RESEARCH ARTICLE   `OPEN ACCESS`

How to cite: Fira Kuswandari, Rahmi Susanti, Michael Alfian Grey, and Dewi Inderiati, "Design and Implementation of a Web-Based Application for Media and Laboratory Reagents Management with QR Code Feature", Journal of Teknokes, vol. 16, no. 3, p. 178–184, September. 2023.

Design and Implementation of a Web-Based Application for Media and Laboratory Reagents Management with QR Code Feature

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ABSTRACT Planning needs, purchasing, determining the availability of practical materials, and keeping an eye on the state of the actual or real amount are the first steps in practical material management operations. This task is completed to ensure the accuracy of the bookkeeping records in order to reduce variations in inventory levels. The goal of the study is to manage media practice materials and QR Code-based laboratory reagents as efficiently as possible. In this study using the Waterfall method which is included in the SDLC (Software Development Life Cycle) model. The laboratory equipment inventory application is made using a sublime text editor and uses PHP, HTML, CSS programming languages and bootstrap frameworks to make the application look more attractive. The system's use demonstrates the efficiency and precision with which data on laboratory equipment is recorded in order for the leadership to make decisions regarding the proper quantity of teaching and learning aids to be purchased. The unique feature of this system is the direct smartphone connection of the notification, which makes it simpler for users to keep track of inventory flow. The inventory service notification system through WhatsApp is expected to contribute to improving the quality of academic services and meeting the needs of its users. From the results of this study states that the application design used can be a solution in overcoming previous problems so as to achieve effective and efficient data collection activities.

INDEX TERMS aplication, media reagent, notification, stok opname, QR Code.

I. INTRODUCTION

The administration of a laboratory has a significant impact on its continuation. The laboratory has a role as a place for students to train skills and expertise through various activities such as experiments and other scientific activities. Practicum has become an important component in learning[1]. An information system in an organization is a system that meets the needs of daily transaction processing that supports the organization's managerial operating functions with the strategic activities of an organization to be able to provide certain external parties with the necessary reports[2]. To assess the quantity of inventory that can be reached, a set of techniques are used in practical material inventory management[3]. Consumables that are procured in large quantities at the lab of the Department of Medical Laboratory Technology include consumables like medium

and reagents. The need for laboratory equipment and materials can be determined through procurement planning with a priority scale [4]. Since this management depends on the availability of useful materials, it's important to keep an eye on how real or actual amounts are doing in order to maintain the accuracy of the records in the accounting and reduce variations in inventory levels. If done well, it may be directly known how much inventory there is, how well it is stored, distributed, and used. The amount of inventory is large (overstock), it results in the emergence of unused funds, and later there is a large risk of damage to consumables. In planning the application of tools, it must be based on needs, not referring to those available in catalogs or brochures offering goods [5]. Physical inventory counting activities are very important in supporting the optimization of practicum material management so that it can monitor and

Jurnal Teknokes

International: Rapid Review: Open Access Journal   **Vol. 16, No. 3, Sept. 2023, pp. 178-184   e-ISSN 2407-8964; p-ISSN 1907-7904**

know the assets owned. This process is a series of stock opname activities that are often found in laboratory warehouses [6]. Stock opname activities are carried out regularly, either monthly, quarterly, one semester, or annually [7]. Stock opname of practical materials is carried out to match the amount of consumables in the warehouse (physical) with the amount of consumables recorded in the database or system. Consumables that are useful an inventory calculation information system that streamlines the process of stock opname operations is one way that stock opaname activities may be conducted successfully and efficiently [8]. Traditional techniques, such the process of calculating incoming and departing commodities as well as actual inventory items, still employ handwriting in the stock opname and are inserted again using the Microsoft Excel program to make frequent reporting. Due to the fact that many items of merchandise are not cleanly organized by code, the manual inventory and sales system of products causes problems with data processing and data search [9]. In the meanwhile, management uses information systems to make choices based on the data, therefore minimizing calculation mistakes that result from manual recording, as has been seen [10]. Utilizing computers or other mobile devices, such as smartphones, tablets, and other such devices, will help handle practical materials in the material warehouse and laboratory more quickly and accurately [11]. In some articles about designing web-based stock-taking programs can create efficiency and effectiveness in the system of calculating and recording stock goods [12]. The laboratory material inventory management information system can be applied online, making it easier for warehouse officers to monitor the availability of goods in the inventory warehouse and in the laboratory, and practical material inventory management in the laboratory can be done digitally [6]. The use of computers as data processors is the best tool for now, because it can increase the speed of work so as to produce output in the form of accurate information as well as energy and time efficiency in processing data[13]. The most important factor in managing inventory is monitoring inventory and the condition of goods because this is used to support operational activities will always be in good condition[14]. An application with a website-based QR-code scanner feature that can help the process of collecting the amount of inventory in the finished goods warehouse owned by the Department of Medical Laboratory Technology, Poltekkes, Ministry of Health, Jakarta 3. Moreover features contained in WhatsApp, such as text messages, can provide information related to the status of the condition of consumables, the location of goods, the number of goods, to users quickly and directly. This research resulted in a system that provides procurement services for consumables and reagents for practicum, research, lending and user management activities. So the author raised a study entitled "Design and Implementation of Web-Based Applications for Media and Laboratory Reagent Management with QR Code Feature".

