MANAGEMENT INFORMATION SYSTEMS OF LABORATORY USING LARAVEL FRAMEWORK: CASE STUDY AT ELECTRICAL ENGINEERING OF UNIVERSITAS NEGERI SEMARANG

Muhammad Irfan Hammam Zuhdi
UniversitasNegeri Semarang
irfan.hammam@gmail.com

Subiyanto
Universitas Negeri Semarang
subiyanto@mail.unnes.ac.id

Sri Sukamta
Universitas Negeri Semarang
ssukamta2014@mail.unnes.ac.id

Abstract

The distribution of services using information system technology greatly helps stakeholders. There were still frequent errors found in the management of scheduling lab work in the Laboratory services which had not using the laboratory information system yet. This paper presents the development of laboratory management information system which facilitate scheduling lab work, a case study at Electrical Engineering Laboratory of UniversitasNegeri Semarang. The steps of constructing this system started from the data collection phase, design phase, and construction phase. This information system was built by using laravel framework based on MVC (Model-View-Controller). The system was created by using PHP programming language and MySQL database. The information system was created to ease and facilitate the Chairman of the Laboratory, Laboratory Institution of Education, and students in monitoring laboratory activities, including data lab work, voting laboratory scheduling data, the data of lecturers, the data of subjects and laboratory data of Electrical Engineering . Based on the test result, SIMLAB is effective enough to be applied in Electrical Engineering laboratory Universitas Negeri Semarang.

Keywords: *management information system, laboratory, framework laravel*

INTRODUCTION

The rapid development of technology nowadays makes us easier to get information from around the world through an Internet-connected computer (Bartuskova, Krejcar, & Kuca, 2015), (Purba & Panday, 2015). The rapid development of technology leads to the higher need of information. Therefore, it is necessary to have an informa-tion system to facilitate access and enjoy the information provided (Pratama, 2014) (Laudon & Laudon, 2005). The information system, nowadays, be-comes the most important part of educational institutions. In the world of education, a ser-vice delivery by using information technology is very helpful to stakeholders (Xiao & Wissmann, 2004). Information systems in educational institutions aim to improve the quality of teaching and helping students in the learning process (Le Ru, Aron, Gerval, & Napoleon, 2015) (Li, 2015).

The quality of education is influenced by many factors, including the availability of adequate educational facilities and competent human resources. One of the facilities and infrastructures in educational institution is the laboratory (Putro & Triyono, 2016). Laborato-ry is a place of experimentation and research. The laboratory in the learning process is used to achieve various goals like the cognitive objectives related to the concepts of scientific concepts, the process of developing skills and increasing understanding of the scientific method.

Laboratory is one of the supporting facilities for the implementation of *Tri Dharma* college, both education and teaching; research and community service. Therefore, in order to make the implementation of *Tri dharma* college run well, an adequate laboratory is needed in term of human resources (HR), equipment, data organization, and other sup-porting facilities (Salahudin, 2007).

A Laboratory Management Information System is a computer-based software appli-cation used in the laboratory to manage and analyze samples, test results, laboratory staff, laboratory equipment and aims to produce reports and other functions. Thus, the func-tions of management information system of laboratory include the management of acti-vities, information, and integration of devices and processing of other computer systems in the laboratory (Skobelev, Zaytseva, Kozlov, Perepelitsa, & Makarova, 2011). The use of Laboratory Management Information System can generally minimize errors made by human (Yusof & Arifin, 2016).

To create the information system as expected above, it is necessary to present a framework to assist in the process of making such system. In a study entitled "an Empirical Study of Evolution of PHP MVC Framework" which compares an MVC based PHP frame-work concluded that framework of the current trend is *laravel framework.* In the survey of web developers using the concept of MVC in the world in 2013, laravel framework also occupied the first position with 26% (Olanrewaju, Islam, & Ali, 2015) (Aminudin, 2015) (Tim Air Putih, 2014).

Laboratory of Electrical Engineering of Universitas Negeri Semarang has not used a laboratory management information system yet which resulted in less efficient services given to students. The laboratory of Electrical engineering still faces difficulties in arranging student lab schedule because the number of practicum tools is not the same with the number of students so that the learning proc-ess still not effective. The solution needed is to build a laboratory management information system that can overcome the problem of scheduling the practicum.

