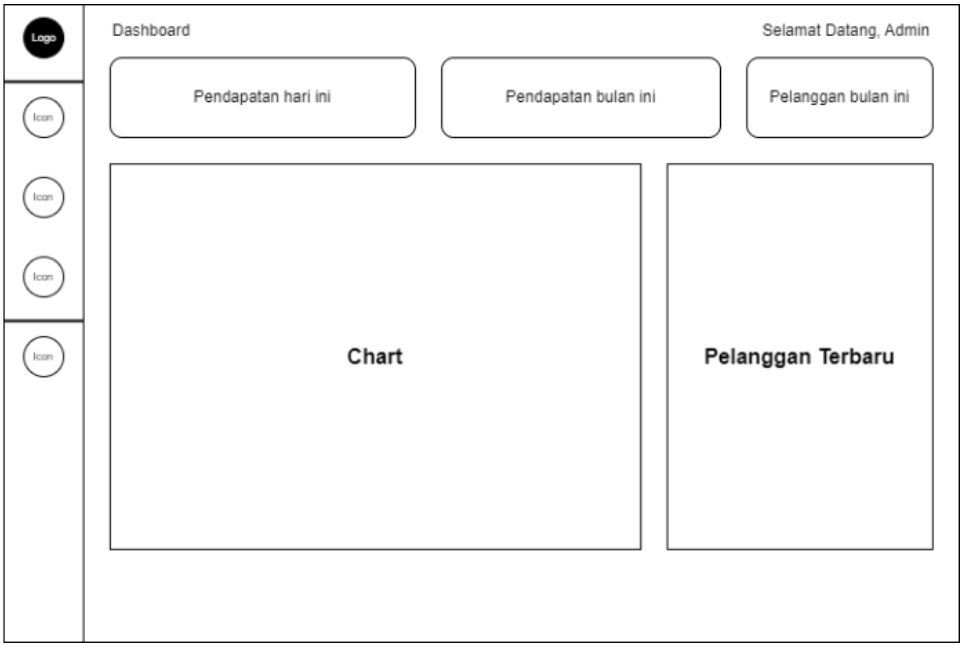

Figure 3. Design Dashboard

3) Users

Displays information on all application user data displayed in tabular form, and this page can only be accessed by users who have an admin role.

Figure 4. Design Page Users

4) Customers

The customer page contains information on customer data that has been entered by the broadcaster displayed in the form of a table.

Figure 5. Design Page Customers

5) Form User

The user form is useful for entering user data that is needed to add user data or change user data. Among them: user name, username, password, and role.

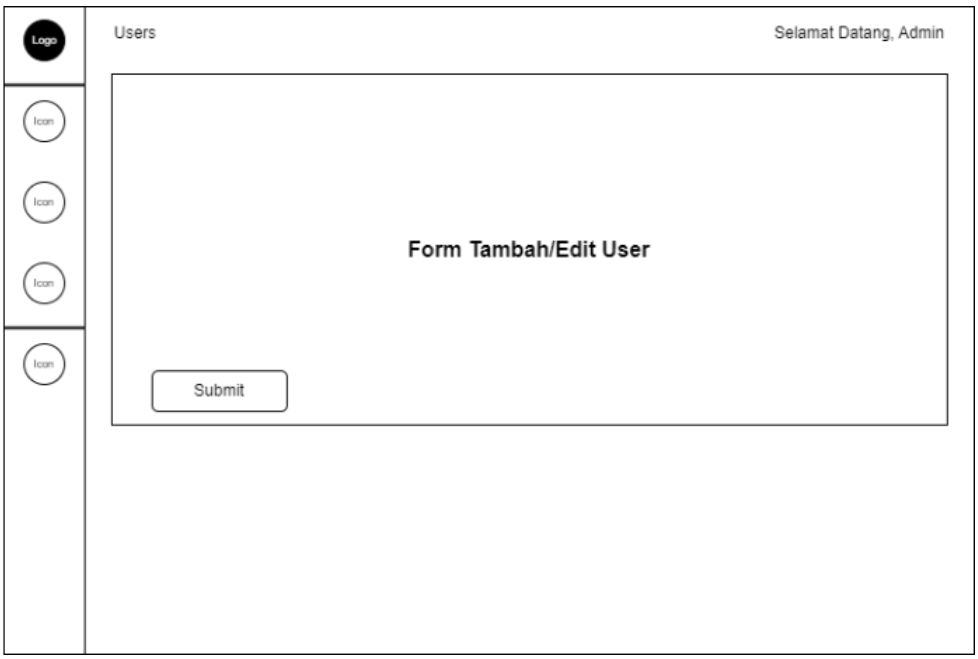

Figure 6. Design Form User

6) Form Customer

This form serves to enter customer data that you want to add or change. The data includes customer name, number of packages, price, and broadcaster.

