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Web-based Application Forecasting of Components and Tools for Practicum in Telecommunication Engineering Laboratory/Workshop of State Polytechnic of Sriwijaya

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Abstract – **State Polytechnic of Sriwijaya is an Indonesian vocational institution that incorporates practical learning into all of its existing study programs. In each laboratory of the study program, students will find the supporting components and resources they need for practicum. Telecommunication engineering is one of them. Currently, the component retrieval and tool borrowing system is still manual, both in the retrieval and return stages, by filling out the given hard-file form sheet. Therefore, a web-based inventory monitoring application is required for laboratory technicians. The creation of this application implements the Prototype Method. The implementation of this method aims to make the application that is created to fit the needs of the user. This system helps laboratory technicians and Telecommunication Engineering students in the process of component retrieval and tool borrowing to be more organized and scheduled and can store reports in the form of soft-files. This information system can also be used by students to monitor the number of components and tools available in real-time. This application are also equipped with forecasting the number of practicum components to kwowing the needs of student practicum in the next year. Forecasting was created using the Weighted Moving Average method. Black box testing is carried out in each menu on the application and gives valid results so that the application can be used.**

Keywords: Web, Prototype Method, Weighted Moving Average, Laboratory

I. INTRODUCTION

In Indonesia, technology and information will continue to develop at a rapid pace. These advances have an influence on many aspects of life, including health, economy, society, and, of course, education. [1]. Based on previous research [2], a computer laboratory management application has been created that helps in data processing so that it can produce easier and more accurate information. Other research [3] also utilizes usability-based web applications to assist in providing and collecting information and data.

Technology and information development are also projected to continue, with a focus on the State Polytechnic of Sriwijaya. State Polytechnic of Sriwijaya is a vocational university that incorporates practical learning into all existing study programs. State Polytechnic of Sriwijaya offers students with the necessary supporting components and instruments in each laboratory of the study program. Some of the required components become facilities that students may use without needing to purchase them. Similarly, current learning resources are transformed into an inventory of laboratories that students may access through a loan system.

Currently, the system of component retrieval and tool borrowing is still done manually. Students still have to bring a manual and fill in the data on the loan form provided. The accountability report sheet is collected in each semester of lectures and causes the stacking of hard-file data. Therefore, a web-based application was created with the aim of being able to help technicians and students in the laboratory of the Telecommunication Engineering Study Program in the process of taking components and borrowing tools/instruments in the laboratory to be more organized and scheduled. This system is expected to be a strategy to optimize the target of the study program, which is to have 90% of the main laboratories and adequate support. The resulting web-based application has the advantage of adding a report data storage system in PDF form. Looking at previous research [4]-[5], the system prioritizes effectiveness and speed of easy-to-reach access. This research applied prototype method which was a method to automate the definition and analysis phase so that it was more specific [6]. Suggestions from users are needed in system development for produce applications to fit the needs.

Each semester of lectures also requires preparation of the number of components that will meet the needs of students in next year according to the needs of each job practicum. Then it takes forecasting to be able to estimate the number of needs of components practicum in the future [7]. Forecasting will involve retrieving historical data and projected for future purposes by applying mathematical models [8]. The mathematical calculation referred to in the discussion here was the use of the Weighted Moving Average method. In this application,

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forecasting menu is made using history data of the needs of component and number of students.

II. METHODOLOGY

A. Research Framework

The research framework described the stages to facilitate the implementation of research in order to achieve the desired results. This research framework is created in the form of diagram blocks that state sequential relationships and have their own work unity (see Figure 1):

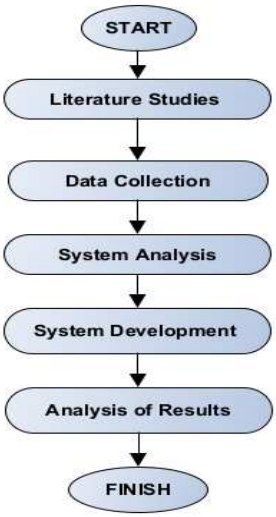


Figure 1. Research Framework

Literature Studies

At this stage, a search for theory reviews obtained from various journals, books and internet sources was conducted to complete the vocabulary of concepts and theories of the title objects studied [5].

