

# Design and Implementation a Web-Based Semester Learning Plan Management Information System

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Received: Maret 5, 2023; Accepted: May 11, 2023

**Abstract**—This research designs and implements an information system to manage web-based Semester Learning Plan using cloud computing technology, software, computers, and repositories as well as a serverless architecture. So far, the preparation of Semester Learning Plan in Department of Electrical Engineering UIN Sunan Gunung Djati Bandung is still done manually using a template in Microsoft Excel format. This method is considered ineffective because filling in takes a long time and the output is sometimes not uniform, both between lecturers and between courses. Based on this background, the author proposed the idea of creating a web-based Semester Learning Plan management information system. The method used to develop this system is the waterfall method which consists of five stages, namely requirements analysis, system and software design, implementation, testing, operation and maintenance. This information system using cloud computing technology and serverless architecture. The result of this research is a web-based Semester Learning Plan management information system. Through this system, lecturers no longer type manually into doc or xls format, but lecturers can directly input into the system or the web. The output is that the Semester Learning Plan can be downloaded and is in accordance with the applicable format and is in pdf format. The existence of this system can increase the effectiveness of lecturers in managing Semester Learning Plan.

**Keywords**— semester learning plan, web based, waterfall method, serverless architecture.

## I. INTRODUCTION

RPS stands for Semester Learning Plan. The RPS for a course is a learning process plan that is determined and developed by lecturers either independently or together for learning activities for one semester which aims to fulfill graduate learning outcomes assigned to the course [1]. RPS is prepared by the lecturer in charge of the course before the lecture activities take place and delivered to students at the initial meeting of the lecture. RPS is intended to guide lecturers and students in the learning process so that the material provided is in accordance with the learning objectives set in the course [2].

Changes in information and communication technology affect and even change things in almost every area of the digital era, one of which is in the education sector. One of these values is digital transformation [3]. Higher education institutions have been infused with technological advances brought about by the Industrial Revolution 4.0 and forced institutions to face digital transformation in all dimensions [4]. Digital transformation in the higher education dimension such as the teaching administration process [5], software infrastructure [6], and administration dimension [7] has made tertiary institutions to adapt to digital transformation in several of these dimensions, one of which is related to the management of lecture administration in the form of lesson plans.

The preparation of this RPS is certainly not a simple matter and is a challenge for lecturers in formulating it so that it is in accordance with the curriculum set by study program. So far, the preparation and management of RPS at the Department of Electrical Engineering UIN Sunan Gunung Djati Bandung is still done manually, using a template in Microsoft Excel format. The template is then filled in independently by each lecturer for each subject taught. This method is considered less effective because it takes a long time to fill in and the resulting RPS output is sometimes not uniform, both between lecturers and between courses. This condition is of particular concern during the adjustment period with the government's program, namely the Merdeka Belajar-Kampus Merdeka (MBKM) program so that tools are needed that can streamline the management of the RPS.

Based on this background, the author proposed the idea of creating a web-based RPS management information system (SIM-RPS) which was then applied to the Department of Electrical Engineering UIN SGD Bandung. The availability of a web-based system is expected to make it easier and more effective for lecturers to manage lesson plans.

Research related to the preparation of web based RPS has been carried out by several researchers using various

methods and different case studies. The first research is from Nada S. Adilah et al [8] which discusses the development of an RPS information system and evaluation of CPL based on a progressive web app at the Department of Informatics, State University of Gorontalo. The preparation of RPS is not optimal and efficient because it still utilizes the Microsoft Excel application. However, after the information system was created, it was found that the process of preparing the RPS and evaluating the feasibility of the CPL could be carried out quickly and optimally.

Budi Yanto and Rika Perma Sari [9] made Web-Based Electronic Semester Learning (E-RPS) at the Faculty of Computer Science, Pasir Pengaraian University. Filling in the RPS is still using a manual system, namely by using Microsoft Word which must be typed by each lecturer. The website-based application is a product resulting from this research and is proven to make it easier for lecturers to fill in the SLP and each student can view or print the RPS independently via the web.

