

Adoption of SNI ISO/IEC 17025:2017 Principles for Laboratory Management Information System Development

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Abstract— The Software Engineering and Information System Laboratory of Sriwijaya University is in charge of building a technology-based system, in accordance to the strategic objectives of Sriwijaya University which prioritizes the principles of Good governance. To support laboratory operations, a management information system is needed to improve efficiency in planning, managing and reporting. The purpose of this research is to develop a laboratory management information system that adheres to the principles in the SNI ISO/IEC 17025:2017 standard. The software was developed using the Framework for the Application System Thinking (FAST). In the requirement analysis phase, an in-depth study was carried out to formulate requirements in accordance with the principles in the SNI ISO/IEC 17025:2017 clause control standard. In the end, a Laboratory MIS was successfully developed using this approach. Implementation of this system could increase the performance of the laboratory in providing better services and results by simplify the operational process, and shorten time consumption.

Index Terms—*Laboratory Management Information System; FAST Method; SNI ISO/IEC 17025:2017; Good Governance; Higher Education;*

I. INTRODUCTION

Information technology has become one of the breakthroughs in the success of an organization, but the absence of good IT governance will cause new burdens or problems on the organization [1]. Therefore, IT governance management is needed so that the technology that has been developed can be used and managed properly[8]. Technological developments also have an impact on Sriwijaya University, as a university that prioritizes good governance in every line of service. By following the era of technology 4.0, Sriwijaya University hopes to realize its strategic goal of becoming a university that improves the quality of learning and student affairs, the quality of institutions, increases research and development productivity, as

well as the realization of Good governance in all Sriwijaya University environments towards a World Class University. So it is very necessary to implement an information technology-based management system in every business[6].

The Software Engineering and Information System Laboratory of Sriwijaya University is in charge of building a technology-based system, this task is based on the strategic objectives of Sriwijaya University which prioritizes the principles of Good governance. To support laboratory operations, a management information system is needed to improve efficiency in planning, managing and reporting. In order for the quality of this laboratory to be recognized, a standardization that covers many aspects and various requirements is needed[7].

The SNI ISO/IEC 17025:2017 standard is an accreditation standard for testing and calibration laboratories used by laboratories that develop quality, administrative, and technical management systems to support laboratory operational activities[3].

The purpose of this research is to develop a laboratory management information system that adheres to the principles in the SNI ISO/IEC 17025:2017 standard. The software was developed using the FAST method. In the requirement analysis phase, an in-depth study was carried out to formulate requirements in accordance with the principles in the SNI ISO/IEC 17025:2017 clause.

II. RESEARCH METHOD

A. Research Model

Good Governance is what underlies the development of information systems in laboratories, which is in accordance with the principles of Sriwijaya University prioritizing Good Governance. Before developing the system, it is necessary to understand that Good Governance is the principle of corporate

governance that intends to improve the company's performance and have a good impact on the company.

Good governance is not only applied to a company but can also be applied by various agencies and organizations. In its implementation, Good Governance has several principles namely Transparency, Accountability, Participation, effectiveness and efficiency, Responsibility, and fairness [7]

B. SNI ISO/IEC 17025:2017

SNI ISO/IEC 17025:2017 was developed by the International Organization for standardization / International Electrotechnical Commission regarding the general requirements for the competence of testing and calibration laboratories, which is a reference for world-class laboratory standardization. In applying this standard, it is necessary to carry out tests to examine or determine the characteristics, content and parameters that determine the quality of a product, component in the laboratory [5]. In Indonesia, the institution that tests this standard is the National Accreditation Committee (KAN).

This standard has the aim of developing trust in the operation of laboratories and contains requirements to demonstrate that the laboratory operates implementing Good Governance principles and is impartial and that the laboratory can provide recognized results[4]. The management system requirements in SNI ISO/IEC 17025:2017 include the following Management system documentation, Management system document control, record control, Actions to overcome risks and take advantage of opportunities, Improvements, Corrective actions, Internal audits, and Management reviews.

C. Framework for the Application System Thinking (FAST)

The FAST (Framework for the Application System Thinking) development method is a system development method that identifies and analyzes problems, opportunities, obstacles that occur, and requests for expected needs to provide suggestions for improvement. The FAST method is a combination of various system development methods that are arranged into several more flexible processes, this FAST development method also has many advantages, including the ability to support good system development and is supported by various techniques[5].

