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Web-Based Management Information System Design for Student Organizations in Kendal Regency Using Next.js Framework

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ABSTRACT

Regional student organizations are essential for student development and fostering regional peer relationships. However, regional student organizations faced challenges in management due to the lack of digitization such as in the proposal's approval, work programs submission, and accountability reports. With these challenges, the development of information systems was essential for simplifying regional student organization management and increasing member participation and involvement. This research focused on the information system design stage, which includes database design and interface design where the goal is to design an information system for student organizations in Kendal area using Node.js technology and Next.js frameworks that use the System Development Life Cycle with a waterfall model for the research method. Next.js is a popular framework that simplified web application development with server-side rendering and static site generation, enhancing system performance and reliability. In conclusion, the design of a Web-Based Management Information System for Student Organizations in Kendal Regency using the Next.js framework successfully incorporated various system components, including Unified Modelling Language diagrams, Entity-Relationship Diagrams, system architecture, and user interface design. The future research should focus on the development and implementation on the proposed system for further improvement of student organizations management in Kendal District.

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1. INTRODUCTION

Regional student organizations or in Indonesian called as ORMADA are a forum for college students to develop their potential and strengthen relationships between students in a particular region. Student organizations originating from certain city/district areas have many forms and names depending on where the organization is formed. The implementation of Regional Autonomy also has a significant impact on the growth of student organizations/communities in the areas where they study [1]. As part of university student organizations, ORMADA has an important role as a platform for students and the people around them to improve their quality of life. Through various social, culture, and community activities that they do, ORMADA has the capability to encourages the participation of students in positive activities in their area. [2] stated that student organizations provide great benefits for students. When fulfilling its duties and responsibilities, it is possible for ORMADA to manage all data and information in an effective and efficient way by using a digital information system.

Information systems are an important element for an organization or an individual when it comes to creating new products, services and new business models [3]. In addition, the information system must fulfill the needs of the organization and can be easily accessed by the users. Therefore, designing a web-based ORMADA information system is a very important thing that needs to be implemented. The rapid development of technology makes it easier for organizations to manage several activities in the sectors of trade, industry, government, and education. Those activities that were previously carried out manually, they slowly turned into digital forms through the digitalization process, in order to simplify and be more time-efficient when completing a number of jobs [4]. Even some organizations that already digitalize still must adapt to technological developments, for example, student organizations that use Google Drive as file storage are considered ineffective and inefficient for carrying out student activities. For example, documentation such as in and out letters that is still stored manually in google drive, and also the process of submitting work programs and budget proposals that are still done manually. Because of these issues, an online and integrated system are needed in order to facilitate the process of monitoring and managing files [5]. Technology that grows rapidly and widely used nowadays is a web-based system, because it is easier for people to access information through the internet that can be accessed anywhere with an internet network [4].

Websites are a collection of elements consisting of text, images, and sometimes video footage or animated sound that make it an attractive information system tool and are highly demanded by its users. Websites can process data into information by identifying, collecting, managing, and providing it so the information can be accessed by many users simultaneously [6]. In the website design, the information system for managing regional student organizations will be dynamic where the information content on the website can be updated, with interactive two-way information content between organization management and organization members [7].

Several previous studies have been conducted on the development of student organization information systems. Previous research was conducted on Student Organization Governance through Information System Development. The research developed an ORMAWA system named Ormawasite. The focus of the research was to develop the management of ORMAWA activities and finances integrated with the student information system (SIMAS). In the research system, the Waterfall method was used. To design the system, the researcher used Structured Analysis and Structured Design (SASD) method with tools such as Use Case Diagram (UCD) and Activity Diagram. It uses Entity Relationship Diagram (ERD) as its database [5]. Previous research also related to the Design of a Web-Based Student Organization Information System at Universitas Advent Indonesia Using Agile Development Methods (Case Study: Universitas Advent Indonesia). The research developed an ORMAWA system at Advent Indonesia University. The system was developed with the Laravel framework and MySQL database. The test method uses black box for alpha test and beta test using an instrument with Likert scale [3].