The presence of Management Infor-mation System for the Laboratory of Elec-trical Engineering is expected to assist in opti-mizing teaching and learning; and assisting the head of the laboratory, PLP (Lab Assis-tant) and Students in monitoring laboratory activities related to the data of scheduling and choosing practicum; course listing; lecturers and students listing, and laboratory stuffs.

RESEARCH METHODS

There were 3 stages in this research, i.e, data collection, design, and build stage. The first stage of research in making the system was the data collection stage by conducting literary studies and interviews. From the process of literary study and interviews, it was obtained workflow, list of the needs of the current situation, laboratory data from the department and the theory concerned with the development of the system. The case was shown in Figure 1.
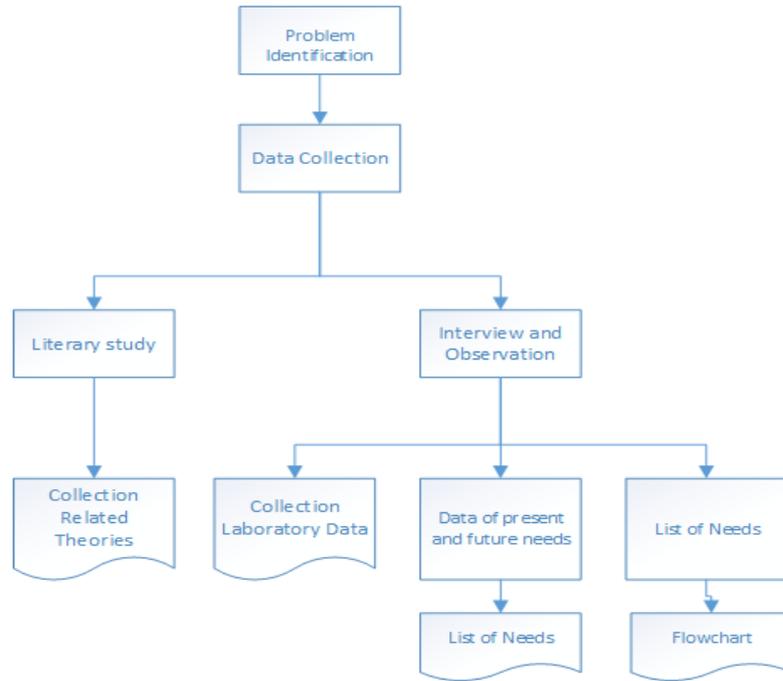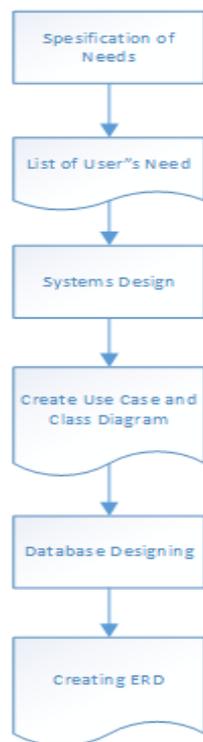
Figure 1.   The Data Collection Stage

Figure 2.   The Design Stage

The next process was the design stage. At this stage, the system design was done according to the needs analysis that had been done. The design process of this system input employed Use Case, Class and Entity Relationship Diagram as database design, as shown in figure 2. The next step was the building stage which was done by preparing tools and materials, then performing the coding by using laravel framework. The building/creation is in accordance to the design made. After that, the system was tested in *alpha testing* to know whether the system has been as expected or not, if it is not appropriate, the coding will be performed again and again. As shown in figure 3.
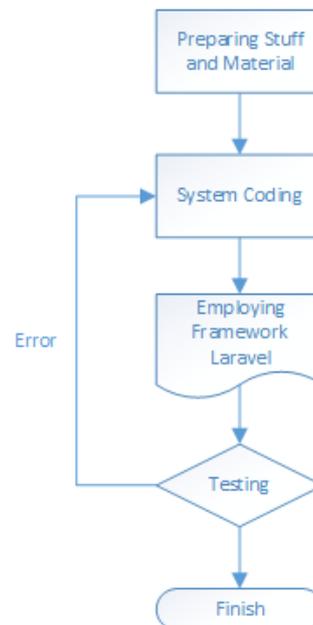

Figure 3.   The Building Stage

Use Case Diagram

There are three level users in SIMLAB (Laboratory Management Information Systems), i.e., administrators, laboratory assistants, and students. Each of them has different access rights. SIMLAB it self aims to assist students in determining the scheduling lab work or practicum, the system consists of a use case for the schedule-making process of practicum by students that consists of data input and view of the data.