II. MATERIALS & METHOD

This research is included in descriptive research with a quantitative approach. This research will present an overview of the use of QR codes in the inventory information system for lab material management in the Department of Medical Laboratory Technology. The location of this research was carried out at the Poltekkes Kemenkes Jakarta 3 Department of Medical Laboratory Technology by collecting data through recapitulation of inventory data (stock opname) of the lab material warehouse, Department of Medical Laboratory Technology. The stages of activities that must be carried out in conducting research using the waterfall method includes requirements analysis, system design, implementation, testing, system deployment, and system implementation.

The research was conducted with coordination in the form of socialization/notification to all employees and all students of the Medical Laboratory Technology department to conduct inventory records. The implementation of an online laboratory material inventory management system can make it easier for warehouse officers to monitor the availability of goods in the inventory warehouse and in the laboratory, and practical material inventory management in the laboratory can be done digitally[15]. The results of the research were collected and data were drawn from the main data (computers that have been integrated) and then made a recapitulation table of stock opname of consumables (media reagents) to be used as accreditation data or as a further assessment. The research data is presented in the form of diagrams and tables and then explained in narrative form. Data collection is carried out using the barcode method for data recording which is then integrated into a computer that can be used as master data so that it can be processed for recapitulation of stock opname of consumables (reagent media) or as a reference for the plan for consumables needs each semester.

Data collection was carried out in the following way:
1. Collecting research materials (laboratory consumables data)
2. Make a procedure for naming consumables
3. Making equipment inventory according to procedure no.2
4. Creating a QR Code application
5. Conduct a questionnaire
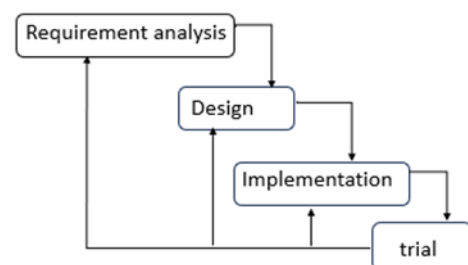6. Make an analysis of the research report

FIGURE 1 **The Waterfall method has very structured steps in developing a system, the stages carried out are: requirement analysis, design, implementation and trial**

The development of a structured system with the Waterfall method has stages carried out, namely:

1. System Analysis

The stages carried out are in the form of collecting information on software needs (software). This method of collecting information can be obtained by means of surveys, interviews, and observations. The data obtained is then analyzed to become complete information about the specifications of the software needs to be designed.

2. System Design

At this stage in the form of a system design design to provide a general overview of the steps that must be done.

3. System Implementation

This stage is in the form of making applications with programming languages, databases used based on the Analysis and Design stages carried out previously

The waterfall method provides a sequential or customized approach to software lifeflow starting from analysis, design, coding, testing, and the support or maintenance stages[16].

III. RESULT

From the results of the analysis of laboratory management needs for the information system for the procurement of media and reagency practise materials that are running, it can be concluded:

1. The process of recording reagentia media consumables as incoming and outgoing goods is done manually.

2. The system for recording consumables data from the results of stock-taking is manually recapitulated in a notebook which is then input into the microsoft excel stock-taking file.