Data Collection

At this stage, the data collection process was carried out by two methods, namely interviews and field studies (observations) with students, lecturers, laboratory technicians and administrative officers of the Bachelor of Applied Telecommunications Engineering Program [4]. The data that will be displayed in the application is the detail data of the courses in accordance with the existing learning modules.

System Analysis

At this stage, identification of problems in the current system was carried out. The problems found are found in the system of component retrieval and borrowing of tools/instruments that were still applied to conventional systems.

System Development

Used the prototype method in application manufacture and the weighted moving average method as a forecasting development method. The software needs used were XAMPP, Visual Studio Code, CodeIgniter, Startboostrap, FPDF, and a web browser. Programming languages used were PHP, CSS, and MySQL [9]-[11].

Analysis of Results

Analysis of the results was done by conducting tests first using the Black Box Testing method.

B. Application Development Methods

The Software Development Method (Application) used was the prototype method. The stages of the prototype method are as follows:

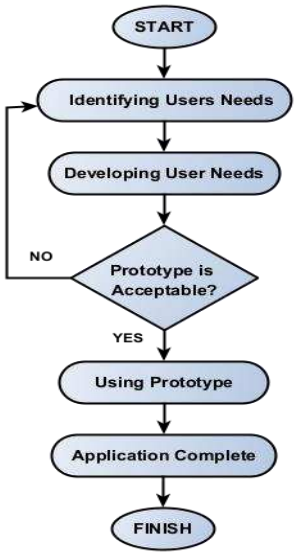


Figure 2. Prototype Method

At the stage of identifying users needs, it conducted interviews with the Laboratory Telecommunication Engineering at State Polytechnic of Sriwijaya, namely Technicians and Students. This stage was done to better know about the obstacles in the laboratory, then got an idea to create the system needed [12]-[13]. Furthermore, building prototypes by creating temporary designs that focus on presentation was to create inputs and outputs according to the needs of the user. Then determine whether the prototype was acceptable or not. This evaluation stage was done to find out if the system was in accordance with the desired for the determination of the next step was coding the system, otherwise there would be revisions to the system that had been built [6]. The last stage of using prototypes to be used as a system until the system was ready for use in the form of applications. Testing of the system was also carried out using black box testing. Blackbox Testing is a method to check the output value based on each input value in a software [14].

C. Forecasting Development Methods

The forecasting stage started with inputting data. The required data in the form of component names and the

required number adjusts to the practicum job in each practicum course and inputs student data. Furthermore, the data would be processed using the weighted moving average method. The formula of the weighted moving average method is as follows:

$$F_t = \frac{C_1 X_{t-1} + C_2 X_{t-2} + \ldots + C_n X_{t-n}}{C_1 + C_2 + \ldots + C_n} \quad (1)$$

It is known that Ft is the forecast period to t, C is the weight used, and X_t is the actual data in period t, and n is the number of periods for future forecasting [15].

III. Results and Discussion

A. Identify the User Needs

The results of user needs identification can be seen in the following diagram use case:

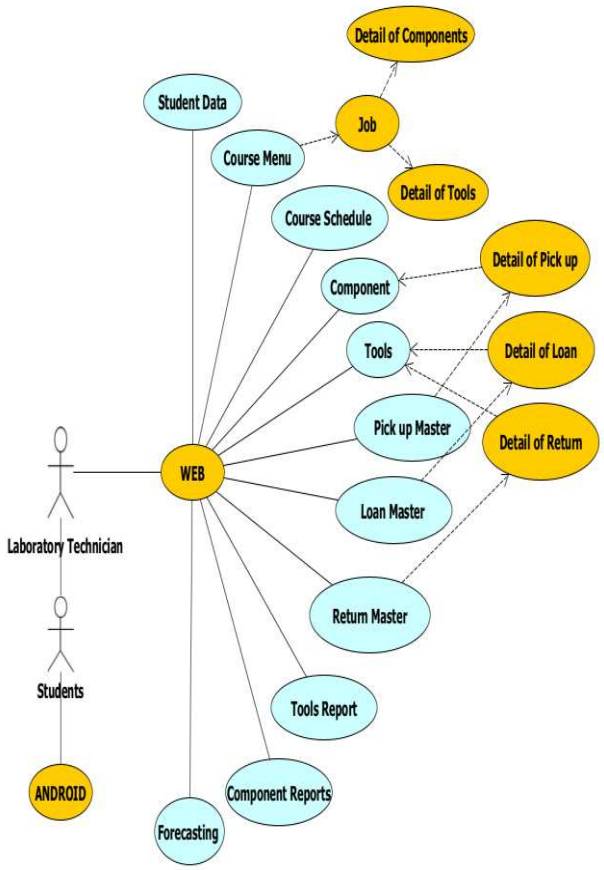


Figure 3. *Use Case Diagram*

B. Development of the User Needs

The development of user needs was based on identifying user needs. The following activity diagram draws the results of developing user needs:

