

## Development of Web-Based computer laboratory management information system at SMKS Pertiwi Batam

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**Abstract:** Development of Computer Laboratory Management Information System at SMKS Pertiwi Batam is an application to support the performance of related institutions. Lack of data collection and the absence of supporting applications and data that are still stored in the form of archives and computers manually. Information systems are designed based on websites using the programming language Codeigniter and MySQL database. During the development of the research system, the waterfall method is used with the stages of requirements, design, implementation, verification and maintenance. This information system serves as a means of sharing information about the inventory of computer lab equipment, the use of computer labs, and the schedules for the use of computer labs. This information system will facilitate the Agency's collection of inventory data, usage and planning of computer labs. It will also eliminate the need for monthly reporting of computer lab data.

**Keywords:** Information system; Computer laboratory; Website; Waterfall model

### 1. Introduction

The development of information technology cannot be separated from the role of facilities. Student success in learning is not only supported by knowledge and attitude factors alone, but also supported by the availability of learning facilities (Eze et al., 2020; Li et al., 2021). Therefore, it is necessary to create facilities that play a role in student learning achievement. The learning facilities in question are computer laboratory facilities. The laboratory functions as a learning infrastructure that is practical in nature (Prasetya et al., 2023). The existence of a laboratory can improve students' cognitive and psychomotor abilities. According to (Plummer et al., 2021) stated that laboratory facilities have a significant effect on student computer learning achievement. This laboratory facility is closely related to computer training at school, including computer equipment and other facilities in it.

The use of computer laboratories at SMKS Pertiwi Batam which is a daily routine, makes the school to build an organisational structure consisting of assistants and heads of computer laboratories to manage computer laboratories so that the learning and teaching process is not constrained by computer units that error or experience trouble. So that computer laboratory assistants perform maintenance every day. One of the maintenance methods carried out is by checking every computer unit available both software and hardware. Then recorded into paper according to the label number of each computer unit. Which later the results of the check will be given to the head of the laboratory as a report material for monitoring the state of the laboratory.

Considering that SMKS Pertiwi Batam already uses a web-based information system, but it is still only limited to the school information system web (Soliman et al., 2021). And has not utilised the

information system in the computer laboratory so that the existing system is less than optimal due to the inventory of computer laboratory equipment ([Xu et al., 2021](#)), laboratory use, laboratory use schedules are still recorded manually on sheets of paper. So with the new web-based computer laboratory management information system will facilitate fast information and will help assistants and heads of computer laboratories in receiving reports in the form of inventory of computer laboratory equipment, computer laboratory usage, computer laboratory usage schedules and can present fast and accurate information.

## 2. Methods

### 2.1 System development life cycle (SLDC)

In the system development phase the author uses the System Development Life Cycle (SDLC) with a waterfall approach which consists of several stages of activity flow that runs in one direction from the beginning to the end of the development of the system development project ([Samala & Amanda, 2023](#)). According to ([Steffen et al., 2022](#)), In the Waterfall model, there are certain stages that must be reached one after the other, in a certain order, like a staircase or a cascading waterfall. There are many different stages in this method, broadly speaking they are Planning, Analysis, Design, Coding, Implementation and Maintenance.

### 2.2 Planning

- a. Selection or setting of organisational goals
- b. Determining the strategies, policies, projects, programmes, procedures, methods, systems, budgets and standards needed to achieve the objectives.

### 2.3 Analysis

System analysis is a term that collectively describes the early phases of system development ([Kumar et al., 2023](#)). System analysis is a problem-solving technique that breaks down component parts by studying how well those component parts work and interact to achieve their goals. Analysis is the earliest stage of system development which is the foundation in determining the success of the information system produced later. This stage is very important because it determines the shape of the system that must be built. This stage can be an easy stage if the client is very familiar with the problems faced in his organisation and knows very well the functionality of the information system to be created. But this stage can be the most difficult stage if the client cannot identify its needs and is closed to outsiders who want to know the details of its business processes.

### 2.4 Design

According to ([Radosavljevic et al., 2020](#)), System design is a strategy for solving problems and developing the best solution to those problems. System design includes how to organise the system into subsystems, hardware, software and procedures. Another explanation of system design is the initial stage where the initial approach to solving the problem is selected". According to ([Kurniawan et al., 2022](#)), "System design is a procedure for converting logical specifications into a design that can be implemented on an organisation's computer system". According to ([Cieza & Lujan, 2018](#)), System design is an advanced stage of system analysis, where the system design describes the system to be built before coding into a programming language." From the above definition, it can be concluded that system design is a strategy for solving existing problems to get the best solution to solving problems and getting certain goals.

## 2.5 Encoding

Coding is writing a set of code that conforms to the specific syntax of the programming language used ([Pang et al., 2021](#)). There are several programming languages including: Java, HTML, CSS, Python, PHP, Ruby, etc. By using programming languages the author can provide a list of instructions on computer devices in accordance with the author's objectives. That is, to build a website.