The design of the RPS application to increase learning achievement for lecturers at the Islamic University of Kalimantan (UNISKA) Muhammad Arsyad Al Banjary has been carried out by Gita Ayu Syafarina et al [10]. Making RPS still uses Microsoft Word so there are differences in filling in each variable. The use of this system has received a good response with an average percentage of 96%, making it suitable for use as an online-based RPS application.

Furthermore, Gallen Cakra Adhi Wibowo and Eko Sedyono [11] designed and built an Information System for web based RPS adaptation using the Laravel framework. The underlying problem is that the RPS is not well documented and the RPS that is made does not follow the material provided by the lecturer because the RPS input still uses Microsoft Excel. The results of the study show that the information system can make it easier for lecturers to manage RPS and can determine its suitability with the material provided by the lecturer.

Muhammad Nugraha et al [2] made a web based RPS Management Information System using the Waterfall Model. The underlying problem is that the process of changing RPS content is not well documented, and it is difficult for users to access the changed content. The results of the study show that the existence of a RPS management information system can make it easier for lecturers or study programs to manage RPS so that users can access changes that occur in RPS.

Furthermore, Indera et al developed an RPS system design in the Information Systems Department [12] and implemented a Web-Based RPS IIB Darmajaya [13]. The background of the first research was the absence of centralized data storage media to store course documents such as SAP, GABPP and RPS. To overcome this, researchers designed a web-based information system for these documents. The development of this system design can make it easier for departments to develop further towards filling in RPS data so that it can be stored properly in the system. The research was then continued towards implementation. By building the Information System, it turns out that the process of filling in RPS data becomes easier and students can see the RPS according to the desired course.

Based on previous studies, it can be concluded that web-based applications for RPS management have been carried out by several researchers to be implemented in several related tertiary institutions. Almost all of them are motivated by ineffectiveness in managing RPS because they still use a manual system in the form of doc or excel forms. Some of these applications are developed using various technologies.

What makes this research different from previous research is the use of a serverless architecture. This research designs and implements an information system to manage web based RPS using cloud computing technology, software, computers, and repositories as well as a serverless architecture. In a serverless architecture the developer can focus on developing the user interface of the application. The SIM-RPS user interface is developed using React and other supporting libraries such as react-dom, react-router-dom, and material-ui.

Serverless architecture is a term used when developers use services that are fully managed and maintained by cloud providers to build an application. To support serverless architectures, cloud providers generally provide serverless services for computing, databases, object/file storage, API gateways, authentication, email services, notifications, logging, monitoring and so on [14]. The advantages of using a serverless architecture include easy and fast application deployment processes, more cost effective because they generally use the pay-what-you-use or pay-as-you-go concept, developers can focus more on developing applications, and better scalability. On the other hand, using a serverless architecture also has several drawbacks, namely cold starts, resource limit, and migration is not easy. To minimize the impact of cold start issue, developers should consider using a programming language that requires a short cold start time. Apart from that, developers can also increase the size of the memory (RAM) that will be used to run program code, as well as optimize dependencies and file size of the program code that is created. Also, never force serverless computing to do what it can't possibly do.

## II. METHODS

The program design process uses the waterfall method. The waterfall model is the basic model of the SDLC (Software Development Life Cycle). The waterfall method is a process method for modeling a software system that is structured and built sequentially. The waterfall model divides the life cycle into a series of phases. This model assumes that a phase can be started after the previous phase has been completed. This means that the output of one phase becomes the input of the next phase. Thus, the development process can be thought of as a sequential flow in a waterfall. Waterfall Model as a self-developed software development model has stages consisting of [15]:

### A. Requirement Analysis

System analysis is carried out to study the various interactions that occur within a system which aims to identify and evaluate problems that occur and what needs are expected, so that a system improvement can be proposed. A review of the current system is carried out to find out how the process of the RPS management system is running.

