WEB-BASED LABORATORY MANAGEMENT INFORMATION SYSTEM DESIGN

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Abstract - The application of information systems is very important in an effort to optimize the laboratory management process at the Electronics Department. At this time the Department of Electronics, Padang State University still uses conventional media and uses applications that are commonly used in the laboratory management process which results in information not being classified appropriately and accordingly. Laboratory management activities carried out in the form of recording goods and all activities that occur in the laboratory, this study aims to design an information system to optimize and collect information from data collection activities, borrowing, returning, maintaining inventory items and using laboratories in the Electronics Department. The method used to develop information systems is waterfall which represents a structured and sequential approach starting from requirements, design, implementation, verification and maintenance. The information system implementation process uses the Laravel framework. Verification or testing of system functionality using the black box testing method where the test results show that all functions contained in the system have successfully displayed the page as expected and can be used for laboratory management information systems in the Electronics Department.

Keywords— Information system, Laboratory Management, Website, Waterfall Method, Laravel Framework.

I. INTRODUCTION

The development of information and communication technology is currently progressing rapidly, along with the transition from the conventional era to the digital era. Almost all companies and agencies do data processing and storage both conventionally and digitally[1]. Data processing and storage becomes an organizational routine so that the information produced is organized and accurate. One form of digital data processing and storage is the management information system[2].

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Previous research on management information systems has been carried out in various institutions including Bakrie University which developed a system to improve the effectiveness of laboratory management[3]. Other studies also show that the application of information systems in laboratory management can reduce recording errors, speed up administrative processes, and increase user satisfaction. For example, research conducted at several universities shows that web-based systems allow real-time access to data, thus facilitating coordination between users and laboratory managers. At the global level, institutions such as Massachusetts Institute of Technology (MIT) and Stanford University have adopted integrated information systems for laboratory management, resulting in significant improvements in operational efficiency and data accuracy. This reinforces the urgency to develop a similar system in the Department of Electronics at Padang State University.

The application of management information systems aims to facilitate data processing and storage activities both in aspects of planning, control, decision making and aspects of resource processing[4]. In the world of education, ranging from elementary to tertiary levels, laboratory facilities are very important to support the teaching and learning process[5]. Laboratories are facilities used to carry out experiments or research in various fields of science such as computers, electricity, physics, chemistry, and others[6]. The laboratory is also a learning process that integrates practice with theory. As a means of supporting practicum-based learning, the lab is equipped with various tools and devices that are in accordance with the related fields of study[7].

To ensure that laboratory facilities are optimally used in academic and research activities, effective laboratory management is needed. Laboratory management is a series of laboratory management processes that include planning, organizing, leading, and controlling to achieve the objectives of the laboratory. Laboratory management activities carried out in the form of schedule preparation, laboratory use, laboratory maintenance and repair, loan and return system for practicum / thesis / dissertation / final assignment / research and community service, provision and reporting of laboratory administration.

At this time, the Department of Electronics at Padang State University still uses conventional media and uses applications that are commonly used in the laboratory management process. So that laboratory management experiences obstacles in processing laboratory activities which cause the input of laboratory equipment and materials to be relatively long, vulnerable to loss or damage to data on the use of laboratory equipment and materials, lack of accessibility of laboratoryrelated information, prone to schedule errors, the business process of borrowing laboratories is not flexible and the process of monitoring laboratory activities is less efficient.

Based on these problems, it is necessary to design and build an integrated management information system to improve the effectiveness of the laboratory management process so that the process of inputting laboratory equipment and materials is fast, information about the laboratory is easy to obtain, determining the appropriate labor use schedule, the loan process can be done anywhere and monitoring laboratory activities is efficient.

To build an information system according to the needs mentioned, a framework is needed that can support the development process. Framework is a term often used by software developers to refer to a framework. This framework consists of various settings or components that have been designed with their respective functions, so that they can help facilitate developers in the process of making applications[8]. In this research, the development of the Department of Electronics laboratory management information system will use the Laravel framework. Laravel is a modern open source web framework that is widely used for developing web applications quickly and efficiently. This framework is equipped with advanced features that support developers in building applications, and offers advantages in writing code that is more concise, easy to understand, and expressive[9].

The development flow uses the waterfall method. This model represents a structured and sequential approach to the software development process[10].

Based on the description above, the application of information systems is very important in an effort to optimize the laboratory management process at the Electronics Department. This research aims to design and implement a web-based information system using Laravel to improve the efficiency of laboratory management. The main contribution of this research is to provide an integrated solution that can overcome laboratory management problems as a whole, starting from data recording, tool lending, to monitoring laboratory activities. Thus, this research is expected to be a model for the development of similar systems in other educational institutions.

II. LITERATUR REVIEW

A. Information System

An information system is a series of coordinated and integrated activities that have a function to manage information. This system operates by receiving information as input, processing it using information technology, procedures, and involving the role of people, and producing useful information as output for its users.

