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A Web-Based Network Device Inventory and Dynamic QR Code Tracking System: Design, Development, and Evaluation PT. XYZ

Desi Fitriana[1], Viving Frendiana[2], Budi Utami[3]
[1,2,3] Program Study of Broadband Multimedia, Department of Electrical Engineering, Jakarta State Politechnic, Depok, Indonesia
[1]desi.fitriana.te21@mhsw.pnj.ac.id, [2]viving.frendiana@elektro.pnj.ac.id, [3]budi.utami@elektro.pnj.ac.id

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***Abstract*— PT. XYZ is an internet service provider that owns various network devices such as routers, switches, and servers. Device management is still performed manually without digital record-keeping, leading to inefficiencies, particularly in the process of requesting and checking device availability. This study aims to develop a web-based inventory information system to manage network devices systematically and efficiently. The system is developed using the Laravel framework and PHP programming language, and it is equipped with a dynamic QR Code feature that is automatically generated for each recorded device. The inventory information system website was tested through a Contract Acceptance Test involving three user roles: Admin, NOC, and CTO, with an average evaluation score of 97.5. In addition, system functionality testing of the system was conducted using the black-box testing method on 75 scenarios, all of which were successfully executed. Security testing results indicated a low security risk level. These overall testing results show that the system functions as intended and capable of meeting user needs optimally.**

Index Terms*— *Inventory Information System; Laravel; Network Devices; Web-based Application;

I. INTRODUCTION

Storage and management play an important role in supporting the smooth operation of a company. One effort that can be made is the implementation of an inventory information system, which provides information on the availability of goods. With the implementation of an inventory information system, the risk of loss and theft of goods can be minimized [1], [19].

PT XYZ is a company engaged in providing internet services and utilizes various network devices such as routers, switches, access points (AP), and servers. However, the company currently lacks a digital information system to support the management of these network devices. Device management including routers, switches, access points, and servers is still performed manually and documented physically in the warehouse without any centralized data storage. Device requests from customers are still delivered directly to the Chief Technology Officer (CTO), requiring manual and repetitive checks of device availability. This results in inefficiency, longer processing times, and a higher risk of data inconsistencies.

To address these issues, this study develops a web-based inventory information system designed to replace the previous manual process. The system supports structured, systematic, and real-time management of network devices and supporting components such as LAN cables, SFP modules, fiber optic (FO) cables, and patch cords.

To support device identification in the field, the system is equipped with a dynamic QR Code feature. Each recorded device is assigned a unique QR Code that can be scanned to display updated information such as the device name, type, and placement location [2], [17], [18], [29]. This QR Code serves as a digital label to facilitate faster and more accurate physical checking.

Previous studies show that inventory systems can improve efficiency by reducing human error, automating data retrieval, and facilitating report generation [3], [4]. Systems with access control improve data security and ensure that only authorized users can manage inventory data [5], [25].

Based on these problems, this study aims to design and develop a web-based inventory information system for network devices using the Laravel framework. The system is implemented at PT XYZ as a strategic solution to improve inventory governance and digital transformation in device management.

I. LITERATURE REVIEW

A. Inventory Information System

An inventory information system is a digital mechanism for recording, controlling, and monitoring stock items [6], [19], [21]. It increases efficiency, minimizes human error, and supports systematic stock management [18], [27]. Modern inventory systems

often include transaction recording, access management, and automated reporting [25], [26].

The inventory information system is designed to facilitate the monitoring process of stock availability efficiently. To support its function, the system can be equipped with features for recording incoming and outgoing item transactions based on date, item code, and item name. To maintain data security and order, the system can also implement user access rights controlled by the administrator [7].

B. *Network Devices*

Networking devices are hardware components used to connect, manage, and facilitate communication between computers or other devices within a computer network. These devices include various types such as routers, switches, access points (AP), and servers [8], [21], [24]. Efficient management of these devices ensures service continuity and reduces operational risks.