## 2.6 Implementation

Implementation comes from the English "to implement" which means to implement. Not just an activity, implementation is an activity that is planned and carried out seriously and also refers to certain norms in order to achieve the objectives of the activity. In another sentence, implementation is the provision of means to carry out something that causes an impact on something. According to ([Chai et al., 2022](#)) argues that "implementation is the expansion of activities that adjust each other". The notion of implementation as a mutually adjusting activity.

## 2.7 Maintenance

According to ([Nadeem et al., 2022](#)), Maintenance is any activity that is included in maintaining equipment systems in working order. In general, maintenance can be defined as a series of activities required to maintain and keep a product or system in a safe, economical, efficient, and optimised operating condition. Maintenance activities are very important, considering the following reasons, namely:

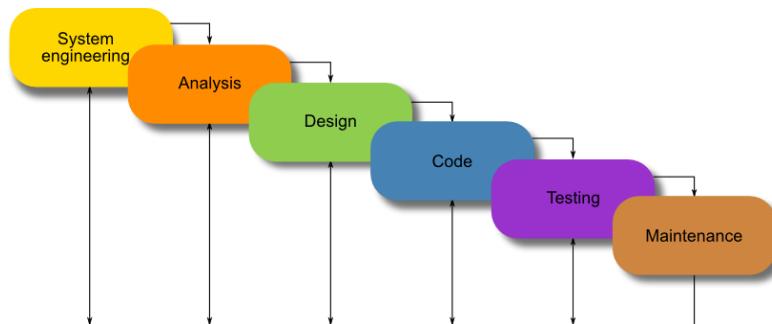
- Any equipment or have where the equipment is subject to failure or damage.
- The malfunction of a piece of equipment or machinery cannot be known with certainty.
- The company always endeavours to remind the life of the equipment by carrying out maintenance.

## 2.8 Waterfall

According to ([Liu et al., 2019](#)), Waterfall is a model that has the characteristic that each phase must be done first before proceeding to the next phase. Thus the results will focus on each phase so that the work is done optimally because there is no parallel work. The advantages of using the waterfall model include:

- The sequence of work using this model becomes more organised from one stage to the next.
- From the user's perspective, it is also more favourable because they can plan and prepare all the data and process needs that will be required.
- The schedule becomes more certain because the schedule of each process can be determined with certainty. So that the target completion of programme development can be clearly seen. With a definite sequence, the progress for each stage can also be seen with certainty.

Figure 1.  
Waterfall model



### 3. Results and discussion

#### 3.1 System requirements analysis

Research and data collection on the current system with the aim of obtaining complete data to be able to design a new system or a system that will be updated from the current system. With the data obtained, it will be implemented in the system that will be created. Based on observations that have been made at SMKS Pertiwi Batam, the system requirements needed are obtained, including the following:

Table 3.  
Media validation  
results

Assessment aspects	Validators			Amount	Validity results	Category
	V1	V2	V3			
Visual Aspect	3	2.5	2.75	8.25	0.69	Valid
Appearance Aspect	3	2.5	2.67	8.17	0.68	Valid
Average				0.68	Valid	

Based on the old information system flow, it can be concluded that several features are needed to meet the needs of the system in the development of computer laboratory management information systems at SMKS Pertiwi Batam, which features can be seen in Table 1.

Table 1.  
System  
requirements

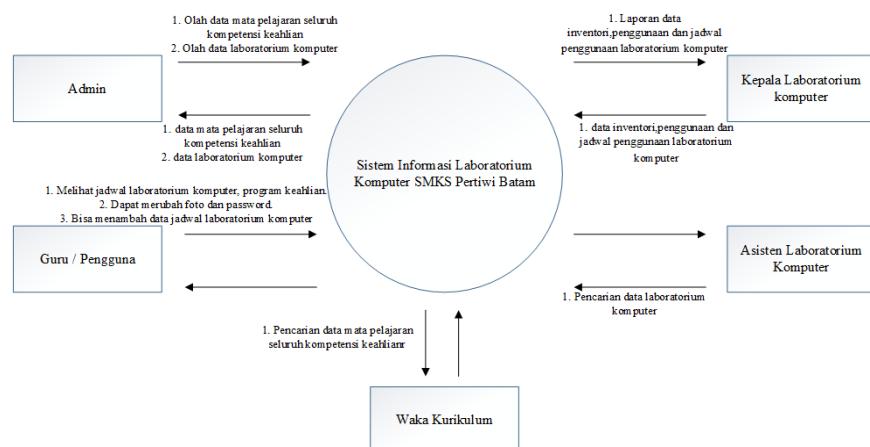
No	Features	Description
1	Login	Serves as an access right to distinguish what pages can be accessed by teachers/users and admin pages.
2	Personal data	Function to display personal data and can change user photos and change passwords.
3	Expertise programme	Serves to display all subjects of expertise competence. As well as being able to create, view, change and delete subjects.
4	Laboratory schedule	Function to display laboratory schedules and can create, view, change and delete laboratory usage schedules.

