MVC Concept in the Development of Information System for Rental Office Utilities Cost

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Abstract

The calculation of the utilities cost of rental office in an office building that is still processed manually and conventionally is certainly troublesome for the building manager. Data processing by using office applications such as spreadsheets becomes ineffective when the number of tenants is increasing and transaction data coming in continues to grow. It causes stakeholders to often experience delays in obtaining the required reports. The research aims to build an application which can be used easily and able to provide information quickly and accurately in the process of calculating the utilities cost of rental office, which consists of the usage costs of electricity, water and gas. The application is developed by using MySQL database and PHP, HTML, CSS, Jquery as programming languages. It also applies the concept of MVC (Model-View-Controller) to the CodeIgniter framework and using agile method in developing the system. The research resulted in a web-based application of the utilities cost information system that is useful for building managers in the process of recording and calculating utilities cost automatically, so it can produce reports quickly and accurately. The advantage of the web-based application is that it allows stakeholders to obtain the required reports because they can be accessed directly online, so that the use of electricity, water and gas at rental offices can be well controlled.

Keywords - Web-based Information System, Rental Office Utilities Cost

I. INTRODUCTION

The office is an organizational unit which consists of a place, staff and administrative personnel to assist the leader (Maryati, 2014). The office becomes an important place in the interconnected work system between personnel, procedures and technology. Companies cannot always have offices in strategic and representative locations, so renting office space is a good business to run. A rental office is an office facility that is grouped in one building as a response to the rapid economic growth, especially in big cities (Marlina, 2008). The building management company rents out office space to tenants within a certain period according to the agreement. Office tenants will

strongly consider the availability of office utilities, especially electricity, water and gas.

In addition to providing electricity, water and gas needs, the building management company must also be able to calculate the exact utility costs that will be charged to tenants. The use of a spreadsheet application to calculate utility costs is ineffective when the number of office tenants is increasing and incoming transactions continue to grow. The possibility of duplication when recording, errors in the calculation formula, or even data loss can occur due to the absence of a good database system and reliable application that manages it, so the quality of the information produced is not credible to be used by stakeholders. This is important to be immediately

addressed, so that the building manager or office tenants are not harmed by invalid information which is resulted from the processing of rental office utility data that is not prudent.

This research aims to build a web-based information system for calculating the cost of rental office utilities using agile method, as a new media that is effective and beneficial for building management company in the process of recording and calculating the costs of using electricity, water and gas automatically, so that it can produce information that is fast and accurate, and can be accessed directly online by stakeholders. This web application is designed using PHP as its programming language and MySQL as its database, with the concept of MVC (Model View Controller) and CodeIgniter framework.

The purpose of applying the MVC concept is to simplify the script and make it easier for web programmers to maintain the system, because the data (Model) is separate from the view (View) as well as its processing (Controller), so that there are no difficulties when fixing bugs in the system, or even doing advanced system development (Ferdiansyah, 2018)

The researchers Indra Mustika, Chris Timotius, and Hasbullah stated that the application of the electrical lighting calculation planning system using an expert system succeeded in helping the calculation process that was easy, fast, and accurate. This was proven by testing the lecture hall (R.130) of the 4th floor of the UPT FPTK building. From the calculations manually or using an expert system the same results are obtained for the number of armatures of 6 armatures, the size of the 62 µf capacitor power repairs and the amount of power and safety requirements before the power factor is fixed at 2200VA and 10 A. After the power factor is repaired the large power requirements to 1300 VA with security 6
A. The drawback of the expert system application is that it can not be used directly (real time) because desktop-based applications (Mustika R.P, Timotius K, & Hasbullah, 2013).

The researchers Tomi Mulki Rahmat and Yenita Juandy prove that the application of a web-based electricity bill information system at PT. PLN (PERSERO) UPJ Prima Prianga can manage electricity account creation data to be well-organized and efficient, it's just that customers cannot see the electricity usage directly because the information system created is still limited to officers making electricity accounts. The application needs to be developed further so that PLN customers can see information on their electricity bill online (Mulki Rahmat & Juandy, 2014).

The researchers Yosep Permana, Asrizal and Zulhendri states that the use of the Kwh meter system application is proven to be able to calculate the costs of energy and electricity usage appropriately, as well as automatically sending the usage data from the Kwh meter handphone to the handphone that is on the PLN system and entered into the customer database PLN, besides the customers can monitor the amount of usage and payment at any time on the LCD contained in the digital Kwh meter. The weakness of this research is sending data from KWH via mobile phones using SMS facilities, where there must be a credit balance on the handphone that could have run out of credit due to data requests and data transmission that can be done at any time (Permana, Asrizal, & Kamus, 2013).