B. Laboratory Management

Laboratory management refers to the process of planning, organizing, supervising, and controlling the resources and activities associated with laboratory operations. It covers various aspects, including management of personnel, equipment, budget, safety, quality, and research development. Laboratory management is critical in ensuring that laboratories operate efficiently, safely and productively. Effective laboratory management helps ensure that the laboratory operates properly, minimizes risks, and supports the achievement of research and testing objectives. It is also important to comply with applicable regulations and industry standards.

From the explanation of laboratory management above, Padang State University has also issued SOPs regarding workshop or laboratory management for each faculty including the Faculty of Engineering. Based on SOP.08.013.00 2018, the scope of laboratory management consists of schedule preparation, laboratory use, and laboratory administration systems. This shows that the university has clear and structured guidelines to ensure laboratory management runs effectively and efficiently.

This SOP can be used as a reference in research that will be carried out in the Department of Electronics laboratory. By following the procedures that have been set, research can be carried out in an organized manner starting from the preparation of laboratory use schedules, utilization of available facilities, to administrative management that supports the smooth running of research activities. Thus, the implementation of this SOP is expected to increase the effectiveness and quality of research in the Department of Electronics laboratory.

C. Website

Web-based information systems offer various significant advantages over manual systems, such as better accessibility because it can be accessed from anywhere and anytime, and faster and more accurate data processing speed by minimizing human error. Digital data storage on a website system saves physical space and facilitates backup, while manual systems are vulnerable to data damage or loss. The website system also facilitates automatic data search and report generation, is more flexible and scalable to expand, and ensures data security through encryption and authentication. Collaboration between users is easier to do in real-time, operational costs are reduced, and monitoring of activities is more efficient. In addition, the website system is more environmentally friendly because it reduces the use of paper[11]. With all these advantages, a website-based information system is a modern, efficient, and effective solution for information management in in the Department of Electronics laboratory.

D. Waterfall

The waterfall model is suitable for projects with clear and well-defined requirements. This model provides a structured approach to software development, where each phase must be completed first before proceeding to the next phase[12].

E. Framework Laravel

Framework laravel is an MVC web development framework designed to improve software quality by reducing development and repair costs and increasing productivity with clean and functional syntax that can reduce a lot of time to implement.[13].

F. PHP

PHP is a scripting language designed for building web applications. When called from a web browser, a program written with PHP will be parsed inside the web server by the PHP interpreter and translated into an HTML document, which will then be displayed back on the web server[14]. *G. Laragon*

Laragon is an application that can turn a computer into a server or local or can be called a web stack system for web development. Laragon can work well to develop a web and has amazing speed. Laragon has several excellent features such as supporting SSL, allowing developers to easily change the version of the supporting program, manage databases, create application projects quickly, and a user friendly display[15].

H. MYSQL

MYSQL is the most popular database among website programmers, for the reason that this program is a database that is very powerful and stable enough to be used as a data storage medium. As a database server that is able to manage databases well, MySQL is considered the most popular and most widely used database compared to other databases[16].

III. METHOD

This waterfall method uses a sequential software lifeflow approach starting from the stages of requiretment, design, implementation, verification and maintenance[17]. The system development process in this study is like the following diagram.



Fig 1. Waterfall Method

Requirement

The requirements gathering and analysis phase involves a comprehensive collection and evaluation of all application requirements. Based on these requirements, the design phase develops application components, workflows, and operational processes. In this research, figma and draw.io were used for the design process.[18]. This research will analyze the business processes currently running in the Electronics Department and evaluate the system functionality needed to overcome the problems that arise. This analysis is based on

information and data obtained through interviews and observations with the head of the Electronics Department laboratory.

TABLE I Business Process Analysis of Proposed System

No.	Business	Ac	tivities	Related
	Process			actors
1	Login	1)	User accesses the	Head of
			laboratory management	laboratory
			information system	, 11
		0	website	laboratory
		2)	Users input their	assistants,
			nassword	lecturers
			password.	leeturers.
2	Laboratory	1)	Laboratory Head or	Head of
	schedule		Laboratory Attendant	Laborator
	preparation		selects the laboratory	у,
	process		scheduling menu	Laboratori
		2)	Laboratory Head or	an.
			Laboratory Attendant	
			add/update laboratory	
			usage schedule	
		3)	The Head of	
			Laboratory or	
			laboratory assistant	
			inputs the schedule data	
			on the laboratory	
			scheduling form then	
3	Laboratory	1)	The head of the	Head of
5	usage	1)	laboratory/laboratory	laboratory
	process		looks at the list of	,
	•		laboratory equipment	laboratory
			and materials on the	assistant,
			website before the	student,
			laboratory is used.	lecturer
		2)	Laboratory users carry	
			laboratory	
		3)	The head of the	
		Ĺ	laboratory/laboratory	
			sees the use of	
			laboratory equipment	
	T 1 .	1)	on the website	
4	Laboratory	1)	The laboratory head or	
	nrocess		selects the laboratory	
	process		maintenance menu.	
		2)	The laboratory head or	
			laboratory assistant	
			selects the add	
			maintenance feature for	
			iadoratory	
		3)	The laboratory head or	
			laboratory assistant	
			inputs the instrument	
			data that will be carried	
			out by the nurse then	
	Fu in (1)	presses the save button.	Q(1, (
3	Lending	1)	Laboratory members	Students,
	system for		see the assets available	laboratory