#### 3.2 System design

System design is the next stage after analysing the existing system and getting a clear picture of what will be made. To achieve the expectation of developing a computer laboratory management information system at SMKS Pertiwi Batam, the development of this information system will be described using data flow diagram, database design and database relations. At this stage, the researcher will show the proposed system process flow that will be made by showing the functions of the system to the teacher/user logically using DFD (Data Flow Diagram) tools, which are as follows:

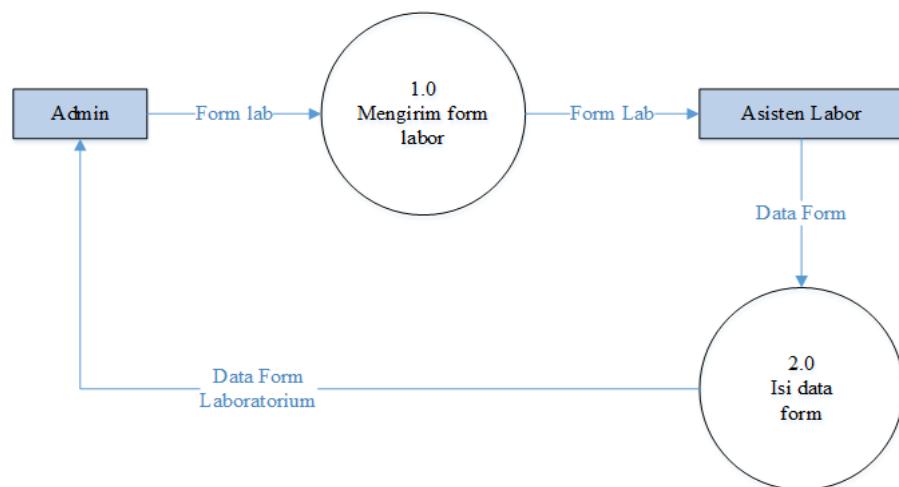
- Context Diagram: The process flow of this application development can be described in a Context Diagram as follows:

Figure 2.  
 Context diagram



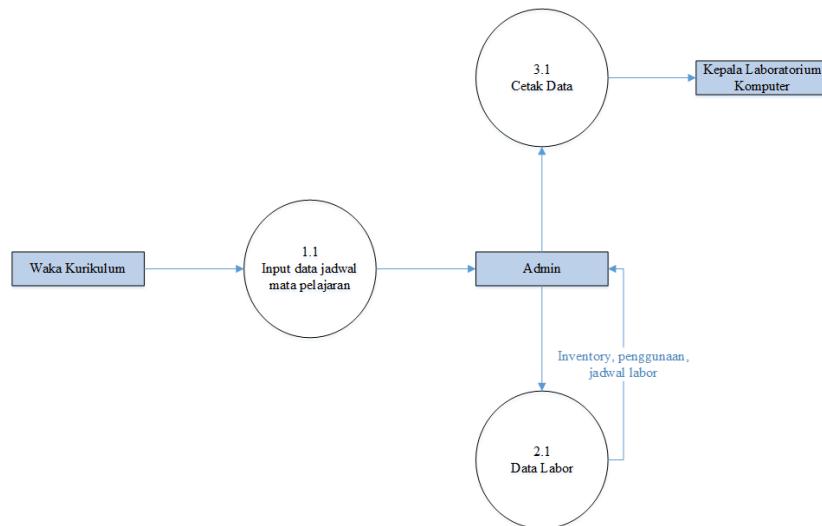
b. DFD Level 0

Figure 3.  
 Level 0 DFD



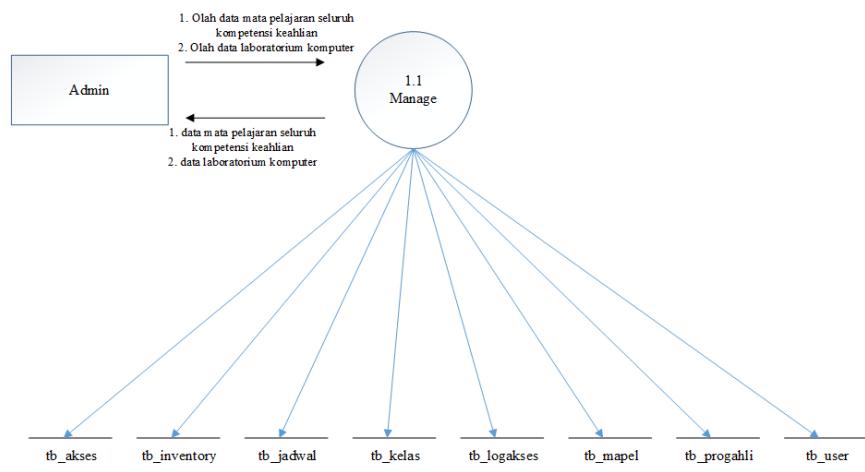
c. Level 1 diagram

Figure 4.  
 Level 1 diagram



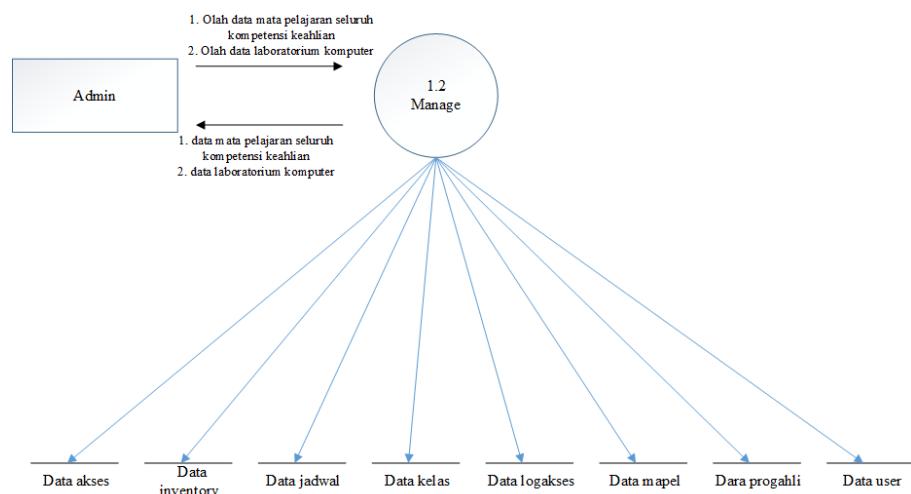
d. Detailed process diagram 1

Figure 5.  
Detailed process  
diagram 1



e. Detailed process diagram 2

Figure 6.  
Detailed process  
diagram 2



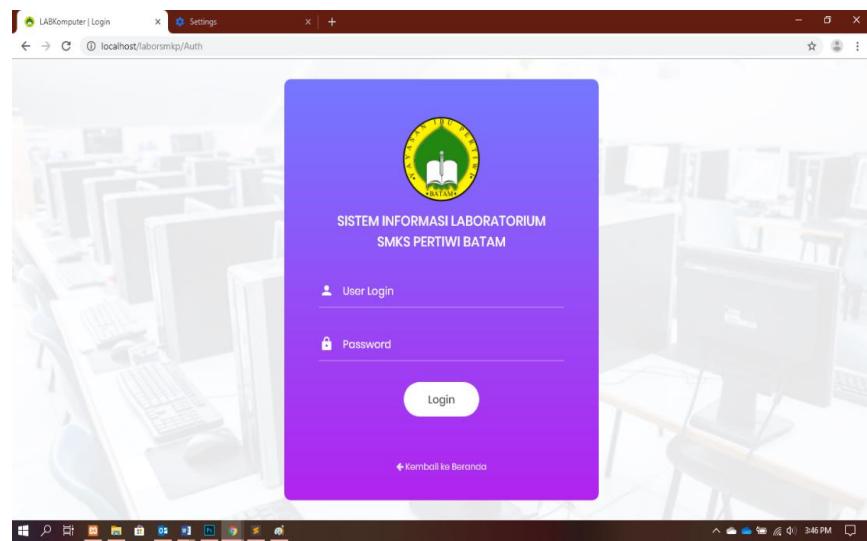
### 3.3 Implementation

Based on the system design that has been made previously, this implementation will include a picture of the development of a web-based computer laboratory management information system at SMKS Pertiwi Batam, which has been run on a web browser, namely Google Chrome.

#### 3.3.1 Teacher side output display

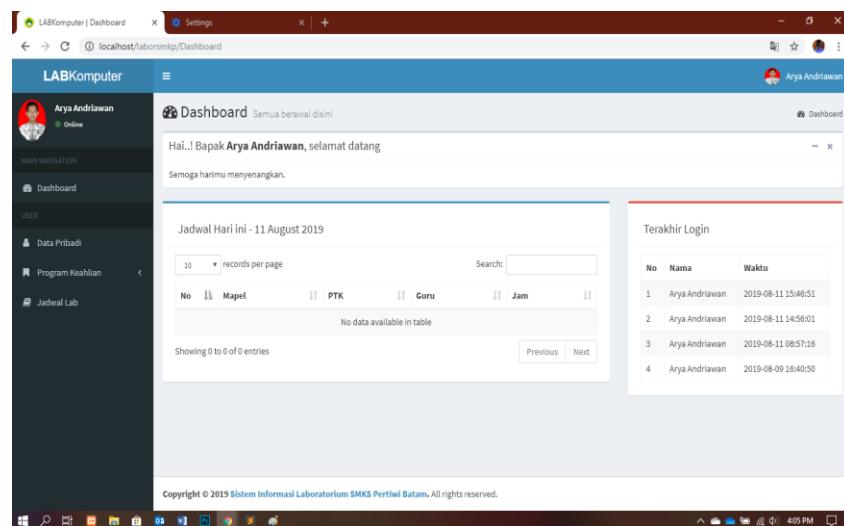
In the picture above there are 2 main menus consisting of home and about us, and there is a login button for teachers to enter the application.