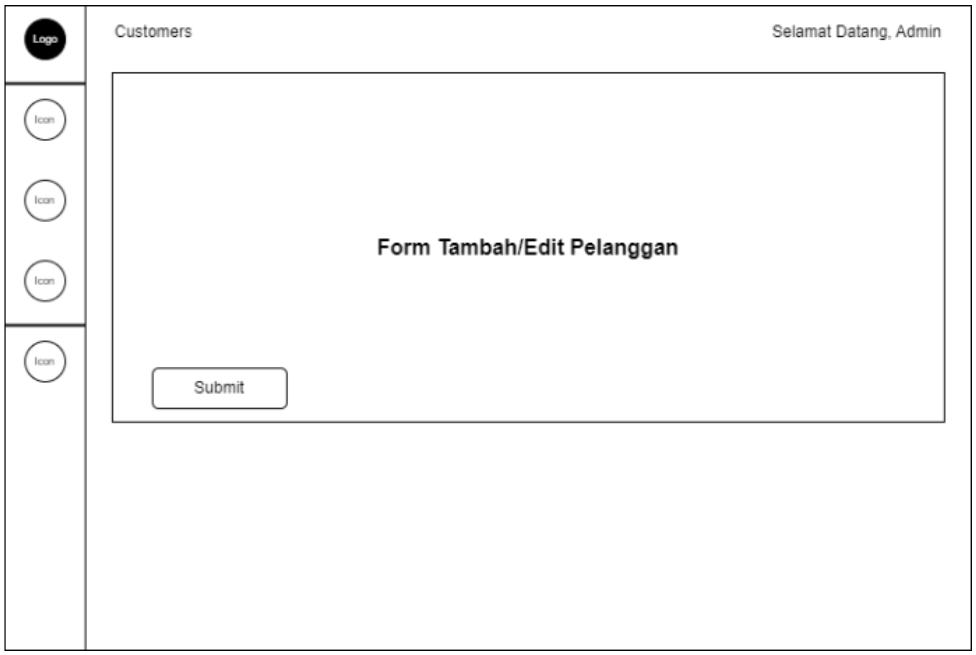

Figure 7. Design Form Customer

B. Component Diagram

Component diagrams are used to model the interrelationships between a collection of components in a system. It does not show the functionality of the system but the functionality of the components themselves[10].

1) Layout

Component layout functions to provide the same appearance for every page that uses it. in this component there is a sidebar component that has 2 dependencies with the logo and menu components. In addition, there is also a footer component in the layout.

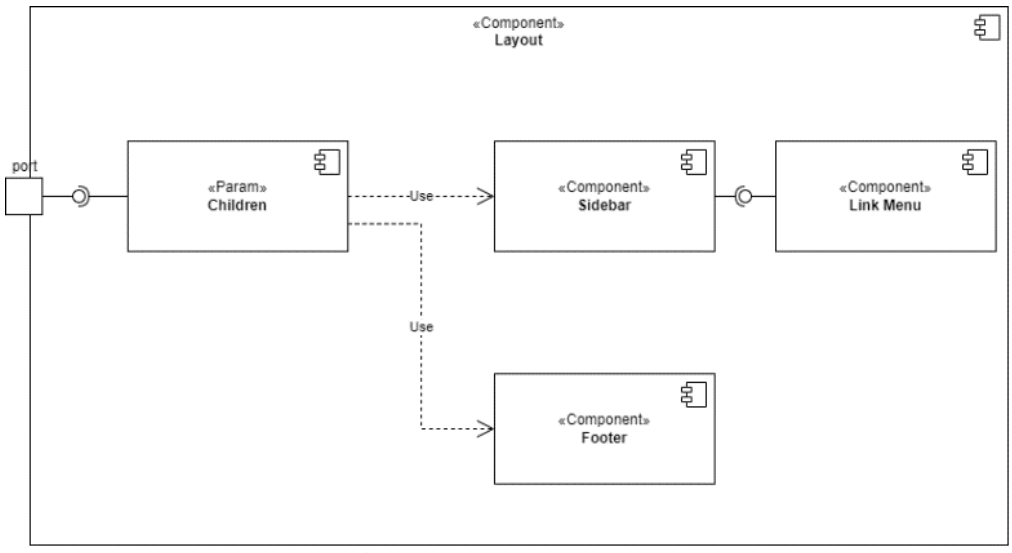

Figure 8. Component Layout

2) Form user and customer
This component functions to provide a form that is used to add or change user and customer data.

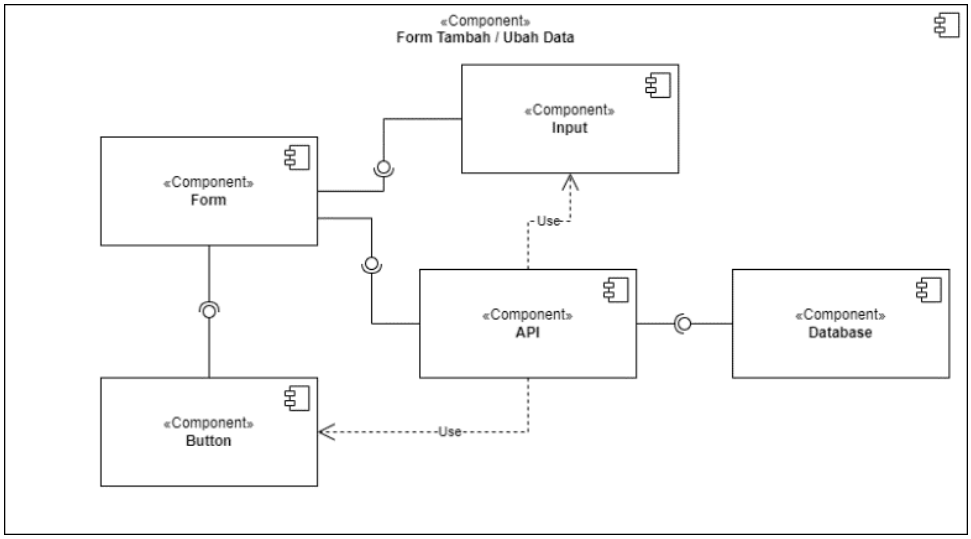

Figure 9. Component form User and Customer

3) Page users dan customers
This component uses the same components, including layout components that function to provide layouts according to UI design and tables to present data content. The only difference lies in the data displayed between users and customers.