practicum,		in the system	assistants,
thesis,	2)	Laboratory members	laboratory
dissertation,		(students and lecturers)	heads.
final project		make loan applications	
and research		by filling out forms on	
		the system	
	3)	The laboratory assistant	
		views the asset loan	
		request	
	4)	The laboratory assistant	
		approves/rejects the	
		request	
	5)	If the request is	
		approved by the	
		Laboran, it will be	
		forwarded to the Head	
		of Labor.	
	6)	Head of Labor views	
		the asset loan request	
	7)	Head of Labor	
		approves/rejects the	
		request	
	8)	If the request is	
		approved, laboratory	
		members (students and	
		lecturers) will receive a	
		notification that the	
		request has been	
		approved.	

Design

After analysis, the research progresses into the design phase based on the findings from the requirement gathering and analysis stage. the research employs UML diagrams (Unified Modeling Language) such as context diagram, use case, activity diagram and ERD.

A. Context Diagram







Fig 3. Use case











After the design stage is complete, the next step is implementation. The database structure that has been designed is then implemented through migration using Laravel to store various types of data, such as information on tools, loans, users, and laboratory activities. Next, application logic was developed, including CRUD (Create, Read, Update, Delete) functions for data management, user authentication, and business processes. In addition, the user interface was integrated with the backend using Laravel's Blade templating. *A. Login Page All User*



Fig 6. Login Page

The login page is the page that appears for the first time when the application is run. The login page is used as an intermediary to enter the application for users who have been granted access rights. On this login page there is the name of the application and a form for entering NIM/NIP/NIK and password then a button to log in and a forgot password button for users who forget the password that has been given.

B. System Design Result Superadmin

The *superadmin* page is a page provided for *superadmins* which includes user data and laboratory room data.



Fig 7. Dashboard Superadmin

Displays a page for superadmins to manage various data and functions in the system. On this display there are 2 activities that can be done by the super admin, namely managing user data and managing laboratory room data.

Data Labor	No	NM/NK/NP	Nama	Role	Akai
	1	superadmin	superadmin	Superadmin	Update Delete
	2	1111	Hadi Kumia Saputra, S.Pd., M.Kom.	Kepala Labor	Update Delete
	э	1112	Edi Prasetio, S.Pd.	Laboran	Update Delete
	4	18076007	RADEN ARIF ALHAJ	Anggota	Update Delete

Fig 8. Data User

In this user data menu, *superadmins* can carry out activities to add user data, view user data, change user data and delete user data.

0.47A	Roles					
ata Üser	Pith Roles	~				
Data Labor	NIM/NIK/NIP	Password				
	Masukkan NIM/NIK/NIP	Masukkan Password				
	Nama	Email				
	Masukkan Nama	Masukkan Email				
	Program Studi	No HP				
	Masukkan Prodi	Masukkan No HP				
	Tembeh Data					

Fig 9. Add User Data

In this form, *superadmins* fill in user data and determine user *roles* according to their respective access rights.

	0		L	0	
Nam Takanbarg Judi Buru					6 8 superador
Deshboard	Dat	a Laboratorium			
TER DATA.					
Data User		nden bata			
Data Labor	No	Nama Laboratorium	Kepsis Labor	Laboran	Alai
	1	Network infrastructure laboratory	Hadi Kumia Saputra, S.Pd., M.Kom.	Edi Prasetio, S.Pd.	Update Delete
			Copyright © 2024. All right reserves	s.	

Fig 10. Laboratory Data

In this labor data menu, *superadmins* can carry out activities to add laboratory data, view laboratory data, change laboratory data and delete laboratory data.



Fig 11. Add Laboratory Data

In this form, the *superadmin* performs the activity of filling in laboratory room data and also performs the activity of determining the laboratory head and laboratory assistant for each laboratory room.

C. System Design Result Head of Labor and Laboratory Assistant

The laboratory head and laboratory assistant page is a page provided for the head of the laboratory and laboratory assistant which includes labor asset data, labor schedule data, asset loan request data, asset return data, labor usage submission data and tool / machine usage control data.