In this study, system development was carried out using the Framework for the Application of System Thinking (FAST) method. FAST is a work structure that can adapt to any type of project. The FAST method can produce a system in minimum time with good quality. There are several stages that must be taken including the definition of scope, problem analysis, requirement analysis, logical design, decision analysis, physical design, construction and testing, and

implementation. Figure 1 shows the stages that are passed.

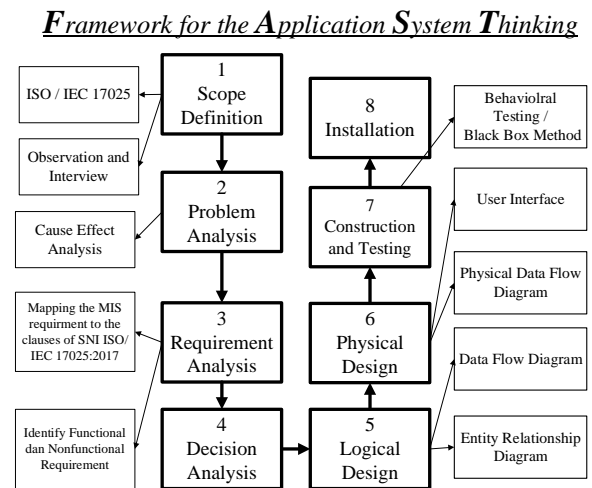


Fig 1. Research Method

III. RESULTS AND DISCUSSINS

A. Scope Definition

The software developed has the aim of facilitating all business processes that occur in the laboratory to be more effective, efficient, easy to monitor and control, in order to achieve good governance in the laboratory environment. With the presence of this system, it is desirable to be able to assist users in minimizing time on the previous system.

TABLE I. SCOPE DEFINITION

Business Goal	Project Goal
<ul style="list-style-type: none"> Assist in managing laboratory data, users, inventory, laboratory use, and laboratory assistant attendance. Accommodate reports of all business processes on a regular basis to the leadership/head of the laboratory. Provide laboratory information to the public. 	<ul style="list-style-type: none"> Simplify all business processes that occur in the laboratory. Minimize time in managing laboratory data.

B. Problem and Requirement Analysis

There are four problems have been identified, as following:

- Lack of information management of laboratory inventory items
- Monitoring and scheduling laboratory usage is difficult
- Laboratory assistant attendance management process is not efficient
- Preparation of laboratory reports requires a long process and time

A mapping of the problems encountered in the computer laboratory will be carried out with the clause in SNI ISO/IEC 17025:2017: 2017. Based on the problem analysis that has been done, it can be detailed the conditions that trigger problems in the laboratory as shown in Table II.

TABLE II. THE PROBLEMS

ID	Description
A	Laboratory inventory data management is done manually
B	Laboratory inventory data is created only when needed (ad hoc)
C	laboratory inventory data that is managed in physical document (paper based) that has not been stored in the database
D	scheduling of laboratory usage is done manually
E	users must come to the lab admin room to find out the schedule
F	Information on laboratory usage schedules is difficult to access
G	laboratory assistant attendance is done manually
H	Assistant attendance data storage and recording is done conventionally
I	Attendance data is difficult to access
J	Monitoring of laboratory operational activities was not documented
K	Recapitulating the lab operational activity report take long time

The problems that have been identified are then seen for compliance with the recommendations for control standards according to SNI ISO/IEC 17025:2017. From a total of 35 clauses, Table III below is the clauses that are considered directly related which can be used as the basis for the functional requirements of the Laboratory Management Information System.

