DEVELOPMENT OF AN INFORMATION SYSTEM FOR ASSET MANAGEMENT

Safara Cathasa Riverinda Rijadi[1], Sinung Suakanto[2]
Infomation System Department, School of Industrial and System Engineering, Telkom University[1,2]
Jl. Telekomunikasi. 1, Bojongsoang, Kab. Bandung, Jawa Barat, Indonesia
safaracathasa@telkomuniversity.ac.id

Abstract - An information system for asset management in a university is very important, especially in a faculty with many majors. There are a lot of assets, including laboratories and items inside. In this research, the authors present the development of an information system using feature-driven development (FDD) methodology in one faculty, the School of Industrial and Engineering, at Telkom University in the main campus in Bandung, as a pilot project. FDD is one of the agile methods, giving flexible and collaborative methods prioritizing the main user, which is the asset maintainer. To communicate between stakeholders, the development of initial models using UML diagrams, such as use case diagrams, sequence diagrams, and deployment diagrams. The modules on this asset management website are administration for building and room data, asset categorization, asset search, and asset maintenance and problem reporting. The website was developed using PHP with a Laravel framework and MySQL database. The testing method was using Black Box Testing, with the result of 87.5% of acceptance. Based on 16 use cases, there are 2 use cases that are not accepted. This website is beneficial for increasing the efficiency of asset listing in terms of lowering the time consumed to do maintenance while still keeping the integrity of the data. Future development will involve more faculty and more campuses at the Telkom University National Campuses.

Keywords - Asset management, Feature-driven development, Website, UML

I. INTRODUCTION

School of Industrial and Engineering at Telkom University in Bandung campus, the main campus, consists of 3 bachelor majors: Information Systems, Information Technology, and Digital Supply Chain, and two master majors: Information Systems and Information Technology. The total number of new students in the School of Industrial and Engineering each year reaches more than 1,000, meaning the student body number for four batches is more than 5,000. Different needs and resources lead to 18 different research and practicum laboratories and workshops. Each laboratory and workshop has different types of assets. Assets, goods, or objects can be owned and have economic or exchange value owned or used by a business entity [1], in this case, faculty. For example, the laboratory for Information Systems major has several different types of computers and 3D printing. Meanwhile, the workshop for Industrial Engineering consists of several machineries for practicum facilities.

With this condition, asset management is very important to implement. Asset management is focused on helping organizations achieve their objectives and determine the optimal blend of activities based on these objectives [2]. In this case, the university, as a non-profit institution, also needs asset management to achieve maximum output for doing research. Several problems highlighted by asset management in universities are no awareness regarding asset management, an imperfect system leading to unclear responsibilities, prone to losing assets, a lack of standard disposal procedures, and no legal framework available in the case of private universities [3], [4]. In addition, private universities often lack experience and expertise for

effective asset management [3]. However, several opportunities can be taken, such as asset utilization and regular maintenance, to prolong the life of the asset products [3].

From a student's perspective, asset management is related to how often they can access the laboratory for learning to balance between theory in classes and practical lessons [5], [6], [7], especially using a virtual laboratory. Virtual, in this case, usually requires a high-spec computer, usually called a supercomputer, which is beneficial for doing simulations for all majors in the School of Industrial and System Engineering [8], [9], [10]. However, with manual scheduling, the students will have difficulty accessing the laboratory since traditional manual scheduling cannot solve the complex workshop scheduling problems. Manual scheduling also cannot provide a schedule quickly, which is less efficient [11], [12].

From the university's perspective as the asset manager, mistakes can be made in planning, procurement, and inventory data related to assets if done manually. The asset lifecycle is very important to be taken care of since extending the life cycle does not mean lowering the cost but sometimes making it more expensive [13]. When the asset cannot be used, there will be downtime in terms of operations. Thus, it leads to the stopping of the business process. With the condition of Telkom University having many campuses in Indonesia (Bandung, Jakarta, Surabaya, and Purwokerto), it is also important that the main campus can see the problems within others. Reporting problems should be done in real-time to reduce the idle time [14], [15], [16]. Due to these problems in the faculty, asset management with a computerized information system is very needed to ensure that the process of registration, requesting, receiving, and maintaining goods can be done without any hassle. The advantages of using computerized asset management are efficiency, scalability, and growth [17], [18], [19], making it possible to leverage the solutions not only at the faculty level but also at the university level.

In this research, the system is first developed as a pilot project for the faculty level only, which is the School of Industrial and System Engineering, located on the main campus in Bandung. The development method uses feature-driven development (FDD) to help build a minimum viable product (MVP), making it possible for the main user, in this case, the asset maintainer, to be included in each step, ensuring that they understand and are aligned with their needs. In addition, developing an information system for asset management and lab room is done using PHP with Laravel framework and MySQL database, considering those are still popular, making it easier for further development in the future. It is expected that the information system will be helpful for both students and lecturers in managing the usage of the laboratory room and its assets. With this pilot project in one faculty, hopefully, it will be manageable to implement it throughout the national campus, not only in Bandung but also in Jakarta, Surabaya, and Purwokerto.

