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The development of Network Power System Website using Extreme Programming Method

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Abstract

Latest advancements in information technology have been widely utilized in various sectors, including the processing and storage of corporate data. Data is an important asset for companies, like the PT Smartfren Telecom Tbk (Smartfren), a leading telecommunication service providers in Indonesia. One crucial dataset at the Smartfren Surabaya branch office is Network Power System (NPS) data, which is currently manually input and stored in Microsoft Excel, causing inefficiency and risk of human error. This study aims to create a website to manage NPS data using the Extreme Programming (XP) method. By doing so, NPS data with more than three thousand records can be easily processed and stored systematically. The research' procedure based on XP includes planning, design, coding, and testing with Black-box and User Acceptance testing with three iterations. Black-box testing result showed a 100% functionality level in each iteration, and User Acceptance Testing results were 87.09% in the first iteration, 87.27% in the second, and 92% in the third. Therefore, this confirms that the NPS website system successfully meets standards and the users' needs. Hence, this study demonstrated the advantages of transitioning from manual way to web-based systems and developed using XP method to evolving the user needs.

Keywords: Extreme Programming, Network Power System, Data Processing, Information Systems

Abstrak

Kemajuan teknologi informasi saat ini telah banyak dimanfaatkan di berbagai sektor, termasuk pengolahan dan penyimpanan data perusahaan. Data merupakan aset penting bagi perusahaan, seperti halnya PT Smartfren Telecom Tbk (Smartfren), perusahaan penyedia layanan telekomunikasi terkemuka di Indonesia. Salah satu data yang krusial di kantor cabang Smartfren Surabaya adalah data *Network Power System* (NPS) yang saat ini masih diinput secara manual dan disimpan di *Microsoft Excel*, sehingga menyebabkan inefisiensi dan resiko *human error*. Penelitian ini bertujuan untuk membuat sebuah *website* untuk mengelola data NPS dengan menggunakan metode *Extreme Programming* (XP). Dengan demikian, data NPS yang berjumlah lebih dari tiga ribu *record* dapat dengan mudah diolah dan disimpan secara sistematis. Prosedur penelitian berdasarkan XP meliputi perencanaan, perancangan, pengkodean, dan pengujian dengan pengujian Black-box dan User Acceptance testing dengan tiga kali iterasi. Hasil pengujian Black-box menunjukkan tingkat fungsionalitas 100% pada setiap iterasi, dan hasil User Acceptance Testing sebesar 87,09% pada iterasi pertama, 87,27% pada iterasi kedua, dan 92% pada iterasi ketiga. Hal ini menegaskan bahwa sistem situs web NPS berhasil memenuhi standar dan kebutuhan pengguna dengan baik. Penelitian ini menunjukkan keuntungan transisi dari cara manual ke sistem berbasis web dan dikembangkan dengan metode XP untuk mengembangkan kebutuhan pengguna.

Kata Kunci: *Extreme Programming*, *Network Power System*, Pengolahan Data, Sistem Informasi

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I. Introduction

The rapid growth of information technology (IT) in recent years has led to an increase in the demand for IT solutions. In the fields of communication technology, services, business, and various other aspects of a company, data management plays an important role in optimizing business performance and strategy. Furthermore, the effective data and information management is essential for companies that want to progress and grow. Hence, proper data processing could improve operational efficiency, encourages innovation, and provides a basis for evaluation and policy-making in the company [1].

In this case, PT Smartfren Telecom Tbk (Smartfren) is one of the leading telecommunication service providers in Indonesia, serving the retail and corporate segments. Operating since 2011, Smartfren introduced the first 4G Long Term Evolution (LTE) Advanced service in Indonesia in 2015 and currently has the widest 4G LTE coverage in Indonesia. Among the important data managed by Smartfrien, especially in Surabaya branch office is Network Power System (NPS) data. This NPS data includes information such as Site ID, Site Name, Tagging (TAG), Final Assembly Code (FAC), Area, Rectifier Type, and IP Address of the rectifier on various towers, which are stored with conventional way like Microsoft Excel format. Moreover, NPS data is critical to managing their network infrastructure.

Currently, NPS data management method has some inefficiencies. It is because based on interviews with a Networking team, several problems often arise due to in-updating data, lack of systematic data updates, and difficulties in accessing the most accurate and up-to-date information. This leads to time inefficiencies, as employees often have to manually match old and new data to determine validity. Currently, approximately three thousand of NPS data regularly undergoing changes due to tower modifications, however, the current data management system is inadequate.

To overcome this problem, the use of information technology is very important to improve efficiency and quality in data management [2]. For example, a web-based platform is a viable solution, offering greater accessibility and flexibility than conventional way [3]. Through the implementation of a website to manage NPS data, it will allow for easier and real-time access for employees, supporting continuous operations and 24-hour availability. Hence, web-based development is appropriate and feasible solution, given the rapid development of technology and the growing need for efficient data management in enterprises.