TABLE III. CLAUSES OF SNI ISO/IEC 17025:2017

Clauses Number	Clauses Description
4.2	The laboratory must provide information to customers, if any information is published
5.5	establish structures, responsibilities, authorities, and document procedures (to the extent necessary) to maintain consistency
5.6	have personnel who (in addition to other duties and responsibilities) have the responsibility and authority to ensure the implementation, maintenance and improvement of the management system, identify deviations from the management system or from procedures for carrying out laboratory activities, initiate actions to prevent or minimize deviations, report to management laboratory related to management system performance and improvement
6.1	must have the necessary personnel, facilities, equipment, systems and supports to produce correct and reliable reports and/or certificates of test and/or calibration results.
6.3.2	Facility requirements that affect the performance of laboratory activities must be documented

Clauses Number	Clauses Description
6.4.1	must have access to the equipment (standards, measuring instruments, software, reference data, solvents, consumables, etc.)
6.4.4	must have procedures for handling, transport, storage, use and maintenance of equipment shall verify that the equipment meets specified requirements before first use or upon reuse
6.4.13	shall have procedures for handling, transport, storage, use and maintenance of the equipment shall verify that the equipment complies with the specified requirements before first use or upon reuse, location of equipment, period of validity, maintenance plan, date of maintenance performed, details on breakdowns, malfunctions that have occurred or modifications that have been made
7.1.9	must cooperate with the customer or his representative in clarifying customer requests and in monitoring laboratory performance in carrying out the work requested by the customer
7.2.2	all methods, procedures and supporting documentation must be kept up-to-date and available for access
7.5.1	must maintain technical records made at the time of carrying out activities and given identification, for each laboratory activity containing results, reports, and sufficient information to contain the date and personnel responsible for laboratory activities, examination of data and results.
7.7	The laboratory must monitor its performance through comparison of results with other (external) laboratories, if the program is available and appropriate. This monitoring should be planned and reviewed
7.11	Data control and Information Management must have access to the necessary data and information. The information management system must be validated for functionality before use. the information management system must: be protected from unauthorized access, protected from tampering and loss, operated in an environment that meets the laboratory's or supplier's specifications, and for non-computerized systems, provide conditions that maintain the accuracy of manual recording and transcription; maintained in a manner that ensures the integrity of data and information; includes records of system failures and repairs as well as appropriate corrective actions instructions, manuals and reference data must be accessible to all relevant personnel
8.2	all documentation, processes, systems, records, relating to compliance with requirements must be included, referenced or linked to the management system of all personnel involved in

Then we mapped information on Table II to Table III, and we generate information as shown in Table IV below.

TABLE IV. MAPPING PROBLEM TO SOLUTION BASED ON SNI ISO/IEC 17025:2017 CLAUSES

Problem ID	Proposed Solution based on SNI ISO/IEC 17025:2017 Clauses
A	4.2, 4.5, 5.6, 7.11, 8.2,
B	7.1.9, 7.11, 8.2,
C	6.3.2, 6.4.1, 7.2.2, 7.11
D	6.3.2, 6.4.1, 7.2.2, 7.11
E	7.1.9, 7.2.2
F	7.2.2,
G	5.6, 6.1, 6.3.2
H	6.3.2, 6.4.1, 7.2.2, 7.11
I	6.3.2, 7.2.2
J	6.3.2, 6.4.1, 7.2.2, 7.11
K	7.11, 8.2

After the problems that occur have been mapped according to the related control standards, then the functional requirements that must be provided by the software can then be formulated. We conclude that there are at least seven main features that the software should be able to run. Table IV describes the functional requirements and clauses in the referenced SNI ISO/IEC 17025:2017 control standard.

TABLE V. FUNCTIONAL REQUIREMENT

Functional Requirement
Login page
Fiture of Data management (Lab Data and user data).
Laboratory Inventory management (C-R-U-D function).
Laboratory Utilization (C-R-U-D function) lab schedule, log book, and guest book.
Lab assistant attendance (CRUD function)
Laboratory Report generator
Public information provider (such as schedule, procedure, etc)

C. Logical and Physical Design

The following Figure 2 describes the business processes that run on the laboratory management information system at the software engineering laboratory and information systems at Sriwijaya University. There are 5 entities in this system, namely Lab administration, head of laboratory, laboratory assistant, chairman, and general user.