This research, the design of a web-based information system is built using Node.js technology, which is a platform written in JavaScript that can be executed outside the web browser. In addition, Node.js also uses non-blocking techniques to speed up the process. In their research, [8] were comparing the performance of web service rest using Laravel, Django, and Node.js frameworks in web-based applications. It was concluded that Node.js is more superior when it comes to complete many requests from a given data set. With the advantages of Node.js, this research will design an information system using the Next.js framework. Next.js is a popular framework that facilitates the development of web applications with server-side rendering (SSR) and static site generation (SSG) features, which can help to improve system performance and system reliability.

From the research results, it shows that the development of student organization information systems is becoming increasingly important. It is due to the need of facilitating the process of managing data and information of organizations that are getting more complex. Therefore, an ORMADA are suggested to create an information system that can manage organizational data and information digitally. By using an information system, the organization's management process can be done more easily and quickly, while also minimizing errors in data processing. In addition, information systems can also increase the participation of organizational members as they can easily access information about the activities through the information system. Moreover, coordination between the members of the organization and the effectiveness of the activities organized by ORMADA is also supported by the information system.

Overall, the purpose of this research is to design a web-based information system for regional student organizations in Kendal Regency that can manage organizational data and information more easily and quickly, as well as increasing the participation of organizational members to participate in activities organized by ORMADA.

This research will focus on the information system design stage which includes database design and interface design. Moreover, this research also only focuses on student organizations in Kendal Regency area. Information system development needs to be carried out using the right development method and tools that can fulfill the requirements, as well as being well integrated. Hopefully, the results of this research can contribute to improve the effectiveness and efficiency of student organization management, as well as providing benefits

for organization members in accessing information. Thus the participation of organizational members will increase.

2. RESEARCH METHOD

The research method used in the design of this information system design is the system development method. System development method is a series of processes and approaches used by system developers to design, develop, and implement information systems or applications. The goal is to ensure that the created system would work properly, be well maintained, improve, and work efficiently. The system development method used in this design is the System Development Life Cycle (SDLC) with a waterfall model. Waterfall is a systematic and sequential information system development model that consists of 5 stages, which are requirements, design, implementation, verification, and maintenance [9]. Each phase can be seen in Figure 1.

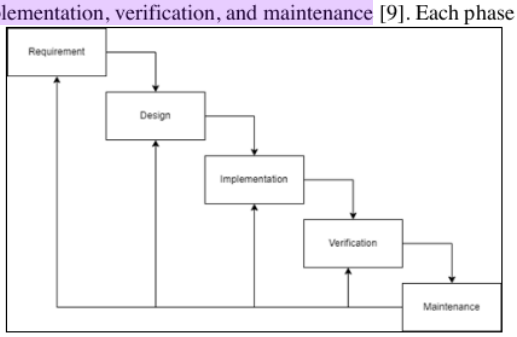

Figure 1. Flowchart of Waterfall Model Development Method
Source: [9]

a. Requirements
This phase, the researchers define system services, objectives, and problems based on the results of consultation with the users which will later be defined in more detail to form a system specification.

b. Design
Based on the existing analysis, the researchers use the Unified Modelling Language (UML) to build a system architecture by categorizing the software system requirements.

c. Implementation
This phase, the researchers implement the software design that will be made using Typescript programming language with Next.js framework that involves verification of each feature.

d. Verification
This phase, the researchers check the entire system by testing in order to find errors or debug during software development.

e. Maintenance
During this process, the system has been implemented and ready to operate, but it is still monitored because if there are any errors that were not discovered during the previous stage, the maintenance stage is needed to improve the system's services.

This research has limitations because it is only up to the design stage, which is the database design and interface design. So that there will be no testing and implementation process.

3. RESULTS AND ANALYSIS

By analyzing the requirements and designing with the waterfall model development method in the previous section, the researchers design a Web-based Information System for the Management of Regional Student Organizations in Kendal Regency using the Next.js Framework.