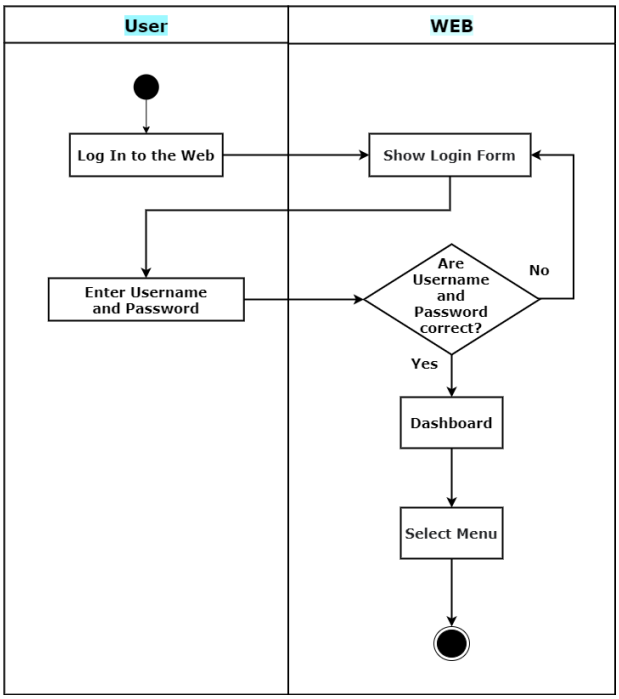


Figure 4. *Activity Diagram Log In*

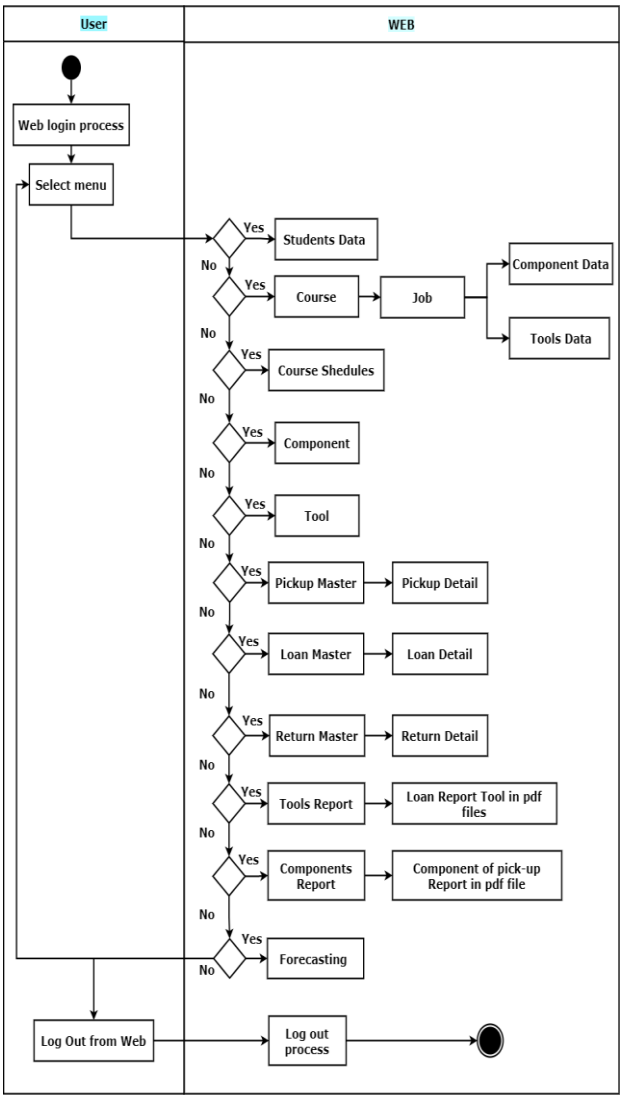


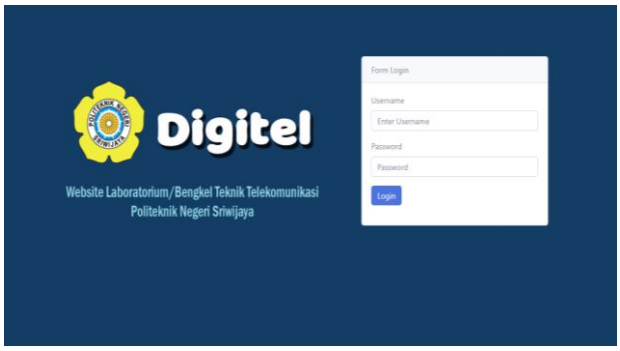
Figure 5. *Activity Diagram Menu*

C. User View Results

After implementation, the programming language produced Web-based applications. Admins can customize their data by inputting, editing, or deleting data, along with how it looks on the web. Here can be seen the user view image:

Login dan Logout

In order to access this application, users, namely laboratory/workshops technicians, are required to fill in the username and password on the login form available. In contrast, to maintain data security, the logout menu is also provided.



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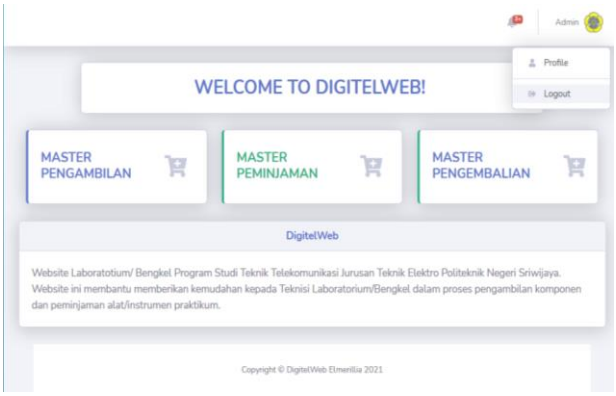


(b)

Gambar 6. (a) Login menu and (b)Logout

Dashboard Menu

After logging in, the web will immediately display the dashboard.

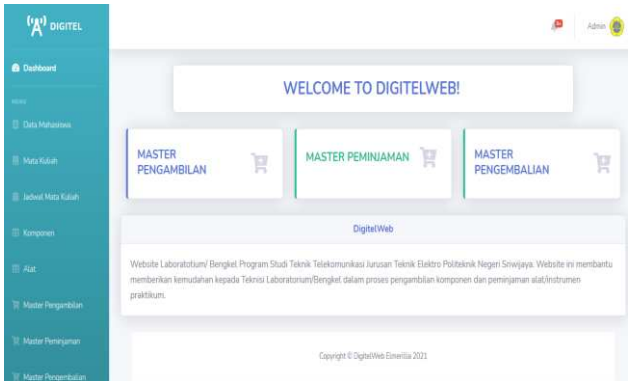


Figure 7. Dashboard Menu

Student Data Menu

This menu displays data information of active students of Telecommunication Engineering Study Program at State Polytechnic of Sriwijaya.