Ö	UNP Alem Tekamberg Judi Gura				6	8 Hadi	Karnia Sa Labor	putra, S.	Pd., M.F
ŵ	Dashboard	Dashboar	b'						
1	Permintaan Peminjaman Aset	ladwal Labor	atoriur	n					
1	Pengembaitan Aset	outrui Lubon	atoriai						
	Pengajuan Pernakaian	Jadwal	Senin	Selasa	Rabu	Kernis	Jumat	Sabtu	Mingg
9	Labor	13:00:00 - 14:00:00			Praktikum Jaringan Komputer				
	Kontrol Pernakaian Alat/Mesin	14:00:00 - 15:00:00		Praktikum Sistem Operasi					
1	Aset Labor								
Ð	Jadwal Labor								

Fig 12. Dashboard Head of Labor and Laboratory Assistant This is a page that functions to display information on various data and functions that can be performed by the head of the labor and laboratory assistants.

ļ	UNP Kan takan bang and tiura				Ś	8 Hadi Kan	nia Saputza, xxr	S.Pd., M.Kom
	Dashboard	Data	a Pengajuan Pe	minjaman Aset Labor				
	Permintaan Perminjaman Aset						Approval	
9	Pengembalian Aset	No	Tanggal Pengajuan	Nama Labor	Deskripsi Persinjar	nan Laboran	Repain	Akal
	Pengajuan Pemakaian Labor	1	16 January 2025	Network infrastructure laboratory	alot pengatur jaring	engatut jaringan (1997)		Gecall
	Kontrol Pemakaian Alat/Mesin	2	16 January 2025	Network infrastructure laboratory	alat pengatur jaring	220		Detail
na	R GATA							
	Aset Labor							
	Jadwal Labor							

Fig 13. Laboratory Asset Loan Request List

This page is a list of laboratory asset loan requests made by labor members. On this page, the head of labor and laboratory assistants carry out activities to approve / reject requests for borrowing laboratory assets.

Tanggal Nama La Tangal N Tangal S	Pengajuan aboratorium Aulai Peminjaman selesai Peminjaman	: 16 January 2025 : Network Infrastructu : 2025-01-16 : 2025-01-16	re laboratory	
Alasan P Detail	Peminjaman	: alat pengatur jaringa	n	
No	Kode Barang	Nama Barang	Tipe/Merk	Jumlah Dipinjam
Status	s Pengajuan			
Status Nama	s Pengajuan		Jabatan	Status Persetujuan
Nama Hadi Ku	s Pengajuan urnia Saputra, S.Pd., M.Kom.		Jabatan Kepala Laboran	Status Persetujuan
Nama Hadi Ki Edi Pra	s Pengajuan arnia Saputra, S.Pd., M.Kom. setio, S.Pd.		Jabatan Kepala Laboran Laboran	Status Persetujuan Glanaga persigian Glanaga persigian
Nama Hadi Ki Edi Pra	s Pengajuan urnia Saputra, S.Pd., M.Kom. sesio, S.Pd.		Jabatan Kepala Laboran Laboran	Status Persetujuan

Fig 14. Laboratory Asset Loan Request Details

This pop-up contains information about the *detailed* data of laboratory asset loan requests. Heads of labor and laboratory assistants can approve or reject requests for borrowing laboratory assets.

Nam Takanberg and tions					Ś	8	Hadi Kurnin Saputra, Kepala Labor	S.Pd., M.Kor		
Dashboard	Dat	a Aset Yang Dip	injam							
Peminjaman Aset	No	Tanggal Pengajuan	Nama Labor		Deskripsi Pe	ninjaman	Status Peminjaman	Akel		
Pengembelian Aset	,	02 January 2025	Network infrastructure laborat	ory	TAAA		Barrowed.	Oetail		
Pengajuan Pemakaian Labor								_		
Kontrol Pemakalan Alat/Mesin										
DI DATA.	Dat	a Historis Pemi	njaman Aset							
Aset Labor							Status			
Jadwal Labor	No Tanggal Pengajuan Nama Labor Deskripsi Peminjaman Peminjaman Aksi									
			Copyright 0	024. All right	reserved.					

Fig 15. Borrowed Asset Data

On this page, the head of the laboratory and the laboratory assistant fill in the condition of the asset after it has been returned by the borrowing laboratory member.

Tany Nom Tany Tany Alao	pgal Pengajaan na Laboratorka gal Mulai Pemi gal Selesai Per an Peminjama	n njaman ninjaman n		2 January Network in 2 January 3 January TARA	2005 frastracture lei 2005 2005	basatory			
De	tail Peminj	aman							
No	Kode Darang	Nama Barang	Tipe/Merk	Jamish Dipinjem	Dalk	Russk Ringsn	Russk Derst	Hilang	Keterangan
1	6660001	Lapeap	Dell	1	8	0	0	0	Masukkan Keterangan
2	6600002	Rouser	Dell	1		0	D	0	Masukkan Keterangan
3	6600003	ниа	D-LINK	1		0	0	0	Masukkan Keterangan

Fig 16. Add Asset Condition

This pop-up functions as a place for the head of labor and laboratory assistants to fill in data on asset returns that have been returned by laboratory.