II. STUDY SIGNIFICANCE

This research aims to create a pilot project regarding an asset management website in order to lower the time needed to list the assets. Thus, in determining the method of this project, this research uses feature-driven development (FDD), which is suitable for creating MVP. There are several other agile methods, such as TDD, Scrum, and Extreme Programming, shown in Table 1. FDD is chosen because it is a flexible and collaborative method that prioritizes asset maintainers. FDD benefits systems with many features and epitomes and a process-oriented, client-centric agile methodology. FDD aims to deliver software solutions that resonate closely with asset maintainer requirements while focusing on quality and efficiency [19]. In the case of the pilot project, FDD is beneficial for producing MVP by focusing on the faculty level on the main campus in Bandung. As the main campus has been implementing this system, the

transition to other campuses will be smoother. Apart from that, the size of the faculty in the Bandung campus is the biggest compared to the others, having three separate buildings.

TABLE I LIST OF FEATURES OF ASSET MANAGEMENT WEBSITE [20]

Aspects	Feature-Driven Development (FDD)	Test-Driven Development (TDD)	Scrum	Extreme Programming
Advantages	Adaptive to change, code has high-quality	Detection of bugs is done at the beginning, and the code has high-quality	High transparency, simple process	Incremental development, high productivity
Disadvantages	Not focusing on critical points of the project	Not suitable for projects with high sync	Need high availability from the team	Not suitable for teams across the country
Main Focus	Development based on features	Development based on tests	Project management and team	Team collaboration
Cycle Development	Feature by feature	Test-first approach	Sprint	Short iteration
Flexibility	High	Moderate	Low	Very high
Types of Projects	Project with clear features	The project which needs a high-quality project	Project with a lot of change	Project with a lot of change

The method of FDD is in Figure 1 [21]. The first step is to develop an overall model, meaning it is needed to determine a system development model. The second step, building a feature list, includes a menu and module on the system. The third step, plan by feature, is creating a plan feature when they have been developed. The fourth step is design by feature, meaning creating a design for the feature. Lastly, build by feature is related to releasing the future based on the design [21].

Figure 1. Feature Driven Development (FDD) Process

In short, FDD is an agile software development life cycle that is chosen due to the nature of the project, which is beneficial for gaining MVP products [22]. It is highly adaptive since the process is quite short. However, FDD still emphasizes good-quality iteration at every step. Meaningful progress and status information is shown to clients, managers, and developers [23]. Thus, this research using FDD can fulfill all needs based on asset maintenance.

III. RESULTS AND DISCUSSION

The research results are explained in this section, and a comprehensive discussion is given regarding developing an information system for asset management.

3.1. Develop an Overall Model

The first phase maps the process and connection between actors and systems, represented by UML diagrams. UML diagrams are beneficial in simplifying complex ideas and systems. It helps developers and stakeholders in a cross-team collaboration have the same big-picture views, which is good for non-technical explanation [24], [25], [26], [27], [28], [29]. Considering that the School of Engineering and Information Systems has several majors that are not fully related to IT, a UML diagram is the best way to create clear communication between stakeholders. Use case diagrams illustrate the interactions between use cases (functional requirements) and actors (users or systems) in a system. It helps stakeholders get

information about the relationships and dependencies between different use cases [30], as shown in Figure 2.