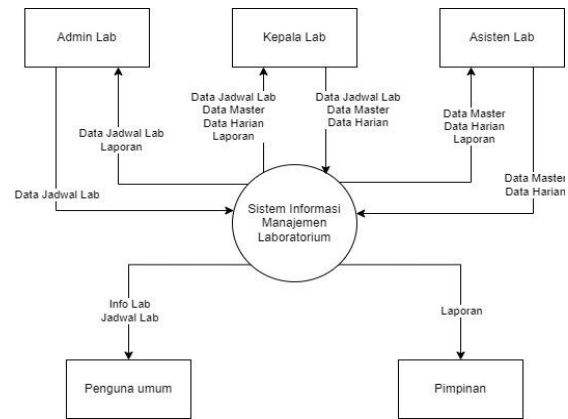


Fig 2. Proposed Context Diagram

Based on the existing context diagram, then explained further into Level-0 Data Flow Diagram (DFD). At this section, 5 processes are involved, namely login, “kelola data master”, “kelola jadwal lab”, “kelola data harian”, dan “laporan”. This processes involves five entities and uses six database tables as show at Figure 3.

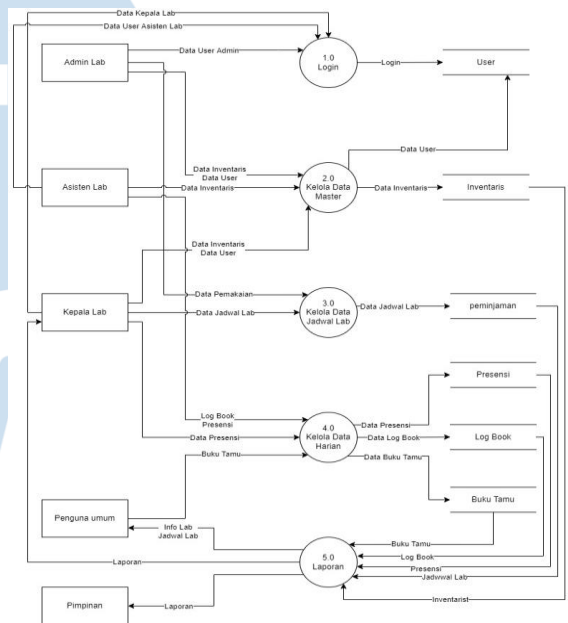


Fig 3. Proposed Level-0 DFD

Next we describe the subprocesses that existed as part of the previous Level-0 DFD. As for Figure 4, it describes the subprocess of “buku tamu”, “log book”, dan “presensi”.

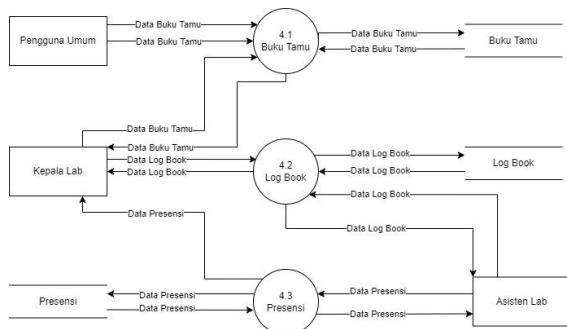


Fig 4. Proposed Level-1 DFD

Figure 5 describes the “jadwal kuliah” and “laporan” subprocess.

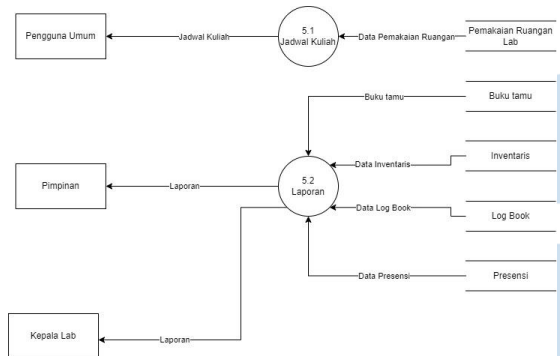


Fig 5. Proposed Level-1 DFD (2)

The next step, we tried to draw a Physical data flow diagram (PDFD). Physical data flow diagram (PDFD) is a depiction of a graph of the system used to define the flow of data from outside and into the system. Physical data flow diagrams do not describe what is going on but illustrate where, how and who is running the processes that occur in the system. Figure 6, Figure 7 and Figure 8 below are PDFDs that have been drawn.