Use case Diagram Admin

Admin as system controller has the main privilege of managing the users in accordance with the permissions. Admins can add, change and delete the user account either PLP or students. As shown in Figure 4.
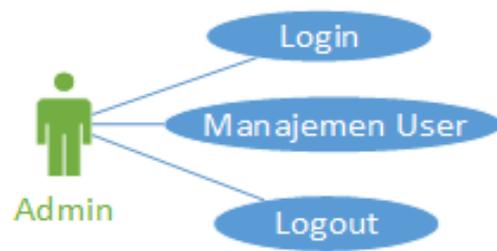
Figure 4.   Use Case Diagram Admin

Use Case Diagram PLP and Students

PLP (Lab Assistant) has the right of accessing the management of course, room or space, schedule, and scheduling registration. While, the students have access right related to input registration schedule and choose the schedule of practical work. As shown in Figure 5.
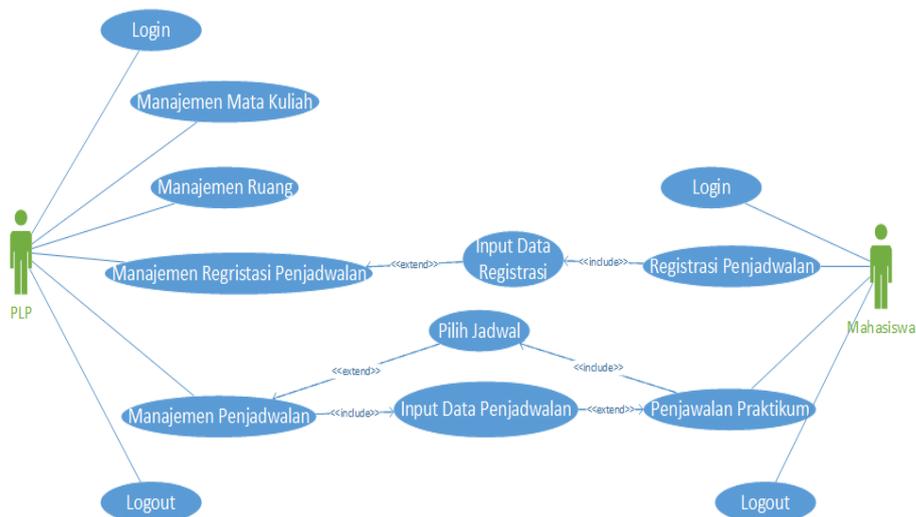
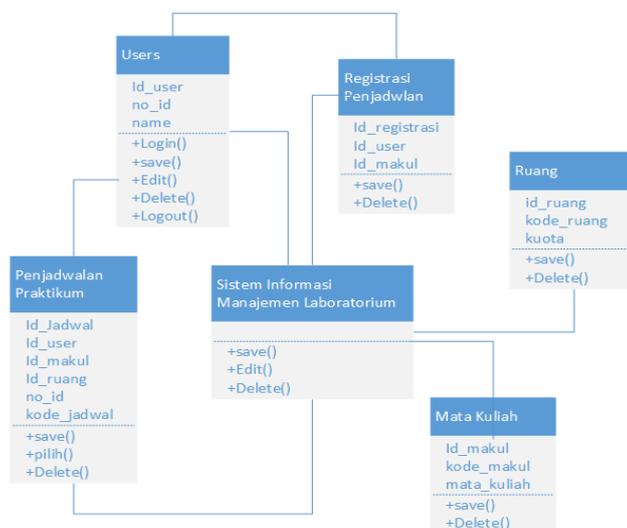Figure 5.   Use Case Diagram PLP and Students
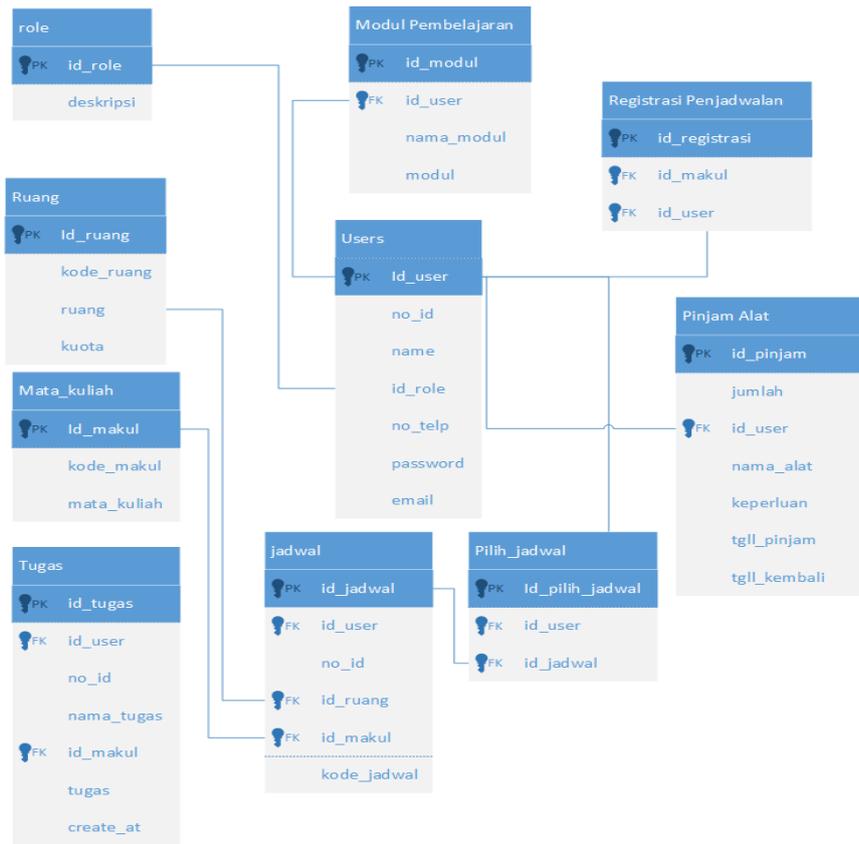
Figure 6.   Class Diagram