Figure 7.  
Teacher login view



- The steps to take on the Teacher login page are:
- Enter the user login (NIP) that has been registered.
- Entering the password as the keyword to enter the application dashboard page.
- Click login, the teacher dashboard page will appear as follows:

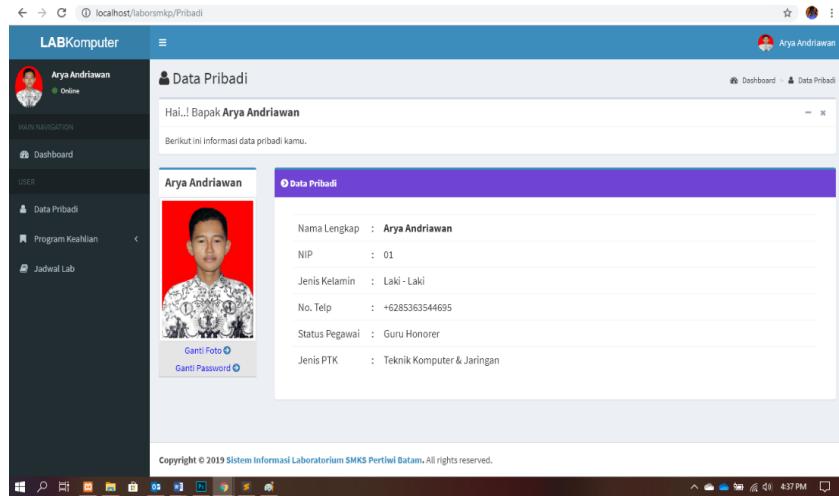
Figure 8. Teacher dashboard view



On the teacher's page there is a teacher's work menu which contains personal data, subject programmes which contain sub-menus of Network Computer Engineering, Accounting, Nursing and Computer Laboratory Schedule menus. More details can be seen as follows:

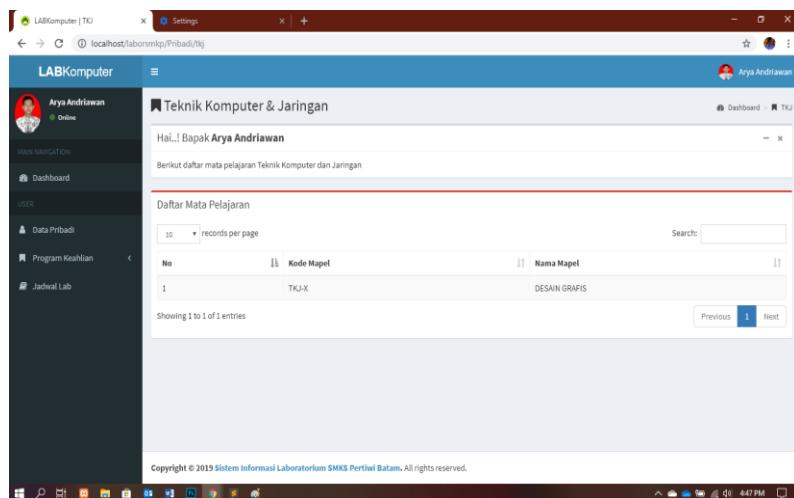
- Personal data display functions to display teacher personal data, change photos and change application login passwords. For the display can be seen below:

Figure 9.  
Teacher personal  
data display



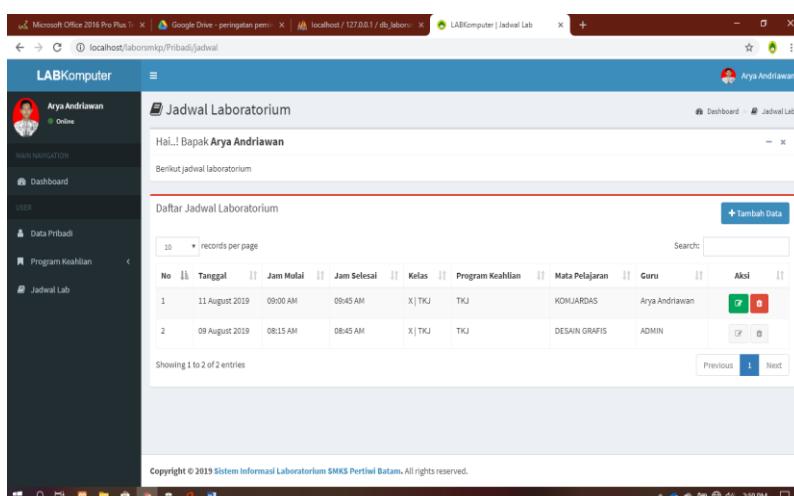
Expertise Programme Data Display to view the list of subjects of all expertise programmes in SMKS Pertiwi Batam. The display is shown in Figure 10.