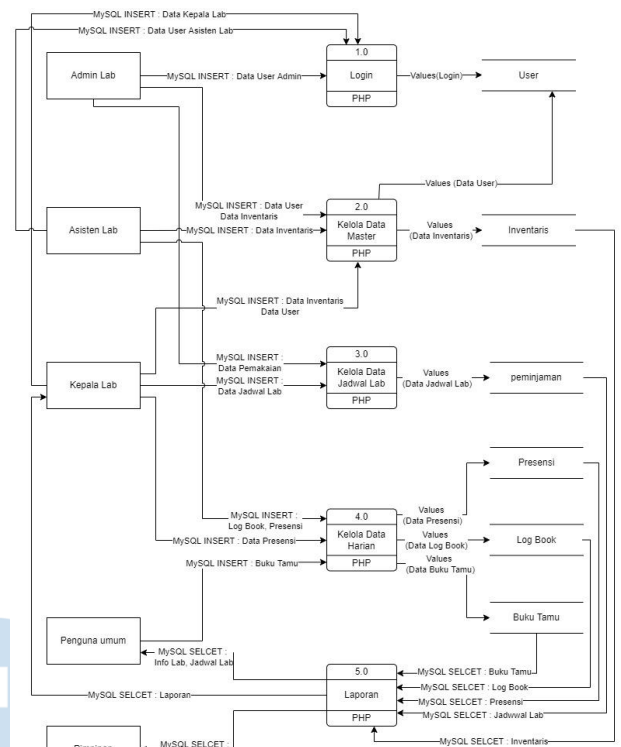


Fig 6. Proposed Level-0 Physical DFD

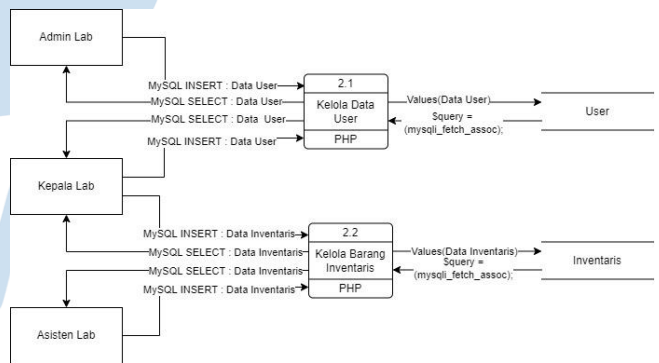


Fig 7. Proposed Level-1 Physical DFD (1)

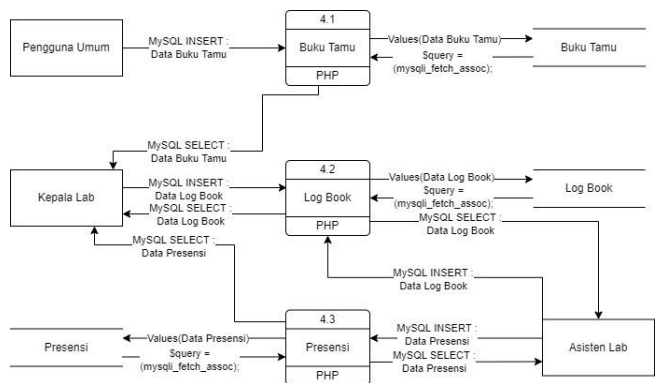


Fig 8. Proposed Level-1 Physical DFD (2)

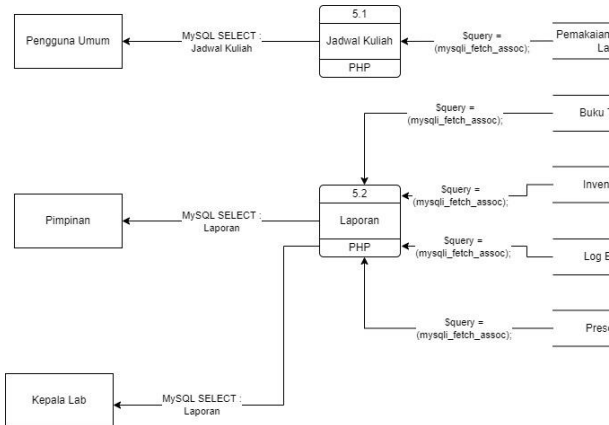


Fig 9. Proposed Level-1 Physical DFD (3)

D. Construction, Testing and Installation

In this section, we begin to build the system construct that was designed in the previous session into code and executable software. Figure 10, Figure 11, Figure 12 and Figure 13 are the example of user interface has been made.