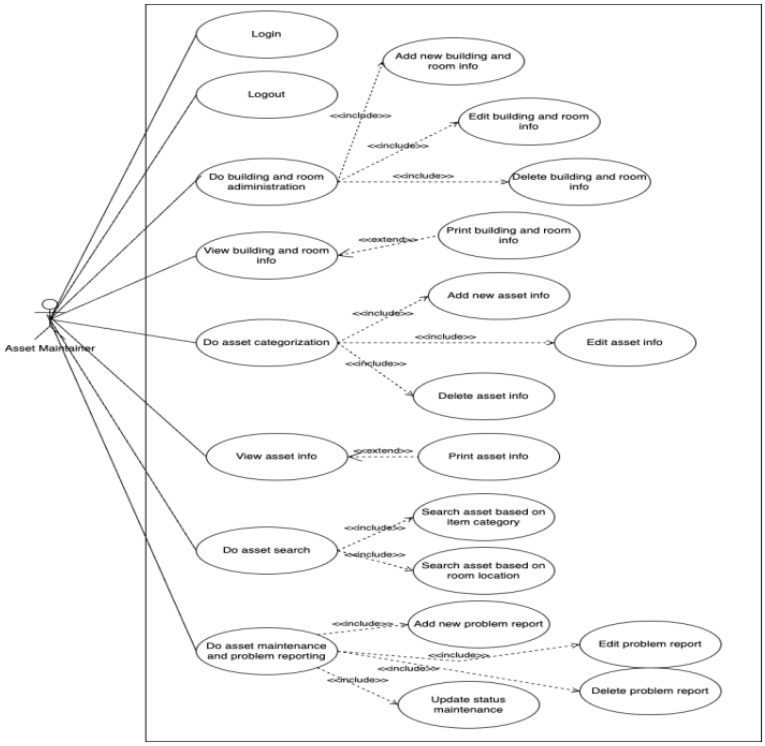


Figure 2. Use Case of Asset Management Website

For this pilot project, the use case only focuses on the role of the asset maintainer as the main user. This was done due to the nature of the project, where the minimum viable product could be reached. In future development, the project will also cover the user types of lecturers and students who mainly use the asset.

3.2 Build Feature List

The second phase starts with building a detailed and prioritized list of features, as seen in Table . The list of features is taken from the use case diagram that had been done in the previous phase. The basic modules include all CRUD.

TABLE II LIST OF FEATURES OF ASSET MANAGEMENT WEBSITE

No	Modules	Detail
1	Administration for Building and Room Data	Add, edit, and delete building and room data
2	Asset Categorization	Add, edit, and delete asset data
3	Asset Search	Search assets based on items and search asset information based on each room
4	Asset Maintenance and Problem Reporting	Add, edit, and delete maintenance information on asset

3.3 Plan by Feature

The third phase is to plan the overall development process. This activity includes all the features and their dependencies. A Gantt Chart is a timeline to visualize project management related to all project tasks, when the deadline for tasks is, and who holds the responsibility. It consists of color-coded horizontal bars [31], as shown in Table . The modules were developed

in six months since they only included minimum viable products that could be used by asset maintainers.

TABLE III GANTT CHART OF ASSET MANAGEMENT WEBSITE

Modules	Month					
	1	2	3	4	5	6
Administration for Building and Room Data						
Asset Categorization						
Asset Search						
Asset Maintenance and Problem Reporting						

3.4 Design by Feature

The fourth phase is preparing design features that are selected to be developed. The feature development is seen in Figure 3 using a sequence diagram. Sequence diagrams are interaction diagrams that visualize the interaction between each process [30]. All features run independently as long as the asset maintainer logs in to the website.