II. LITERATURE REVIEW

2.1. Web Based Information System Development

System development is an activity to create a new system or replace or improve an existing system, both in whole or in part (Pressman, 2002). According to Tata Sutabri in Wildaningsih's study stated that the information system is a system that meets the needs of daily transaction processing, supporting operations, managerial and strategic nature of an organization (Wildaningsih & Yulianeu, 2018).

There are five elements in an information system (Ladjamudin, 2013). The following figure will show each of the elements.
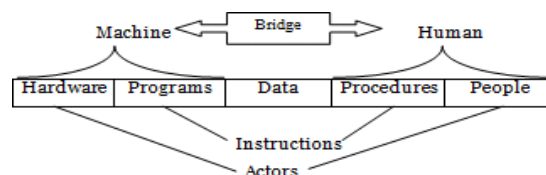
Source : (Ladjamudin, 2013)

Fig 1. Five Elements of Information Systems

The five elements are interconnected or interact with each other and can be classified as follows:

1. Hardware and Programs, with the function as a machine.

2. People and Procedures, people and also how to use machines.

3. Data, which is the intermediary between humans and machines so that the data processing takes place.

Website is one of the many communication media that contains information in the form of text, sound, images, or videos that can be accessed publicly by the

wider community (Pamungkas, Alfarishi, Aditiarna, Muklhisin, & Alfa Aziza, 2019)

Web-based information system is an information system that utilizes web technology and internet networks to provide information services. For this reason, it is necessary to provide web servers, web applications and databases that store and manage data, then present information on web applications (Ferdiansyah, 2018).

2.2. Basic Concepts of MVC (Model View Controller)

According to Deacon in the research of Arief Hidayat and Bayu Surarso stated that Model-View- Controller (MVC) is a concept introduced by the inventor of Smalltalk (Trygve Reenskaug) to encapsulate data along with processing (model), isolating from the manipulation process (controller) and views to be represented on a user interface (Hidayat & Surarso, 2012). According to Burbeck in the research of Arief Hidayat and Bayu Surarso stated that the technical definition of MVC architecture is divided into three layers (Hidayat & Surarso, 2012):

1. Model, used to manage information and notify observers when information changes. Only models that contain data and functions are related to data processing.

2. View, is responsible for graphical mapping to a device. View usually has a 1-1 relationship with a surface and knows how to make it. The view attaches to the model and renders its contents to the surface of the screen.

3. Controller, accepts input from the user and instructs the model and view to take action based on that input.
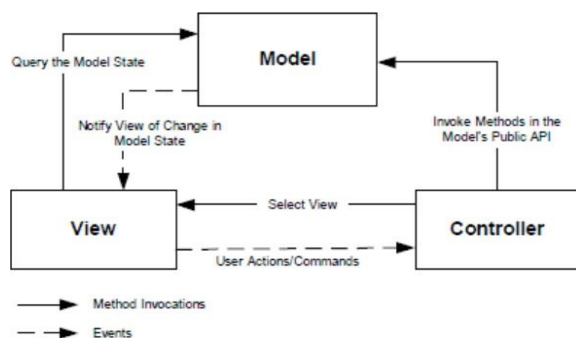
Source: (Gulzar, 2002)

Fig 2. Relationship between model, view, and controller.

According to Balani in the research of Arief Hidayat and Bayu Surarso stated that MVC Architecture has the benefit of separating between

models and views allowing multiple views to use the same model. As a result, component models of an application are easier to implement, test and maintain, because all access to the model runs through these components (Hidayat & Surarso, 2012)

III. PROPOSED METHOD

3.1. Data Collection Technique

Some data collection techniques used in the research are:

A. Observation.

Do direct observations of office buildings to get complete and clear information about how the system of calculating the utility costs charged to tenants in an office building.

B. Interview.

Asking technical questions to office building managers about how they determine the cost of utilities and responses from office tenants about the exact amount of utility costs they must pay each month.

C. Literature review

Search for and study various related literature to support material discussed in the research.