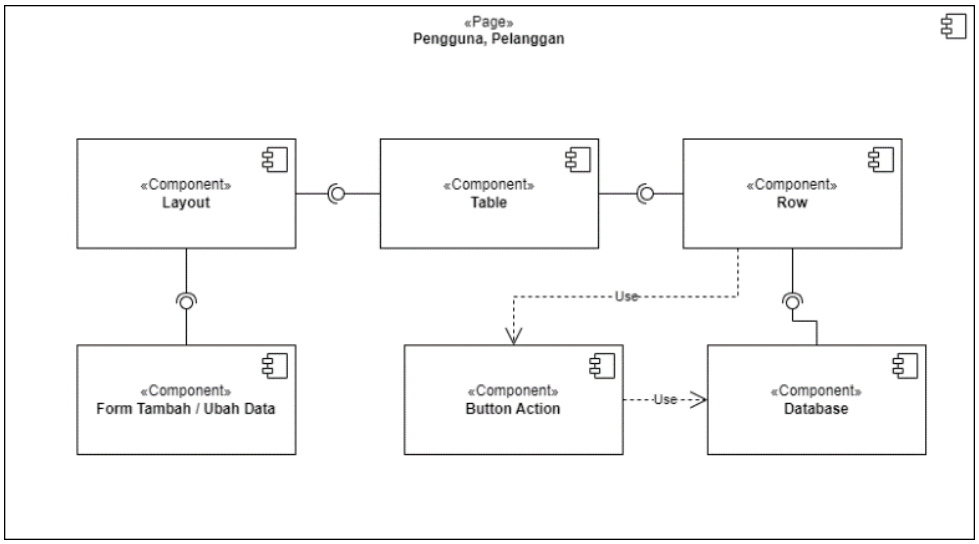

Figure 10. Page Users and Customers

C. Design database

The database design below is a table design to create a financial management system consisting of 4 tables including user, customer, income and outcome tables. The user table is interrelated with the other three tables, namely customer, income, and outcome.

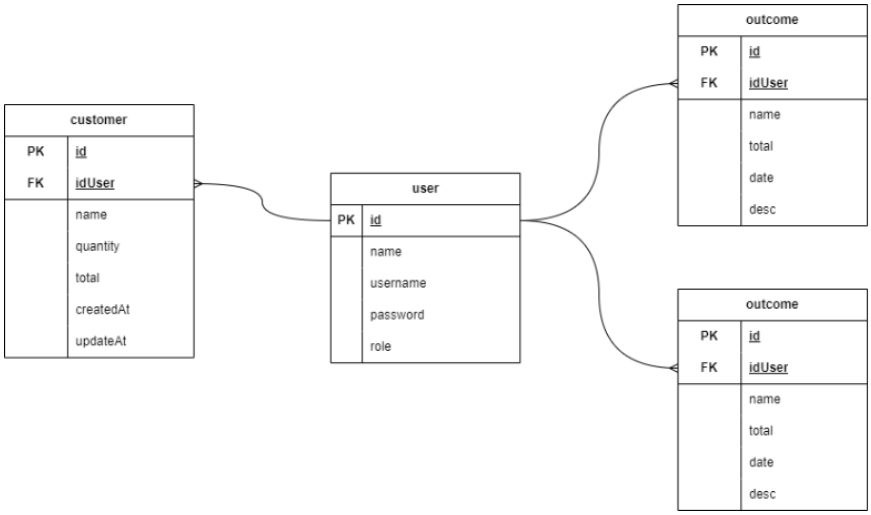

Figure 11. Design Database

2.2.3. Implementation and Unit Testing

At this stage, the entire system design that has previously been made is implemented into the form of program code, where the results are still in the form of components that must be connected[11]. At this stage, the database design is also built using ORM according to the schema that has been created.

2.2.4. Integration and System Testing

This stage is a stage to combine or connect the components that have been made in the previous stage. In addition to connecting components, in this stage testing is carried out to test the functionality of the system and avoid system errors[9].

2.2.5. Operation and Maintenance

In the final stage, the finished system will be run and maintained. The purpose of this maintenance is to correct errors, improve system implementation and improve system performance[12].

3. RESEARCH RESULTS AND DISCUSSION

The result of this research is a website-based financial management system for Radio Larasati FM that can be used by business owners for the financial management of karaoke venue rentals.