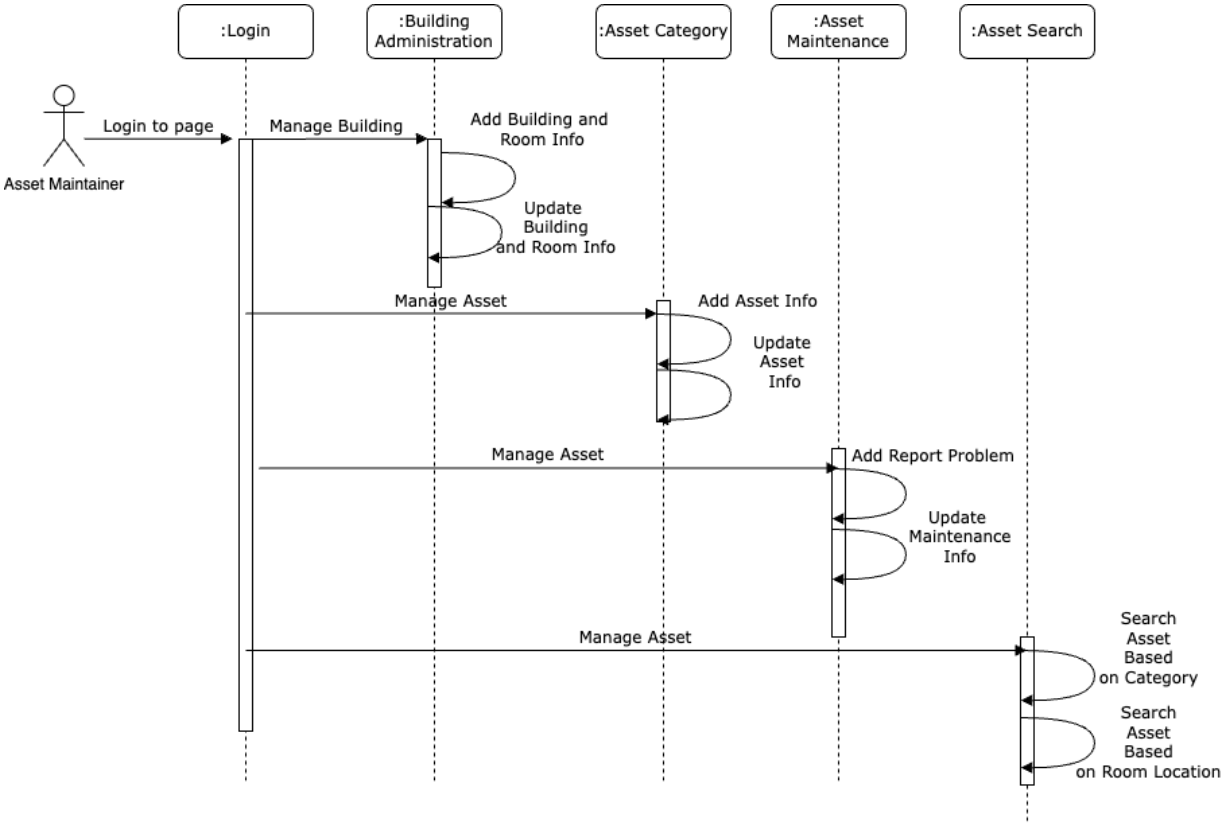


Figure 3. Sequence Diagram of Asset Management Website

3.5 Build by Feature

The last phase is where the technical action is conducted. The deployment diagram illustrates the deployment of software components in a distributed system, helping visualize software and hardware connections in various environments [30]. It is seen in Figure 4. In this development, the stack used is PHP with Laravel framework and MySQL database. The reason for using this stack is that it has many supports across platforms and is still popular

among developers. According to a survey done by StackOverflow, the PHP programming language is positioned at 11th among more than 20 languages. Meanwhile, the Laravel framework is positioned at 15th compared to more than 20 frameworks. In addition, MySQL ranks second among the others [32].

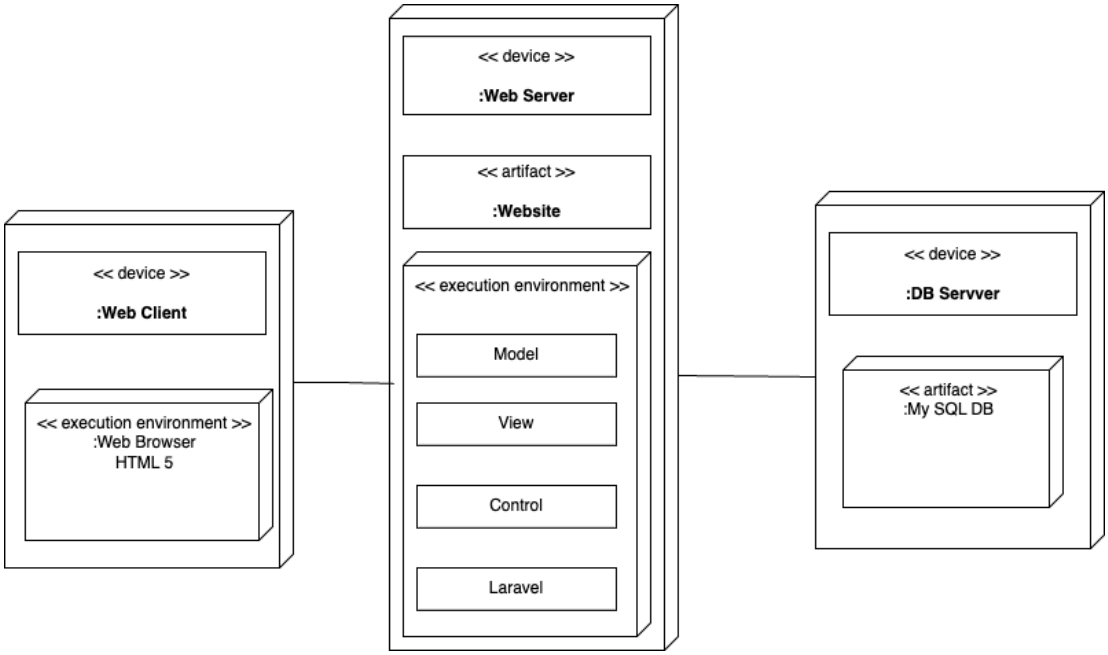


Figure 4. Deployment Diagram of Asset Management Website

3.5.1 Administration for Building and Room Data

In Figure 5, the asset maintainer can add a building and a new room. Each room is located in a specific building and has specific purposes, such as a classroom, practice room, prayer room, and so on. Asset maintainers can edit the name of the building and the name of the room and delete the room later when needed.