The previous studies mentioned that develop the website need a proper methodology such as an Agile software development approach [4]. Agile is designed to deliver high-quality software that can adapt to changing needs over time [5]. Under Agile approach, the Extreme Programming (XP) method is well suited for this project due to its emphasis on simplicity, iterative development, and direct user involvement [6]. XP is known for its flexibility and risk mitigation, making it ideal for projects with evolving requirements [7]. Furthermore, the development process follows four phases of XP method, such as planning, design, coding, and testing to ensure a robust and user-accepted software [8].

The previous studies have shown the effectiveness of web-based solutions using the XP methodology in a variety of contexts, that is develop the web-based information dissemination and trainee selection tests showed a significant improvement in accessibility and usability [9]. Similarly, develop the inventory management systems highlight the utility of XP in creating effective data logging and tracking tools [10].

Therefore, this study aims to develop a Network Power System (NPS) Website using the XP method and evaluate its quality through Black-box Testing and User Acceptance Testing (UAT). The goal is to provide solutions that meet the specific needs of companies, ensuring efficient and reliable data management.

II. Literature Review

A. Network Power System (NPS) in Smartfren' Surabaya branch office

PT Smartfren Telecom Tbk (Smartfren) is one of the leading telecommunications companies in Indonesia with rapid development. The company is a pioneer in 4G LTE internet services and VoLTE services, helping Indonesia enter the digital era. Smartfren continues to innovate by launching the first commercial 4G LTE Advanced service in Indonesia in 2015 and becoming the first VoLTE service provider in Indonesia in 2016. In 2017, Smartfren strengthened its position with the migration of Code Division Multiple Access (CDMA) customers to the 4G network, becoming the only operator with a fully 4G network. With around 15,000 4G Base Transceiver Station (BTS) spread across 200 cities in Indonesia, Smartfren offers flexible data services through a wide selection of data packages, Andromax smartphones, and MiFi modems.

Data Network Power System (NPS) is an internal designation at PT Smartfren Surabaya Branch, covering important information on many towers that will always be updated. This data is managed by the Networking division, which oversees the installation, replacement, repair, and decommissioning of towers. As a result, the database, which is stored in Microsoft Excel, is frequently updated. NPS is also concerned with electrical power and its distribution to subsystems of satellite-connected towers, ensuring smooth communication and data exchange.

B. The website development with Extreme Programming Method

According to Welling, a website is a medium consisting of several interrelated pages, used to display information in the form of images, videos, text, sound, or a combination of all of them [11]. The website is multi-platform, accessible from a variety of internet-connected devices. The main functions of a website include promotion, marketing, information, education, and communication [12]. However, websites can also be used as a platform for e-commerce transactions, collaboration, and digital content sharing. These functions continue to evolve along with technological innovations and increasingly diverse user needs.

Furthermore, the Agile approach allows for faster problem resolution with better quality, as well as greater responsiveness to change. Agile is a set of iterative-based software development methodologies, in which requirements and solutions evolve through organized team collaboration [13]. One method in Agile is Extreme Programming (XP), which emphasizes user satisfaction, quick feedback, and small, incremental product releases [14]. Previous research has shown the effectiveness of XP in a variety of contexts. For example, a previous studies created a web-based application to facilitate the registration process and the implementation of job trainee selection exams, showing that XP can improve accessibility and usability [9]. Previous research designed a web-based sales strategy using the XP method, the results of which showed time and cost efficiency in the product purchase process [2]. Another previous study also developed a web-based inventory application using the XP method, showing that XP can effectively overcome inventory management problems [6].

Therefore, XP is a method that simplifies the stages of system development to be more efficient, adaptive, and flexible [15]. The stages of XP include planning, design, coding, and testing [16]. At the planning stage, an analysis of user' needs and a previous studies of related literature are carried out to solve problems with the latest technology. In the design stage, Class Responsibility Collaboration (CRC) Cards are used to recognize and organize object-based classes. The coding stage involves creating code with pair programming and refactoring to improve the quality of the program structure. Continuous Integration is used to detect errors quickly. Finally, the testing stage to validate the website quality, it used the tools like Black-box Testing and User Acceptance Testing (UAT). Hence, the developed website could meet the needs of users and functions properly [17].

C. Website Quality Testing Using Black-box Testing and User Acceptance Testing

In this study, the XP method was chosen because it is suitable for small to medium-sized teams, allows effective communication through pair programming, and provides quick feedback to maintain the quality of the application. XP also emphasizes on rigorous testing to ensure the products developed meet user expectations. With this approach, it is hoped that the development of the Network Power System (NPS) website could be

efficiently and effectively in terms of the software quality. Hence, we used testing like Black-box Testing and User Acceptance Testing (UAT).

Black-box Testing is software testing that focuses on functionality without looking at the internal structure of the code [21]. These tests help expose ambiguities or inconsistencies in the specification of the requirements and are conducted from the user's point of view [18]. On the other hand, User Acceptance Testing (UAT) involves end-users to verify that the software meets their needs and expectations, increasing user trust and getting feedback for further improvements [19].