3.2. System Development Model

The information system for calculating the cost of rental office utilities is developed using the agile method. Agile is a system development method based on the rapid adaptation of the developer to the system changes made (Zulkarnaini, Fauzan Azima, & Nur Laila, 2019). The stages of system development using the agile method can be seen as shown below :

Source: (Rahardi & Fauzan Azima, 2019)

Fig 3. Agile Development Method

1. Planning

At this stage, developers and users jointly create a system design by interviewing, observing and

examining existing documents directly. Developers can create a complete design as a preliminary guideline in system development, such as running system analysis and interface design.

2. Implementation

At this stage, the programmer implements system development into a web-based application with the PHP programming language using the concept of MVC and the CodeIgniter framework. The application design that is built has responsive capabilities to various devices with different screen sizes.

3. Software Testing

At this stage, software testing is done to look for errors (bugs) from applications that have been made. At this stage blackbox testing is also carried out to test the validity between the input provided and the output produced. This testing phase is very important to produce quality software.

4. Documentation

At this stage, various documentation is made, such as module and program function documentation, file backups, database design, subroutines, input and output values. The documentation phase aims to make it easier for developers and programmers when doing maintenance or system development.

5. Deployment

At this stage the application system is deployed (deployment) so that it can be used by office building management staff as users.

6. Maintenance

At this stage periodic system maintenance is carried out, because any good system application will not be completely free from gaps (bugs) that must be analyzed and corrected.

IV. RESULT AND DISCUSSION

4.1. Planning

Based on observations in an office building, there are a number of needs in the application of information systems for

calculating utility costs for office tenants, as follows:

1. Administrative Support Staff. Can manage data master of office tenant, office unit, meter type, tariff. Can manage transaction data to calculate electricity, water and gas usage by office tenants. Can manage reports for electricity, water and gas usage by office tenants. Supervisor. Can see electricity, water and gas usage reports. Can confirm if the input results are correct.

2. Manager. Can see electricity, water and gas usage reports. Can confirm if the input results are correct.

The following is design of the interface display of the rental office utility cost calculation information system:

1. Display of Login

Fig 4. Display of Login

2. Display of Home Menu
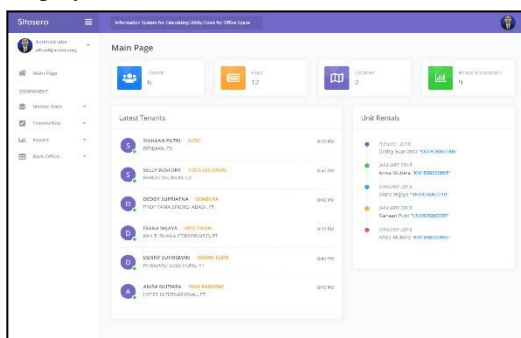
Fig 5. Display of Home Menu

3. Display of Tenant Master

Fig 6. Display of Tenant Master

4. Display of Floor Master

Fig 7. Display of Floor Master

5. Display of Meter Type Master

6. Display of Unit Master

Fig 9. Display of Unit Master

7. Display of Rental Unit Transactions

Fig 10. Display of Rental Unit Transactions

8. Display of Meter Calculation Transactions

Fig 11. Display of Meter Calculation Transaction

9. Display of Meter Usage Report

10. Display of User Management

Fig 13. Display of User Management

4.2. Implementation

The application of information system for rental office utilities cost is developed using serverside language: PHP, framework: CodeIgniter, script language: JQuery; style sheet languages: CSS and Bootstrap, markup languages: HTML. Besides, the application uses MySQL as DBMS software to manage data. The implementation of the MVC concept in the information systems applications for rental office utilities cost can be seen as follows:

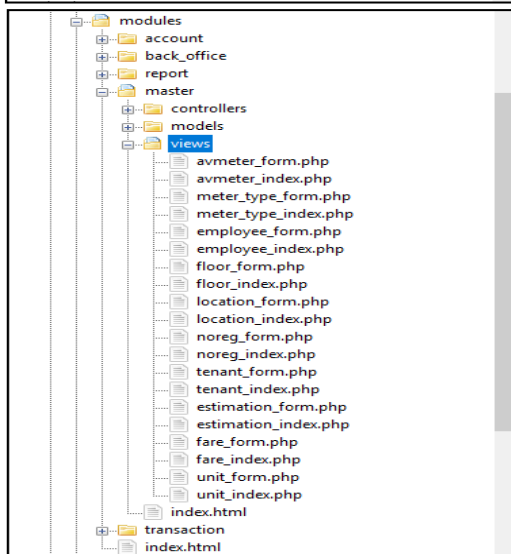a. Implementation in the Model Section
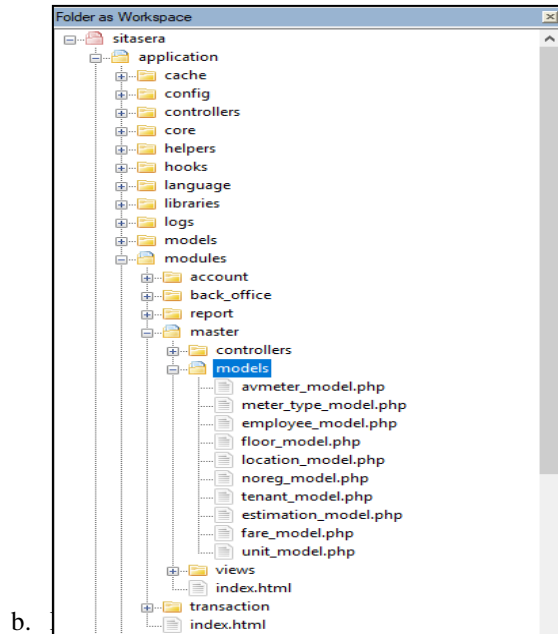
b.

Fig 15. Implementation in the View Section
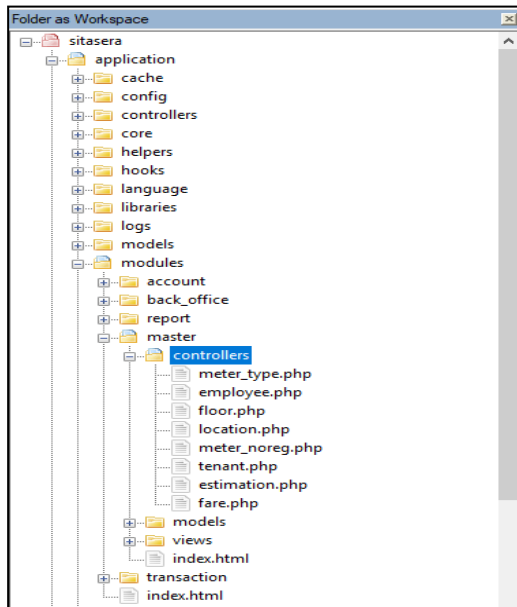
c. Implementation in the Controller Section

Fig 16. Implementation in the Controller sectionSoftware Testing

Testing the information systems applications for rental office utilities cost is done using blackbox testing. Testing is done by giving input from the userto the system that is already running and observing the output of the system. Here are the test results:

Table 1. Software Testing Results.

Id Uji	Use Case	Testing Criteria	Result
UC 1	Log in to the system application.	The system accepts login access if the Username and Password are correct. Then enter the main page.	Valid
UC 2	Manage tenant data	The system can display, add, update and delete tenant profiles, specifically for logging in with Administration Support Staff	Valid
UC 4	Manage meter type data	The system can display, add, update and delete meter profiles, specifically for user logging in with Administration Support Staff	Valid

UC 5	Manage tariff data	The system can display, add, update and delete tariff profiles, specifically for user logging in with Administration Support Staff	Valid
UC 6	Calculates the cost of electricity usage	The system can calculate the cost of electricity usage, specifically for user logging in with Administration Support Staff	Valid
UC 7	Calculate the cost of water usage	The system can calculate the cost of water usage, specifically for user logging in with Administration Support Staff	Valid
UC 8	Calculate the cost of gas usage	The system can calculate gas usage, specifically for user logging in with Administration Support Staff	Valid
UC 9	Confirm the results of input data on electricity, water and gas usage	The system can confirm the results of input data on electricity, water and gas usage, specifically for user logging in with Supervisor and Manager	Valid
UC 10	Print electricity usage reports	The system can display and print electricity usage reports	Valid
UC 11	Print water usage reports	The system can display and print water usage reports	Valid
UC 12	Print a report on gas usage	The system can display and print gas usage reports	Valid

4.17. Dokumentation

The information system for calculating the cost of rental office utilities is documented in the following UML diagrams :

A. Usecase Diagram

The following are use case diagrams for each actor involved in the application of information system for calculating the cost of rental office utilities:

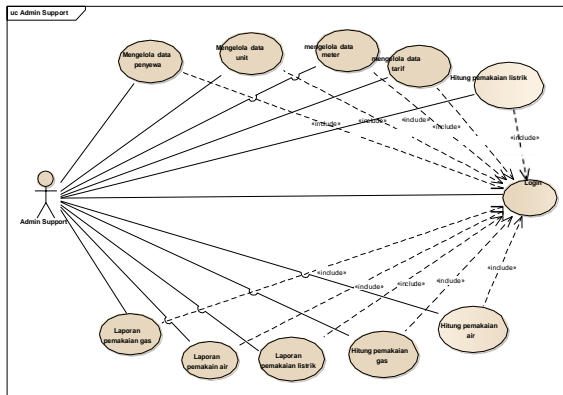1. Use Case Diagram of Administration Support Staff

Fig 17. Use Case Diagram of Administration SupportStaff

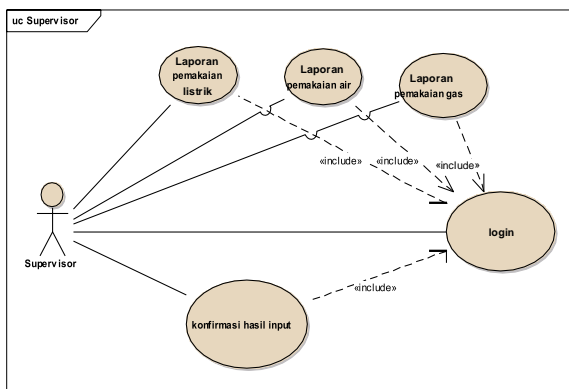2. Use Case Diagram of Supervisor

Fig 18. Use Case Diagram of Supervisor
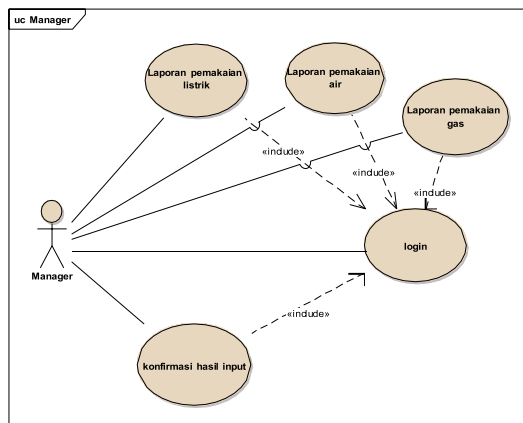
1. Use Case Diagram of Manager

Fig 18. Use Case Diagram of Manager

B. Activity Diagram

The following are use activity diagram of the application of information system for calculating the cost of rental office utilities:

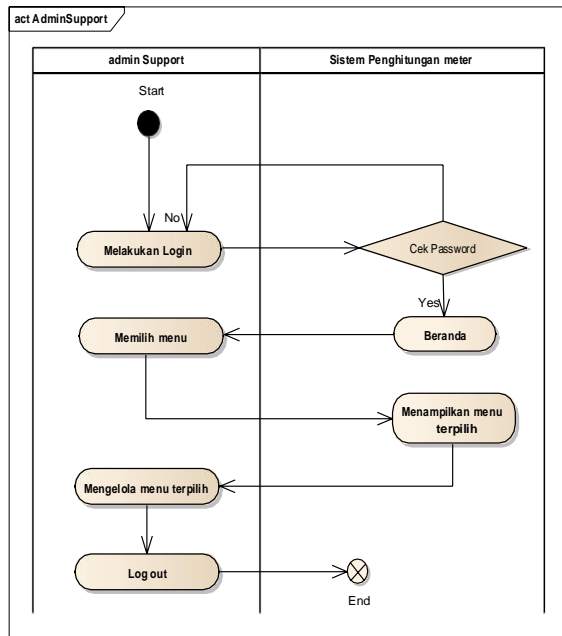1. Activity Diagram of Administration Support StaffLogin