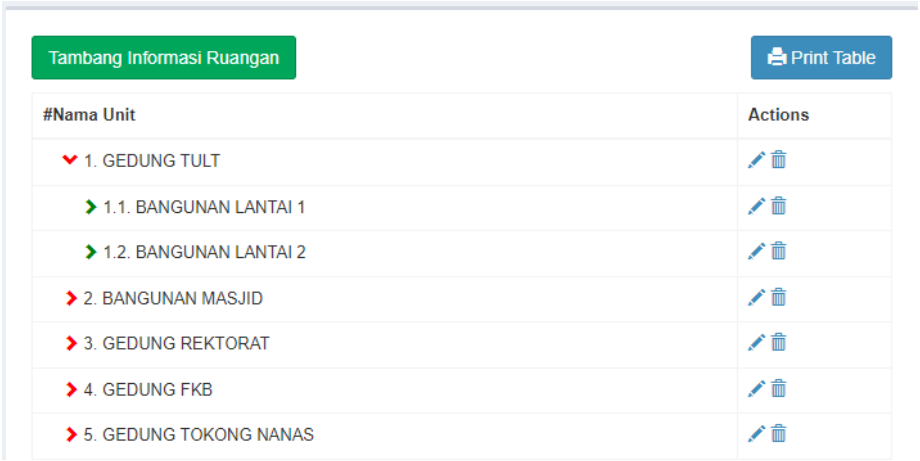


Figure 5. Dashboard for Building and Room Data

Figure 6 shows how to add a new room. Firstly, the asset maintainer needs to add the location, whether it is on the main campus, Telkom University Bandung, or other campuses. Next, the asset maintainer can add a new building and floor with a specific name. After that, the asset maintainer must provide the room's name, unit name, and number of room registrations. In

addition, Figure 7 shows that the room is added to specific buildings and floors. Therefore, the asset maintainer can see all units in each building in more detail.

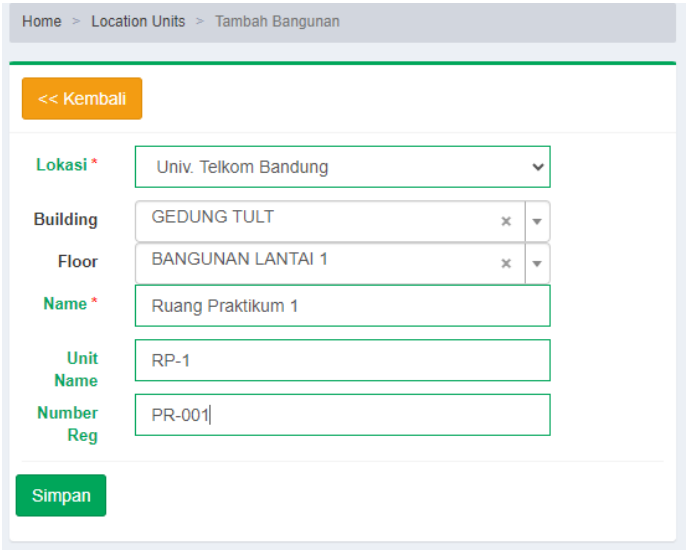


Figure 6. Add New Building and Room Information

Figure 7. View Building and Room Information

3.5.2 Asset Categorization

To create a more structured asset management, the developed system is categorized into several asset categories (asset masters). These asset categories later help to manage assets better. Asset maintainers can search and filter the asset, as shown in Figure 8.

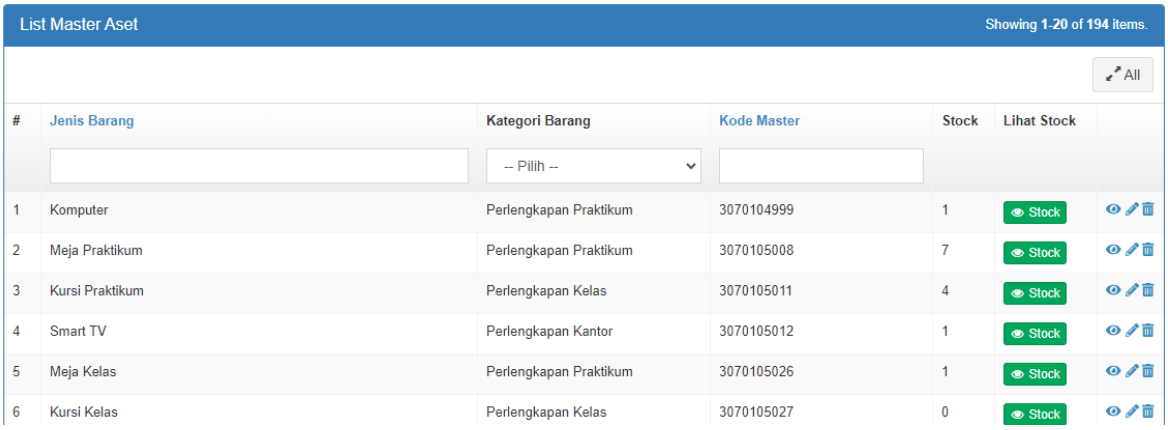


Figure 8. Dashboard for Asset Categorization Information

The asset maintainer can add these assets by selecting the option to add asset item data, as shown in the following example in Figure 9. Asset maintainer can add the asset by vendor, the date of the new asset acquired, the asset's price, and the asset's condition. In addition, the asset should also have information regarding the default placement or master location. The location includes the name of the university, location unit, and notes regarding the specification.