III. RESEARCH METHOD

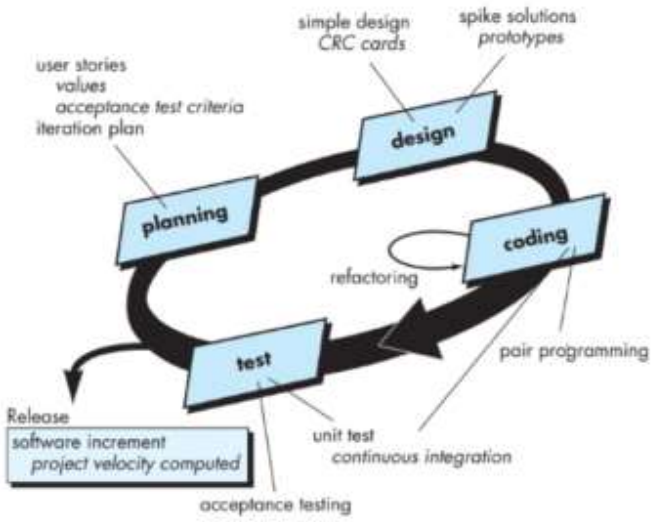

Fig. 1. Stages of the Extreme Programming process [17]

In the previous study, Extreme Programming (XP) method was used to simplifies the various stages of system development, hence, make it more efficient, adaptive, and flexible [15]. Furthermore, there were several stages that must be passed in XP method, including Planning, Design, Coding, and Testing. The reason for choosing the XP method in this study, the XP method could emphasize user satisfaction, rapid feedback, and small and gradual product releases so that even the slightest error can be detected quickly at the beginning of development [14].

1) *Planning:* Planning in the XP method is an important step in software development. The main goal of this planning process is to draw up a plan for the iteration or development cycle that will be implemented in XP [24]. In this planning stage, the development team will collaborate to compile and organize the tasks that need to be completed in the next iteration.
2) *Design:* Designing in XP includes not only system architecture, but also component modeling, user interface settings, and code structure. The goal of designing in XP is to create solutions that are easy to understand, easy to test, and easy to modify according to changing needs.
3) *Coding:* Coding involves writing program code based on a pre-designed algorithm or plan. The program's code includes mathematical operations, repetition, data structures, string manipulation, decision-making, logic, and interaction with inputs and outputs. This is done to adapt the planning that has been designed so that it can be implemented according to the expected business process.

4) *Testing:* Testing is carried out to evaluate software with the aim of ensuring that it functions according to the requirements and meets user expectations. Testing will be carried out using Black-box Testing and User Acceptance Testing. Black-boxes aim to test software from the external side without paying attention to the details of the implementation or the structure of the program's code [22]. The main focus of this testing is to ensure that the software can produce functions, inputs, and outputs that match the user's needs. Then, User Acceptance testing tests the features and ensures that the application has met the components of the requirements created from the user's point of view [23]. An assessment scale is symbolized as X, following Table I of the assessment scale.

TABLE I
ASSESSMENT SCALE

X Value Weight	Description
1	Strongly Disagree
2	Disagree
3	Sufficient
4	Agree
5	Srongly Agree

After explaining the assessment scale, direct testing is carried out on users to get data results from the previous assessment scale. Users will test the website both end-to-end and functionally. Furthermore, users will be asked questions about the features of the website. Then, all the data results that have been obtained from the statements of the respondents, the results will be calculated using the following formula:

$$P = \frac{f}{n} \text{ x } 100\% \quad [20]$$

Information:
P : Percentage
f : Answer Frequency
n : Number of Respondents

Table II presents the criteria for assessing the respondents' results. This material will be used for further development if any features are considered inadequate or do not function optimally when used by users.

TABLE II
ASSESMENT CRITERIA

Percentage	Description
0%-20%	Very Bad
21%-40%	Bad
41%-60%	Enought
61%-80%	Good
81%-100%	Very Good

IV. RESULTS AND DISCUSSION

The results in this study were divided into three subsections based on the XP iterations, namely the first, second, and third iteration, where each iteration presents the results of all phases in the XP method that has been worked on. strongly disagree, disagree, sufficient, agree, and strongly agree.

A. First Iteration

The first iteration focused on creating the Login feature, Dashboard Page, NPS Data List Page, Add, Delete, Edit, and Details features of NPS Data. The work is carried out based on a predetermined order of priority. The

first feature is login, login is the first page opened by the user after logging in to the browser. After the login feature, there is a dashboard page. The dashboard page appears when the user has logged in using a valid username and password, here is what the dashboard looks like in figure 2.