C. *QR Code*

QR Codes are two-dimensional barcodes that can store static or dynamic data [2], [9], [10]. Dynamic QR Codes redirect users to updated online information, making them suitable for inventory systems requiring continous data updates [17], [18], [29]. QR Codes have four error correction levels (L, M, Q, H) that allow scanning even when partially damaged.

In this system, one of the features developed is the generation of dynamic QR Codes for each inputted device data, which contains a link to the device detail page based on its ID so that it remains valid even if the device data is updated. The QR Code generation uses the Simple QrCode library with the error correction level set to H (High), enabling the QR Code to still be scanned even when damaged—such as from scratches or dirt—up to 30% [2]. This facilitates the physical identification process of devices in the field.

D. *Website*

A website is a collection of pages that contain various types of information and can be accessed via the internet by users around the world. In general, there are two types of websites: static and dynamic. A static website displays fixed information and can only be updated by a webmaster or developer, without requiring a database. Meanwhile, a dynamic website requires information updates by multiple users and needs a database to manage its content [11]. In the development of this inventory information system, a website is needed that allows users to store and manage devices effectively.

In developing this website, there are three main components required, namely frontend, CRUD, and backend. The frontend is the user interface (UI) that directly interacts with the users. The CRUD component (Create, Read, Update, Delete) functions to handle the processes of adding, reading, updating, and deleting data within the system [11]. Meanwhile, the backend is the part of the system that operates on the server side and is responsible for processing data, executing application logic, and communicating with the database.

E. *Laravel*

Laravel is a PHP-based framework that was first developed by Taylor Otwell. Laravel is built by applying the Model-View-Controller (MVC) concept, which is a programming architecture that divides the system into three main components: model, view, and controller. This concept separates the logic process, user interface, and data management (database), making application development more structured. The main purpose of using MVC is to separate the process from the user interface, allowing developers to more easily update or modify one component without affecting the others [12], [25].

F. *Contract Acceptance Test (CAT)*

Contract Acceptance Testing is conducted to evaluate whether the developed system meets user requirements and expectations [13]. This evaluation is carried out by distributing questionnaires to end users to measure their level of satisfaction with the inventory information system website. In this study, CAT focuses on two main aspects: the user interface and the system process. The system process aspect is intended to evaluate how well the website performs its functions, while the user interface aspect aims to evaluate the ease of navigation and visual comfort from the perspective of end users.

G. *Functionality Testing*

In the aspect of functionality testing, the black-box testing method is used, which is a type of testing that evaluates the functionality of the system based on input and output without considering the internal structure of the program code. The testing is carried out by preparing a number of test cases that include inputs, expected outputs, and the final results produced by the system [14], [27].

To measure the success rate of feature implementation, the Feature Completeness Matrix is used, which is a matrix that calculates the extent to which the designed features have been successfully implemented [15]. This matrix is calculated using the formula:

$$X = \frac{1}{P} \quad (1)$$

where:

I = the number of functions that have been successfully implemented

P = the total number of functions that were designed

The value of X is in the range of $0 \leq X \leq 1$. The closer the value is to 1, the higher the success rate of feature implementation in the system. The system can be considered to run well if the value of X is close to or equal to 1.

H. *Security Testing*

Security testing is a process aimed at assessing the extent to which a website is able to protect information from unauthorized access. This testing ensures that the system has the capability to prevent various threats, including potential vulnerabilities, unauthorized access, and data leaks. The testing process is conducted using supporting tools, one of which is Sucuri SiteCheck, a software used to detect system weaknesses and evaluate the overall security level of the application [16], [26], [27].

II. METHODOLOGY

This study aims to design and develop a Website-Based Inventory Information System for Network Devices at PT. XYZ. The primary objective is to assist in managing network devices more effectively through digital and systematic processes of recording, monitoring, and management.

A. *System Block Diagram*

In this study, a website-based inventory information system was developed to digitally and efficiently record and manage network devices at PT. XYZ. In building this system, the PHP programming language was used with the Laravel framework to support system development, and MySQL was used as the database to store all device information.