Furthermore, an analysis of the problems encountered is carried out to find out the procedures for each data needed and generated from the current RPS management system. From this analysis it produces data that must be processed so that it can produce data output as needed. After reviewing the ongoing procedures and determining the problems, software requirements specifications can then be determined which will later be used to build a more effective RPS management system. Non-functional requirements analysis is carried out to determine system requirements specifications. For example, determining the input specifications required by the system, the output to be produced by the system, and the processes needed to process the input to finally produce the desired output. Analysis of non-functional requirements includes analysis of hardware requirements, analysis of software requirements, and analysis of user requirements. In this section, functional requirements are analyzed, both data and information flow. The context diagram depicts data flows between the system and the outside of the system, both data flows into and out of the system. Furthermore, Entity Relationship Diagram (ERD) is used as a tool to model the relationship between objects or entities and their attributes.

### B. System Design

System design uses the UML model which consists of database design and interface design. Database design is used to design data that is connected and stored together in an RDBMS (Relation Data Base Management System). While the interface is a specification of the appearance of the system to be built. The interface is designed in such a way as to make it easier for users to operate the system.

### C. Implementation

The implementation stage is carried out after the system design process has been completed. The system design that has been made will be implemented using hardware, software and programming languages to build the system. Database implementation is done through the firebase console to manage the firestore database. Based on the data model design that has been made, collections and documents are input manually through the firebase console. The interface of the application is implemented using a library for interfaces, namely React. Then to manage navigation and between pages using React Router DOM. As for components such as input and buttons then layouting uses system design from Google, namely material design through React components ready to use material UI.

### D. Testing

The next stage is testing the system that has been made. The first test is software testing which cannot be missed in the software development cycle. Through software testing, it will be known whether the system being built meets the criteria made when designing the system. In testing the RPS management information system, a software testing approach will be used, namely black box testing. This test focuses on the functional requirements of the system being built so that it is possible to find errors or functional errors by testing various input conditions into the system.

Furthermore, beta testing is a test that is carried out objectively where the system created is tested directly in the field. From beta testing, we will get information about user

satisfaction, especially in fulfilling the needs of the initial goals of system development. The data collection technique carried out in beta testing is through a questionnaire. Retrieval of questionnaire data was carried out to permanent lecturers of Electrical Engineering by filling out the Google form provided.

### E. Operation and Maintenance

The last stage is about operation and maintenance. After the application has been tested through beta testing and there are questionnaires from users during testing, the next step is to use the SIM-RPS application in a real environment. Lecturers, especially permanent lecturers in Electrical Engineering, will begin to get used to compiling RPS using this application. Notes for improvements from users both based on the results of the questionnaire and from user experience in using the application, then improvements are made in stages. The SIM-RPS application is maintained so that it can function properly by carrying out maintenance at any time.

## III. RESULTS AND DISCUSSION

The following is the results of the needs analysis that has been carried out. At the Department of Electrical Engineering UIN Sunang Gunung Djati Bandung, RPS is prepared following the template set by the Faculty of Science and Technology in Ms. Excel. The RPS template is then distributed to all lecturers who teach courses in the semester to be held. Lecturers compile RPS for a number of courses they teach and then send it to the department's admin staff via email. Based on the results of discussions with several lecturers, a procedure like this has its own challenges, such as:

- Lecturers need quite a long time to prepare RPS, especially if the lecturer teaches quite a lot of subjects
- Some of the contents of the RPS are still not in line with the curriculum set by the department
- The output of the RPS is not uniform
- The RPS archive is not well documented
- RPS that have been updated are sometimes not sent to the department anymore
- There is no evaluation of RPS at the end of the semester

From these problems, a description of the needs for the system to be designed is then made as shown in Table 1.

TABLE I. REQUIREMENT DESCRIPTION

No	Requirement Description
1	System users are authenticated before using the system, with a username and password.
2	Displays the current semester and school year and a list of courses taught on the lecturer's account page
3	Displays a list of lecturer and course names as well as RPS data by semester and school year on the admin account page
4	Lecturers process RPS data (create, read, update, delete) and then submit it to the system and there is a notification to the admin
5	Admin (head of department) checks the RPS and verifies it. If there are still improvements to the RPS or the RPS has been verified, the system will send a notification to the lecturer concerned.