Figure 10.  
Teacher expertise  
programme display



The data entry screen of the computer lab schedule list is used to enter data for the computer lab schedule (Figure 11).

Figure 11.  
Input display of  
teacher laboratory  
schedule



### 3.3.2 Admin side input view

a. To enter the admin page, type <http://localhost/laborsmkp> and the home page of SMKS Pertiwi Batam Computer Lab will be shown in Figure 12.

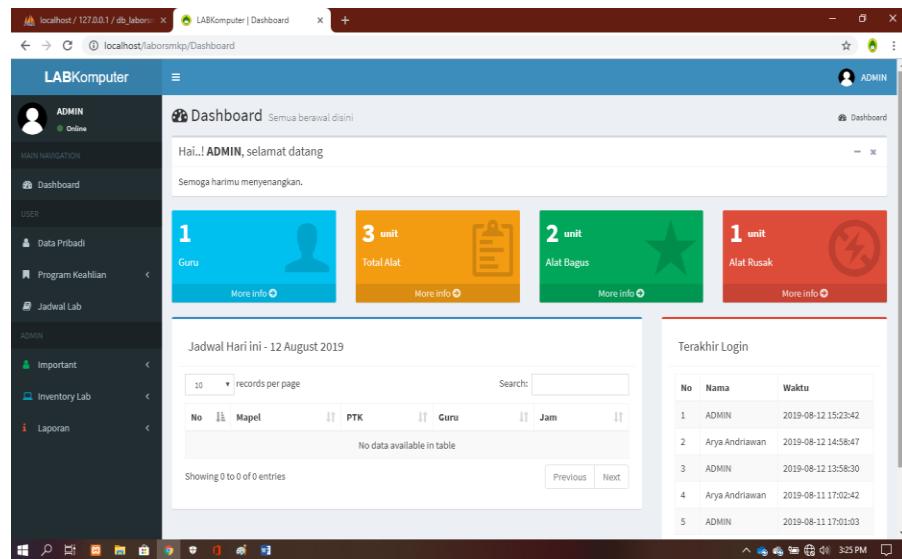
Figure 12.  
Admin home view



b. The steps to take on the admin login page are as follows:

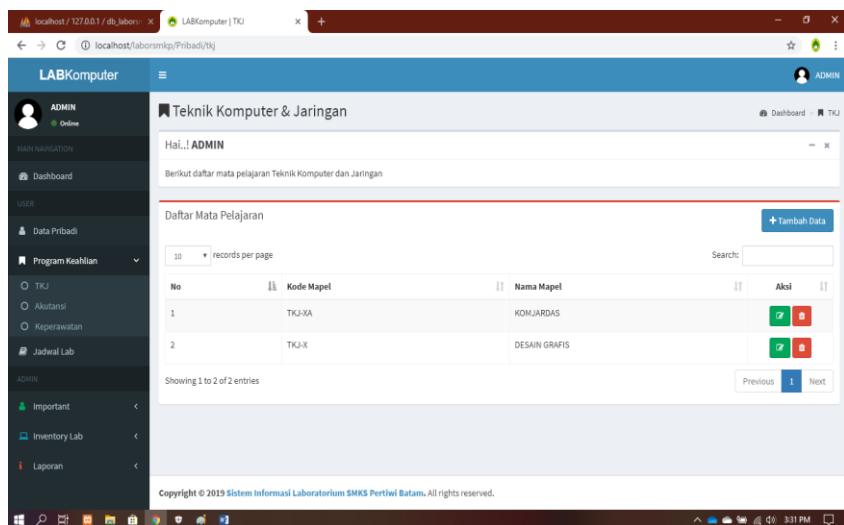
- 1) Enter the user login (admin).
- 2) Enter the password as the keyword to enter the application dashboard page.
- 3) Click Login, the Admin Dashboard page shown in Figure 13.