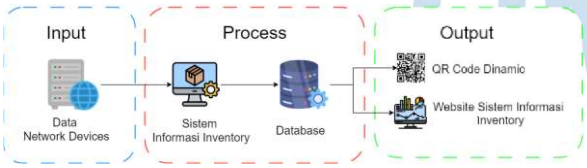

Fig. 1. System Block Diagram

Figure 1 shows the system block diagram, which illustrates the main components involved in the realization of this inventory system. The system receives input in the form of network device data, such as device name, purchase date, or warranty period. This data is then stored in the database. In the final stage, each recorded device will automatically be assigned a dynamic QR Code that redirects to the device's detail page, and all device information is displayed through the system's website interface.

B. *System Design and Development*

The development process of the network device inventory information system consists of the following stages:

- Planning: The initial stage involves conducting interviews and literature studies, as well as identifying system requirements and the functions to be developed to address the issues faced by the company in managing network devices [7]. This includes the login page, dashboard, device entry and exit records, and user management pages.
- System Design: In this stage, the user interface (UI) is designed in detail using mockups, along with the database structure design to store device or user information.
- Development: The system was developed using PHP version 8.2 and the Laravel 11 framework. All data is stored in a MySQL database. This process includes implementing secure login features, device data management, device entry and exit logging, and user management according to their access rights. In addition, a responsive and user-friendly web page display is created to make it easier for users to operate the system.

C. *Use Case Diagram*

The system workflow model, which describes the interaction between users and the system, is illustrated using a use case diagram. As shown in Figure 2, the system supports three types of user accounts: Admin, Network Operation Center (NOC), and Chief Technology Officer (CTO). Each role has different responsibilities that reflect the actual workflow in PT XYZ. The involvement of these three actors is based on the organizational structure of the company and the real-world business processes related to device management.

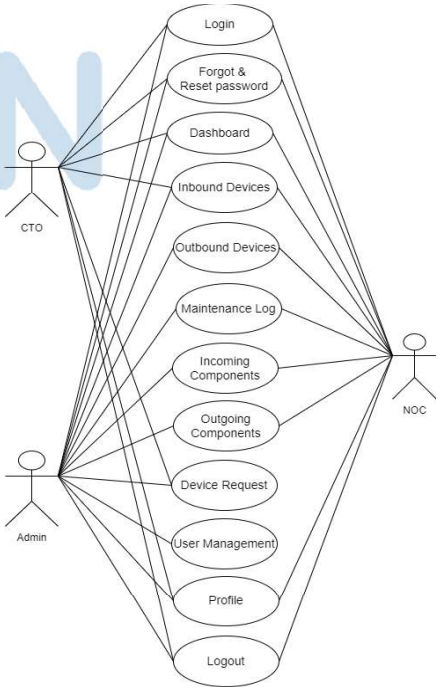

Fig. 2. Use Case Diagram

The Administrator is the primary system manager responsible for maintaining all operational data within

the inventory system. This role is assigned to the warehouse or IT support staff who handle data input, system configuration, and user account management. The NOC team is responsible for monitoring and maintaining the company's network infrastructure. They require access to device data in real time when performing installation, troubleshooting, or device replacement activities in the field. The CTO is responsible for high-level decision-making related to device procurement and ensuring the availability of critical infrastructure. In the existing workflow, device requests are communicated directly to the CTO, which often leads to manual and unrecorded decisions. The new system aims to formalize this decision-making process.

Based on Figure 2, users can log in to the inventory information system and perform the following actions:

Log in to the system and be redirected to their respective dashboards based on their user roles.
Reset the password when it's forgotten.
Manage data in Inbound Device, Outbound Device, and Maintenance Log.
Manage data in Incoming Component and Outgoing Component.
Manage device requests through the Device Request menu.
Manage users through the User Management menu.
Access and update their personal profile, including changing their password.

D. *Business Process Background & System Purpose*

Before the system was developed, PT XYZ relied on manual documentation for managing network devices. Device availability checks were conducted using paper forms or direct physical verification in the warehouse. This resulted in several issues: lack of centralized digital records, slow verification when devices were needed for deployment, no real-time monitoring of device placement, no structured approval mechanism for procurement, potential for data loss, duplication, and errors, difficulty tracking devices once deployed in the field. The system was developed to eliminate these limitations and establish a standardized, digitized, and traceable workflow.