On Figure 10 there is a username and password that the user uses to access the system

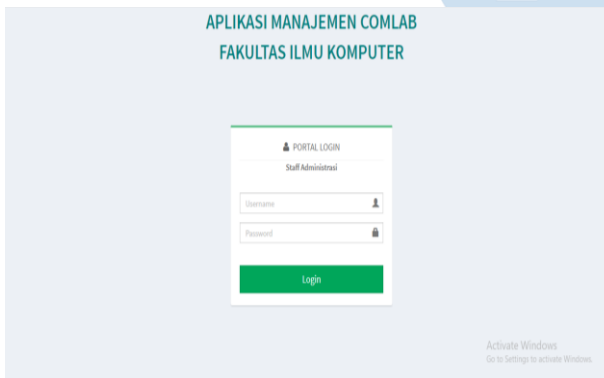


Fig 10. User Interface of Login Page

On figure 11 the user will be greeted with a welcome word and information, on this page there is also a side bar main menu that is useful for selecting the features you want to use.

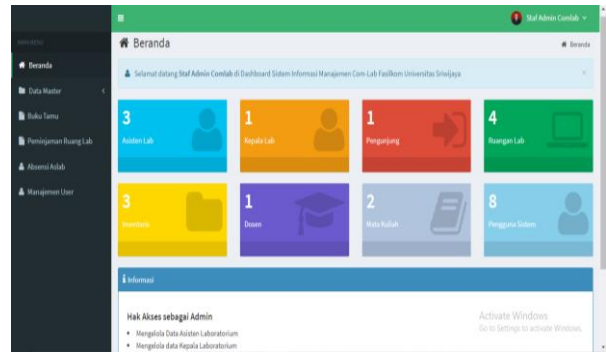


Fig 11. Home Page

On figure 12 the laboratory assistant can make attendance and also see the details of the presence that has been made.



Fig 12. Lab Assistant Attendance Page

In figure 13 the laboratory assistant and head of the laboratory fill out a list of activities that occur in the laboratory every day.

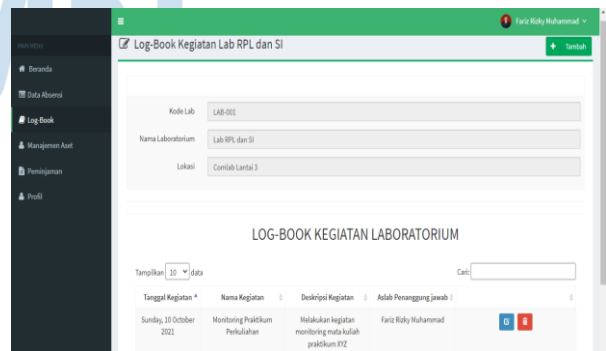


Fig 13. Log Book

The software is then tested using the black box method. testing was carried out on seven functional features of the software as well as 52 test cases. The results obtained by the software were declared successful for all test cases, with a 100% success rate. The following are the results of black box testing on the laboratory management system:

TABLE VI. TESTING BLACK BOX LOGIN.

Test case	Test procedure	Output	Conclusion
Login	Enter the correct email and password	Go to main page	Succeed
	Entered the wrong email and password	The system shows message "login failed"	Succeed
	Press the login button	Button can be pressed	Succeed

TABLE VII. TESTING BLACK BOX USER DATA

Test case	Test procedure	Output	Conclusion
User data	Pressing the plus button on user data	Go to the add user data page	Succeed
	Pressing the cancel button on add user data	Exit page add user data	Succeed
	Fill in user data on add user data	Add user data column can be filled in	Succeed
	Pressing the Save button on add user data	User data can be retrieved and stored in the database	Succeed
	Pressing the edit button on the table in the user data	Go to the change user data page	Succeed
	Press the cancel button on change user data	Exit page change user data	Succeed
	Change user data on change user data	User data in the user data column can be changed	Succeed
	Pressing the Save button on change user data	User data can be retrieved and stored in the database	Succeed
	Pressing the delete button on user data	User data deleted from database	Succeed

TABLE VIII. TESTING BLACK BOX INVENTORY DATA.