3.1. Requirements

At the analysis stage, the data collection process is carried out in order to obtain information about the ORMADA management information system application that will be created and further developed according to its requirements. Table 1 provides information about the items that are required in the Web-based Kendal Regency Regional Student Organization Management Information System application using the Next.js Framework.

Design stage is used to translate software requirements from analysis stage to design. In the application design, there are 7 web interface designs, including the Main Page, Event Page, Article Page, Management Page, About Us Page, Login Page, and on the website. There is a dashboard page with the Create Read Update Delete (CRUD) Data function. There is also a database design in the application design.

Table 1. Requirement Item for Web-Based Regional Student Organization Management Information System

No	Item	Information
1	Application Type	Web-Based Kendal Regency Regional Student Organization Management Information System Application Using Next.js Framework
2	Target Device	Computer, Laptop, Tablet and Smartphone
3	GUI	Main Page, Event Page, Article Page, Management Page, About Us Page, Login Page, and Data CRUD Dashboard Page
4	Image	Gallery images from the event
5	Application Synopsis	The Web-based Kendal District Student Organization Management Information System application is used as an information system in order to provide information to the public about Kendal Regional Student Organization. This application also makes it easier for ORMADA members and administrators to manage the organization
6	Software	Typescript Programming Language, Node.js Engine, Next.js Framework, MongoDB Database, Prisma Object-Relational Mapping (ORM), Type-Safe Remote Procedure Call (tRPC), Next Auth Auth Authentication
7	Hardware	Laptop and Server

Some frameworks and technologies were used in the development of this system to fulfill the requirements that have been defined. The following is a discussion about the application of each technology in the system.

1. Node.js
   Node.js is a runtime environment for JavaScript, the name of the runtime environment is JavaScript V8 Engine. Node.js is a platform that written with JavaScript which can be executed outside the web browser. In the book [10] explains Node.js is an interesting new platform that can be used to develop web applications, application servers, all kinds of client network servers, and general purpose programming. The platform is designed for extreme scalability in network applications through a clever combination of server-side JavaScript, asynchronous I/O, and asynchronous programming.
2. Next.js
   Next.js is used as the main framework on the client side of the system. Next.js enables the development of high-performance applications with server-side rendering (SSR) features that simplify SEO optimization. The implementation of Next.js in this system ensures a responsive user interface and boosts system performance. The research [11] explains this system allows engineers to create a powerful web with JavaScript without stressing on building a back-end foundation. It works in the most common way to crossovers applications with client-side as well as server-side delivered pages.
3. tRPC
   The use of tRPC is to manage the communication between the client and the server. tRPC allows users to easily build and use a fully secure API. When any error in the API contract will be detected before the application is run, it will reduce the number of bugs found when the application is run [12]. The tRPC in this system is used to connect the business logic on the server with the user interface on the client, which makes it easier for data management and communication between the client and the server.
4. MongoDB
   This system uses MongoDB as its database. MongoDB is a NoSQL database that allows storing and managing data in Binary JSON (BSON) format [13]. The advantages of MongoDB in terms of scalability and flexibility facilitate dynamic data management and improve system performance. The research [14] compared MongoDB and MySQL databases with SQL relation databases, it was concluded that MongoDB showed better performance in CRUD operations especially when working with large data and having concurrent access to it.
5. Next Auth

Next Auth is used for the user authentication process. Next Auth provides integration with various external authentication providers, such as Google, Facebook, and Twitter. In this system, Next Auth ensures the security of user data and simplifies the authentication process [15].

6. Prisma
This is one of the most advanced and easy-to-use Object Relational Mapper (ORM) for Node.js and TypeScript. Prisma is used to create queries and transform data in MongoDB using JavaScript Objects. It utilizes TypeScript code to improve data type safety and enhance the IDE's auto-completion capabilities [16].

3.2. System Design

3.2.1. Use Case

In this research, the software system design is made with the Use Case Diagram (UCD) model which is one of the UML types.