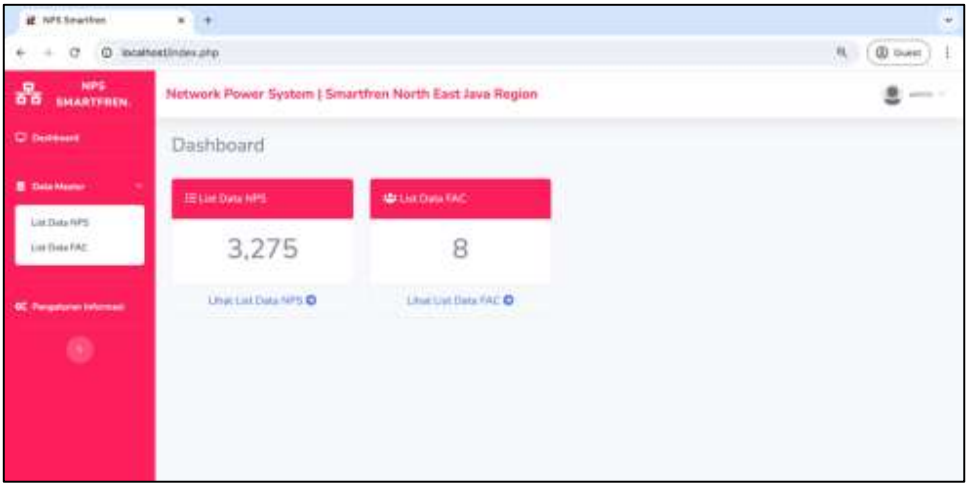

Fig. 2. Dashboard Page

After the dashboard page, there is an NPS Data List page. On the NPS Data List page, there is NPS Data in a table with columns No, Site ID, Site Name, TAG, FAC, Area, Recti Type, IP Recti, and Options. The NPS Data List page also displays many features, including the Add NPS Data, Location Area, Details, Edit, and Delete NPS Data features. The following is the page of the List Data NPS in figure 3. In the Add NPS Data feature, a pop up is issued in which there is a form to add NPS Data to the NPS Data List Page which includes Site ID, Site Name, TAG, FAC, Area, Recti Type, IP Recti, and Input Date.

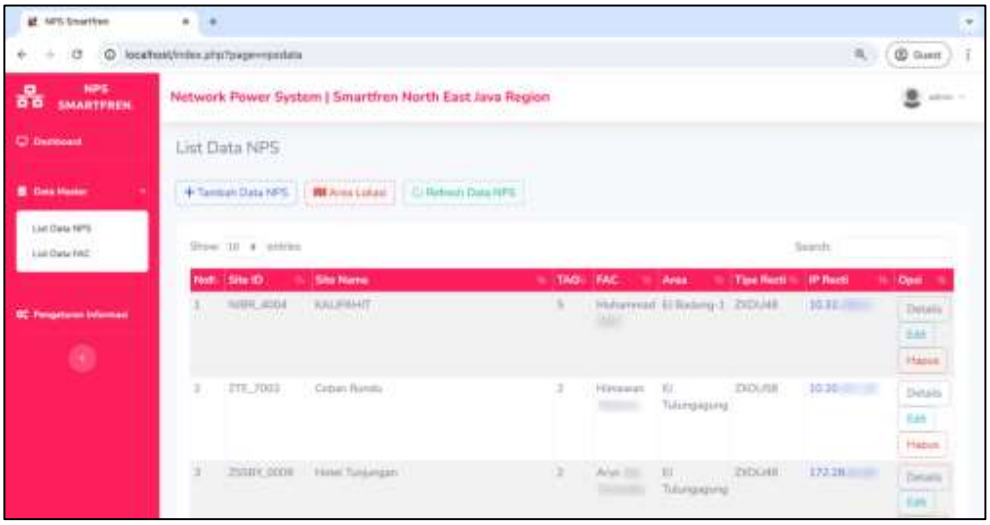

Fig. 3. NPS Data List Page

For the NPS Data Edit Feature, users are directed to the Edit NPS Data page in which users can change the NPS Data according to the form column they want to change. In addition, the Delete NPS Data feature that users can delete NPS Data just by clicking the Delete button on the NPS Data line to be deleted. Then after

clicking, a message appears to confirm whether you are willing to delete or not, then the user if you want to delete then click Ok on the message, if not then click cancel on the message. If the data has been successfully deleted, then the Delete Data Successful message will be displayed on the NPS Data List page. Finally in this iteration is the NPS Data Details feature, there are details of NPS Data including Site ID, Site Name, TAG, FAC, Area, Recti Type, IP Recti, Input Date, and Update Date. There are two columns, namely Area and IP Recti, if clicked, the system will direct to a new page, namely to the maps, and IP Recti to the Private IP for the Company's Internal network. After carrying out the implementation stage on the design, then conducting testing using black-box testing. The test covers all the components on the page to be tested. The following are the results starting in Table III.