Test case	Test procedure	Output	Conclusion
Inventory data	Pressing the plus button on the inventory data	Go to the add inventory data page	Succeed
	Pressing cancel button on add inventory data	Exit page add inventory data	Succeed
	Filling inventory data on add inventory data	Add inventory data column can be filled	Succeed
	Pressing the Save button on add inventory data	Inventory data can be retrieved and stored in the database	Succeed
	Pressing the edit button on the table in the inventory data	Go to the change inventory data page	Succeed
	Press cancel button on change inventory data	Exit page change inventory data	Succeed
	Change inventory data on change inventory data	Inventory data in the inventory data column can be changed	Succeed
	Pressing the Save button on change inventory data	Inventory data can be retrieved and stored in the database	Succeed
	Pressing the delete button on the inventory data	Inventory data deleted from database	Succeed

TABLE IX. TESTING BLACK BOX LOAN DATA.

Test case	Test procedure	Output	Conclusion
Loan data	Pressing the plus button on the loan data	Go to the add loan data page	Succeed
	Pressing the cancel button on add loan data	Exit page add loan data	Succeed
	Fill in the loan data on add loan data	The column for adding loan data can be filled in	Succeed
	Pressing the Save button on add loan data	Loan data can be retrieved and stored in the database	Succeed
	Pressing the edit button on the table in the loan data	Go to the change loan data page	Succeed
	Menekan tombol batal pada ubah data peminjaman	Exit page change loan data	Succeed
	Change loan data on change loan data	Borrowing data in the loan data column can be changed	Succeed
	Pressing the Save button on change loan data	Loan data can be retrieved and stored in the database	Succeed

TABLE X. TESTING BLACK BOX PRESENCE DATA.

Test case	Test procedure	Output	Conclusion
Presence data	Pressing the fill presence button on the attendance data	Enter the presence data content page	Succeed
	Pressing the cancel button on the contents of the presence data	Exit the presence data content page	Succeed

	Fill in the presence data in the presence data content	The presence data field can be filled in	Succeed
	Pressing the Save button on the contents of the presence data	Presence data can be retrieved and stored in the database	Succeed
	Pressing the presence detail button on the table in the lab assistant data	Enter the presence data detail page	Succeed
	Pressing the print button on the presence data details	The system directly prints attendance data in excel form	Succeed
	Choose the month in the presence data you want to print	The presence data column can be selected according to the selected month	Succeed

TABLE XI. TESTING BLACK BOX LOGBOOK DATA.

Test case	Test procedure	Output	Conclusion
Logbook data	Pressing the plus button on the logbook data	Enter the add data logbook page	Succeed
	Pressing cancel button on add data logbook	Exit page add data logbook	Succeed
	Fill in logbook data on add logbook data	The column for adding logbook data can be filled in	Succeed
	Pressing the Save button on add logbook data	Logbook data can be retrieved and stored in the database	Succeed
	Pressing the edit button on	Go to the change	Succeed

	the table in the data logbook	logbook data page	
	Pressing cancel button on change logbook data	Exit page change logbook data	Succeed
	Change logbook data on change logbook data	Logbook data in the logbook data column can be changed	Succeed
	Pressing the Save button on change logbook data	Logbook data can be retrieved and stored in the database	Succeed
	Pressing the delete button on the logbook data	Logbook data deleted from database	Succeed

TABLE XII. TESTING BLACK BOX GUESTBOOK DATA.

Test case	Test procedure	Output	Conclusion
	Pressing the add button on the guestbook data	Go to the add guestbook data page	Succeed
	Pressing the cancel button on add guestbook data	Exit page add guestbook data	Succeed
Guestbook data	Fill in guestbook data on add guestbook data	The column for adding guest book data can be filled in	Succeed
	Pressing the Save button on add guestbook data	Guestbook data can be retrieved and stored in the database	Succeed
	Pressing delete button on guestbook data	Guestbook data deleted from database	Succeed

IV. CONCLUSION

The laboratory management information system at the Sriwijaya University software engineering laboratory and information system can be successfully created using the SNI ISO/IEC 17025:2017 approach to assist the software engineering laboratory and information system at Sriwijaya University in improving laboratory quality. It can also increase the performance of the laboratory in providing better services and results by simplify the operational process, and shorten time consumption.

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