3.1. User Interface Implementation

A. Login Page

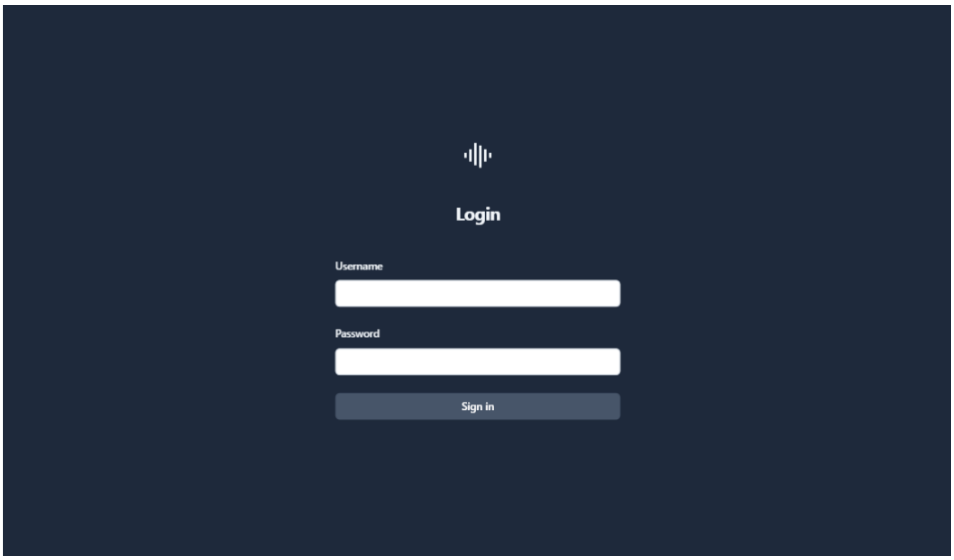

Figure 12. Login Page

The display above is a login page that is used to validate users accessing the application system. This page uses a form component that contains two input boxes and a button to sign in.

B. Dashboard Page

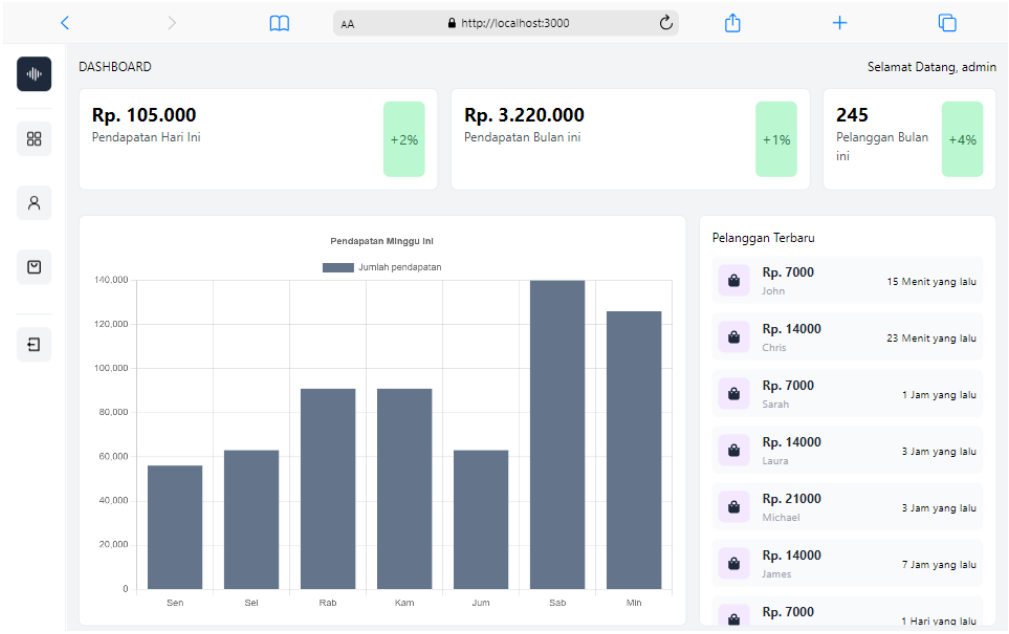

Figure 13. Dashboard

This page is the main page that presents information such as daily revenue, total customers for one month, one-week revenue graph, and the latest customers. This page only uses the layout component.

C. Page Users

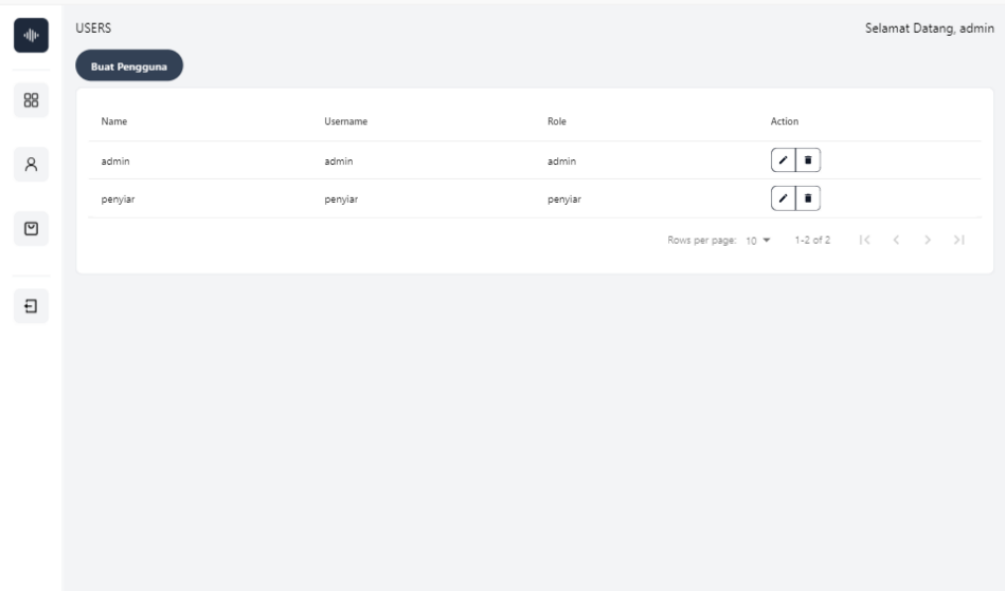

Figure 14. Page Users

The picture above is a view of the user's page that displays application user data. This page uses layout components and table components to display user data..