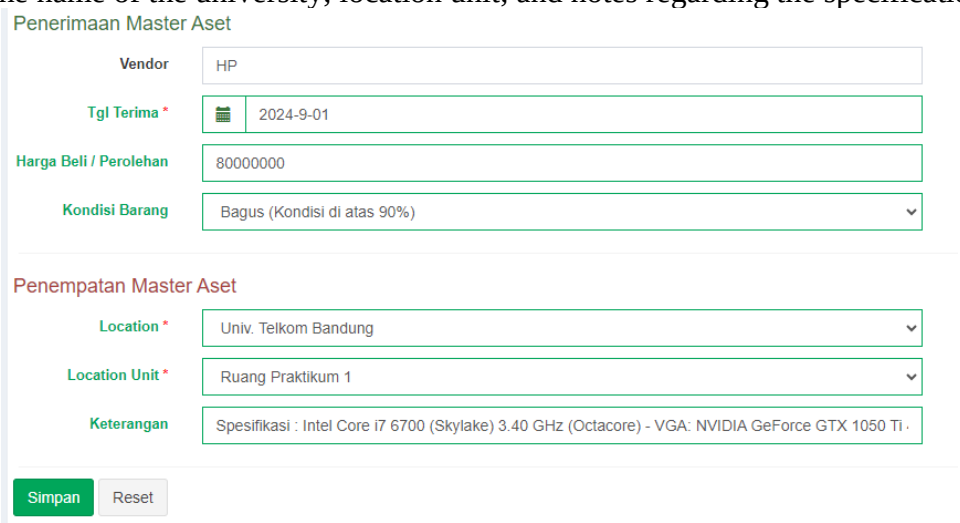


Figure 9. Add New Asset

3.5.3 Asset Search

Asset search can be done by filtering the type of items, as seen in Figure 10. After clicking the items, the location of the items can be seen. The dashboard includes the type of items, the code of items, the location, and the room name.

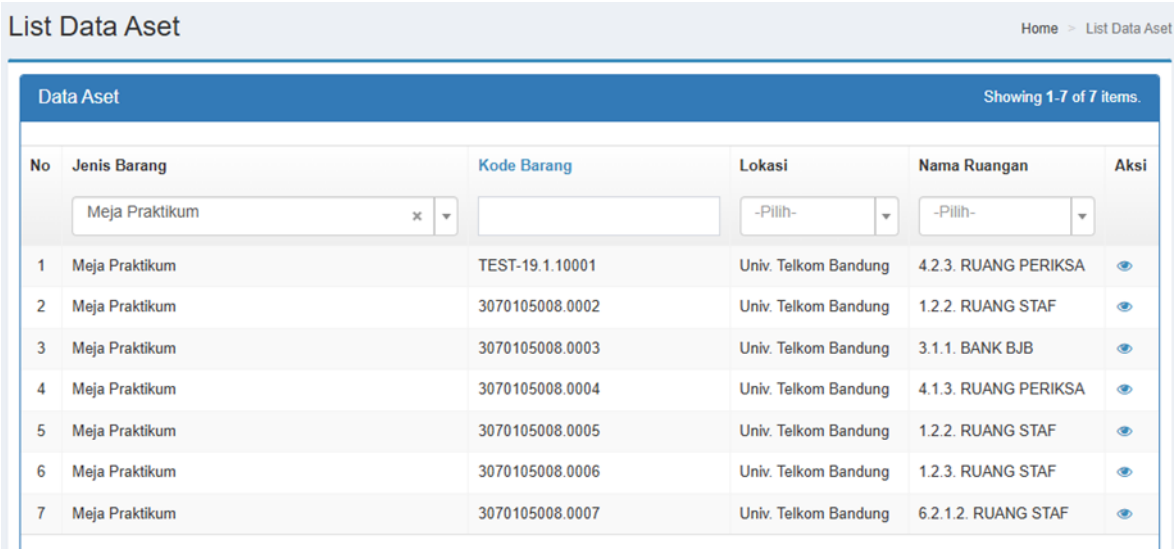


Figure 10. Dashboard for Asset Search Based on Items

In addition, searches can also be done based on the location of the asset placement. For example, if the asset is placed in a certain room, it can be known what assets are in that room in Figure 11. The dashboard includes the types of items, the code of items, the location, and the room name.