6	Admin (educational staff) processes majors, semester and academic year data		Delete) operations. Meanwhile, RPS data can only perform Read operations.
		Lecturers	Lecturers have the main task of managing (Create Read, Update, Delete) RPS data based on the courses taught each semester. Lecturers can read curriculum information, semesters and active courses.

Furthermore, a user requirements analysis is presented in Table 2.

The list of functional requirements is presented in the form of an ERD and a context diagram as shown in Figures 1 and 2.

TABLE II. REQUIREMENT DESCRIPTION

User	Requirement
Administrator	An administrator has access rights to run features including managing curriculum data, semesters, courses and notifications. Manage means he can perform CRUD (Create, Read, Update, Delete) operations.

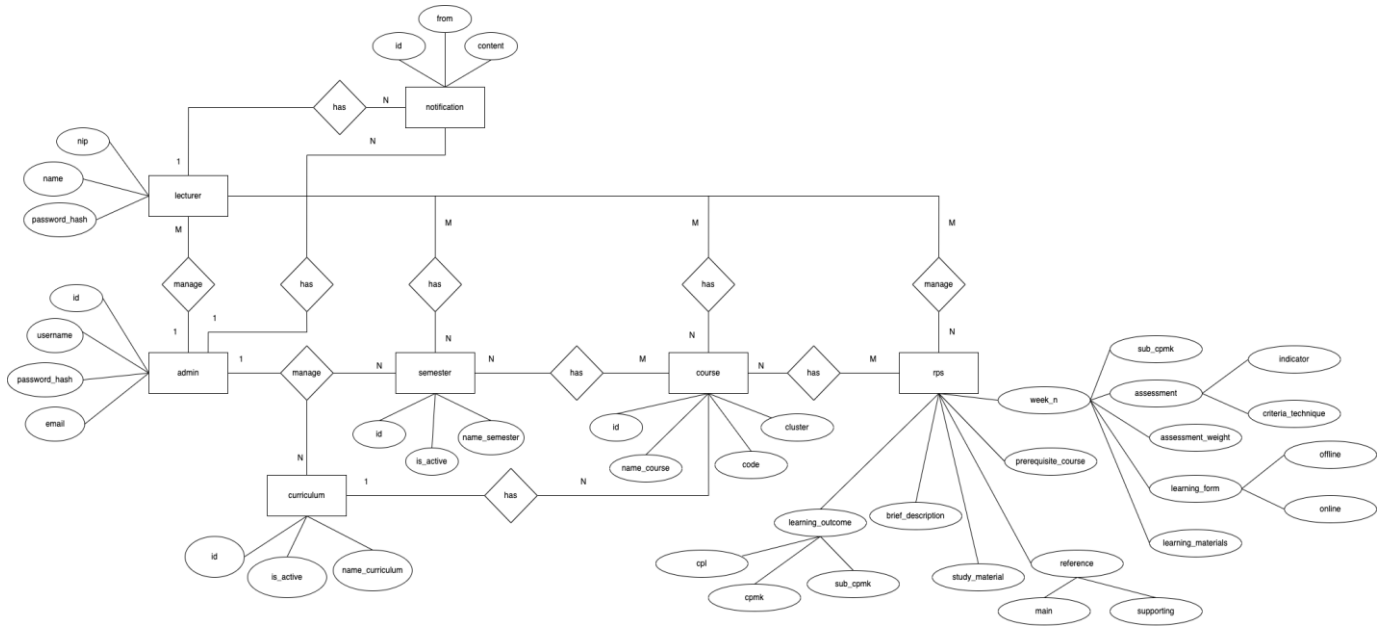


Fig. 1. Entity Relationship Diagram

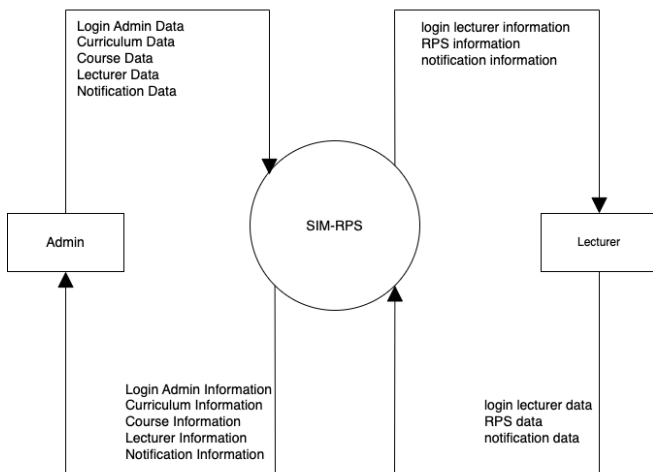


Fig. 2. Context Diagram

The implementation stage is carried out after the system design process has been completed. The system design that has been made will be implemented using hardware, software and programming languages to build the system.

Database implementation is done through the firebase console to manage the firestore database. Based on the data model design that has been made, collections and documents are input manually through the firebase console. The interface of the