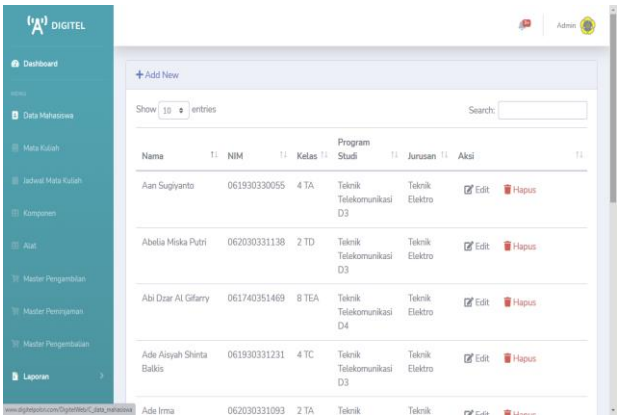
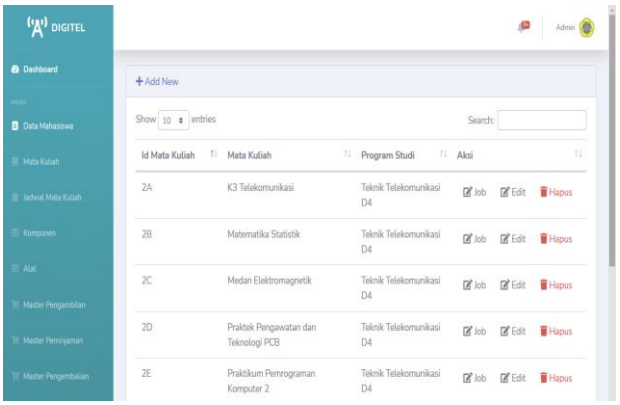


Figure 8. Student Data Menu

Course Menu

In the course menu there are 3 information that can be accessed, namely course data, practical course job data, and detailed data of components and tools of each practicum job.



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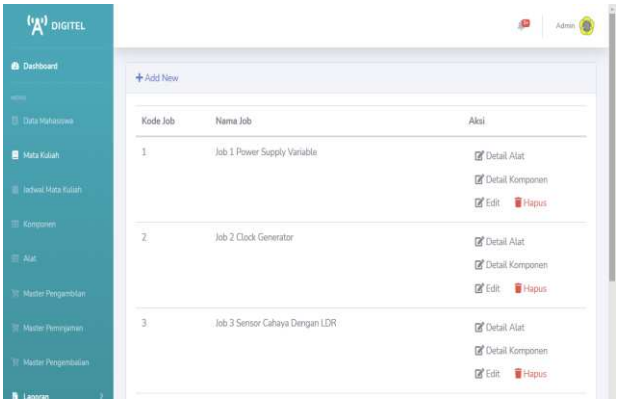


(b)

Figure 9. (a) Course Menu and (b)Job Menu

Course Schedule Menu

This menu provides information on course schedules.

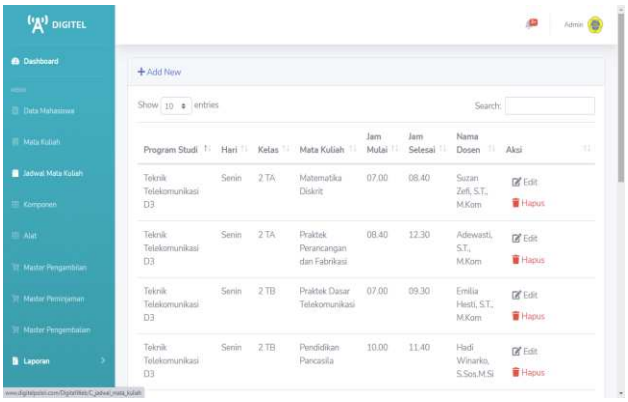
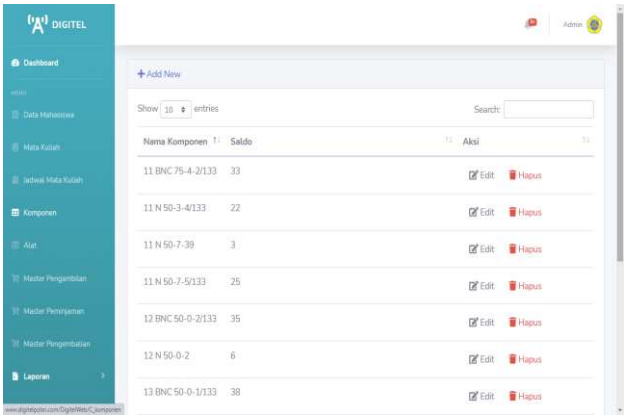


Figure 10. Course Schedule Menu

Component Menu and Tools Menu

This menu displays the tool data and provides information on the number of Components and Tools in realtime.