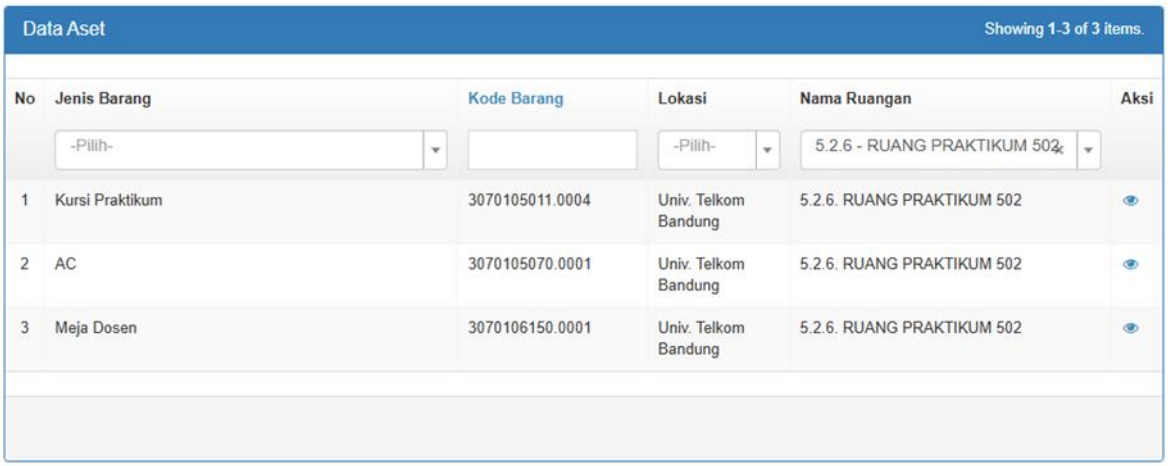


Figure 11. Dashboard for Asset Search based on Room

3.5.4 Asset Maintenance and Problem Reporting

Asset maintenance begins with creating features related to reporting asset damage, as shown in Figure 12. The progress dashboard of asset reporting is in Figure 13. Asset maintainers can add new reports, including the name of the assets, the date of reporting, the notes for damage, the photo condition of the items, and the name of the person who reports it. After submitting the report, the asset maintainer is able to see maintenance updates. In the dashboard of asset maintenance, there are the names of items, the repair date, the vendor repair, the status of maintenance, and the repair costs. For the status of maintenance, there are three options, which are ‘not yet’, ‘in progress’, and ‘done’.

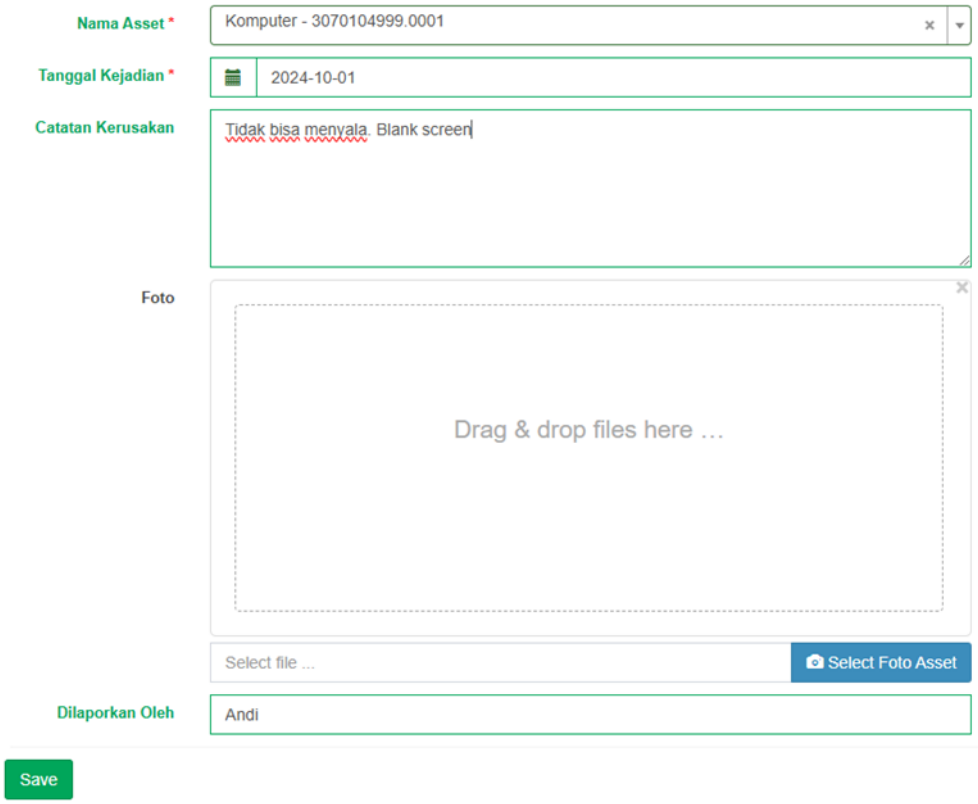
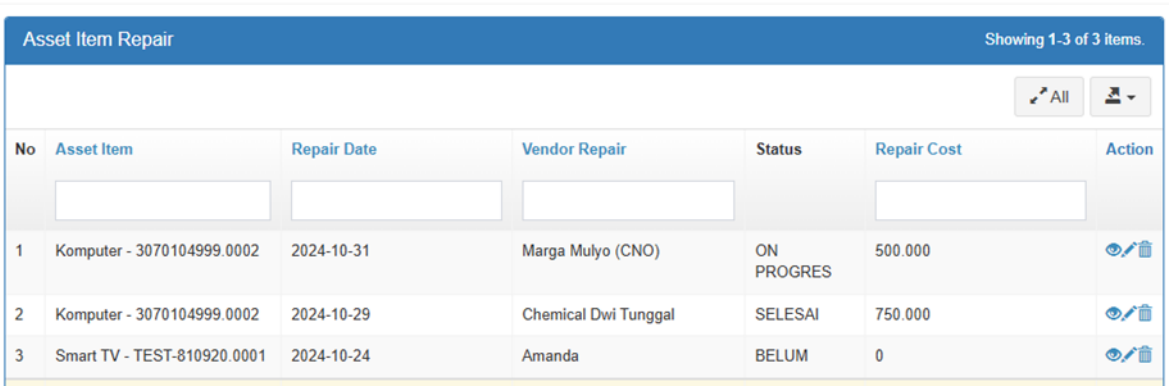