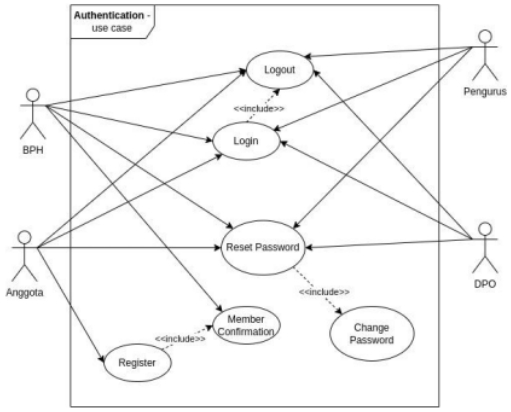

Figure 2. Authentication Use Case

Figure 2 shows the authentication system process, which shows after the member actor registers, he/she needs to wait for the member's approval from BPH, where BPH is responsible for carrying out the functions for monitoring, controlling, and coordinating of the organization.

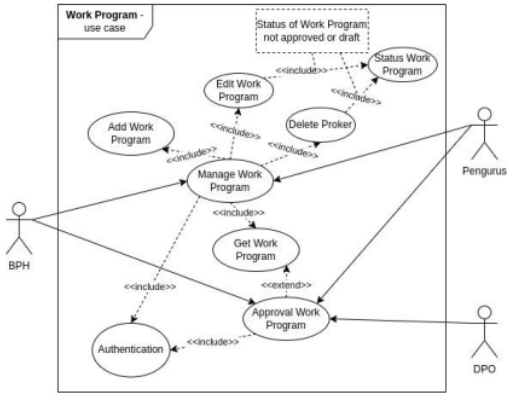

Figure 3. Work Program Use Case

Figure 3 shows the processes that are involved in work program submission system along with the actors that can access the work program submission feature.

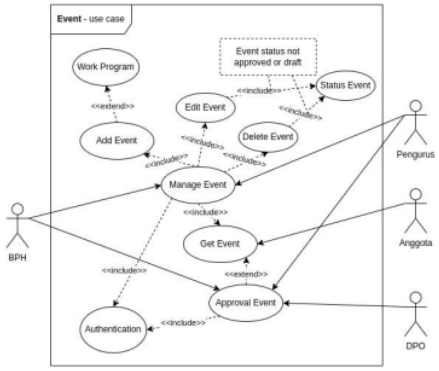

Figure 4. Event Use Case

Figure 4 shows the processes that involved in the event submission system. The event submission process does not always require a relationship with existing work program data.

3.2.2. Entity Relationship Diagram

The research on information systems design for regional student organizations requires a database design that can support the design of information systems that are reliable and suitable for the requirements. Important entities in the database can be seen in Figure 5 which has many entities where the main entities are users, articles, management, structure Organizational, period, work Program, event, gallery, short Link, and link Hub. In addition, there is an entity relationship which represents the relationship between the main entities, where the entities relationship are category Articles, task Department, approval Program, approval Event, LPJ Event, proposal Event, link Hub Thema, and link Hub Detail.