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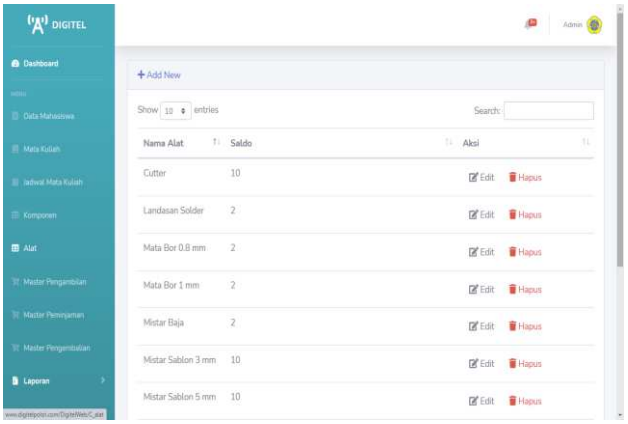


(b)

Figure 11. (a) Component Menu and (b)Tool Menu

Pick up Master Menu

Pick up Master is a menu that facilitates laboratory/workshops technicians and students in the process of providing practicum components. Simply by selecting the job name and student data, the component needs data will be displayed immediately for the loan process. Furthermore, the balance in the component menu will be automatically reduced.

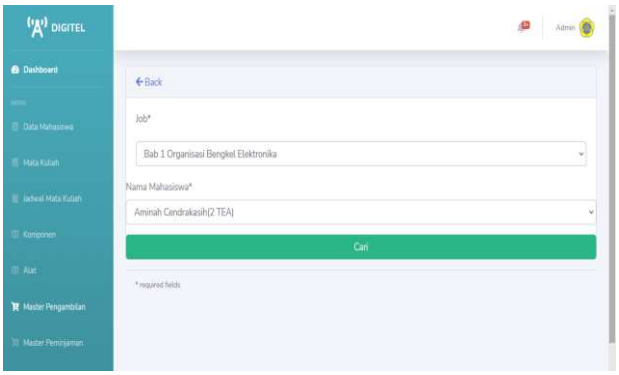
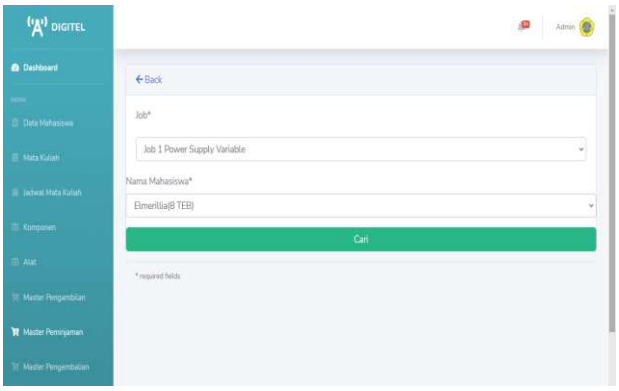


Figure 12. Pick up Master Menu

Loan and Return Master Menu

Loan and Return Master are menus that facilitate laboratory/workshops technicians and students in the process of borrowing tools/practicum instruments. Simply by selecting the job name and student data, the component needs data will be displayed immediately for the loan process. Furthermore, the balance in the tool menu will be automatically reduced. After completion of the practicum, students will be asked to return the borrowed instruments. The instrument return data will be inputted on the return master and the tool balance on the tool menu will return the initial order.