application is implemented using a library for interfaces, namely React. Then to manage navigation and between pages using React Router DOM. As for components such as input and buttons then layouting uses system design from Google, namely material design through ready-to-use React material UI components.

The following is the result of implementing this system:

- Login Page



### Login Dosen

Alamat Email \*  
nikesartika@uinsgd.ac.id

Password \*  
\*\*\*\*\*

**SIGN IN**

Fig. 3. Login Page

- Dashboard Page



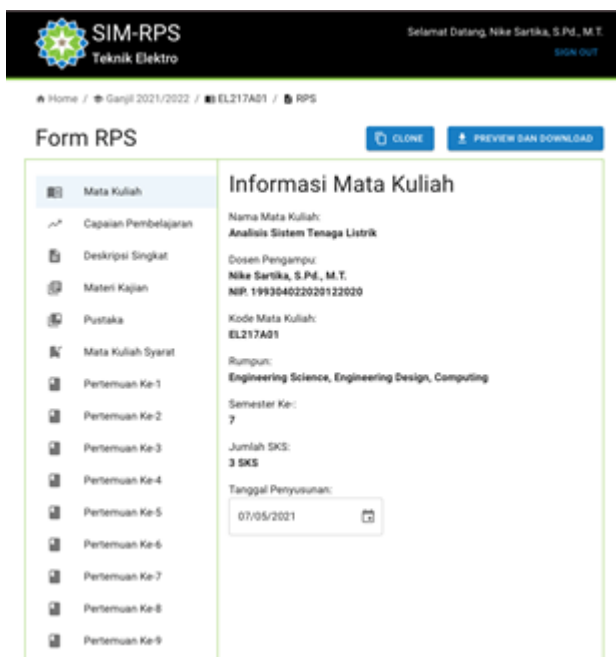
SIM-RPS Teknik Elektro Selamat Datang, Nike Sartika, S.Pd., M.T. **SIGN OUT**

#### Daftar Semester dan Mata Kuliah

Genap 2021/2022	Teknik Tegangan Tinggi Kode: EL210A03 Jumlah SKS: 3
Ganjil 2021/2022	Pengantar Sistem Tenaga Listrik Kode: EL215003 Jumlah SKS: 3
Ganjil 2020/2021	Analisis Sistem Tenaga Listrik Kode: EL217A01 Jumlah SKS: 3
Genap 2020/2021	Elektronika Daya Kode: EL217A02 Jumlah SKS: 3

Fig. 4. Dashboard Page

- Form RPS Page



SIM-RPS Teknik Elektro Selamat Datang, Nike Sartika, S.Pd., M.T. **SIGN OUT**

Home / Ganjil 2021/2022 / EL217A01 / RPS

### Form RPS

**Informasi Mata Kuliah**

**Mata Kuliah**

- Capaian Pembelajaran
- Deskripsi Singkat
- Materi Kajian
- Pustaka
- Mata Kuliah Syarat
- Pertemuan Ka-1
- Pertemuan Ka-2
- Pertemuan Ka-3
- Pertemuan Ka-4
- Pertemuan Ka-5
- Pertemuan Ka-6
- Pertemuan Ka-7
- Pertemuan Ka-8
- Pertemuan Ka-9