0	UNP Remained for R				ь (8)	Hadi Kumia S Kepala Labor	aputra, S.Pd., M.Ko
6 E	Dashboard Permintaan Peminjaman Aset	dd/mm/yyyy	a dd/mm/yyyy a	Filter			
Ē	Pengembalian Aset	Data Pengajua	an Pemakaian Laborate	orium			
E	Pengajuan Pemakaian Labor	Nama Pengguna	Laboratorium	Tanggal dan Waktu	Alasan Pemakala	n Status A	Aksi
E	Kontrol Pemakaian Alat/Mesin	RADEN ARIF ALHAJ	Network infrastructure laboratory	16 January 2025 18:28	ta mantap	-	Approve Reject
ASTE	R DATA						
::	Aset Labor						
E	Jadwal Labor	Data Historis	Pemakaian Laboratoriu	m			9
				Record door	Makes A1	eese Bernskalan	Platue
		Nama Pengguna	Laboratorium	ranggar dan			012002

Fig 17. Approval/Rejection of Requests from Labor Members to Use the Laboratory

On this page, the head of the laboratory or laboratory assistant can approve/reject requests for laboratory members to use the laboratory.

٩	UNP Kan takanberg and these									s (e	Edi Prasetio, S.Pr Laboran	
ଜ	Dashboard	(0000001) Laptop	- Dell								~	
E	Permintaan Perminjaman Aset											
B	Pengembalian Azet			K	ontrol	l Pemakaian Alat/Mesin						
Ð	Pengajaan Pemakalan Labor	Kode Asset Nama Asset	: 000000 : Laptop	1								
e	Kontrol Pemakaian	Hari/Tanggal		Nama Pengguna			NM		Jam Pemakalan		Keterangan	
-	Alat/Mexin	Kamin 2, Januari 202	15	DECEN A	DIE ALLIA		16076007	19 (9 (ulat 10	Selesal 22.43.05		
зп	ATAG R				The Party of the						~	
1	Aset Labor										0	
Ð	Jadwal Labor											
		Tanggal	Nama Peng	guna		Jam Mulei		Jam Malai		Keteranga	in.	



On this page, the head of labor and laboratory assistants can input users of tools/machines in the laboratory and see the history of their use.

8	UNP Alam Takandamy Judi Tara							ь (8)	Hadi Kumia Seputra, S.Pd., M.I Kepala Laber
ŵ	Dashboard	Dat	a Asset Lab	oratorium					
Ð	Permintaan Peminjaman Aset	Tan	ibeh Dete						6
E	Pengembalian Aset		and the second second				Kondisi		
m	Pengajuan Pemakalan	No	Nama Darang	Keterangan	Jumiah	Belk	Rasak Ringen	Rusak Berat	Akai
	Labor	1	Lapsop	Laptop	30	25	4	1	Data Perawatan Edit Delet
Ð	Kontrol Pernakaian Alat/Mesin	2	Router	Router	15	14	0	1	Data Perawatan Edit Delet
		3	HUB	HUB	25	20	4	1	Data Perowatan Ecri Delet
H	Aset Labor								
•	Jadwal Labor								

Fig 19. Laboratory Asset Data

On this page, laboratory heads and laboratory assistants can view labor asset data, add labor asset data, update labor asset data, delete labor asset data and perform asset maintenance.

UNP Alam Takamberg Judi Bury			G	Hadi Kumia Saputra, S.Pd., M.Kom. Kepala Labor			
Daahboard	Tambah Data Aset Lab	oratorium					
Permintaan Peminjaman Aset	Kode Alat/Barang						
Pengembalian Aset	Missukkan Kode						
Pengajuan Pemakaian	Nama Alat/Barang		Tipe/Merk				
Labor	Masukkan Nama		Masukkan Tipe				
Kontrol Pernakaian Alat/Mesin	Jamlah Alat/Barang		Satuan Unit				
	Masukkan Jumlah		Unit/Bush/Set/				
	Kondisi Baik	Kondisi Rusak Ringan		Kondisi Rusak Berat			
Aset Labor	Masukkan Kondisi Balk	Masukkan Kondisi	lusak Ringan	Masukkan Kondisi Rusak Berat			
Jadwal Labor	Keterangan						
	Masukkan Keterangan Kembali Submit						
		Copyright © 2024	All right reserved.				

Fig 20. Add Laboratory Asset Data

In this form, the head of labor and laboratory assistants can add asset data contained in the laboratory.

٩	UNP Keen Takambarg Jack Dury					6	B Edi Prasetio, S.Pd. Laberar	
	Dashboard	Kembali						
B	Permintaan Perninjaman Aset	Data Pe	rbaikan	Barang			Print to PDF	
B	Pengembalian Aset							
Ð	Pengajuan Pemakaian Labor	Tambah D	ala Perbaiki	sn				
P	Kontrol Pernakaian	Nama Asse	1	: HUB				
	AlatWesin	Kode		: 0000003				
MASTE	R DATA	Tipe		: D-LINK				
	Aset Labor	Keterangar		HUB				
B	Jadwal Labor	Tanggal	Jenis Keru	isakan		Perbaikan	Aksi	
					Data kosong			

Fig 21. Item Repair Data

On this page, the head of labor and laboratory assistants can fill in the maintenance data for each item that has been recorded on the laboratory asset data page.