3. There is no data that can be organized properly, resulting in the risk of loss and damage to data.

From the problems of the ongoing management system, a special application prototype design for stock opname is carried out which aims to:

1. Designing a database for data collection of reagent media consumables and stock-taking data to be stored properly and more effectively.

2. Making stock-taking reports more effective and efficient

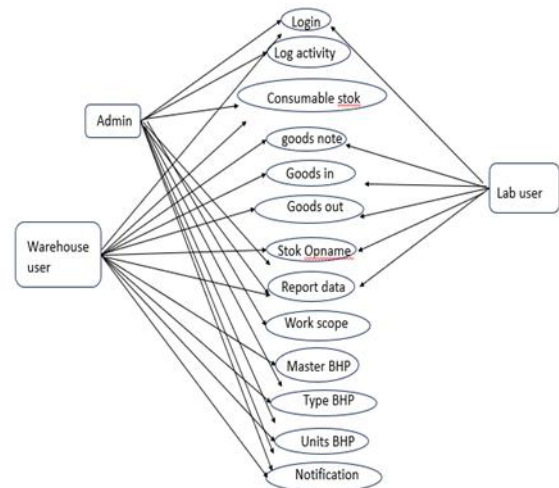3. The database can be stored and managed by authorized staff properly

FIGURE 2 **application prototype design**

Based on Figure 1 shows the concept flow of this application prototype using 3 users in the laboratory material inventory information system at the Department of Medical Laboratory Technology, namely admin users, warehouse users and lab users. Those who act as admin users are PLPs, those who become warehouse users are warehouse officers and laboratory officers who are given responsibility as lab users. What distinguishes the three actors is the authority in the system. After logging in using the user and password of each level, it will play a role according to the user level agreed at the time of system requirements analysis.

1. Codeigniter

Codeigniter is open source and has a full range of features that have been packaged into one so that it is currently widely used by web developers[17]

Login Screen

FIGURE 3 **Login screen**

This page shows the security page before entering the main menu page. Here the user must fill in the user name and password correctly to be able to enter the menu page. Figure 2. on the login layer display there is a field to fill in the username and password besides that there is a login button to enter the main menu.
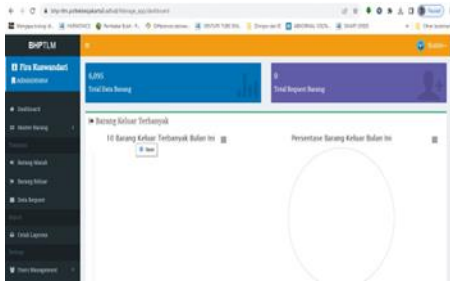
Main Menu Screen

FIGURE 4 Main menu screen

Figure 4. Is a view of the main menu of the dashboard. There is a master item menu that contains units, categories, data and stock items. transaction menu, namely incoming goods, outgoing goods and request data. For the report menu there is a print report. For the settings menu, which contains user management**.**
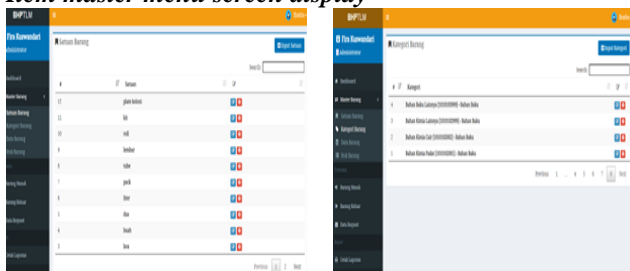
Item master menu screen display

FIGURE 5 Main menu screen
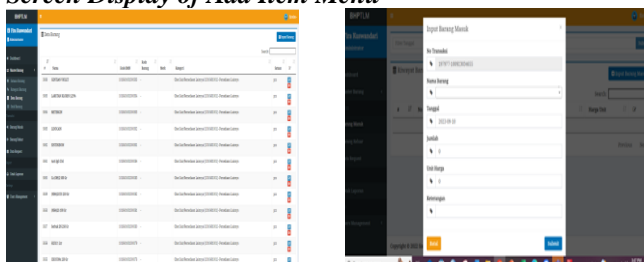
Screen Display of Add Item Menu

FIGURE 6 Main menu screen

On this page, the admin can process the report on the results of stock-taking corrections made on the admin page. Figure 6. Is a display of the add menu item, where there is a field for add photos of goods and there are fields that are needed to add item data to the database. This screen also has a save button to save data and cancel button. Scanning using a QR code in the inventory data collection process aims to identify

goods. The use of QR codes can make the process faster and more efficient, and also minimize the possibility of goods recording errors [18].