**Informasi Mata Kuliah**

Nama Mata Kuliah: Analisis Sistem Tenaga Listrik  
Dosen Pengampu: Nike Sartika, S.Pd., M.T. NIP. 199304022020122020  
Kode Mata Kuliah: EL217A01  
Rumpun: Engineering Science, Engineering Design, Computing  
Semester Ke: 7  
Jumlah SKS: 3 SKS  
Tanggal Penyusunan: 07/05/2021

**CLONE** **PREVIEW DAN DOWNLOAD**

Fig. 5. Form RPS Page

- Preview Page



Fig. 6. Preview Page

- Download or Print Page



Fig. 7. Download or Print Page

Software testing is an important thing that cannot be missed in the software development cycle. Through software testing it will be known whether the system built meets the criteria made when designing the system. In testing the RPS management information system, a software testing approach will be used, namely black box testing. Black box testing focuses on the functional requirements of the system being built. With this test, it is possible to find functional errors by testing various input conditions into the system. Table 3 shows the results of software testing.

TABLE III. SOFTWARE TESTING RESULT

No	Test Description	Result
1	Login with registered username and password	As expected
2	View course data	As expected
3	Manage learning achievement (CPL Prodi, CPMK, Sub-CPMK)	As expected
4	Manage course brief description data	As expected
5	Manage Study Material Data	As expected
6	Manage Bibliography Data	As expected
7	Manage prerequisite course data	As expected
8	Manage data for each meeting	As expected
9	View RPS data	As expected
10	Download or print RPS data	As expected

The next test is beta testing. Beta testing is an objective test in which the system created is tested directly in the field. From beta testing, we will get information about user satisfaction, especially in fulfilling the needs of the initial goals of system development. The data collection technique carried out in beta testing is through a questionnaire using 5-point Likert scale. Questionnaire data collection was carried out online using Google Form. Six responses were collected from Department of Electrical Engineering lecturers. Table 4 shows the results of beta testing.

TABLE IV. QUESTIONNAIRE RESULT

Question	SA	A	N	D	SD
The use of language on the menus provided by SIM-RPS is easy to understand	66.7%	33.3%	0%	0%	0%
The steps for compiling an RPS are simple and easy to understand	50%	50%	0%	0%	0%
Menu navigation on the SIM-RPS is in the right position	83.3%	16.7%	0%	0%	0%
Interesting SIM-RPS display	50%	50%	0%	0%	0%
The SIM-RPS page is easy to access	83.3%	16.7%	0%	0%	0%
There are no problems logging into SIM-RPS	66.7%	33.3%	0%	0%	0%
The SIM-RPS output is in accordance with the applicable format	83.3%	16.7%	0%	0%	0%
The developed SIM-RPS is more effective in managing RPS compared to using the manual method	66.7%	33.3%	0%	0%	0%
Having a SIM-RPS makes it easier to view the RPS archive for each course	83.3%	16.7%	0%	0%	0%

Note:

SA : Strongly Agree

A : Agree

N : Neutral

D : Disagree

SD : Strongly Disagree

After testing, the next step is for the lecturer to prepare the lesson plans for each subject taught in the coming semester. The system maintenance process is carried out based on feedback or bug reporting from users while using the system. This is done on an ongoing basis. The system is backed mainly by Google Firebase platform services which required less server administration and have autoscaling capabilities.

#### IV. CONCLUSION

Based on the results of the research that has been done, it is concluded that this web-based RPS management

information system can run well as needed. The existence of this system can increase the effectiveness of lecturers in managing RPS. Of course, this system still needs to be further developed so that the effectiveness of RPS management increases. To develop this system further can be done by adding other features. It is strongly recommended that this management information system be integrated with existing systems such as LMS or academic management system.

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