(1) wrateship	Danosad - Selan Decords X Selan - Witherdows >1 Dev - S W		v - p
> 0	A Not secure sistem-labor test/asset-maintenance/create/3	⊼ C Q ▲	0.0.4.00
UNP		s 8	Idi Pranetio, S.Pd.
Dashboard	Tambah Data Perbaikan		
Pernintaan Perninjaman Aset	Tangpal		
Peopembalian Aset	dd/mm/yyyy		
Pengajuan Pernakalan Labor	Jenis Kerusakan Masukkan Jenis Kerusakan		
Kontrol Pernakaian Alat/Mesia			
	Perbalkan		
Aset Labor	Masakkan Perbaikan		
Jadwal Labor			
	Kembali Submit		

Fig 22. Add Item Repair Data

In this form, the head of the laboratory and laboratory assistants fill in data on damage to goods and fill in data on repairs that have been carried out.

UNP Kam Takambarg Jadi Buru					¢.	8 Had	Kumia S la Labor	aputra, S	Pd., M.K
Dashboard	Dat	ta Jadwal	Laborat	torium					
Permintaan Peminjaman Avet	Таг	mbah Jadwal							
Pengembalian Aset	No	Hari	Mata Kuli	ah	Jam Mulai	Jam Berakhi	r		Aksi
E Pengajuan Pemakaian Labor	1	Selasa	Prektikum	i Sistem Operasi	14.03.03	15:00:00		Edit	Delete
B Kontrol Pemakaian Alat/Mesin	2	Rabu	Praktikum	n Jaringan Komputer	13.03.00	14:00:00		Edit	Delata
STER DATA									_
	Jac	Iwal Labo	atoriun	n					0
§ Aset Labor									
Jadwal Labor		Jadwal	Senin	Selana	Rabu	Kamla	Jumat	Sabtu	Minggu
3 Aset Labor	13.0	Jadwal 10.00 - 14.00.00	Senin	Selana	Rabu Praktikum Janingan Komputer	Kamis	Jurnet	Sabta	Minggu

Fig 23. Laboratory Schedule Data

On the labor schedule page, laboratory heads and laboratory assistants can view labor schedule data, add labor schedule data, update labor schedule data and delete labor schedule data.

UNP Alen Tekenberg Jedi Eins				6	B Edi Prasetio, S.Pd. Laboran
Dashboard Permintaan Perminjaman Aset	Tambah Jadwal Labora Mata Kalah	torium			
Pengajuan Pemakalan Labor Kontrol Pemakalan Alat/Mesin	Hari Pilih Hari Jam Mulai		Jam Berakhir		~
Aset Labor	Kembali Submit	0			0
Japwa Labor					

Fig 24. Add Laboratory Schedule Data

In this form, the head of labor and laboratory assistant can add laboratory schedules.

D. System Design Result Student and Lectures

On this page, students and lecturers can view the laboratory schedule, borrow assets and borrow laboratory space.

🚳 UNP Kan Talanbarg Jadi bary R		S RADEN ARIF ALHA
Dashboard	Dashboard	
Pengajuan Peminjaman Alat/Bahan	Jadwal Laboratorium	
Pengajuan Peminjaman Labor	- Pilih Laboratorium -	× Plih

Fig 25. Dashboard Students and Lecturers

It is a page that functions to display information on various data and functions that can be performed by students and lecturers.

Dashboard	Da	ta Pengajuan	Peminjaman			
Pengajuan Perninjaman Alat/Bahan		ukan Peminjaman				
m Pengajuan	No	Tanggal Pengajuan	Neme Labor	Deskripsi Peminjaman	Status	Akai
Peminjaman Lebor	1	02 January 2025	Network infrastructure laboratory	TAAA	Permintana disetapat	Detail
	2	16 January 2025	Network infrastructure laboratory	alat pengatur jaringan	Mananggi peratujuan	Detail Batalkan Pengaju
	3	16 January 2025	Network infrastructure laboratory	alat pengatur janingan	(Veranger periodicies)	Detail Batalkan Pengaju
	30					

Fig 26. Asset loan request data

On this page, students and lecturers can apply for an asset loan and cancel the asset loan application. In addition, students and lecturers can also directly view the approval / rejection status of borrowing labor assets.