Figure 7.   ERD SIMLAB

Class Diagram

Class diagrams were made to explain which classes are available in the system in which each class displays the variables, properties and methods available in it and its relationship among them. The classes contained in SIMLAB are as shown in Figure 6.

Entity Relationship Diagram

In Laboratory Management Information System of Electrical Engineering, the processing system centered on a database. The database proceeded the design of database on SIMLAB by using Entity Relationship Diagram (ERD) method to know the relationship among tables/entities to each other as shown in Figure 7.

System Encoding

The Laboratory Information Management System was made by using laravel framework. Laravel is PHP framework with MVC design *(Model-View-Controller)* which is used to create website application. Model-View-Controller (MVC) is a concept for encapsulating data along with processing (model), isolating from the process of manipulation (controller) and view to be represented on a user interface (Deacon, 2009) Figure 8 illustrates the basic relationship of Model-View-Controller.
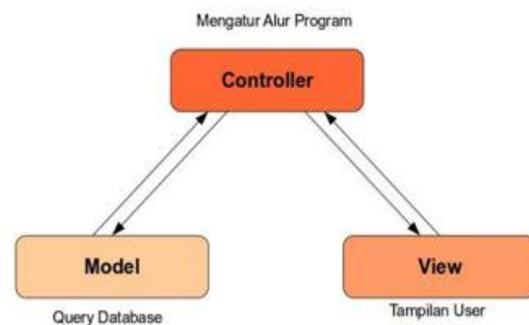

Figure 8.   Model-View-Controller

Model

It is part of the application code associated with the database. When discussing the model, it will definitely discuss about the database. To retrieve all existing data in the user table database, then all it takes is to create a model named user. After that, just

enter the data from all data created from the table users such in the following way:

```
protected $fillable =
['name', 'email', 'password',
'id_role', 'image', 'status',
'no_telp', 'no_id', 'prodi' ];
```

View

It is the code section associated with the display to the user. View can be defined as a visual representation of a web application that allows the user to interact directly to the application. Laravel also emphasizes the use of this view with templating. Templating on Laravel is by using Blade.