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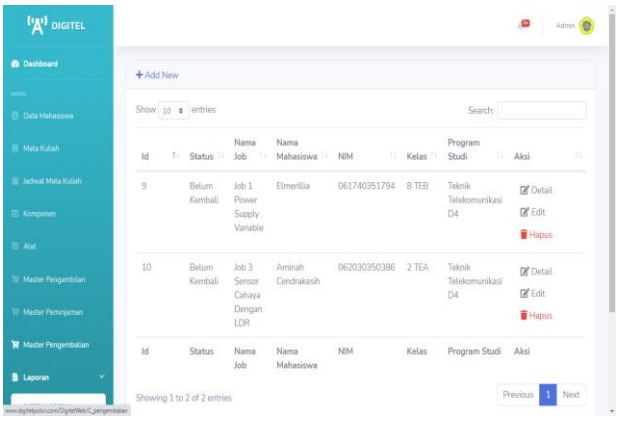
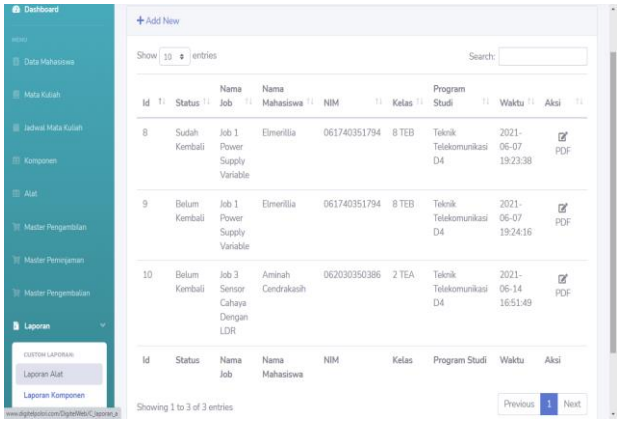


(b)

Figure 13. (a) Loan Master Menu (b) Return Master Menu

Tools Report Menu and Component Reports

In both of these menus, the borrowed tool data and picked up components will be displayed in a PDF file. With this menu is expected no more buildup of hard file reports and all reports can be stored neatly so as to facilitate technicians in carrying out their duties.



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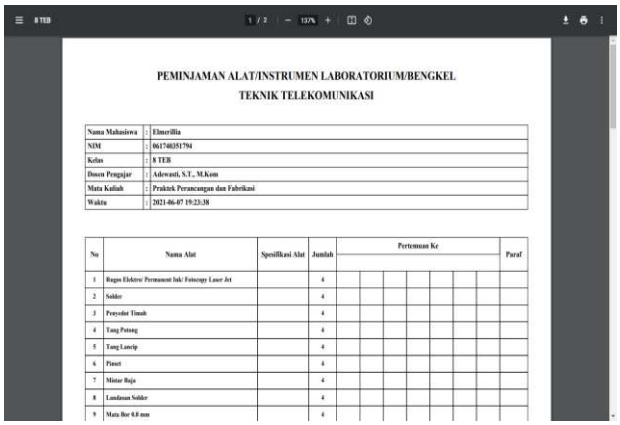

(b)

Figure 14. (a) Tool Report Menu (b) PDF data display borrowing tool

Forecasting Menu

Forecasting component requirements for the next academic year is displayed on the forecasting menu. The forecasting menu is expected to assist laboratory/workshop technicians and the inventory section in preparing the needs for practicum components. The forecasting menu is the result of calculations using the weighted moving average (WMA) method with input data on component requirements for each job and the number of students in the last 7 years.

Table 1. WMA Results Number of New Students of Applied Undergraduate of Telecommunication Engineering Study Program

Period	Year	Number of Students	WMA	Error (E_t)	MSE
1	2015	37			
2	2016	42			
3	2017	42			
4	2018	38			
5	2019	37	39,9	2,9	1,2
6	2020	43	38,8	-4,2	2,52
7	2021	45	40,1	-4,9	3,43
8	2022	…….	**42,1**		

Weighted Moving Average =

$$F_t = \frac{(45.4)+(43.3)+(37.2)+(38.1)}{10} = 42,1 \qquad (2)$$

The results of forecasting the number of new students of the Applied Undergraduate of Telecommunication Engineering Study Program in 2022 are 42,1. The WMA results will then be multiplied by the number of component requirements in one semester. So that the forecasting needs for the number of components is obtained in the following year.