Daabboard				0.	100110
	Form Pengajuan Peminjama	n			
Pengajuan Peminjaman	Pilih Laboratorium				
Alat/Bahan	Pillh Laboratorium				~
Pengajuan Peminiamon Labor	Deskripsi Perninjaman				
	Masukkan alasan peminjaman				
	Tanggal Mulai Peminjaman		Tanggal selesai Peminjaman		
	dd/mm/yyyy		dd/mm/yyyy		
	Pilih Barong Kode Barong	Nama Aset	Tipe/Merk	Tersedia	Juniah
		Plih Laboratoriu	um terlebih dahulu		
	Kembali Ajukan Peminjaman				

Fig 27. Add Asset loan request data

On this page, students and lecturers fill in requests for assets to be borrowed. The data filling process starts from selecting the laboratory where the required asset is available, filling in the reason for borrowing, filling in the borrowing start date, filling in the borrowing end date and selecting the asset and the number of assets needed.

Dashboard	Ajakan Pemakaian Laboratorium				
Peminjaman Alat/Bahan	Data Pengajuan Pemakai	an Laboratorium			
Pengajaan	Laboratorium	Tanggal dan Waktu	Alasan Persakalan	Status	Aksi
Peninjaman Labor	Network infrastructure laboratory	02 January 2025 23.46	TAAA	Approved	
	Network infrastructure laboratory	16 January 2025 18:28	te mantap		Defete

On this page students and lecturers can apply for laboratory use.

UNP Kan Takantang Jadi Sara		6	8 RADEN ABIF ALHAJ
Dashboard	Tambah Penggunaan Laboratorium		
Persisjeran	Pilh Laboratorium		
Allegalation	Pith Laboratorium		· · ·
Persinjaman Labor	Tonggal den Waktu		
	dd/mm/yyyy <		•
	Alasan Pemakaian		
	Masukkan Alasari Pernakalari		
	Kembali		



On this page, students and lecturers can apply for labor usage. The process of filling in the labor usage submission data starts from selecting the laboratory, determining the date and time of labor usage and the reason for labor usage.

Verification

After implementation, then enter the verification stage. The verification process on this system uses black box testing. the type of black box testing used focuses on the functionality of the system for users. System functionality testing is carried out on all superadmin pages, all pages for the head of labor and laboratory assistants and all pages for students and lecturers. The test results are as shown in tables II, III and IV.

TABLE II Superadmin Access Page Testing

No	Test Case	Expected Results	Testing Results	Status
1	Enter the login page	Login page displayed	Login page displayed	Success
2	Login to the system with username and password	Display the admin page	Display the admin page	Success
3	Error entering data during login	Display notification of incorrect username or password	Display notification of incorrect username or password	Success
4	Select the dashboard page	Display the admin dashboard page	Display the admin dashboard page	Success
5	Select the user data menu	Display the user data page	Display the user data page	Success
6	Select add data on the user data page	Display the user data filling page	Display the user data filling page	Success
7	Select user roles on the user data entry page	Display superadmin, labor head, laboratory assistant, member options	Display superadmin, labor head, laboratory assistant, member options	Success
8	select the update button on	Display the user data filling page	The user data filling page can be	Success

	the user data page	whose data can be edited	edited.	
9	select the delete button on the user data page	User data deleted	User data deleted	Success
10	Select the labor data menu	Display the labor room data page	Display the labor room data page	Success
11	select add data on the labor data page	Display the laboratory room data filling page	Display the laboratory room data filling page	Success
12	Select the laboratory head on the labor data page	Display a selection of laboratory heads who are already registered in the user data	Display a selection of laboratory heads who are already registered in the user data	Success
13	Select a laboratory assistant on the labor data page	Display a selection of laboratory assistants who are already registered in the user data	Display a selection of laboratory assistants who are already registered in the user data	Success
14	select the update button on the labor data page	Display the labor data filling page where the data can be changed	Display the labor data filling page where the data can be changed	Success
15	select the delete button on the labor data page	Labor data deleted	Labor data deleted	Success

 TABLE III

 Head of Labor and Laboratory Assistant Access Page Testing

No	Test Case	Expected Results	Testing Results	Status
1	Enter the login page	Login page displayed	Login page displayed	Success
2	Login to the system with NIP and password	Display the Head of Labor / Laboratory page	Display the Head of labor / Laboratory page	Success
3	Error entering data during login	Display notification of wrong NIP or password	Display notification of wrong NIP or password	Success

4	Select the dashboard menu	Display the dashboard page of the head of labor / laboratory assistant	Display the dashboard page of the head of labor / laboratory assistant	Success
5	Select the labor asset loan request menu	Display the labor asset loan application data page	Display the labor asset loan application data page	Success
6	Select the detail button on the labor asset loan request page.	Display a pop- up to approve or reject an asset loan on the labor asset loan application page.	Display a pop-up to approve or reject an asset loan on the labor asset loan application page.	Success
7	Select the asset return menu	Display the borrowed asset data page	Display the borrowed asset data page	Success
8	Select the details button on the asset return page	Display a pop- up to fill in the returned asset and confirm the return on the asset return page.	Display a pop-up to fill in the returned asset and confirm the return on the asset return page.	Success
9	Select the labor request menu	Display the labor submission data page	Display the labor submission data page	Success
10	select the approve button on the labor usage submission page	Display approved status on laboratory usage data	Display approved status on laboratory usage data	Success
11	select the reject button on the labor usage submission page	Display notification of successful rejection of laboratory usage data	Displays a successfully rejected notification on the laboratory usage data	Success
12	Select the tool/machin e usage control menu	Display the tool/machine usage control page	Display the tool/machin e usage control page	Success
13	Select an asset on the tool/machin	Display the list of assets then display	Display the list of assets then display	Success