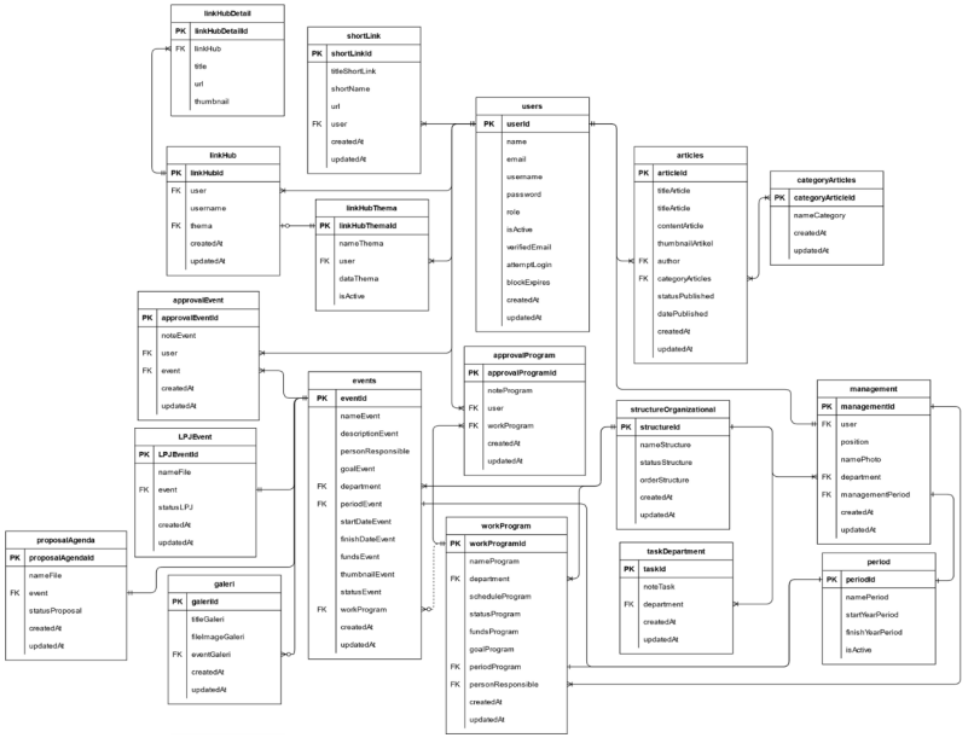

Figure 5. Entity Relationship Diagram

3.2.4. System Architecture

To develop a regional student organization information system, an architecture that can organize and integrate all components in the system in a good and structured form is needed. It can be seen in Figure 6 where the main component is Node.js Server, which is the server to run Node.js that has a backend and frontend interconnected with tRPC. To store event accountability report and event proposal files, Google Drive is used as storage media. In order to manage the existing Google Drive, this system uses Node.js which is connected to the API Key.

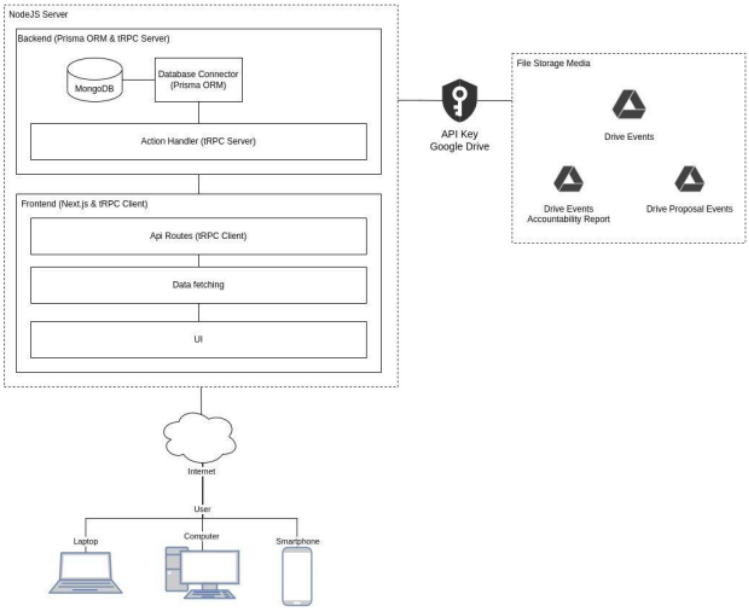

Figure 6. System Architecture

3.2.4. Interface

1. Main Page

   As for the interface of the main page of the website, there is a navbar that displays the logo, the main website page menu and the login page button, as well as the ORMADA photo which has a word that explains ORMADA and the tagline of each ORMADA period as shown in Figure 7.

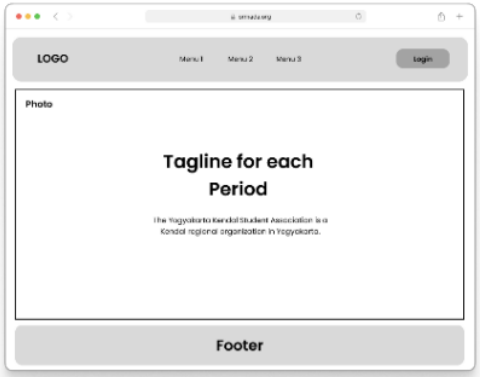

Figure 7. Main Page Interface Design

2. Event Page
In the event page interface, there are lists of event cards that will be held in the near future and those that have already been held as shown in Figure 8.