D. Page Customers

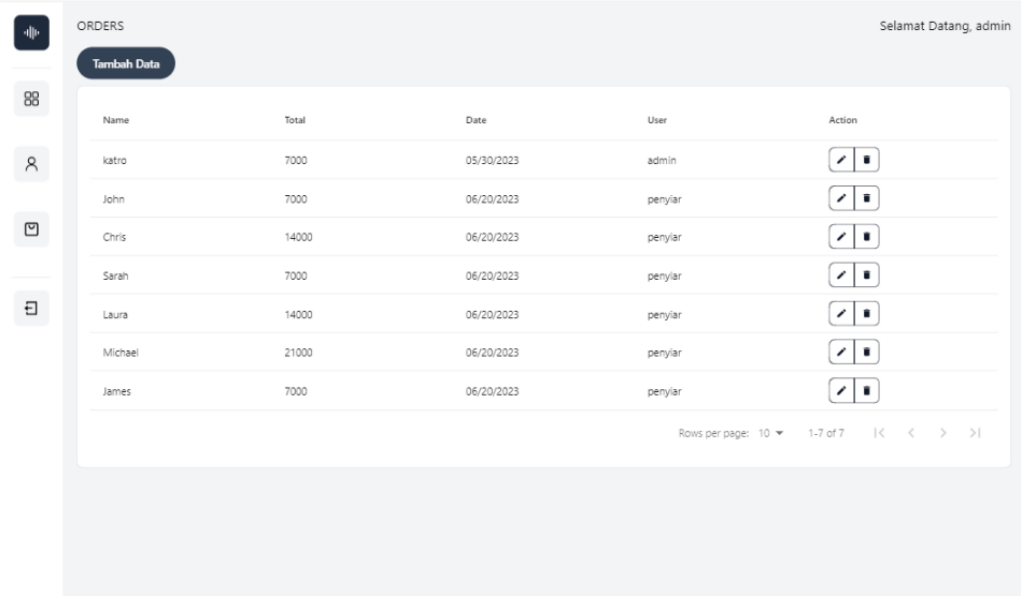

Figure 15. Page Customers

The picture above is a view of the customer page that has been entered by the admin and broadcaster. This page uses table components to display customer data and uses layout components so that this page has sidebars and navbars.

E. Form User

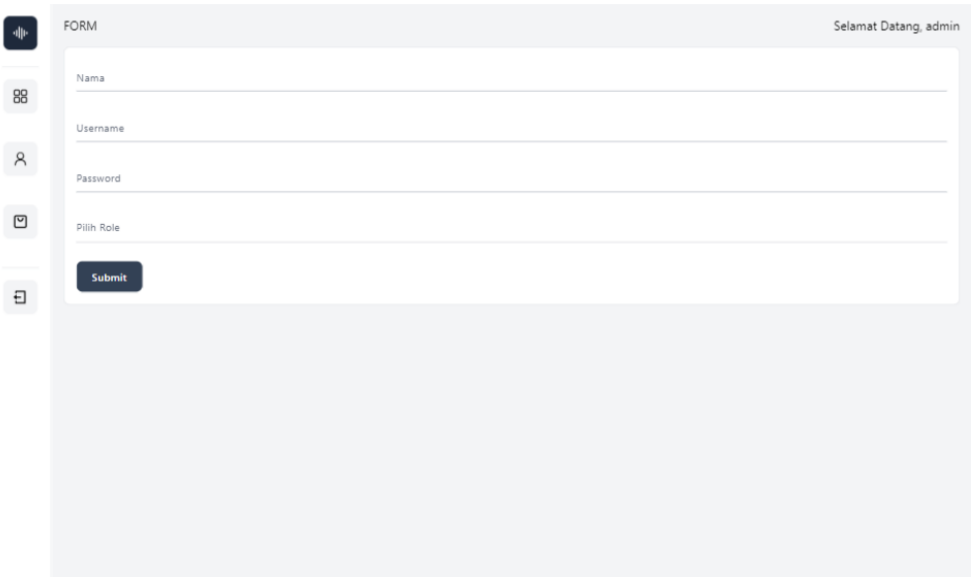

Figure 16. Form User

The user form is useful for entering user data that is needed to add user data or change user data. This page uses form components and layout components.