TABLE III
BLACK-BOX TESTING FIRST ITERATION

BLACK BOX TESTING	Scenario	Status
1. LOGIN FEATURE	1. Users can view and fill in the input form username, password and click the Login button	100% Passed
	2. Users see login failed error when username and password are incorrect	100% Passed
	3. Users will be redirected to the home page when they successfully log in	100% Passed
2. DASHBOARD PAGE	1. Users can view the Total Amount of Data on the dashboard page	100% Passed
	2. Users will be redirected to the NPS Data List page when they click View NPS Data List on the dashboard page	100% Passed
	3. Users will be redirected to the FAC Data List page when they click View FAC Data List on the dashboard page	100% Passed
	4. Users will be redirected to the Information Settings page when clicking on the Information Settings sidebar on the dashboard page	100% Passed
3. NPS DATA LIST PAGE	1. Users can see the entire NPS Data List on the Smartfren Network Power System	100% Passed
	2. Users will be redirected to the NPS Data Details page when they click the Details button on the selected NPS Data row	100% Passed
	3. Users will be redirected to the Edit NPS Data page when they click the Edit button on the selected NPS Data row	100% Passed
	4. Users will be displayed with a Delete NPS Data message when they click the Delete button on the selected NPS Data row	100% Passed
	5. Users will be shown a pop up Add NPS Data if they click the Add NPS Data button on the List NPS Data page	100% Passed
	6. Users will be shown a Location Area pop up if they click the Location Area button on the NPS Data List page	100% Passed
4. ADD NPS DATA FEATURE	1. Users can fill in NPS Data on the Add NPS Data form	100% Passed
5. EDIT NPS DATA FEATURE	1. Users can change the selected NPS Data rows on the Edit NPS Data page form	100% Passed
6. DELETE NPS DATA FEATURE	1. Users can delete NPS Data that will not reappear in the NPS Data List	100% Passed
7. DETAILS NPS DATA FEATURE	1. Users can view Data Details on the selected NPS Data row	100% Passed

In the First Iteration User Acceptance Testing, we provide eight question items to users as shown in Table IV. The purpose of these questions is to gather feedback on the usability and functionality of the system. By analyzing the responses, we aim to ensure that the final product meets user expectations.

TABLE IV
QUESTION ITEMS FOR FIRST ITERATION

Question Item
1. Is the initial appearance of the Smartfren Network Power System Website interesting and makes you want to know more details?
2. Is the login flow on the Smartfren Network Power System Website clear and easy to understand?
3. Is the flow of viewing the dashboard page on the Smartfren Network Power System Website clear and easy to understand?
4. Is the flow of viewing the NPS Data List on the Smartfren Network Power System Website clear and easy to understand?
5. Is the flow of viewing NPS Data Details on the Smartfren Network Power System Website clear and easy to understand?
6. Is the flow of Adding NPS Data on the Smartfren Network Power System Website clear and easy to understand?
7. Is the flow of Delete NPS Data on the Smartfren Network Power System Website clear and easy to understand?
8. Is the flow of NPS Data Editing on the Smartfren Network Power System Website clear and easy to understand?

After the users completed to answers the questions then we analyze the result with weight values as shown in Table V. In detail, the questions are measured based on the value of the X1-X5 represent weight, which means the parameter of the user's answer count. Each X has a sequential rating weight, starting from strongly disagree, disagree, sufficient, agree, and strongly agree. The results showed that the total final sum of the tests scored 135 and the average total percentage of each X weight was 87,09%. Based on the results of the test, it can be concluded that all the features worked on in the first iteration have been fully functional.

TABLE V
USER ACCEPTANCE TESTING FIRST ITERATION

Qustion Item	X Value Weight					Sum	Percentage
	X1	X2	X3	X4	X5		
1	0	0	0	8	15	23	92%
2	0	0	0	8	15	23	92%
3	0	0	0	12	10	22	88%
4	0	0	0	8	15	23	92%
5	0	0	3	8	10	21	84%
6	0	0	3	4	0	7	70%
7	0	0	0	4	5	9	90%
8	0	0	3	4	0	7	70%
Average						135	87,09%

Note: X mean Assesment Scale

B. Second Iteration

The second iteration focuses on creating a FAC Data List Page, Add, Delete, Edit FAC Data features, Edit Information Settings feature, View Profile feature, and Logout feature. The priority of the work is in accordance with the predetermined order. The following is the display of the FAC Data List page in figure 4, There are columns above to add FAC Data, then in the table there are several columns including No, FAC, Input Date, and Options.