E. *System Testing Methods*

Several types of testing were conducted to ensure that the system meets the defined standards and requirements, including:

Contract Acceptance Test: The testing was carried out in the form of questionnaires distributed to end users, namely Admin, NOC, and CTO. This test covered two main aspects: the system processes and the user interface appearance.
Functionality Testing: The testing was conducted using the black-box method based on 75 test cases covering various scenarios, including login, device management, device requests, user management, and other features.
QR Code Testing: This testing aimed to ensure that the QR Code feature functions properly. The test was conducted 6 times, both when device data was added and when it was updated.
Security Testing: The testing was conducted using the Sucuri SiteCheck tool to detect potential malware, system vulnerabilities, and to evaluate the website's security configuration [16].

III. RESULT AND DISCUSSION

A. *Website Realization*

The following is the implementation result of the web-based network device inventory information system developed using Laravel and applied at PT. XYZ. Each menu in the system has specific functions and access rights that are adjusted according to the user's role, such as Admin, NOC, and CTO.

Fig. 3. Login Page

Figure 3 displays the Login Page, where users must first log in by entering their registered username, password, and captcha code. If successful, users will be redirected to the dashboard page according to their respective roles.

Fig. 4. Forgot Password Page

Figure 4 shows the Forgot Password Page, which is used when users cannot remember their password in order to regain access to the system. On this page, users can enter their username and email, and the system will send a password reset link to the provided email. Additionally, a function called handleForgot() is implemented to handle the password reset process on the website. This function works by receiving the user's

username and email address, after which the system sends an email containing a link to reset the password.

Fig. 5. Admin Dashboard Page

Figure 5 displays the Dashboard Page for users with the Admin role. The appearance of this dashboard page is adjusted based on the user's role. This page presents a summary of information such as the number of inbound and outbound devices, device requests, and the total number of users. In addition, it displays information related to maintenance schedules and device warranty periods that are nearing their end.

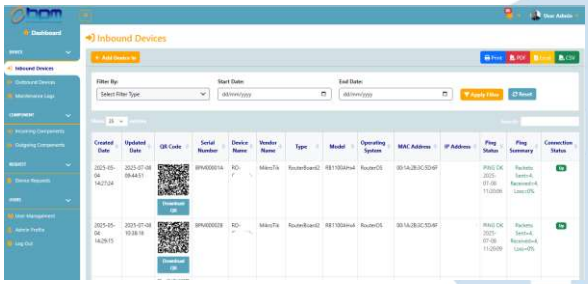

Fig. 6. Inbound Device Page

Figure 6 displays the Inbound Device Page. This page is used to record data of devices entering the system. Users can input details such as device name, serial number, device type, placement location, warranty period, purchase date, device status, and entry date. This page is also equipped with a report feature that can be downloaded in PDF format, containing detailed information about the recorded devices. Additionally, each time device data is saved (after the user inputs the data and clicks the Save button), the system automatically generates a QR Code for that device.

The entire process, including data saving, automatic QR Code generation, and PDF report download, is managed within the DeviceInController.php file. The generated QR Code is dynamic, meaning it contains a URL that directly links to the device's detail page within the system. By scanning the QR Code, users can instantly access the device information without having to search manually.

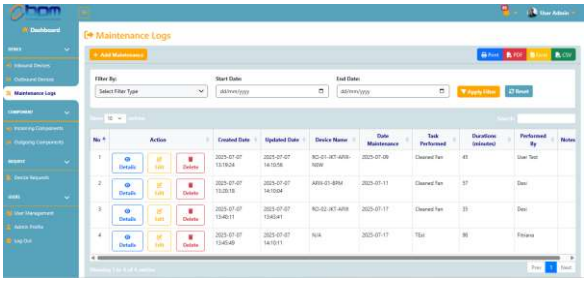

Fig. 7. Maintenance Page

Figure 7 shows the Maintenance Log Page. This page is used to record device maintenance schedules. The data entered includes device name, maintenance date, tasks performed, and the name of the technician who performed the maintenance.