Figure 13.  
Admin home view



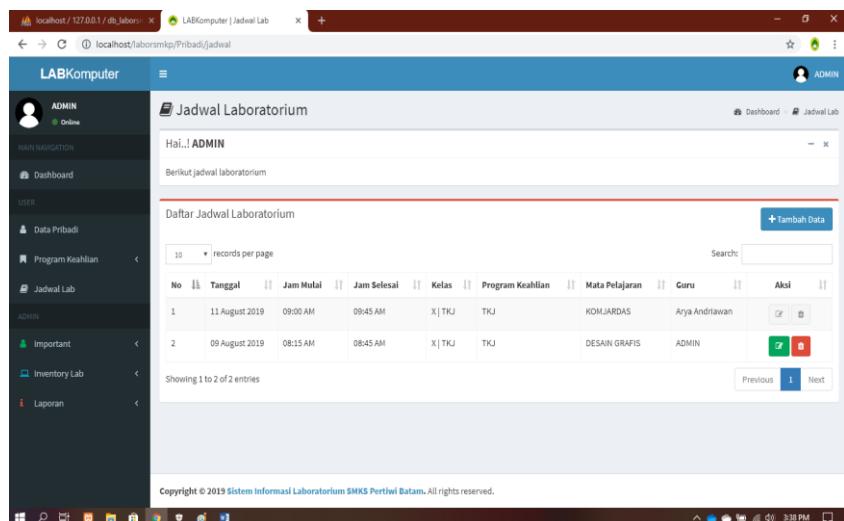
- 4) Expertise programme data entry screen to view the list of subjects of all expertise programmes in SMKS Pertiwi Batam (Figure 14).

**Figure 14.**  
 Expertise programme data input display admin



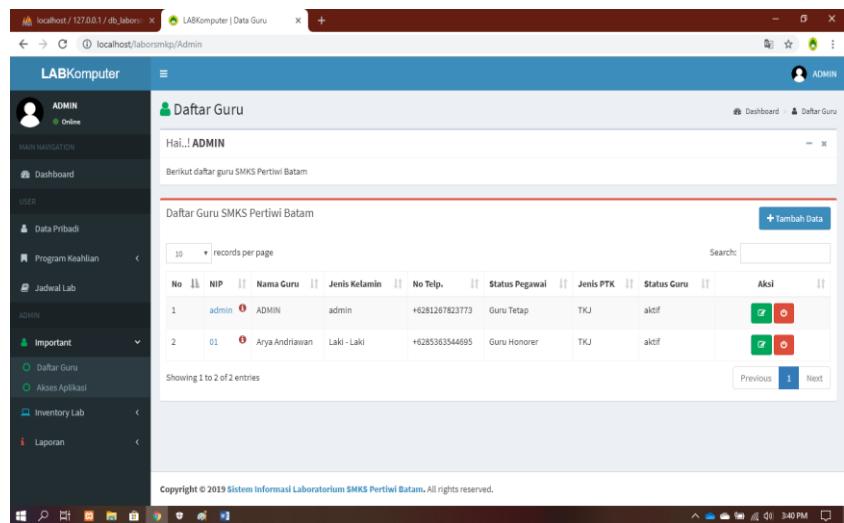
5) The Data Entry Screen of the Computer Lab Usage Schedule List functions to enter data for the computer lab usage schedule (Figure 15).

**Figure 15.**  
 Admin laboratory usage schedule data input display



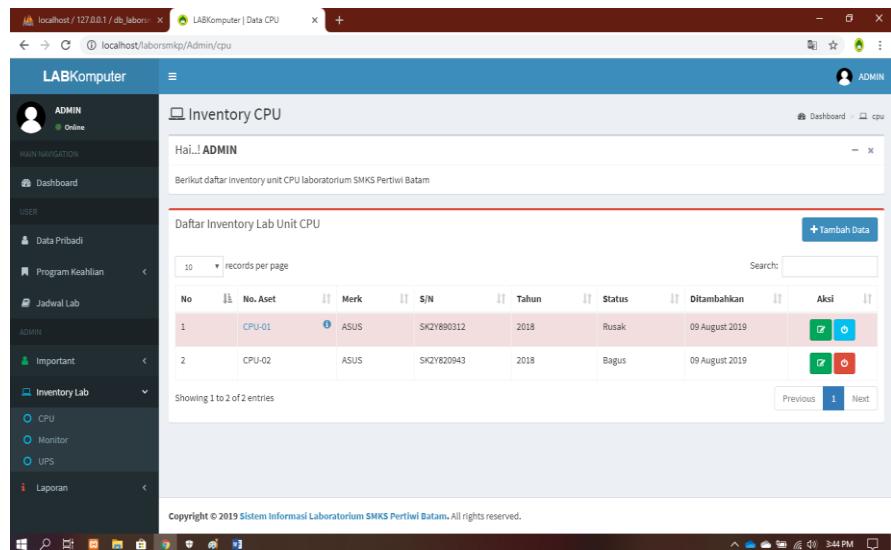
6) The Teacher List data entry screen functions to add teachers to have access to this computer lab application (Figure 16).