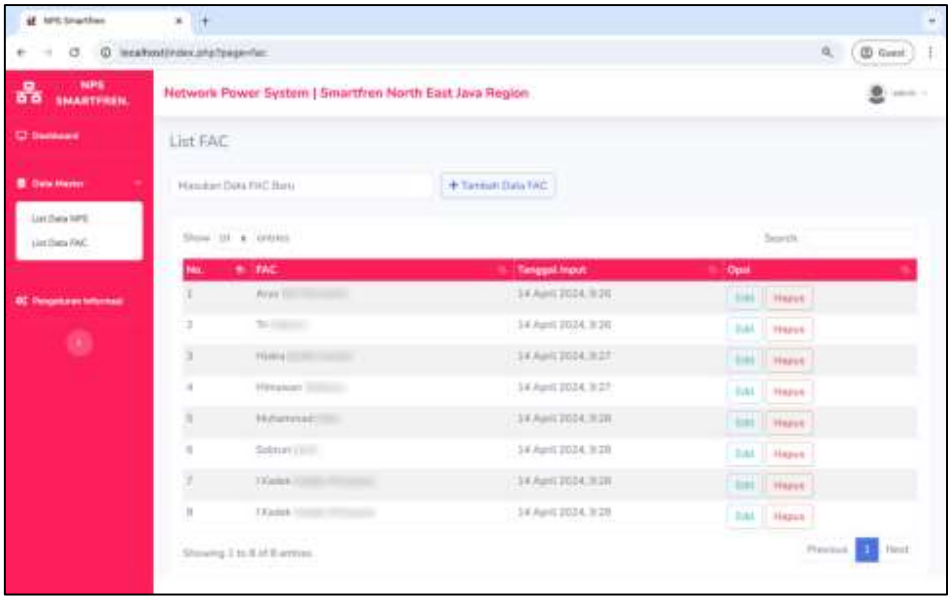

Fig. 4. FAC Data List Page

After the FAC Data List Page is presented, the next step is to create the Add NPS Data and Edit NPS Data features. In the Add NPS Data and Edit NPS Data features, the above columns are divided into two functions. The first function to add data is when the user fills in the "enter new FAC data" column and then clicks the add data button, and the data is entered into the FAC Data List table. The second function is when the user clicks edit on the selected data to be edited in the table, the data column to be edited appears, and the button next to the column changes the function to Edit NPS Data.

Furthermore, the Delete FAC Data feature, allows users to delete FAC Data by pressing the Delete button on the selected data row. After that, a confirmation message appears asking for the user's assurance. If they agree, the user clicks Ok, if not, they click Cancel. After successful deletion, a Successful Data Deletion message will appear on the FAC Data List page. In the Edit Information Settings feature, the Information Settings display has a form that has two columns, namely Company System Name and Company Region, which functions for naming in the website header. To change the Information, the user can change the two columns and then click the Edit Information button, then the Information on the website header has changed. Here is figure 5 below.

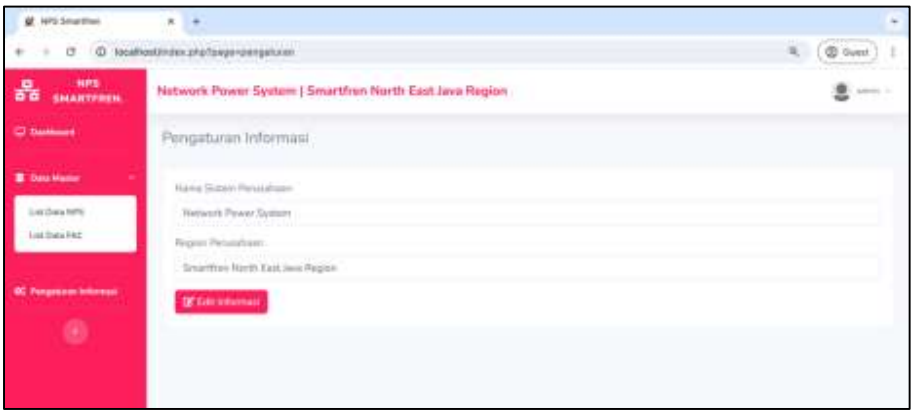

Fig. 5. Edit Information Settings Feature

On the Profile Feature view, you can only see the details of the admin managed account and the admin photo that can be entered in the Smartfren Network Power System Website. Here's what the Profile feature looks like in figure 6.

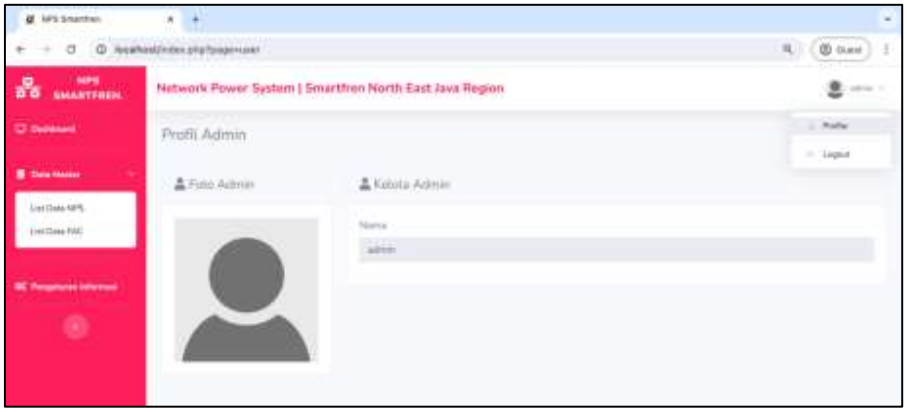

Fig. 6. Profile Feature

Furthermore, the end of this second iteration is the Logout feature. When the user has finished using the Website Network Power System, then the user clicks on the profile icon on the website header and then selects logout on the dropdown, then the system will delete the session on the website to log out and display the message Logout Successful and the user is redirected on the login page again.