In building an interesting look at lab management information system with the laravel framework, then it was used the bootstrap Admin LTE.

Below is the script from jadwal.blade.php file

```
@foreach($input_jadwal as
$input_jadwal)
<tr>
<td>{{ $input_jadwal->kode_jadwal
}}</td>
<td>{{ $input_jadwal->kode_makul
}}</td>
<td>{{ $input_jadwal->mata_kuliah
}}</td>
<td>{{ $input_jadwal->name }}</td>
<td>{{ $input_jadwal->ruang }}</td>
<td>{{$input_jadwal->pemilih}}/{{
$input_jadwal->kuota }}</td>
</tr>@endforeach
```

Route and Controller

Route

In building the information system by using laravel framework, it is required routing. Routing is the process by which an item can get to its destination from one location to another. In the case of laravel framework, the item in question is a page website. In laravel, routing for web applications is in **route.php** files in the folder **app.** The Sricpt route on SIMLAB leading to the home page is:

Route::get('home', 'HomeController@index');

Controller

It is the section of code that connects between Model and View. The function of the controller is to accommodate the direction of the routing which will be processed. All controllers inside the Laravel app is in the app/Http/ controller **folder**. The controller from rekap_jadwalController is as follows:

```
$input_jadwal =
DB::table('input_jadwal as a')
->leftjoin('mata_kuliah  as b',
'a.id_makul', '=',      'b.id_makul')
->leftjoin('users as c', 'a.no_id',
'=', 'c.no_id')
->leftjoin('ruang as d', 'a.id_ruang',
'=',    'd.id_ruang')
->select("*")
->get();
```

Testing and Validation of SIMLAB

System testing and validation was done in the laboratory of Electrical Engineering. Laboratory of Electrical Engineering of UNNES has 8 learning support laboratories: computer lab, computer network lab, STL lab, electrical lab, electronics lab, audio video lab, microcontroller lab, and control and RCL lab. SIMLAB testing was done by using two kinds of testing, i.e., alpha and user acceptance test.

Alpha Testing

Alpha testing was done by System builder. Alpha testing was done to find out whether The built system still has Error on system or display. In alpha testing, Testing of some functions already created on the system were done. The functions tested were related to: add, change, delete, edit data, see, and select data.

User Acceptance Test

The researcher prepared the test sheet/instrument by writing down all the functions and how to execute and then asked the user to try the laboratory information management system software, if the scenario form is the same as the expected result, it means the test succeeded.

RESULT AND DISCUSSION

Test Result

Alpha test results can be seen in Table 1 while Test Results user can be seen in Table 2.

Table 1.   Alpha Testing

Function	Scenario	Results	Status
Add Data	Add User (Admin) Add a course (PLP) Add space (PLP) Add Scheduling Registration (student)	Data Successfully Added	Worked
Clear Data	Users (Admin, PLP, and students) can delete the content by clicking the delete icon.	Data Successfully deleted	Worked
Edit Data	Change the content that has been added without deleting it by the way the user clicks the edit icon and changes what needs to be replaced and then save it.	Data Successfully Changed	Worked
View Data	View the table of students who have entered the schedule by clicking the icon see detail.	Data successfully viewed	Worked
Select Data	Students can add select schedule of practicum by clicking icon select schedule on menu scheduling sub menu select schedule.	Data Successfully selected	Worked