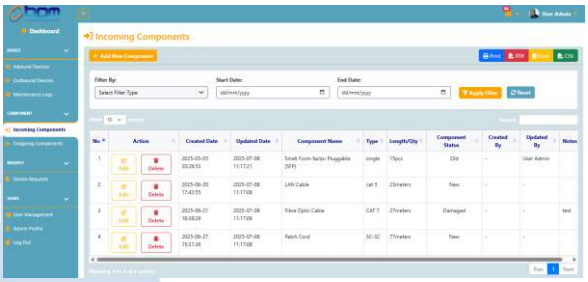

Fig. 8. Incoming Component Page

Figure 8 presents the Incoming Component Page. This page is used to record components entering the system. The recording process includes information such as component name, entry date, component quantity (in meters or pieces, depending on the type of component), and component status. On this page, there are reporting features available that can be downloaded in PDF, Print, Excel, or CSV formats, and can be customized for daily, weekly, or monthly views. The reports can also be filtered based on created date, updated date, start date, and end date.

The component units such as meters or pieces on this page will automatically decrease if the component is used on the Outgoing Component Page. As a result, the quantity displayed will adjust according to the remaining stock available.

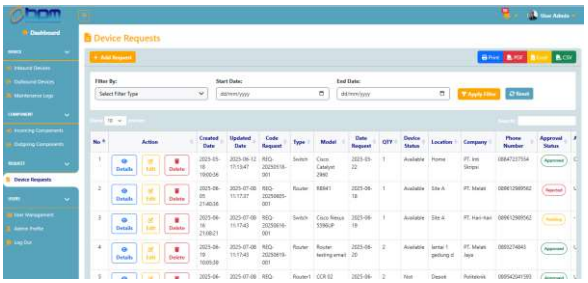

Fig. 9. Device Request Page

Figure 9 displays the Device Request Page. On this page, the admin can input device procurement requests into the system, which include information such as device type, device category, quantity, and request

date. Once the request data is entered, the information is saved in the system and automatically sent to the CTO's email for approval processing. The CTO can approve or reject the request directly through the system by selecting either Approved or Rejected. The result of the approval will then be automatically sent back to the admin's email as a notification.

Additionally, a request report is available for download in PDF format, containing detailed information about the device request and its approval status. This report serves as a formal record of the agreement between the client and the company.

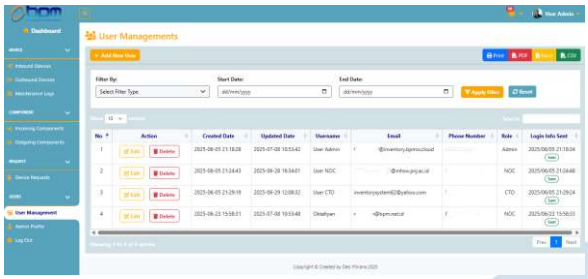

Fig. 10. User Manage Page

Figure 10 displays the User Management Page. This page is used to create user accounts, which consist of information such as name, email, phone number, access rights (role), and password for logging into the system. The account information is then sent to the user's email.

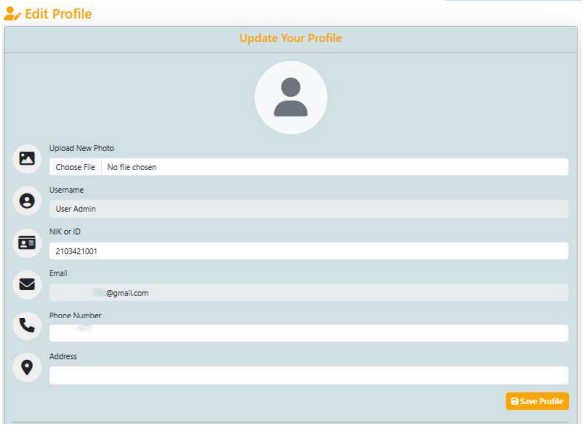

Fig. 11. Admin Profile Page

Figure 11 displays the Admin Profile Edit Page. On this page, users can update their personal information, such as phone number and address, as well as upload a profile photo.