After carrying out the implementation stage on the design, the next is to conduct testing using Black-box Testing and using User Acceptance Testing. The test covers all the components on the page to be tested, here are the results describe in Table VI.

TABLE VI
BLACK-BOX TESTING SECOND ITERATION

BLACK BOX TESTING	Scenario	Status
1. FAC DATA LIST PAGE	1. Users can see the FAC Data List on the Smartfren Network Power System	100% Passed
	2. Users will be displayed a warning message to fill in the fields if they click the Add FAC Data button on the selected Data row	100% Passed
	3. Users will be displayed FAC Data in the Edit FAC Data column if you click the Edit button on the selected FAC Data row	100% Passed
	4. Users will be displayed with the Delete FAC Data message when clicking the Delete button on the selected FAC Data row	100% Passed
2. ADD FAC DATA FEATURE	1. Users can fill in FAC Data in the Add FAC Data column	100% Passed
3. EDIT FAC DATA FEATURE	1. Users can change FAC Data in the Edit FAC Data column	100% Passed
4. DELETE FAC DATA FEATURE	1. Users can delete FAC Data that will not reappear in the FAC Data List	100% Passed
5. EDIT INFORMATION SETTINGS FEATURE	1. Users can change the Information Settings of the Smartfren Network Power System Website on the Information Settings page form	100% Passed
6. PROFILE FEATURE	1. Users can view the account profile registered on the Smartfren Network Power System Website	100% Passed
7. LOGOUT FEATURE	1. Users will be redirected to the Login page when they successfully logout on the Smartfren Network Power System Website	100% Passed

The Second Iteration User Acceptance Testing, we provide eight question items to users as shown in Table VII. The purpose of these questions is to gather feedback on the usability and functionality of the system. By analyzing the responses, we aim to ensure that the final product meets user expectations.

TABLE VII
QUESTION ITEMS FOR SECOND ITERATION

Question Item
1. Is the flow of viewing the FAC Data List on the Smartfren Network Power System Website clear and easy to understand?
2. Is the flow of Adding FAC Data on the Smartfren Network Power System Website clear and easy to understand?
3. Is the flow of Delete FAC Data on the Smartfren Network Power System Website clear and easy to understand?
4. Is the flow of FAC Data Editing on the Smartfren Network Power System Website clear and easy to understand?
5. Is the flow of viewing the Information Settings on the Smartfren Network Power System Website clear and easy to understand?
6. Is the flow of Edit Information Settings on the Smartfren Network Power System Website clear and easy to understand?
7. Is the flow of viewing the Profile on the Smartfren Network Power System Website clear and easy to understand?
8. Is the Logout flow on the Smartfren Network Power System Website clear and easy to understand?

After the users completed to answers the questions then we analyze the result with weight values as shown in Table VIII. In detail, the questions are measured based on the value of the X1-X5 represent weight, which means the parameter of the user's answer count. Each X has a sequential rating weight, starting from strongly disagree, disagree, sufficient, agree, and strongly agree. The results showed that the total final sum of the tests scored 96 and the average total percentage of each X weight was 87,27%. Based on the results of the test, it can be concluded that all the features worked on in the second iteration have worked as a whole and received a very good response from users.

TABLE VIII
USER ACCEPTANCE TESTING SECOND ITERATION

Qustion Item	X Value Weight					Sum	Percentage
	X1	X2	X3	X4	X5		
1	0	0	0	4	5	9	90%
2	0	0	0	4	5	9	90%
3	0	0	0	8	0	8	80%
4	0	0	0	4	5	9	90%
5	0	0	0	0	10	10	100%
6	0	0	0	8	0	8	80%
7	0	0	0	12	10	22	88%
8	0	0	3	8	10	21	84%
Average						96	87,27%

Note: X mean Assesment Scale

C. Third Iteration

The third iteration focuses solely on creating the Location Area feature. The work is in accordance with the Iteration Plan that has been determined. For the display of the Location Area feature, users click the location area button on the previous NPS Data List page and can see the pop up of the city area where there is a tower or Network Power System. It works for users to see the coverage of the NPS location area. The following is shown the coding and design implementation of the Location Area feature in figure 7.