Table 2.   User Acceptance Test

Case Test	Scenario	Expected results	Status (Worked/ Failed)
User Login	Fill out the username and password form. Example username: 5302412072Password: admin2012	Successfully login and dashboard page appears	worked
User Input	Fill data such as name, NIP, email, password then click "simpan"	Data goes to user table (student or PLP)	worked
Edit Self Data	Edit self data in the menu of profile nama, NIM, email and password	The data will change according to the data entered	Worked
Courses Input	Fill in the makul code, SKS on the makul data input menu then click "Tambah" button	Data enter into the course table	Worked
Room Input	Fill in the "ruang" code, ruang, and kuota on the data input menu ruang then click "tambah"	Data goes to the room table	worked
Scheduling Registration	Click "tambah registrasi" and then "isi data mata kuliah"	The data will go to the Registration list	Worked
See Scheduling Registration	Click on the "menu penjadwalan" and select the "Submenu Registrasi"	It will show a scheduling regristation recap	worked
Scheduling Input	Click the" input jadwal" and fill out the form such as kode jadwal, mata kuliah, nama dosen and ruang, then click "simpan"	The data will go into the scheduling list	worked
Select Schedule	Click the "jadwal" menu then click on the selected schedule by clicking the checklist icon	The data will go into the table select schedule	worked
View Scheduling Details	Click the schedule detail icon in the scheduling table	It will appear the names of students who have chosen the schedule	worked
Logout system	Click the "logout" button in the upper right corner	It will exit from SIMLAB	worked

Discussion

Laboratory Information Management System was made by using PHP programming language assisted by laravel framework. The system that has been created can facilitate registation of scheduling, scheduling practicum and selecting schedule. SIMLAB display is by using bootstrap admin LTE Laravel version.

Reviewing the results of *alpha* testing, it is shown that the system made has already run correctly in accordance with its function of adding, deleting, editing, viewing and selecting the data. The result of the user test, once the user runs the system, is in accordance with the instrument that has been created, the overall presentation of success was 100%. From user login testing until system logout (Table 2), it has been in accordance with expected result.

In making SIMLAB there are 3 user level namely Administrator, PLP, and students. Each user has different permissions. Administrators have permissions to manage users (PLP and students) that is to add and delete users. PLP has access rights to input courses and laboratories, manage student scheduling registration, and input the schedule of practicum. Students have the right of access to input scheduling registration, choosing schedule of practicum. Registration of student scheduling become input guide of scheduling practicum for PLP. Students who take the practice course are required to register the scheduling first. So the lab will run smoothly because the willingness of practice tools is in accordance with the number of students of practicum. The Scheduling page displays a table of scheduling inputted by PLP. Students can choose a practical schedule for the scheduled schedule for 1st semester, as shown in Figure 10.

SIMLAB helps them solve the scheduling problem that is still becoming a constraint in scheduling of the lab. Students may request the opening of the practicum class by way of scheduling registration, and selecting the lab schedule. So that, the students' practicum program becomes better and efficient because the number of practicum tools available is in accordance with the number of students in practicum in one class.
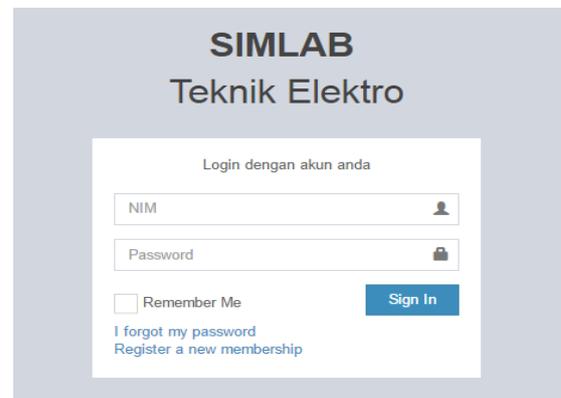

Figure 9. Login SIMLAB

Figure 10. Choose the Practice Schedule

CONCLUSION

Information and communication technology can improve service to user by using information system. SIMLAB which has been created can facilitate scheduling such as scheduling registration, input and selection of schedule. The built information system can assist the head of the laboratory, PLP, and students in monitoring laboratory activities, including data of scheduling, laboratory used, lecturers, students, and practicum course. The detailed information in the development of Laboratory Management Information System can be seen in research methods that can be used for system development. From the test results, it is indicated that SIMLAB which has been made is feasible to be applied in the Department of Electrical Engineering of UNNES

Recommendation

Based on the conclusion above the recommendation for the head of laboratory, PLP, and students is to utilize or use SIMLAB as a system to facilitate scheduling practicum which is still a problem in the laboratory of Electrical Engineering of UNNES.

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