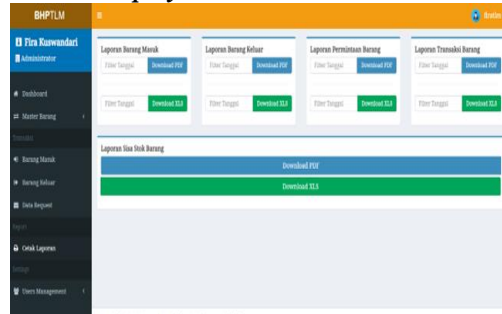### *Report Screen Display*

FIGURE 7   report screen display

Figure 7. Is a screen display of the report incoming goods, outgoing goods, requests for goods and goods transactions in the laboratory warehouse of the Department of medical laboratory technology. In the goods request data report, a notification will appear that is connected to the whats app application which can only be connected to admin users and warehouse officers. The use of an app based website information system is an effective and efficient solution in managing goods data so as to minimize data loss. The data will be stored and recorded centrallyin data base so as to make stock opname reports easier [19]. Its implementation begins with the preparation of each user's account and access rights, as different rules are established between warehouse officers, PLP and leaders. In the stock-taking process, warehouse officers can only scan stock at one time without any changes and are directly sent to the data center, PLP can scan stock and can change the amount of stock before the data is sent to the data center and leaders do not have access restrictions or can manage stock and update stock regularly. The stock-opname report can be seen directly by all users after scanning the stock of goods, so that it can provide accurate and fast data and can tell the difference contained in the database and actual goods in the warehouse.

2. Use Interface system

Implementation is carried out from the results of user interface design that has been done at the design stage.

Validation test

Validation Testing is a test that is one of the black box tests. With black box testing, it is trying to find weaknesses in system weaknesses such as feature incompatibilities, display errors, database errors, and other errors so that there are no gaps in the system after the system is run. The purpose of validation testing is to determine the validity of the function of a software needed by the user [20]

Table 1. Validation test results

Test code	Function	Result test

VT 01	Add tool data	Valid
VT 02	Change tool data	Valid
VT 03	Clear tool data	Valid
VT 04	Output login device data	Valid
VT 05	Tool state status	Valid
VT 06	Confirm tool status	Valid

The use of this notification system is used to send notifications to the user's WhatsApp number and make the process of disseminating consumables inventory service information more qualified

Table 2. Test send massage to individual

Test procedure	Expected results	Test results	Conclusion
Search for consumables using a search bar	The consumables data searched is displayed in the table	The data of the consumables searched is displayed in the table	[√] sucsess [ ] failed
Fill in the message input and press the send button on the table	Message sent to WhatsApp user number	Message sent to user's WhatsApp number	[√] sucsess [ ] failed
Press the send button without inputting a message	-Message not delivered -An error message appears	-Message not delivered -An error message appears	[√] sucsess [ ] failed
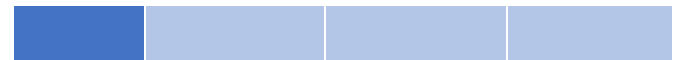
3. Evaluation of laboratory management information system against stock opname applications made

Evaluation of laboratory management is considered effective if there is an evaluation of laboratory work program implementation activities supported by follow-up of the evaluation that has been carried out. Supervision of work programs is carried out to prevent deviations from the established work program and ensure the achievement of program relevance and effectiveness[4]. The information system benefit parameter is intended to evaluate to three users whether the information system built has a benefit value compared to before the information system existed. Usability parameters are intended to assess the usefulness of information systems. Evaluation is carried out by giving questionnaires to end users[21]
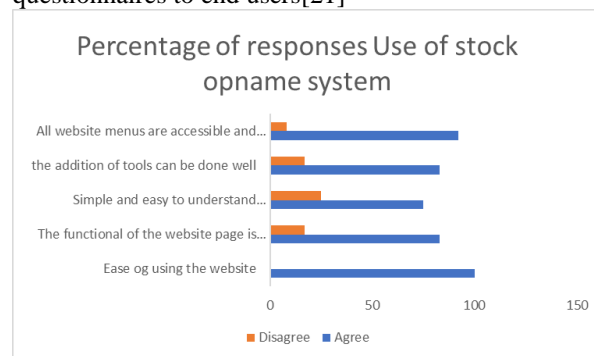