F. Form Customer

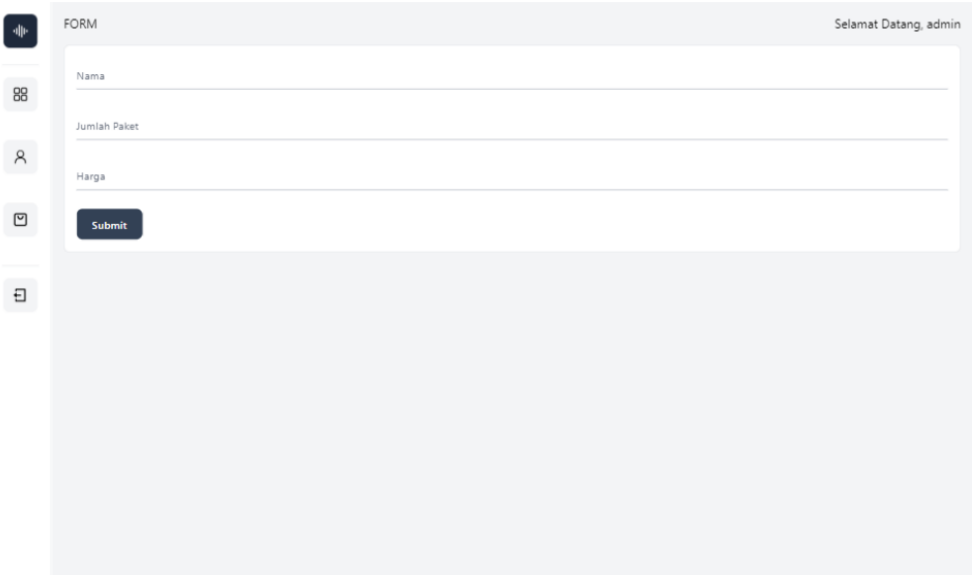

Figure 17. Form Customer

This form serves to enter customer data that you want to add or change. Where this page uses the same components as the user form, namely the layout component and the form component.

3.2. Comparison Of Components With Non-Components

A. Dashboard

Component Based | Non-Component Based

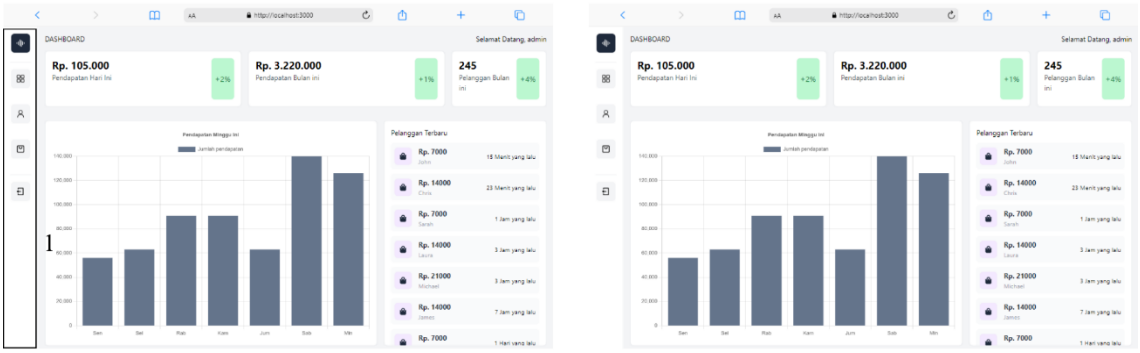

Figure 18. Component Based and Non Component Based Dashboard Page

The picture above is a comparison between dashboard pages that use component-based and non-component. The difference lies in writing the program code where the dashboard page that applies the component-based layout used is made separately so that it is reusable. Unlike the non-component, each element is written in one file.

B. Page Users

Component Based | Non-Component Based

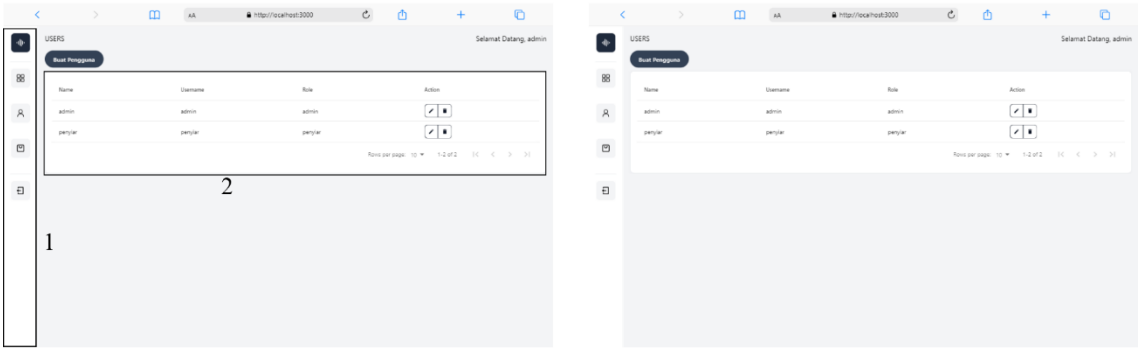

Figure 19. Component Based and Non Component Based Page User

The difference between the two pages above lies in the writing of the code, the first uses component-based where the layout and table are made into separate files so that they can be reused on other pages that require these components.

C. Page Customers

Component Based Non-Component Based

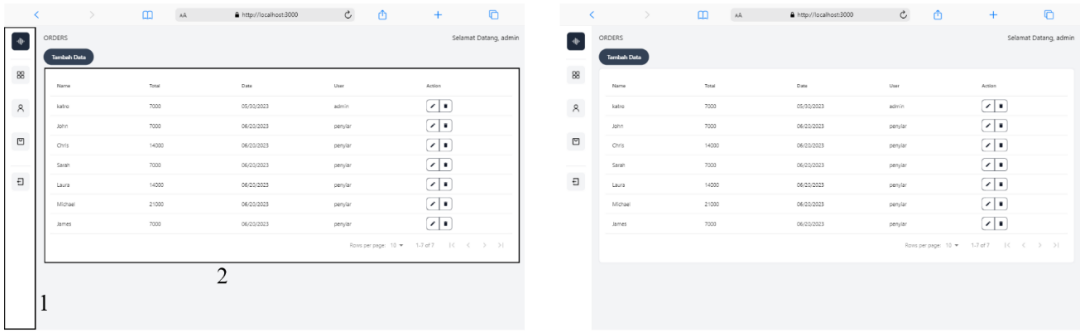

Figure 20. Component Based and Non Component Based Customer

The customer page uses the same components as the user page, namely layout and table components. While non-component program code is rewritten in the page file.