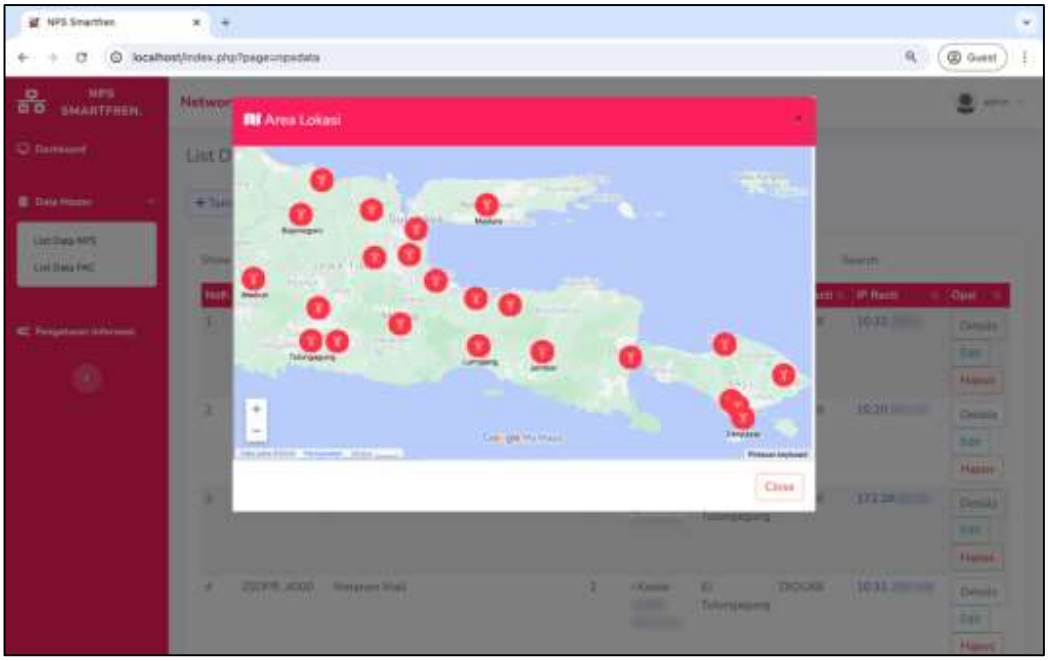

Fig. 7. Location Area Feature

In the third iteration only on the Location Area feature, after carrying out the implementation stage on the design, the next is to test using Black-box Testing and using User Acceptance Testing. Here are the results of testing starting from table IX.

TABLE IX
BLACK-BOX TESTING THIRD ITERATION

BLACK BOX TESTING	Scenario	Status
1. LOCATION AREA FEATURE	1. Users can see the Smartfren Network Power System Location Area	100% Passed

In the Third Iteration User Acceptance Testing, we provide one question item to users as shown in Table X. The purpose of these questions is to gather feedback on the usability and functionality of the system. By analyzing the responses, we aim to ensure that the final product meets user expectations.

TABLE X
QUESTION ITEMS FOR THIRD ITERATION

Question Item
1. Is the flow of viewing the Location Area on the Smartfren Network Power System Website clear and easy to understand?

After the users completed to answers the questions then we analyze the result with weight values as shown in Table XI. In detail, the questions are measured based on the value of the X1-X5 represent weight, which means the parameter of the user's answer count. Each X has a sequential rating weight, starting from strongly disagree, disagree, sufficient, agree, and strongly agree. The results showed that the total final sum of the tests scored 23 and the average total percentage of each X weight was 92%. Based on the results of the test in the third iteration, it can be concluded that the features worked on in this iteration have worked as a whole and received a very good response by users.

TABLE XI
USER ACCEPTANCE TESTING THIRD ITERATION

Qustion Item	X Value Weight					Sum	Percentage
	X1	X2	X3	X4	X5		
1	0	0	0	8	15	23	92%
Average						23	92%

Note: X mean Assesment Scale

After completing all the iterations of testing that have been carried out, the results of this study are in accordance with existing theories that support the use of agile methodologies such as Extreme Programming in software development, especially in contexts where needs can change rapidly. The following is a summary of the results of the two tests on all parameters shown in Table XII. Improving user satisfaction through iterative testing and refinement is consistent with agile principles, which emphasize continuous feedback and incremental development.

TABLE XII
RESULT SUMMARY

No.	Iteration	Black-box Testing	User Acceptance Testing
1	First Iteration	7 item test features and all item scenarios with 100% all passed.	8 items question with 87,09% average percentage.
2	Second Iteration	7 item test features and all item scenarios with 100% all passed.	8 items question with 87,27% average percentage.
3	Third Iteration	1 item test feature and 1 item scenario with 100% passed.	1 item question with 92% average percentage.

V. CONCLUSION

Based on the results of the study, it can be concluded that the Development of the NPS Website can facilitate users in data management and storage compared to the previous method that only used Microsoft Excel. This reduces the potential for human error and ensures that data is always systematically updated. In this study, the implementation of XP method has proven to be effective in three iterations. Regarding the testing, it all the features on the website worked well 100%, with all tests successfully passed in each iteration and high user satisfaction across three iterations, with the final score in UAT indicating that user needs were met very well. In addition, the NPS website was received by company that indicated that the solution with NPS website as a our proposed succeeded in overcoming problems in Smartfren's NPS data management. Hence, this study also broadens the understanding of effective data management solutions in corporate environments, especially in the telecommunications sector. This study was limited by the scope of its sample size and the specific context of Smartfren's NPS data management needs. Future studies could explore the application of similar web-based data management solutions in other industries and with a larger, more diverse sample to validate these findings further. These findings provide a strong case for other organizations to consider adopting a similar approach to improve their operational efficiency and data integrity.

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