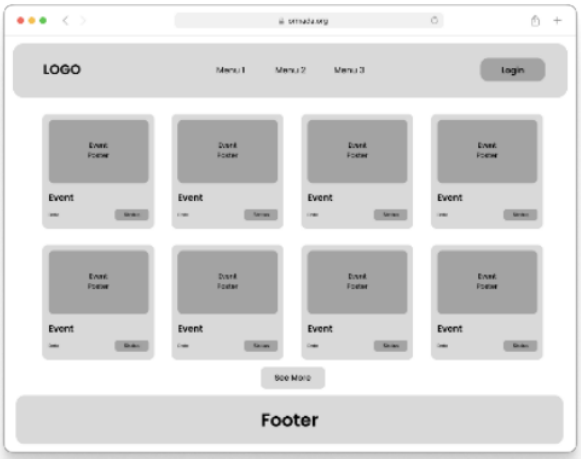

Figure 8. Event Page Interface Design

3. Article Page
As shown in Figure 9, the interface of the article page contains all the articles that have been published

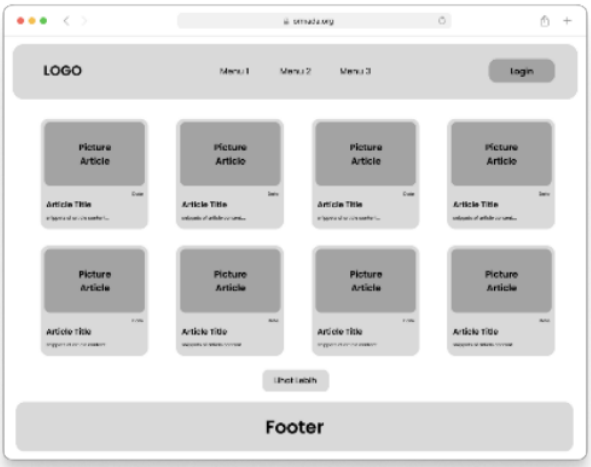

Figure 9. Article Page Interface Design

4. Management Page
On the management page interface, a general user can see the general data of active management. The general data of management such as name, management position, university, and social media accounts is listed in Figure 10.

Figure 10. Management Page Interface Design

5. About Us Page
In the about us page interface, we present a brief history of the organization, along with the vision and mission of each active period as shown in Figure 11.

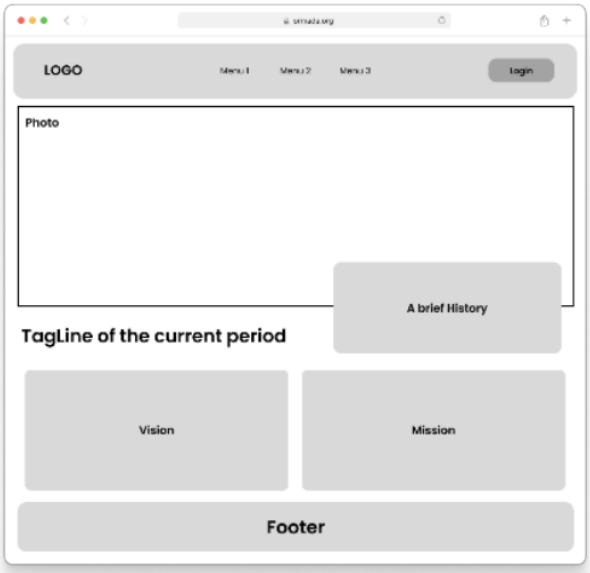

Figure 11. About Us Page Interface Design

6. Login Page
The login menu is a multi role/user login to go to the dashboard page, and on this page interface, there is a slide image as shown in Figure 12.