Figure 12. Add Problem Report for Maintenance Request



No	Asset Item	Repair Date	Vendor Repair	Status	Repair Cost	Action
1	Komputer - 3070104999.0002	2024-10-31	Marga Mulyo (CNO)	ON PROGRES	500.000	
2	Komputer - 3070104999.0002	2024-10-29	Chemical Dwi Tunggal	SELESAI	750.000	
3	Smart TV - TEST-810920.0001	2024-10-24	Amanda	BELUM	0	

Figure 13. Dashboard for Asset Maintenance

3.6. Testing

During each process of development, there was black box testing for each module in order to ensure that the asset maintainer could use the website easily. The black box testing is done based on the use case. Table 4 shows the results of the test. Of the 16 use cases, there are two that have not succeeded, meaning the acceptance rate is 87.5%.

Apart from testing using the black box method, the researcher also asked the asset maintainer about their experience using this website. Previously, the asset maintainer needed to fill out a form every day to recheck the asset condition in each room. The form is then scanned and uploaded to Google Drive. However, the physical form still needed to be saved in case of an audit. This is where the problems happened since there were several workers who did maintenance, and sometimes they forgot to save the physical forms, leading to problems when the asset was audited. With the usage of the website, they felt it would be better for integrity

since not all people could access it, only the workers with asset maintainer roles. Therefore, the report would be considered valid.

TABLE IV BLACK BOX TESTING RESULT

No	Use Case	Acceptance	Notes
1	Login	Succeed	
2	Logout	Succeed	
	Do Administration for Building and Room Data		
3	a. Add new building and room info	Succeed	
4	b. Edit building and room info	Succeed	
5	c. Delete building and room info	Succeed	
	View building and room info		
6	a. Print building and room info	Not succeed	Cannot print into PDF
	Do Asset Categorization		
7	a. Add new asset info	Succeed	
8	b. Edit asset info	Succeed	
9	c. Delete asset info	Succeed	
	View asset info		
10	a. Print asset info	Not succeed	Cannot print into PDF
	Do Asset Search		
11	a. Search assets based on category	Succeed	
12	b. Search assets based on room location	Succeed	
	Do Asset Maintenance and Problem Reporting		
13	a. Add new problem report	Succeed	
14	b. Edit problem report	Succeed	
15	c. Delete problem report	Succeed	
16	d. Update status maintenance	Succeed	

IV. CONCLUSION

An information system is a crucial technology, especially in an organization where many stakeholders use it. In terms of asset management, the website could increase its efficiency in listing assets while still maintaining integrity. By implementing an asset management information system, the organization can handle the data more accurately and faster, generate real-time reports, and provide accurate information. Using the FDD model is also beneficial in presenting appropriate specifications with many features, which is very helpful for creating MVP in case of doing a pilot project. After the test using a black box based on 16 use cases, there were two use cases that did not succeed, so the acceptance rate was 87.5%. However, the asset maintainer believes this is still hopeful of cutting their time in listing assets while still maintaining integrity since user access is limited. It is hoped that the developers will not feel confused during the process. In the future, management assets can use more technology, such as RFID, to help track the assets in each room in real time.

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