Fig 19. Activity Diagram of Administration SupportStaff Login

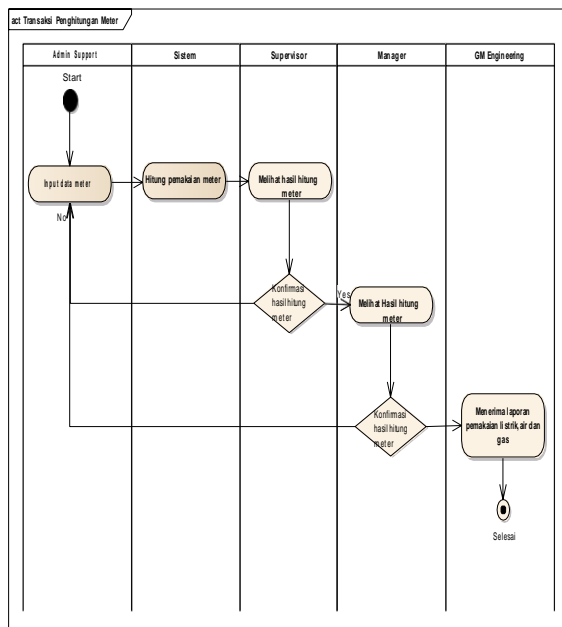1. Activity Diagram of Meter Calculation

Fig 20. Activity Diagram of Meter Calculation

c. Basis Data Design

The following is an information system application database design for calculating the cost of rental office utilities in the form of Class Diagrams:
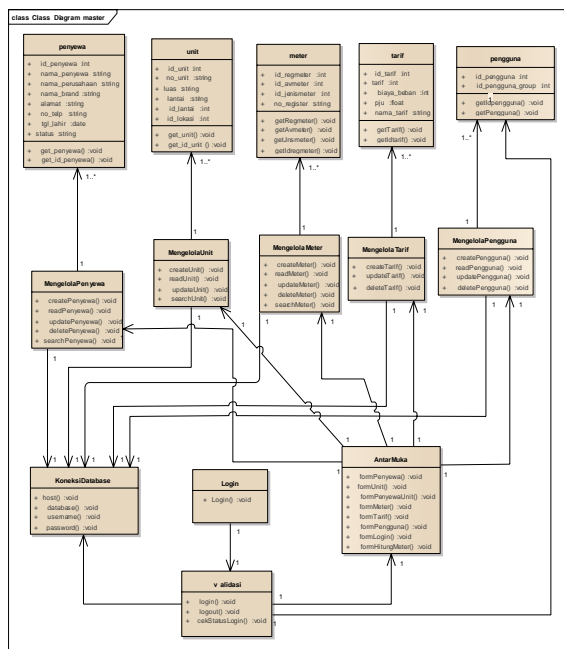
Fig 21. Class Diagram of Information System forCalculating the Cost of Rental Office Utilities

C. Sequence Diagram

The following are sequence diagram of the application of information system for calculating thecost of rental office utilities :
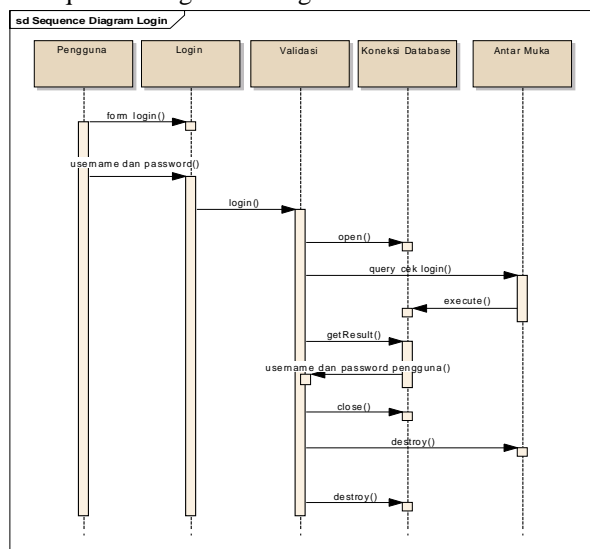
1. Sequence Diagram of Login