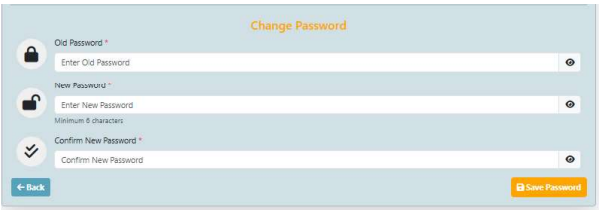

Fig. 12. Change Password Page

Figure 12 displays the Change Password Page. This page allows users to update their previously provided password. The form consists of input fields for the old password, new password, and confirm new password, ensuring security during the password update process.

To implement the password change process, the changePassword() function is used within the AdminProfileController. This function is responsible for validating the input, verifying the current password, and saving the updated password to the database. The view for the change password page is created in the resources/views/admin/profile directory with the filename edit.blade.php. Furthermore, to display and process this page, a route is defined in the routes/web.php file. This route handles the flow from the page to the controller, enabling all related functions to be properly executed when a user attempts to change their password.

B. Contract Acceptance Test

The Contract Acceptance Testing was conducted by distributing questionnaires to three user roles, namely 1 Admin, 4 NOC, and 1 CTO. The testing was conducted to evaluate two main aspects: the system user interface (UI) and the system process. Each user role was provided with a set of questions corresponding to their system access rights. Each question was evaluated based on five categories: Highly Appropriate (5), Appropriate (4), Less Appropriate (3), Not Appropriate (2), and No Response (1).

TABLE 1. RESULT OF THE CTO QUESTIONNARE

No	Question	HA	A	LA	NA	NR
	User interface					
1	Is the appearance of the inventory information system website attractive and user-friendly?	5	-	-	-	-
2	Is the login page of the inventory information system website easy to understand and as expected?	5	-	-	-	-
3	Is the dashboard page of the inventory information system website easy to understand and as expected?	5	-	-	-	-
4	Is the inbound device page of	5	-	-	-	-

No	Question	HA	A	LA	NA	NR
	the inventory information system website easy to understand and as expected?					
5	Is the device request page of the inventory information system website easy to understand and as expected?	5	-	-	-	-
6	Is the user profile page of the inventory information system website easy to understand and as expected?	5	-	-	-	-
System Process						
7	Is the login process functioning as expected?	5	-	-	-	-
8	Is the inbound device process functioning as expected?	5	-	-	-	-
9	Is the device request process functioning as expected?	5	-	-	-	-
10	Is the user profile process functioning as expected?	5	-	-	-	-
11	Does the QR Code on the inbound device page facilitate easier device identification and monitoring?	5	-	-	-	-
Total		**55**	-	-	-	-

Table 1 shows the result of questionnaire completed by one of the user roles, namely the CTO. In this test, the CTO was given 11 questions covering the user interface and system processes. The questionnaire results indicate that the CTO achieved the maximum score with a total of 55 out of 55. Meanwhile, the Admin answered 19 questions with a maximum total score of 95 and achieved a full score. The NOC answered 15 questions per person with a maximum score of 300 for the four individuals, and the average score obtained was 69.5 out of 75.

If the assessment is converted to a scale of 0–100, the Admin and CTO scores are 100 each, while the NOC obtained an average score of 92.6. With an overall average of 97.5, the system is rated as very good and has met the needs of the company' users.

C. Web Application Testing

Web Application Testing is used to test websites to identify errors before they are used and accessed by the public. In this study, software evaluation was conducted to ensure that the website was fit for use. The evaluation consisted of functionality and security.

1. Functionality Testing

Functional testing is conducted to ensure that all features operate according to the requirements. The testing covers various pages within the network device inventory information system, including login, dashboard, device inbound and outbound, device requests, user management, and user profiles. In total, 75 test scenarios were executed. Table 2 presents six sample scenarios selected from the total 75 test cases performed.