Figure.8 Percentage of responses use of stock opaname system

This website-based Inventory Application that uses PHP and MySQL programming languages has been created, so the application is very helpful in terms of recording stock of goods, searching for goods data and making it easier to make reports on incoming goods and outgoing goods.

IV. DISCUSSION

This research took a case study in the laboratory of the Department of Medical Laboratory Technology Poltekkes Kemenkes Jakarta III, because in that laboratory there is no media that can process web-based laboratory data. The use of laboratory management administration with Microsoft Office Excel is still considered unsupportive because the application cannot store data and information centrally in a database[22]. Therefore, by conducting research on web-based laboratory information system applications in the laboratory. The implementation of this laboratory equipment management information system can run through a localhost environment with a web server that supports PHP. Localhost makes our computer a local server to be used as a place to build temporary websites and then hosted online on the internet. The web server used in this study is an XAMPP application in which Apache web server, PHP, and MySQL

have been integrated. The web browser used is Mozilla Firefox 61.0.2. This laboratory equipment management information system uses the MySQL database management system, a database management system that is easy to use with PHP. The use of databases is an optional component in making web applications because it depends on the needs of the web to be created[23]. From the results of the context diagram mapping, six tables were obtained, namely the tool table, materials table, loan table, employee table, unit table, and user table. This can be used as a form of improvement to laboratory data processing and make it easier for laboratory staff to handle inventory of tools and materials, use, check, return, report making and other documentation. Expert validation is asking for feedback and suggestions in this test carried out by two information system experts. Two experts, hereinafter referred to as validators whose job is to assess the loan information system that has been made, show good results and are feasible to be implemented in the computer engineering laboratory. And some respondents who have responded to the inventory information system of tools and materials that have been made and show good results and are worthy of implementation. This test is carried out using the ISO 25010 standard as a test reference. There are several tests carried out, namely, testing functionality, performance efficiency, portability, and usability. The results of the software quality test in terms of functionality obtained a feasibility percentage of 100%, meaning that the information system for borrowing tools and materials is acceptable in terms of its function. Website-based applications can produce neat computerised records and authors can improve features such as alerts or alerts when goods have reached the minimum stock and features to print reports of incoming and outgoing goods[24]. The Waterfall method is a system development method that the author chose to build a laboratory inventasis system (simaslab). This model provides an ordered approach[21]. All of these services will use application programs, so the processing time will be faster with minimal error rates. Application programs in laboratory management can speed up service processing with minimal error rates [19]. Information systems are proven to make service activities in the laboratory run more effectively and efficiently[25]. Likewise, statements from other studies that information systems created using PHP programming language and MYSQL databases, focus more on laboratory equipment inventory, borrowing and returning laboratory goods and descriptions of items contained in the laboratory of SMP Negeri 1 Manggar[25]. The use of databases makes it easier for users to search for existing inventory data, so that inventory data will not be lost and stored properly[26]. The use of current inventory applications in laboratory management has several benefits, using web-based inventory applications:

1. Avoid Shortage of Goods (Out Of Stock)
2. Improving Service

3. Controlling Inventory and Decision MakingFurthermore, the development of this application is very possible to use the Android platform to support the industrial revolution 4.0. This application is expected to replace the previous application and simplify the process so that stock-opname activities in related laboratory warehouses can be completed in the expected time.

V. CONCLUSION

The conclusion of the description and discussion of "Design and Implementation of Web-Based Applications for Media and Laboratory Reagent Management with QR Code Feature" is it can run well. The inventory service notification system through WhatsApp is expected to contribute to improving the quality of academic services and meeting the needs of its users. From the results of this study states that the application design used can be a solution in overcoming previous problems so as to achieve effective and efficient data collection activities. The management can monitor the inventory of goods in warehouses and laboratories so that they can decide when to procure practicum materials appropriately.

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