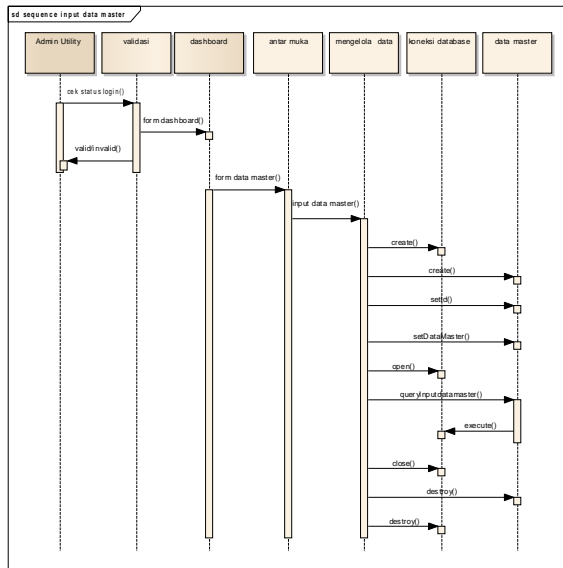Fig 22. Sequence Diagram of Login

2. Sequence Diagram of Data Master

Fig 23. Sequence Diagram of Data Master

D. Component Diagram
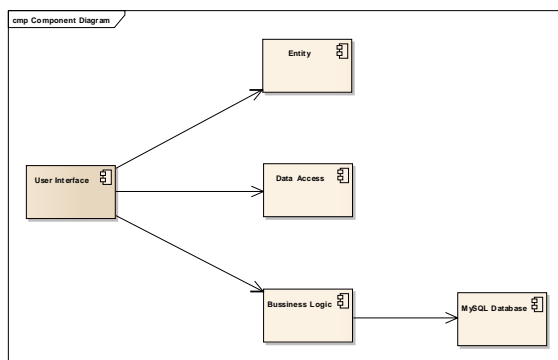
Fig 24. Component Diagram of Information Systemfor Calculating the Cost of Rental Office Utilities

E. Deployement Diagram
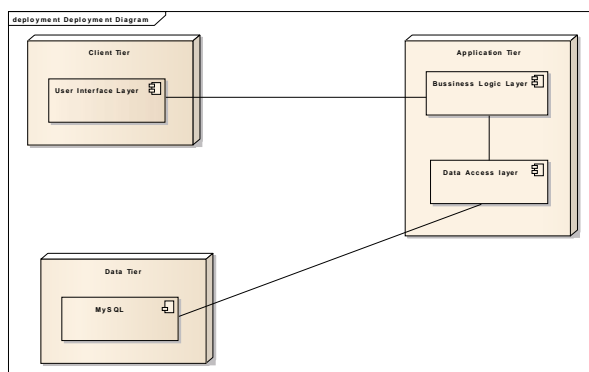
Fig 25. Deployment Diagram of Information Systemfor Calculating the Cost of Rental Office Utilities

4.2 Deployment

After the software testing phase is completed withvalid results, the web-based office tenant office utilitycost calculation information system is hosted on a server so that it can be operated by the building manager on an intranet. The application is accessed online through a web browser, both by the administrative support staff in

charge of managing the data, as well as supervisors and managers who confirm the validity and receive reports on cost of rental office utilities.

4.2. Maintenance

Following the system life cycle, periodic system maintenance needs to be done, because any good system applications will not be completely free from gaps (bugs) that must be analyzed. Improvement and development of the system can be done per module or as a whole, adapted to the development needs of existing business processes.

V. CONCLUSION AND SUGGESTION

5.1. Conclusion

The results of the research concluded that the use of the application of information system for calculating the cost of rental office utilities is able to answer the building management needs in managing rental office cost data. Support administration staff can easily manage office tenant data, office unit data, meter type data and tariff data. The application helps administrative staff to calculate the cost of rental office utilities automatically, and print reports on electricity, water and gas usage quickly and accurately. While Supervisors and Managers can easily see reports on the cost of using rental office utilities and provide confirmation if the input results from the administrative support staff are correct. All management is in one integrated system and easy to use and managed data guaranteed accuracy.

The implementation of the MVC architecture concept to the development of the application of information system for calculating the cost of rental office utilities succeeded in increasing the modularity and reusability of the system. The level of complexity of the code in software, both when creating it and improving it, can be reduced significantly, thereby increasing the flexibility and modularity of software systems. New programmers who continue to manage the web have no difficulty understanding and connecting the logic of existing program scripts, because they already use the same platform in an MVC architecture concept.

5.2.   Suggestion The research carried out only covers the system requirements needed by building managers, both administrative support staff, supervisors and managers in terms of calculating office space utility costs, namely the costs of using electricity, water and gas by tenants. Further research is expected to include the calculation of all costs incurred by tenants while renting office space and can be accessed online by tenants, so there is no need to wait for verbal or written information from the building manager.

Next, it is important to pay attention to the security of the intranet network used, the security of web applications that have been built from outside hacking, and good database backups to avoid data loss due to damage to the system. While the application of the MVC architecture concept in web applications needs to be directed to use the latest version of the framework and also utilize web service technology to further improve the performance and security of the system that has been built.

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