TABLE 2. RESULT OF BLACK-BOX TESTING

No	Scenario Test	Expected Result	Test Result
1	Login with a registered username and password	Redirected to the dashboard page according to the user's role	Success
2	Login with an unregistered username and password	Displayed login error message	Success
3	Add inbound device data	Data successfully added	Success
4	Edit inbound device data	Data successfully edited	Success
5	Delete inbound device data	Data successfully deleted	Success
6	Click the logout button	Logged out and redirected to the login page	Success

The result of functionality testing showed that all 75 test scenarios were successfully executed. The system's functional success rate was calculated using (1), as follows:

$$X = \frac{75}{75} = 1$$

A value of X equal to 1 indicates that all functions are running as expected, thus it can be concluded that the system is functioning properly.

Additionally, testing was conducted on the QR Code feature. This testing aimed to ensure that the QR Code could be automatically generated and scanned correctly every time device data was added or updated. The testing was conducted six times, and the results showed that the QR Code was successfully generated and directed to the corresponding device data without any errors.

2. Security Testing

System security testing was carried out using the Sucuri SiteCheck tool to detect potential vulnerabilities or weaknesses in the system and to comprehensively evaluate its security level before the system is officially launched. The testing process begins by accessing the website https://sitecheck.sucuri.net/, then entering the URL of the inventory information system (using either http or https protocol) into the available input field. After that, the user clicks the "Submit" button and waits for the analysis process to complete. The test results will display information related to the website's security status, including potential threats, malware, and insecure configurations.

Fig. 13. Result of Security Testing

Based on the security testing results shown in Figure 13, it was found that the security risk level of the inventory information system website falls under the Low Security Risk category. The analysis results indicate that the inventory information system website for network devices was not detected to contain any malware and is not included in the blacklist. The low security risk category shows that the inventory information system website has a good security system and is safe for user to access. Therefore, the system has met website security requirements with a low risk level.

D. System Deployment Status

The developed web-based network device inventory system has been deployed in a pilot environment within PT XYZ. During this pilot implementation, the system is being used by selected Admin and NOC personnel to evaluate its performance in real operational conditions. This evaluation includes validating the accuracy of device data recording, monitoring the reliability of the dynamic QR Code scanning process, and assessing the effectiveness of the digital procurement approval workflow. Full deployment will follow after the pilot phase receives final management approval.

IV. CONCLUSION

Based on the results of testing on the developed inventory information system, it can be concluded that the system was successfully designed and implemented to support the management of network devices at PT. XYZ effectively and efficiently. The system was developed using the Laravel 11 framework with PHP version 8.2, and is equipped with a dynamic QR Code feature built using the Simple QrCode library. This QR Code feature has been tested and is capable of automatically generating a code when device data is added, which can then be scanned correctly to display the appropriate device information.

The Contract Acceptance Test (CAT) was conducted by involving all user roles who directly interact with the system, namely 1 Admin, 4 NOC, and 1 CTO. The results test showed that the Admin and CTO each obtained the maximum score of 100 after being coverted to a scale of 0-100, while the NOC achieved an average score of 92.6. Thus, the overall average score from all three roles was 97.5. This result demonstrates that the system is considered highly feasible and has successfully met the users' needs within the company environment.

The Web Application Testing was focused on functionality and security aspects. Based on th result of functionality testing using the black-box testing method, 75 test scenarios were conducted, all of which produced results as expected with no functional errors found. From the security perspective, testing using the Sucuri SiteCheck tool showed that the system falls under the Low Security Risk category, with no indications of malware or blacklist blocking. Therefore, it can be concluded that the system is secure for use and accessible appropriately.

This study has several limitations. The system is optimized for internal operational workflows and has not yet been integrated with external platforms such as automated network monitoring or asset management systems. In addition, the system's role structure and workflow are tailored specifically to PT XYZ's organizational processes, and adjustments may be required when implemented in different environments.

Future research can focus on integrating the system with SNMP-based or API-driven monitoring tools to enable automatic updates of device status and condition. Furthermore, applying data analytics or machine learning models for inventory forecasting may provide added value for long-term device management optimization.

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