	e usage control page	the tool / machine control page	the tool / machine control page	
14	select the tool/machin e control data entry on one of the asset lists in the tool/machin e control page.	Display options for filling in the date, username, start time, end time and description.	Display options for filling in the date, username, start time, end time and description.	Success
15	select the labor asset menu	Display the laboratory asset data page	Display the laboratory asset data page	Success
16	select the add data button on the labor asset data page	Display the page for filling in labor asset data	Display the page for filling in labor asset data	Success
17	select the maintenance data button on the labor asset data page	Display the item repair data page	Display the item repair data page	Success
18	select the add data button on the item repair data page	Display the page for adding repair data	Display the page for adding repair data	Success
19	select the edit button on the item repair data page	Display the page for filling in repair data updates	Display the page for filling in repair data updates	Success
20	select the delete button on the item repair data page	Delete item repair data	Delete item repair data	Success
21	select the edit button on the labor asset data page	Display the page for filling in laboratory data updates	Display the page for filling in laboratory data updates	Success
22	select the delete button on the labor asset data page	Delete labor asset data	Delete labor asset data	Success
23	select the labor schedule	Display the laboratory schedule data	Display the laboratory schedule	Success

	menu	page	data page	
24	Select the add data button on the labor schedule data page	Display the laboratory schedule filling page	Display the laboratory schedule filling page	Success
25	Select the edit button on the labor schedule data page	Display the laboratory schedule update page	Display the laboratory schedule update page	Success
26	Select the delete button on the labor schedule data page	Delete laboratory schedule data	Delete laboratory schedule data	Success

TABLE IV Students and Lecturers Access Page Testing

No	Test Case	Expected Results	Testing Results	Status
1	Enter the login page	Login page displayed	Login page displayed	Success
2	Login to the system with username and password	Student / Lecturer page displayed	Student / Lecturer page displayed	Success
3	Error entering data during login	Display notification of incorrect NIM/NIP or password	Display notification of incorrect NIM/NIP or password	Success
4	Select the dashboard page	Student/lecturer dashboard page displayed	Student/lectu rer dashboard page displayed	Success
5	Select a tool/material loan request	Display the tool / material loan application data page	Display the tool / material loan application data page	Success
6	Select the loan request button on the tool/material loan request page.	Display the page for filling out the loan application for tools / materials	Display the page for filling out the loan application for tools / materials	Success
7	select a laboratory in the list of laboratories on the page of filling out the loan	Display a list of laboratories that have been inputted in the labor room data	Display a list of laboratories that have been inputted in the labor	Success

	application for equipment / materials		room data	
8	Select the detail button on the tool/material loan application page.	Display pop-up of loan details and application status	Display pop- up of loan details and application status	Success
9	Select the cancel request button on the tool/material loan request page.	A submission deletion warning pop-up appears if you press the yes button then the data is deleted otherwise the data is canceled.	A submission deletion warning pop-up appears if you press the yes button then the data is deleted otherwise the data is canceled.	Success
10	select the labor loan application menu	Display laboratory submission data	Display laboratory submission data	Success
11	select the apply for laboratory usage button on the labor loan application page.	Display the page for filling out the labor usage request	Display the page for filling out the labor usage request	Success

Based on the test results listed in Tables II, III, and IV, it can be concluded that the system functions perfectly (100%) for users.

Maintance

The last phase in the waterfall method is the operation and maintenance of the completed software. At this stage, the software is run and maintenance activities are carried out, including fixing errors or bugs that were not detected in the previous stages.

IV. CONCLUSIONS

This final project produces a web-based laboratory management application that is used by laboratory heads, laboratory assistants, students, and lecturers. This application was developed with PHP and Laravel, using MySQL as a database and Laragon as a web server. The system built is divided into three main parts: for superadmin (managing user data and laboratory space), for laboratory heads and laboratory assistants (managing assets, schedules, borrowing, returning, and controlling the use of equipment), and for students and lecturers (viewing schedules and applying for borrowing assets and laboratory space).

The results show that this system improves accuracy and efficiency in laboratory management. This system also has the potential to be adopted by other institutions to improve transparency, accountability, and efficiency of laboratory management.

Further development is recommended to integrate this system with the university's academic system, to facilitate data synchronization. In addition, the application of artificial intelligence (AI) can be done to predict asset maintenance needs and optimize laboratory schedules automatically, so that this system continues to grow and provide greater benefits in the future.

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