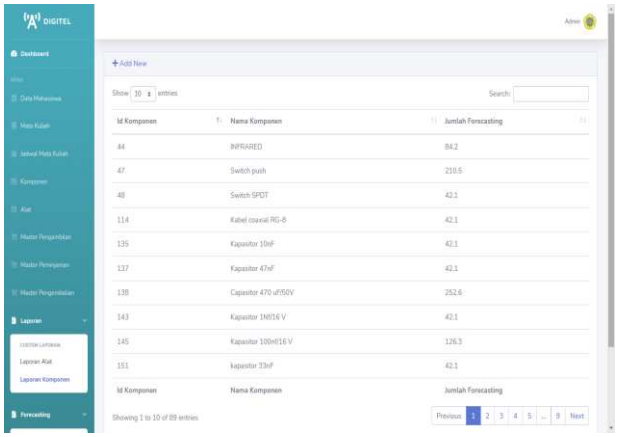

Figure 15. Forecasting Menu

D. Program Trial

The testing process was performed to see if the system created was valid or accepted. Testing was done with Black Box testing. From the results of the tests conducted obtained results that the application created already had a system that ran according to the procedure. The app could also display real-time data. Usability evaluation has been carried out with laboratory technicians and the application function is in accordance with the expected needs. All available menus could be used. The following are test results using black box testing:

Table 2. List of Black Box Test Results

Input	Observation	Conclusion
Username and password	Login to the web via the login form	Valid
Logout button	Log out from web	Valid
Dashboard button. Quick access	Display the dashboard menu. Open menu:	Valid

button on dashboard : - Pick up master, - Loan master, - Return master	- pick up master, - loan master, - return master	
Student data Menu button	View student data	Valid
Course Menu button	View course data	Valid
Job button on course Menu	View course job data	Valid
Button of component detail or tool details on the job Menu,	View component details or tool details data on the job menu:	Valid
Course schedule Menu button,	View course schedule data	Valid
Component Menu button,	View components data	Valid
Tool Menu button,	View tools data,	Valid
Pick up master Menu button, search button	Displays form of job options and student names	Valid
Loan master Menu button,	Displays form of job options and student names.	Valid
Action button in pick up and loan master Menu: - Form of job and student name, - Search button	- Displays job options and student names. - Displays data on the need for practicum components or the needs for practicum tools	Valid
Fitur button in detail of pick up and loan master Menu: - Modify button - Give button on tool needs view in loan master	- Modify component or tool requirement data. - Running the system give to the component requirements view in the pick up master and the number of components in the component menu will decrease, or tool requirements view in the loan master and the number of tool in the tool menu will decrease	Valid
Return master Menu button,	View loan data from the loan master	Valid
- Detail button on return master Menu, - Already back button from the return details	- Displays data on borrowed tools according to the process in the loan master, - Running the system has been restored to change the loan status and change the number of tools in the tool menu	Valid
Tool report button	Displays a list of loans that have been made according to the data from the loan master	Valid
Component report button	Displays a list of pick up that have been carried out according to data from the pick up master	Valid
- Pdf button in tool or component report, - Button in pdf report: Save and print	- Displaying a pdf file of borrowed tool data or displaying a pdf file of pick up component data - Save pdf files to local pc and run the print process	Valid
Forecasting menu button	Shows component requirement forecasting	Valid
Action feature button in web menu: - edit, - delete, or - add new	unlock action features to: - modify data, - clear data, - add new data	Valid

IV. CONCLUSION

Through the application of the prototype method, every application design process was done, taking into account the needs of the user. A trial of use has been carried out with laboratory technicians, the application forecasting components and practical tools laboratory in Telecommunication Engineering at Sriwijaya State Polytechnic web-based in general has met the needs.

The design results have provided the features of the Pick up Master Menu, Loan and Return Master Menu. Laboratory technicians can also use the report menu to display an inventory responsibility report for components and practicum tools. All menus in the application have been tested using black box testing and are acceptable.

Thus, the existence of this application can help the process of retrieving components and borrowing tools/instruments practicum laboratory in Telecommunication Engineering at State Polytechnic of Sriwijaya more effectively and efficiently and provide excellence in the process of data storage. Forecasting generated to determine component requirements in 2022 can be stated quite accurately based on the MSE value and the amount of data used. This web also provides convenience for laboratory technicians and inventory employees in preparing component needs through existing forecasting data. It is hoped that this application can be implemented in real terms so that it can help laboratory technicians and students. This application is also expected to be an example for applied in other study

program laboratories. Furthermore, it is necessary to improve the inventory data system of entry, addition, and expenditure of components and tools in the laboratory.

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