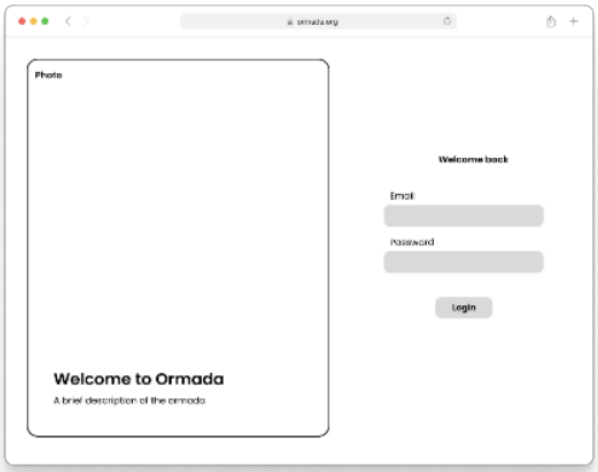

Figure 12. Login Page Interface Design

7. CRUD Data Dashboard Page
On the dashboard page interface, there are many features that can be accessed, such as work program input menu as shown in Figure 13.

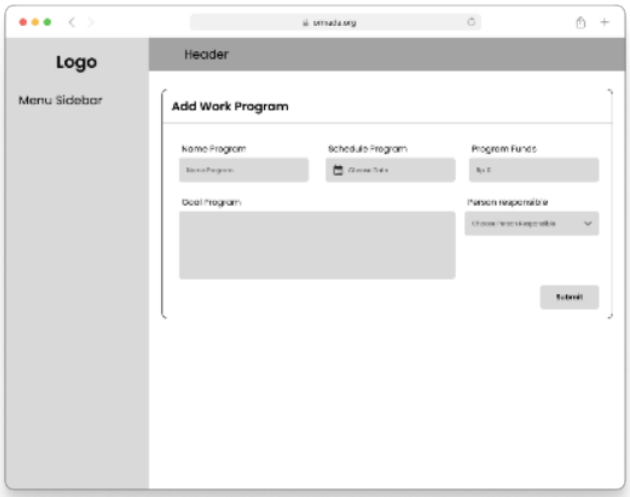

Figure 13. Interface Design of Work Program Input Menu on Dashboard Page

Not only work program input menu, we can also access the event accountability report file upload form from the dashboard page, which can be seen in Figure 14.

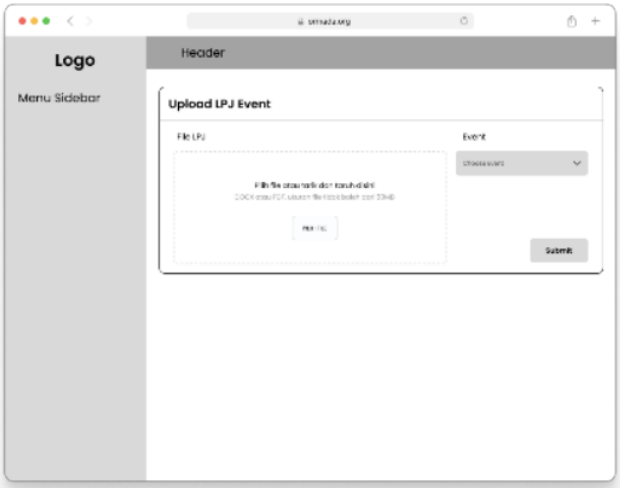

Figure 14. Interface Design of Event Accountability Report File Upload Form on Dashboard Page

4. CONCLUSION

From the discussion of Web-Based Management Information System Design for Student Organizations in Kendal Regency Using Next.js Framework, various system components have been designed successfully, including Unified Modelling Language (UML) diagram, Entity-Relationship Diagram (ERD), system architecture, and user interface design. In the future, this research will be continued by focusing on the development and actual implementation of the proposed system, with an aim to improve the effectiveness and efficiency of student organization management in Kendal District.

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