D. Form User

Component Based Non-Component Based

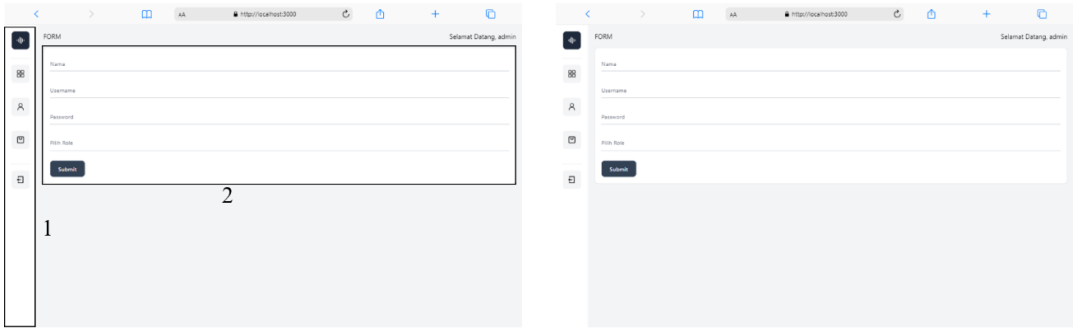

Figure 21. Component Based and Non Component Based Form User

The user form page uses two components, namely layout and form components. While pages that do not apply component-based each web element program code is written as a whole.

E. Customer Form

Component Based Non-Component Based

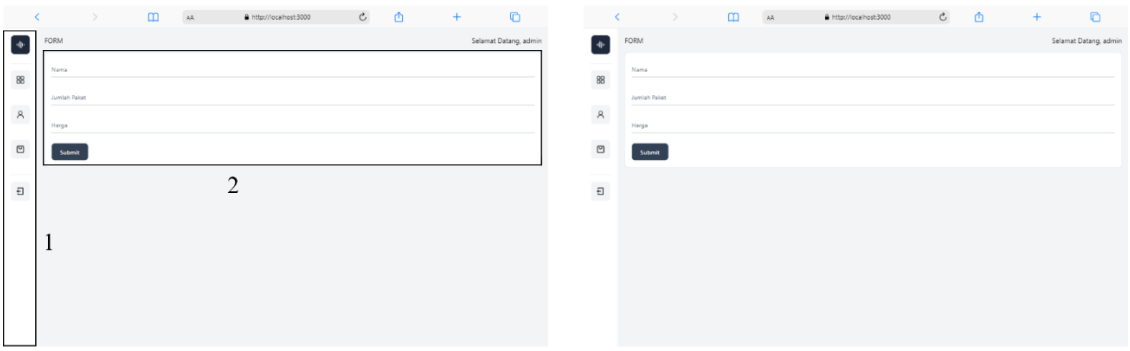

Figure 22. Component Based and Non Component Based Form User

The image above is a comparison of customer form pages that use component-based and non-component-based. On pages that use component based using the same components as the user form page, this can happen because the concept of component-based is reusable program code. While non-component based, the program code is written as a whole.

Table 2. Comparison Component Based and Non-Component

No.	Page Name	Component Base			Non-Component Base		
		Modularity	Reusability	Consistency	Modularity	Reusability	Consistency
1	Login	✓	✓	✓	×	×	×
2	Dashboard	✓	✓	✓	×	×	×
3	Users	✓	✓	✓	×	×	×
4	Customers	✓	✓	✓	×	×	×
5	Add User	✓	✓	✓	×	×	×
6	Edit User	✓	✓	✓	×	×	×
7	Add Customer	✓	✓	✓	×	×	×
8	Edit Customer	✓	✓	✓	×	×	×

3.3. Implementation of ORM

A. Users

Table 3. Comparion of ORM with SQL in user table

Function	Method	SQL
Create users	user.create(data)	INSERT INTO `user` (`id`, `name`, `username`, `password`, `role`) VALUES (NULL, '', '', '', '')
Get users	user.findMany()	SELECT * FROM `user`
Update users	user.update(id, data)	UPDATE `user` SET `name`='name',`username`='username',`password`='password',`role`='role' WHERE `id`=id
Delete users	user.delete(id)	DELETE FROM `user` WHERE `id`=id

The table above compares how to query user data using ORM and SQL. It is clear that by using ORM the query becomes shorter than querying with SQL.

B. Customers

Table 4. Comparison of ORM with SQL in customer table

Function	Method	SQL
Create customer	customer.create(data)	INSERT INTO `customer` (`name`, `quantity`, `total`, `idUser`, `createdAt`, `updateAt`) VALUES ('', '', '', '', '','')
Get customer	customer.findMany()	SELECT * FROM `customer`
Update customer	customer.update(id, data)	UPDATE `customer` SET `name`='name',`quantity`='quantity',`total`='total',`idUser`='idUser',`createdAt`='createdAt',`updateAt`='updateAt' WHERE `id`=id

Function	Method	SQL
Delete customer	customer.delete(id)	DELETE FROM `customer` WHERE `id`=id

The table above is a comparison of querying customer data using ORM or SQL. With ORM the query becomes shorter which speeds up application development. While using SQL queries to manipulate customer data is more complicated than ORM.