**Figure 16.**  
 Admin teacher list data input display



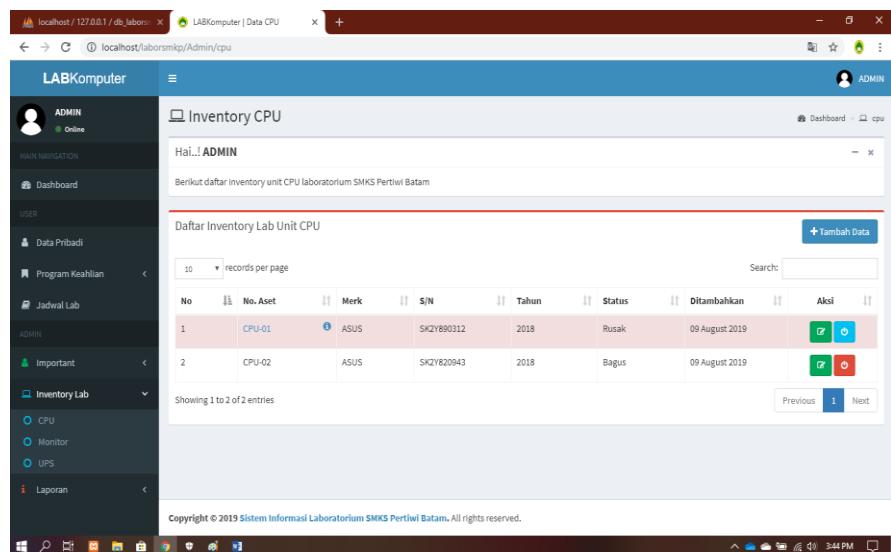
7) The Computer Lab Inventory Data Entry screen functions to find out in detail how many assets are in the Computer Lab.

Figure 17.  
Admin inventory  
data input display



8) Display of application usage reports, laboratory usage and display of computer laboratory inventory reports, which can later be printed in softcopy and hardcopy.

Figure 18.  
Admin laboratory  
data report display



### 3.3.3 Testing

In the testing phase, the author uses the following hardware and software specifications:

- a. Motherboard : Intel
- b. Processor : Intel Core i3 CPU M330 @ 2.13Ghz
- c. Harddisk : 320GB
- d. RAM : 4 GB (3.47 GB Usable)
- e. Keyboard : Standart
- f. Mouse : Standart
- g. Operation system : Windows 10 Pro 64-bit
- h. Web Browser : Microsoft Edge dan Google Chrome

Software testing of Computer Laboratory Management Information System Development at SMKS Pertiwi Batam is then tested using a black box technique model. Black box testing is used to test the specific functions of the designed software. The black box testing technique is a test conducted to observe the results of the execution of the software. Observing these results through test data and checking the functionality of the software itself.

Table 2.  
 Black box testing

No	Module	Tests conducted	Expected results	Final result
1	Login	Login to Admin and Teacher side	Admin and Teacher page view	Successful
2	Input	Inputting data on expertise programmes, subject schedules, teachers and computer laboratory asset data	Display of newly added data	Successful
3	Delete	Delete data on expertise programmes, subject schedules, teachers, and computer lab asset data	The selected data has been deleted	Successful
4	Edit	Change data on expertise programmes, subject schedules, teachers, and computer laboratory asset data	Changes to selected data	Successful
5	Search	Enter the keyword you are looking for	Display the searched data	Successful
6	c	Print asset data, computer laboratory usage into softcopy and hardcopy	Display asset data, computer lab utilisation into softcopy and hardcopy	Successful
7	Security	Directly access the desired page	Tampil halaman login	Successful

#### 4. Conclusion

With regard to the problem formulation and the research objectives contained in this study, followed by the implementation, several conclusions can be drawn, including:

- The development of a web-based Computer Laboratory Management Information System at SMKS Pertiwi Batam is designed using bootstrap, codeigniter and MySql as a database. So this application can be run on a multiplatform and it is very possible to be developed in the future and can be uploaded.
- By using the computer laboratory scheduling application, computer laboratory usage, computer laboratory inventory becomes faster and more effective.

After developing a web-based Computer Laboratory Management Information System at SMKS Pertiwi Batam, there are several suggestions that need to be applied for the further development of this system:

- a. The information system that has been created is expected to be applied in related agencies.
- b. Creating a system that is able to store student activity record data every time students carry out practical activities using data replication on the client server.
- c. The system design can be developed again with a more attractive user interface design.
- d. Develop a system that is able to store data on computer laboratory activities of SMKS Pertiwi Batam according to the class of students who use the computer laboratory.

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## Declarations

### Author contribution

Hanafi as research implementer, designing media and collecting data. Novi Hendri Adi as research and article concept designer. Agung Budi Kusuma as research and article concept designer. Sai Kham Le as proof-reader.

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### Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Ethical clearance

There are no human subjects in this manuscript and informed consent is not applicable.

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