Table 5. Comparison between ORM and SQL

No.	Type	Code Reduction	Abstraction	Efficient	Overhead	Complexity	Performance
1	ORM	✓	✓	✓	✓	×	×
2	SQL Query	×	×	×	×	✓	✓

The table above is a summary of the results of the comparison of the use of ORM and SQL, the result is that ORM is more efficient and less in writing program code when doing a query.

4. CONCLUSION

Based on the results of the study, it is known that the process of developing a financial management system at Radio Larasati FM using Component-Based and ORM has proven to be more efficient. Because with the Component-Based concept, the application system development process focuses on reusing components instead of writing them repeatedly. In addition, by using ORM, the query process to the database becomes simpler than native SQL.

Thus, the combination of component-based software development and object-relational mapping (ORM) has been proven to increase the effectiveness of the software development process.

5. SUGGESTED

The following are some suggestions for the use of financial management systems based on the research results that have been concluded previously. Implementation of this system employees must be given training in the use of financial management systems in order to use the system properly and correctly. In addition, this system also requires a server that has high enough specifications so that this system has good performance.

6. REFERENCES

[1] S. Saepudin, E. Pudarwati, C. Warman, S. Sihabudin, and G. Giri, “Perancangan Arsitektur Sistem Pemesanan Tiket Wisata Online Menggunakan Framework Zachman,” Jurnal Sisfokom (Sistem Informasi dan Komputer), vol. 11, no. 2, pp. 162–171, Aug. 2022, doi: 10.32736/sisfokom.v11i2.1415.

[2] S. Muthoharoh and A. P. Nugraheni, “Evaluasi Penerapan Simda Keuangan Pada Dinas Kepemudaan Olahraga Dan Pariwisata Kota Magelang,” 2020.

[3] R. E. D. Ramadhana and A. Fatmawati, “Sistem Informasi Manajemen Keuangan di Pondok Pesantren Adh-Dhuha,” Jurnal Teknik Informatika (Jutif), vol. 1, no. 2, pp. 93–99, Dec. 2020, doi: 10.20884/1.jutif.2020.1.2.20.

[4] S. Sarwindah, Y. Yurindra, M. Marini, and E. Elvia, “Pengembangan Sistem Layanan (SPAB) Sarana Penyedia Air Bersih Berbasis Web,” Jurnal Sisfokom (Sistem Informasi dan Komputer), vol. 11, no. 2, pp. 180–186, Aug. 2022, doi: 10.32736/sisfokom.v11i2.1374.

[5] J. Purnama and Y. I. Melani, “Aplikasi Satu Pintu Penerimaan Siswa Baru Pada Sekolah Menengah Atas,” Jurnal Sisfokom (Sistem Informasi dan Komputer), vol. 11, no. 1, pp. 32–38, Mar. 2022, doi: 10.32736/sisfokom.v11i1.1214.

[6] G. Eko, Y. Yunita, and H. Amalia, “Rancang Bangun Sistem Informasi Pelayanan Jasa Home Service Dengan Model Waterfall Pada CV. Gian Motor Autoservice,” Perspektif, vol. 17, no. 1, 2019.

[7] M. Julkarnain and D. Afriliyansa, “Rancang Bangun Aplikasi Tata Kelola Desa Berbasis Web Menggunakan Metode Waterfall Di Kantor Desa Sepukur,” 2021.

[8] D. C. P. Buani and I. Suryani, “Sistem Informasi Jasa Travel (SIJAVEL) Menggunakan Metode Waterfall pada Remember Travel,” Evolusi: Jurnal Sains dan Manajemen, vol. 8, no. 2, 2020.

[9] T. Wahyudi, S. Supriyanta, and H. Faqih, “Pengembangan Sistem Informasi Presensi Menggunakan Metode Waterfall,” Indonesian Journal on Software Engineering (IJSE), vol. 7, no. 2, pp. 120–129, 2021, [Online]. Available: http://ejournal.bsi.ac.id/ejurnal/index.php/ijse120

[10] S. Yadav, R. Jindal, and S. Anand, “A Study on Comparison of UML and ER Diagram,” International Research Journal of Engineering and Technology, 2020, [Online]. Available: www.irjet.net

[11] A. T. Herdiansyah et al., “Perancangan Sistem Informasi Point of Sale Berbasis Website pada Toko Azam Grosir dengan Metode Waterfall,” Program Studi Teknik Informatika Universitas Pamulang, vol. 6, no. 2, pp. 2622–4615, 2021, doi: 10.32493/informatika.v6i2.11773.

[12] T. Rijanandi, T. D. C. S. Wibowo, I. Y. Pratama, F. Dharma Adhinata, and A. Utami, “Web-Based Application with SDLC Waterfall Method on Population Administration and Registration Information System (Case Study: Karangklesem Village, Purwokerto),” Jurnal Teknik Informatika (JUTIF), vol. 3, no. 1, pp. 99–104, 2022, doi: 10.20884/1.jutif.2022.3.1.145.